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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US

CONFIRMATION NO. 9013

POA ACCEPTANCE LETTER

Etheridge Law Group
2600 East Southlake Blvd., 120-324
Southlake, TX 76092



OC000000131597711

Date Mailed: 02/04/2022

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/01/2022.

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.

/sstephanos/

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(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 151091

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(c).

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

☐ The address associated with Customer Number:

OR

☒	Firm or individual name Etheridge Law Group		
	Address 2600 East Southlake Blvd., Suite 120-324		
	City Southlake	State TX	Zip 76092
	Country US		
	Telephone (817) 470-7249		Email jim@etheridgelaw.com

Assignee name and address: WSOU Investments, LLC
11150 Santa Monica Boulevard, Suite 1400
Los Angeles, CA 90025

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, 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 <i>Stuart Shanus</i>	Date August 23, 2021
Name Stuart Shanus	Telephone 310-633-2327
Title President of WSOU Investments, LLC	

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 1.11 and 1.14. This collection is estimated to take 18 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.

Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt	
EFS ID:	44884958
Application Number:	14302052
International Application Number:	
Confirmation Number:	9013
Title of Invention:	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
First Named Inventor/Applicant Name:	Jae Hyun HWANG
Customer Number:	30594
Filer:	Sean Dylan Burdick/Mita Encarnacion
Filer Authorized By:	Sean Dylan Burdick
Attorney Docket Number:	29250-002735-US
Receipt Date:	01-FEB-2022
Filing Date:	11-JUN-2014
Time Stamp:	02:35:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	815926-US-NP_aia0096.pdf	135001	no	3
			6a8251f8e941cf34e87a3f8f0e145a924232f21d		

Warnings:

Information:					
2	Power of Attorney	WSOU_Executed_POA_Etheridge_Correspondence.pdf	568072 a740c804b91684000432730d03925b2a06b4ffcbe	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			703073		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Jae Hyun Hwang et al.

Application No./Patent No.: 9,450,884 Filed/Issue Date: September 20, 2016

Titled: Software Defined Networking Based Congestion Control

WSOU INVESTMENTS LLC, a corporation

(Name of Assignee)

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

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

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

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

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

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

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

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

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

1. From: Jae Hyun Hwang To: Bell Labs Seoul Ltd

The document was recorded in the United States Patent and Trademark Office at
Reel 033776, Frame 0368, or for which a copy thereof is attached.

2. From: Bell Labs Seoul Ltd To: Alcatel Lucent

The document was recorded in the United States Patent and Trademark Office at
Reel 039323, Frame 0024, or for which a copy thereof is attached.

[Page 1 of 2]

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

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Thierry E. Klein To: Alcatel-Lucent USA Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 033776, Frame 0349, or for which a copy thereof is attached.

4. From: Alcatel-Lucent USA Inc. To: Alcatel Lucent

The document was recorded in the United States Patent and Trademark Office at
Reel 039865, Frame 0978, or for which a copy thereof is attached.

5. From: Alcatel Lucent To: WSOU Investments, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 052372, Frame 0675, or for which a copy thereof is attached.

6. From: _____ To: _____

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

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

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

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

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

/Sean D. Burdick/

Signature

Sean D. Burdick

Printed or Typed Name

January 31, 2022

Date

51513

Title or Registration Number

Privacy Act Statement

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

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

AO 120 (Rev. 08/10)

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

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

DOCKET NO. 6:20-cv-01083-ADA	DATE FILED 11/25/2020	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF WSOU Investments, LLC d/b/a Brazos Licensing and Development		DEFENDANT Arista Networks, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,409,715	8/5/2008	WSOU Investments, LLC d/b/a Brazos Licensing and Development
2 8,472,447	6/25/2013	WSOU Investments, LLC d/b/a Brazos Licensing and Development
3 9,450,884	9/20/2016	WSOU Investments, LLC d/b/a Brazos Licensing and Development
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
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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

AO 120 (Rev. 08/10)

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

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

DOCKET NO. 6:20-cv-01083-ADA	DATE FILED 11/25/2020	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF WSOU Investments, LLC d/b/a Brazos Licensing and Development		DEFENDANT Arista Networks, Inc.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 7,409,715	8/5/2008	WSOU Investments, LLC d/b/a Brazos Licensing and Development
2 8,472,447	6/25/2013	WSOU Investments, LLC d/b/a Brazos Licensing and Development
3 9,450,884	9/20/2016	WSOU Investments, LLC d/b/a Brazos Licensing and Development
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 NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/302,052	09/20/2016	9450884	29250-002735-US	9013

30594 7590 08/31/2016
HARNESSE, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

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 154 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):

Jae Hyun HWANG, Anyang, KOREA, REPUBLIC OF;
Thierry KLEIN, Fanwood, NJ;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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)

30594 7590 05/20/2016
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

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.
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US	9013

TITLE OF INVENTION: SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	08/22/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHAN, SAI MING	2462	370-230000

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 Harness, Dickey & Pierce, P.L.C.
2 P. O. Box 8910
3 Reston, VA 20195

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)

Alcatel Lucent - Boulogne-Billancourt, France

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 credits any overpayment, to Deposit Account Number 12-2325 (enclose an extra copy of this form).

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Patty Giebler/
Typed or printed name Patty Giebler

Date 8/18/16
Registration No. *****

Electronic Patent Application Fee Transmittal				
Application Number:		14302052		
Filing Date:		11-Jun-2014		
Title of Invention:		SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		
First Named Inventor/Applicant Name:		Jae Hyun HWANG		
Filer:		Niraj A. Desai/Patty Giebler		
Attorney Docket Number:		29250-002735-US		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
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	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt	
EFS ID:	26676807
Application Number:	14302052
International Application Number:	
Confirmation Number:	9013
Title of Invention:	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
First Named Inventor/Applicant Name:	Jae Hyun HWANG
Customer Number:	30594
Filer:	Niraj A. Desai/Patty Giebler
Filer Authorized By:	Niraj A. Desai
Attorney Docket Number:	29250-002735-US
Receipt Date:	18-AUG-2016
Filing Date:	11-JUN-2014
Time Stamp:	11:31:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$960
RAM confirmation Number	9540
Deposit Account	122325
Authorized User	GIEBLER, PATTI
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 CFR 1.20 (Post Issuance 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)	2016-08-18_815926_Issue_Fee_Payment.pdf	51242	no	1
			c4bed3d4715f4976eeb6598f93de6ac7ea179916		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30522	no	2
			b6a7281f6ba6673ac9d5ec4d8ac1647b5bed2ed5		

Warnings:

Information:

Total Files Size (in bytes):	81764
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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

NOTICE OF ALLOWANCE AND FEE(S) DUE

30594 7590 05/20/2016
HARNESSE, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

EXAMINER

CHAN, SAI MING

ART UNIT

PAPER NUMBER

2462

DATE MAILED: 05/20/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US	9013

TITLE OF INVENTION: SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	08/22/2016

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 ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

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

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

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

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
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)

30594 7590 05/20/2016
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

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.
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US	9013

TITLE OF INVENTION: SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	08/22/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHAN, SAI MING	2462	370-230000

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

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

2. For printing on the patent front page, list

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

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

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

(A) NAME OF ASSIGNEE

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

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

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

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

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

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

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

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US	9013
30594 7590 05/20/2016 HARNESSE, DICKEY & PIERCE, P.L.C. P.O. BOX 8910 RESTON, VA 20195			EXAMINER CHAN, SAI MING	
			ART UNIT	PAPER NUMBER
			2462	

DATE MAILED: 05/20/2016

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

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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. 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.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 14/302,052	Applicant(s) HWANG ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	AIA (First Inventor to File) Status Yes

-- 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 3/30/2016.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-20. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- 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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ 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) | 5. ☒ Examiner's Amendment/Comment |
| 2. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 6. ☐ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

EXAMINER'S COMMENT

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims 1-20 are allowed.

Claim 1 is allowed because the closest prior art, Ma et al (U.S. Patent No. 8949444), and Excell (U.S. Patent Publication No. 2012/0195192), either singularly or in combination, fail to anticipate or render obvious a method comprising: "monitoring, by the network switching element, a data flow traversing the target port of the network switching element," and "determining, by the network switching element, a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network switching element," in combination with all other limitations in the claim as claimed and defined by applicants.

Because the above limitations of claim 1 patentably define over the art of record, claim 1 is allowable. Independent claims 11 and 20 include similar limitations as claim 1 and as a result are allowable for similar reasons as claim 1.

Response to Arguments

Applicant's arguments filed on 3/30/2016 have been fully considered and persuasive.

Conclusion

Any response to this Office Action should be **faxed to** (571) 273-8300 **or mailed to:**

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

Hand-delivered responses should be brought to

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

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Sai-Ming Chan whose telephone number is (571) 270-1769. The Examiner can normally be reached on Monday-Thursday from 8:00 am to 5:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Yemane Mesfin can be reached on (571) 272-3927. 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) or 571-272-4100.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist/customer service whose telephone number is (571) 272-2600.

/Sai-Ming Chan/

Primary Examiner, Art Unit 2462

May 15, 2016

Issue Classification 	Application/Control No. 14302052	Applicant(s)/Patent Under Reexamination HWANG ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	

CPC						
Symbol					Type	Version
H04L		47	I	70	F	2013-01-01
H04L		47	I	12	I	2013-01-01
			I			
			I			
			I			
			I			
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			I			
			I			

CPC Combination Sets						
Symbol			Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
		20	
(Assistant Examiner)	(Date)		
/SAI-MING CHAN/	5/15/2016	O.G. Print Claim(s)	O.G. Print Figure
Primary Examiner.Art Unit 2462		1	1
(Primary Examiner)	(Date)		

Issue Classification 	Application/Control No. 14302052	Applicant(s)/Patent Under Reexamination HWANG ET AL.
	Examiner SAI-MING CHAN	Art Unit 2462

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION														
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED									
370			230			H	0	4	L	1 / 00 (2006.01.01)										
CROSS REFERENCE(S)																				
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																			

NONE		Total Claims Allowed:	
		20	
(Assistant Examiner)	(Date)		
/SAI-MING CHAN/ Primary Examiner.Art Unit 2462	5/15/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Search Notes 	Application/Control No. 14302052	Applicant(s)/Patent Under Reexamination HWANG ET AL.
	Examiner SAI-MING CHAN	Art Unit 2462

CPC- SEARCHED		
Symbol	Date	Examiner
H04L47/12, H04L47/70	1/4/2016	SC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	230	1/4/2016	SC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST image and keyword search in USPAT, US-PGPUB, DERWENT, EPO, JPO, and IBM_TDB (see attached search strategy)	1/4/2016	SC
Inventor name and Assignee search in PALM EXPO and EAST	1/4/2016	SC
Updated search	5/15/2016	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
H04L	47/70	5/15/2016	SC
H04L	47/12	5/15/2016	SC

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with ((ports devices nodes flow) near5 switching))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/15 16:49
L2	0	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with ((ports devices nodes flow) with switching))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/15 16:50
L3	4	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with ((ports devices nodes flow) with switching)) and ((total sum) with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/15 16:53
L4	4	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with ((ports devices nodes flow) with switching)) same ((total sum) with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/05/15 16:54
S1	2	"20140362789"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:02
S2	3	"20130028293"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:11
S3	3	wo near2 "2010" near2 "025348"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:50
S4	4	wo near2 "2010/025348"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:51
S5	3	"20100054219"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:54
S6	0	hwang near5 ("j." jae) and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:21

S7	0	hwang near5 ("j." jae) and bandwidth near5 allocation	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S8	0	hwang with ("j." (jae hyun)) and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S9	10	hwang and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S10	25	((@rlad<"20140620" or @ad<"20140620") and fair\$share same band\$width near8 allocat\$3	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:24
S11	20	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and (determin\$3 same band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:34
S12	19	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and (determin\$3 with band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:34
S13	5	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:49
S14	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width near8 allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:55
S15	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/07 00:00
S16	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3 measur\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/07 00:01
S17	10	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3 measur\$3) with (currnet existing available) with band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/07 00:01
S18	11	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2016/01/04 00:32

		((determin\$3 monitor\$3 measur\$3) with (current existing available) with band\$width)	DERWENT; IBM_TDB			
S19	3	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
S20	2	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
S21	2	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total near5 weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
S22	1	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) same (total near5 weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:34
S23	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total near5 weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:50
S24	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:51
S25	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:53
S26	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same (band\$width) same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:54
S27	23	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:56
S28	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 with weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:56
S29	0	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) same (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:58
S30	36	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3	US-PGPUB; USPAT; EPO;	OR	ON	2016/01/04 01:02

		same weight) and (total with weight with (ports devices nodes))	JPO; DERWENT; IBM_TDB			
S31	21	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (total with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:02
S32	21	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:04
S33	23	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:04
S34	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:06
S35	26	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:07
S36	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (ports devices nodes flow) with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:11
S37	43	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:16
S38	0	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) same (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:16
S39	375	((@rlad<"20140611" or @ad<"20140611") and (fair with shar\$3) and (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:23
S40	29	((@rlad<"20140611" or @ad<"20140611") and (fair with shar\$3 same weight) and ((total sum) with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:24
S41	3930	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:49
S42	3703	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3)	US-PGPUB; USPAT; EPO;	OR	ON	2016/01/04 11:49

		and (weight with (ports devices nodes flow) with (total sum))	JPO; DERWENT; IBM_TDB			
S43	170	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow) with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:50
S44	3703	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:54
S45	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:54
S46	674	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow)) and ((total sum) with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:55
S47	227	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow)) same ((total sum) with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:55
S48	12	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with allocat\$3) same (weight with (ports devices nodes flow)) same ((total sum) with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:56
S49	61	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:44
S50	0	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:45
S51	3	((@rlad<"20140611" or @ad<"20140611") and ((fair\$shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:45
S52	1164	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:53
S53	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply43)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:53
S54	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth)	US-PGPUB; USPAT; EPO;	OR	ON	2016/01/04 12:53

		with rtt) same (((link near3 capacity bandwidth) with rtt with multiply\$3)	JPO; DERWENT; IBM_TDB			
S55	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same ((capacity bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:03
S56	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same ((capacity link) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:37
S57	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth)) same ((capacity bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:37
S58	23	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth)) same ((capacity bandwidth) with rtt (round adj trip adj time)) with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:38
S59	2533	((@rlad<"20140611" or @ad<"20140611") and (bandwidth same time\$out)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:50
S60	76	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with time\$out)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:50
S61	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timeer)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51
S62	232	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51
S63	23	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) with expiration	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51
S64	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) with expir\$5 with event	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:57
S65	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) same expir\$5 with event	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
S66	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth	US-PGPUB; USPAT; EPO;	OR	ON	2016/01/04 13:58

		near5 allocat\$3 with timer) same expir\$5 with timeout	JPO; DERWENT; IBM_TDB			
S67	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expir\$5 with timeout	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
S68	26	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with timer) same expir\$5 with timeout	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
S69	37	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expiration	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:03
S70	1	"20150365325"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:29
S71	24	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with time\$out) and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
S72	9	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with timer) same expir\$5 with timeout and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
S73	15	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expiration and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
S74	13	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt) and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
S75	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply\$3) and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
S76	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth)) same ((capacity bandwidth) with (rtt (round adj trip adj time)) with multiply\$3) and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
S77	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes flow)) and (H04I12/\$ ho4I47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
S78	2	((@rlad<"20140611" or	US-PGPUB;	OR	ON	2016/01/04

		@ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow)) and (H04l12/\$ ho4l47/\$).cpc.	USPAT; EPO; JPO; DERWENT; IBM_TDB			14:37
S79	4	(@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (weight with (ports devices nodes flow)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38
S80	2	(@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (ports devices nodes flow) with (total sum)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38
S81	2	(@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (total sum)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	0	(monitor\$3 with data near3 flow near4 travers\$3 near5 target near5 port with network near5 switching adj3 element).clm.	US-PGPUB; USPAT	OR	ON	2016/05/15 16:58
L7	0	(determin\$3 with network near5 switching near4 element with "fair-share" near5 bandwidth near4 allocation with target adj3 port).clm.	US-PGPUB; USPAT	OR	ON	2016/05/15 16:59

5/ 15/ 2016 4:59:50 PM**C:\ Users\ schan1\ Documents\ EAST\ Workspaces\ 14302052 Congestion Control.wsp**

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Jae Hyun HWANG, et al. Conf. No.: 9013
Application No.: 14/302,052 Examiner: Sai Ming CHAN
Filing Date: June 11, 2014 Art Unit: 2462
Title: SOFTWARE DEFINED NETWORKING BASED CONGESTION
CONTROL
Atty. Dkt. No.: 29250-002735-US

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314
Mail Stop Amendment

March 30, 2016

AMENDMENT UNDER 37 C.F.R. §1.111

Sir:

In response to the non-final Office Action mailed January 12, 2016, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Claims begin on page 2,
Remarks begin on page 13 of this Amendment.

	Claims remaining after		Highest number previously paid for		Present extra
Total	20	-	20	=	0
Independent	4	-	4	=	0

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A method of adjusting bandwidth allocation by a network switching element in a communications network, the network switching element including a target port, the method comprising:

monitoring, by the network switching element, a data flow traversing the target port of the network switching element;

determining, by the network switching element, a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow;

determining, by the network switching element, a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network switching element; and

adjusting, by the network switching element, the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

2. (Currently Amended) The method of claim 1, wherein the network switching element includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and the determining the fair-share bandwidth allocation comprises:

determining a weight value for each of the plurality of ports of the network switching element;

determining a total weight value based on the weight value of each of the plurality of ports; and

determining the fair-share bandwidth allocation for the target port based on the weight value of the target port and the total weight value.

3. (Original) The method of claim 2, wherein the monitoring comprises:

receiving a data packet associated with the data flow;

determining whether the received data packet is one of a flow termination packet and a flow initiation packet;

increasing the total weight value by the weight of the target port if the received data packet is a flow initiation packet; and

decreasing the total weight value by the weight of the target port if the received data packet is a flow termination packet.

4. (Original) The method of claim 2, wherein the determining the bandwidth allocation for the target port comprises:

determining a link capacity for the target port, the link capacity being a highest amount of bandwidth that may be allocated to the target port;

determining a round trip time (RTT) associated with the data flow; and

determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

5. (Original) The method of claim 4, wherein the determining the fair-share bandwidth allocation further comprises:

determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and

determining a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

6. (Original) The method of claim 2, wherein the monitoring comprises:

defining a time out value for a timer, the timer being associated with the bandwidth allocation for the target port; and

determining that a timeout event has occurred with respect to the data flow based on expiration of the timer.

7. (Original) The method of claim 6, wherein the monitoring further comprises:

receiving a data packet associated with the data flow;

resetting the timer to be equal to the timeout value if the timeout event does not occur before the data packet is received; and

decreasing the total weight by the weight of the target port if the timeout event does occur before the data packet is received.

8. (Original) The method of claim 7, wherein the monitoring further comprises:

increasing the total weight by the weight of the target port when a subsequent data packet is received after the timeout event occurs.

9. (Original) The method of claim 8, wherein the monitoring further comprises:

determining a timeout fraction based on a number of times that the total weight is increased by the weight of the target port when the subsequent data packet is received after the timeout event occurs;

determining a target fraction based on the timeout fraction; and

adjusting the timeout value based on the target fraction.

10. (Original) The method of claim 6, wherein the timeout value is based on a desired minimum timeout value and a desired maximum timeout value, and the desired minimum timeout value is larger than a round trip time (RTT) associated with the data flow.

11. (Currently Amended) A method of adjusting bandwidth allocation by a network controller in a communications network, the network controller being configured to control a network switching element, the network switching element including a target port, the method comprising:

receiving, by the network controller, data flow information from the network switching element, the data flow information including information about data flows traversing of the target port of the network switching element;

determining, by the network controller, a bandwidth allocation of the target port based on the data flow information, the bandwidth allocation of the target port being a bandwidth that is currently allocated for each of the data flows traversing the target port;

determining, by the network controller, an over-subscription ratio, the over-subscription ratio being a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port;

transmitting, by the network controller, the over-subscription ratio to the network switching element based on the over-subscription ratio and a threshold value;

determining, by the network controller, a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network switching element; and

adjusting, by the network controller, the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

12. (Currently Amended) The method of claim 11, wherein the network switching element includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and the determining the fair-share bandwidth allocation for the target port comprises:

determining the bandwidth allocation for each of the plurality of ports of the network switching element;

determining a weight value for each of the plurality of ports;

determining a total weight value based on the weight value for each of the plurality of ports; and

determining the fair-share bandwidth allocation for the target port based on the weight value of the target port and the total weight value.

13. (Original) The method of claim 12, wherein the determining the bandwidth allocation for each of the plurality of ports comprises:

determining a link capacity for the target port, the link capacity being a highest amount of bandwidth that is able to be allocated to of the target port;

determining a round trip time (RTT) for one of the data flows traversing the target port; and

determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

14. (Original) The method of claim 13, wherein the determining the fair-share bandwidth allocation for the target port comprises:

determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and

determining a network fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation of the target port.

15. (Currently Amended) The method of claim 14, wherein the network switching element is associated with a secondary network switching element, the secondary network switching element including a secondary set of ports, and the secondary network switching element determines a weighted fair-share bandwidth allocation for each of the secondary set of ports.

16. (Original) The method of claim 15, wherein the adjusting the bandwidth allocation for the target port comprises:

- determining a data flow traversing the target port and a secondary target port, the secondary target port being one of secondary set of ports;

- determining the weighted fair-share bandwidth allocation for the data flow traversing the target port and the secondary target port;

- determining the network fair-share bandwidth allocation for the data flow traversing the target port and the secondary target port;

- adjusting the bandwidth allocation for the target port based on the weighted fair-share bandwidth allocation when the weighted fair-share bandwidth allocation is less than the network fair-share bandwidth allocation; and

- adjusting the bandwidth allocation for the target port based on the network fair-share bandwidth allocation when the network fair-share bandwidth allocation is less than the weighted fair-share bandwidth allocation.

17. (Currently Amended) An edge switch for adjusting bandwidth allocation in a communications network, the edge switch including a target port, the edge switch configured to:

- monitor a data flow traversing the target port;

- determine a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow;

determine a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network switching element; and

adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

18. (Currently Amended) The edge switch of claim 17, wherein the edge switch includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and in the determining the fair-share bandwidth allocation, the edge switch is configured to:

determine a weight value for each of the plurality of ports of the network switching element;

determine a total weight value based on the weight value of each of the plurality of ports; and

determine the fair-share bandwidth allocation based on the weight value for the target port and the total weight value.

19. (Original) The edge switch of claim 18, wherein, in the determining the bandwidth allocation for the target port, the edge switch is configured to:

determine a link capacity for the target port, the link capacity being a highest amount of bandwidth that is able to be allocated to the target port;

determine a round trip time (RTT) associated with the data flow;

determine the bandwidth allocation for the target port by multiplying the link capacity by the RTT;

determine a fair-share weight value by dividing the weight value for the target port by the total weight value; and

determine a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

20. (Currently Amended) A Software Defined Networking (SDN) controller for adjusting bandwidth allocation in a communications network, the SDN controller being configured to control an aggregation switch, the aggregation switch including a target port, the SDN controller is configured to:

receive data flow information from the network switching element, the data flow information including information about data flows traversing of the target port;

determine a bandwidth allocation of the target port based on the data flow information, the bandwidth allocation of the target port being a bandwidth that is currently allocated for each of the data flows traversing the target port;

determine an over-subscription ratio, the over-subscription ratio being a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port; and

transmit the over-subscription ratio to the aggregation switch based on the over-subscription ratio and a threshold value;

determine a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network switching element; and

adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

REMARKS

Claims 1-20 are pending in this application. Claims 1, 11, 17 and 20 are the independent claims. Claims 1, 2, 11, 12, 15, 17, 18 and 20 are amended. Reconsideration and allowance of the present application is respectfully requested.

Applicant appreciates the Examiner's acknowledgement and consideration of the drawings filed June 11, 2014.

Rejections under 35 U.S.C. §102 – Ma

Claims 1 and 17 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent 8,949,444 to Ma et al. ("Ma"). This rejection is respectfully traversed.

With regard to claim 1, Ma teaches a flow control scheme that takes place at a proxy device 120. Specifically, the proxy device 120 monitors round trip times (RTT) of acknowledgement messages (ACKs) for data flows leaving source ports (associated with user device 110) and arriving at destination ports (associated with resource 130), in order to allow the proxy device to reallocate data flows to the appropriate source / destination ports. Based on this understanding, Ma does not teach "monitoring, by the network switching element, a data flow traversing the target port of the switching element" (as recited in claim 1). That is to say, Ma does not monitor data traveling through a "target port" of the proxy device 120, itself. Instead, Ma only monitors data flows from ports that are at the user device 110 or the resource 130, where the user device 110 and resource 130 are not a "network switching element" (as recited in claim 1).

Furthermore, Ma does not teach regulating a bandwidth for a port at the proxy device 120. Rather, as described in col. 9, l. 3-24 (relied upon by the Examiner), Ma

teaches regulating data flow for bandwidth allocation of ports at the user device 110 and resource 130 (i.e., at a source and destination of the data flow). For this reason, Ma does not teach “determining, by the network switching element, a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow,” “determining, by the network switching element, a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element” and “adjusting, by the network switching element, the bandwidth allocation for the target port based on the fair-share bandwidth allocation” (as recited in claim 1). For these reasons, Ma does not teach all of the limitations of claim 1.

With regard to independent claim 17, Applicant asserts that this claim contains features similar to claim 1, such that at least the same arguments can be made.

For at least the reasons argued above, Applicant asserts that independent claims 1 and 17 are patentable. Therefore, Applicant respectfully requests that this art ground of rejection of these claims under 35 U.S.C. §102 be withdrawn.

**Rejections under 35 U.S.C. §103 – Ma in view of various combinations of Excell
and Matthews**

Claims 2, 6, 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ma in view of various combinations of U.S. Patent 6,714,555 to Excell et al. (“Excell”) and U.S. Patent Publication 2012/0195192 to Matthews et al. (“Matthews”). This rejection is respectfully traversed.

Excell and Matthews do not remedy the deficiencies of Ma, with regard to claims 1 and 17, nor does the Examiner make such an assertion. Therefore, claims 1

and 17 are patentable over any combination of Ma, Excell and Matthews. Due at least to the dependence of the remaining claims on respective claims 1 and 17, Applicant asserts that the remaining claims are also patentable. Therefore, Applicant respectfully requests that this art ground of rejection of these claims under 35 U.S.C. §103 be withdrawn.

Allowable Subject Matter

Applicant notes with appreciation the Examiner's indication that claims 11-16 and 20 are allowed, and claims 3-5, 7-10 and 19 contain allowable subject matter. However, Applicant asserts that all of the pending claims are patentable, for at least the reasons argued above.

CONCLUSION

In view of the above remarks and amendments, Applicant respectfully submits that each of the rejections has been addressed and overcome, placing the present application in condition for allowance. A notice to that effect is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to contact the undersigned.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,
HARNESS, DICKEY, & PIERCE, P.L.C.

By



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GDY/^{SP}CES/vvw

Electronic Acknowledgement Receipt	
EFS ID:	25340186
Application Number:	14302052
International Application Number:	
Confirmation Number:	9013
Title of Invention:	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
First Named Inventor/Applicant Name:	Jae Hyun HWANG
Customer Number:	30594
Filer:	Gary Daniel Yacura/Valencia Waters
Filer Authorized By:	Gary Daniel Yacura
Attorney Docket Number:	29250-002735-US
Receipt Date:	30-MAR-2016
Filing Date:	11-JUN-2014
Time Stamp:	08:42:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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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	2016March30Amendment.PDF	2471360 60f0e8de8e700971080685f32d9a3aa3020c ca58	no	15

Warnings:

Information:

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.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 14/302,052		Filing Date 06/11/2014		☐ To be Mailed	
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO									
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)							
FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)			
☒ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A		280			
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =		*	X \$ =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =		*	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 \$310 (\$155 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		280	
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	03/30/2016	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X \$80 =		0	
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X \$420 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		0	
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						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.									

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.
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US	9013
30594 7590 01/12/2016 HARNESS, DICKEY & PIERCE, P.L.C. P.O. BOX 8910 RESTON, VA 20195			EXAMINER CHAN, SAI MING	
			ART UNIT 2462	PAPER NUMBER
			NOTIFICATION DATE 01/12/2016	DELIVERY MODE ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

demailroom@hdp.com
gyacura@hdp.com
pshaddin@hdp.com

Office Action Summary	Application No. 14/302,052	Applicant(s) HWANG ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	AIA (First Inventor to File) Status Yes

-- 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 MONTHS 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 6/11/2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ 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*

- 5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☒ Claim(s) 11-16 and 20 is/are allowed.
- 7) ☒ Claim(s) 1,2,6,17 and 18 is/are rejected.
- 8) ☒ Claim(s) 3-5, 7-10 and 19 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 6/11/2014 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).

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).

Certified copies:

- 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)).

** 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) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 6/11/2014 has been considered by the Examiner and made of record in the application file.

Claim Rejections - 35 USC § 102

Claims 1 and 17 are rejected under 35 U.S.C. 102 (a) 2 as being anticipated by **Ma et al. (U.S. Patent # 8949444)**.

Consider **claims 1 and 17**, Ma et al. clearly disclose a method of adjusting bandwidth allocation by a network element in a communications network, the network element including a target port (col. 1, lines 29-31 (destination device)), the method comprising:

monitoring, by the network element, a data flow traversing the target port (fig. 5 (505), col. 12, lines 43-58 (RTTs associated with ACKs may be monitored));

determining, by the network element, a bandwidth allocation for the target port (col. 3, lines 36-40 (measure the available bandwidth associated with established flows)), the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow (col. 3, lines 36-40 (measure the available bandwidth associated with established flows based on, for example, a monitoring of round trip times (RTTs) associated with acknowledgements (ACKs)));

determining, by the network element, a fair-share bandwidth allocation for the target port (col. 9, lines 3-24 (implement fair-sharing algorithm)), the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element (col. 9, lines 3-24 (implement fair-sharing algorithm)); and

adjusting, by the network element, the bandwidth allocation for the target port based on the fair-share bandwidth allocation (col. 9, lines 3-24 (may allocate more or less bandwidth/implement fair-sharing algorithm)).

Claim Rejections - 35 USC § 103

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

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole

would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 2 and 18 are rejected under 35 U.S.C. 103 as being unpatentable over **Ma et al. (U.S. Patent # 8949444), in view of Excell et al. (U.S. Patent # 6714555).**

Consider **claim 2**, and **as applied to claim 1 above**,

claim 18, and **as applied to claim 17 above**,

Ma et al. clearly disclose the fair sharing and target port.

However, Ma et al. do not specifically disclose a weight value for each of the plurality of ports.

In the same field of endeavor, Excell et al. clearly show:

wherein the network element includes a plurality of ports (col. 3, lines 66- col. 4. line 3 (weight output ports)), and each of the plurality of ports is assigned a

corresponding bandwidth allocation (col. 3, lines 66- col. 4. line 3 (allocate bandwidth)),
and the determining the fair-share bandwidth allocation comprise:

determining a weight value for each of the plurality of ports (col. 3, lines 66- col. 4.
line 3 (weight output ports));

determining a total weight value based on the weight value of each of the plurality
of ports (col. 3, lines 66- col. 4. line 3 (total of each share of the output ports)); and

determining the fair-share bandwidth allocation based on the weight value of the
target port and the total weight value (col. 3, lines 66- col. 4. line 3 (total of output ports
does not exceed total link bandwidth)).

Therefore, it would have been obvious to a person of ordinary skill in the art
before the time of invention to demonstrate a method of adjusting bandwidth allocation,
as taught by Ma, and show a weight value for each of the plurality of ports, as taught by
Excell, so that network congestion can be minimized.

Claim 6 is rejected under 35 U.S.C. 103 as being unpatentable over **Ma et al.**
(U.S. Patent # 8949444), and Excell et al. (U.S. Patent # 6714555), in view of
Matthews et al. (U.S. PG-Pub. # 2012/0195192).

Consider **claim 6**, and **as applied to claim 2 above**, Ma et al. clearly disclose the
method as described.

However, Ma et al. do not specifically disclose a time out value for a timer.

In the same field of endeavor, Excell et al. clearly show:

wherein the monitoring comprises:

defining a time out value for a timer, the timer being associated with the bandwidth allocation for the target port (par. 22 (bandwidth preference timer/configured to limit the time it can dynamically allocate bandwidth)); and

determining that a timeout event has occurred with respect to the data flow based on expiration of the timer (par. 22 (specific level of congestion is detected)).

Therefore, it would have been obvious to a person of ordinary skill in the art before the time of invention to demonstrate a method of adjusting bandwidth allocation, as taught by Ma, and show a time out value for a timer, as taught by Matthews, so that network congestion can be minimized.

Allowable Subject Matter

Claims 11-16 and 20 are allowed.

Claims 3-5, 7-10 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any response to this Office Action should be **faxed to** (571) 273-8300 **or mailed to:**

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Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Sai-Ming Chan whose telephone number is (571) 270-1769. The Examiner can normally be reached on Monday-Thursday from 8:00 am to 5:00 pm.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Yemane Mesfin can be reached on (571) 272-3927. 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) or 571-272-4100.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist/customer service whose telephone number is (571) 272-2600.

/Sai-Ming Chan/

Primary Examiner, Art Unit 2462

January 4, 2016

Notice of References Cited	Application/Control No. 14/302,052	Applicant(s)/Patent Under Reexamination HWANG ET AL.	
	Examiner SAI-MING CHAN	Art Unit 2462	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-8,949,444 B1	02-2015	Ma; Qingming	H04L65/105	709/228
*	B	US-6,714,555 B1	03-2004	Excell; Michael John	H04L49/30	370/395.43
*	C	US-2012/0195192 A1	08-2012	Matthews; Brad	H04L47/30	370/230
	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	CPC Classification
	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).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Application Number	New Application
				Filing Date	June 11, 2014
				First Named Inventor	Jae Hyun HWANG
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	1	of	1	Attorney Docket Number	29250-002735-US

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

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

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NON PATENT LITERATURE DOCUMENTS				
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.		T ²
	CA	Alizadeh, M. et al. "DATA CENTER TCP (DCTCP)", SIGCOM'10, 2010, PGS. 1-12, NEW DELHI, INDIA.		
	CB	BENSON, T. ET AL. " NETWORK TRAFFIC CHARACTERISTICS OF DATA CENTERS IN THE WILD", IMC'10, 2010, MELBOURNE, AUSTRALIA, PGS. 1-14.		
	CC	HWANG, J. ET AL. "IA-TCP: A RATE BASED INCAST-AVOIDANCE ALGORITHM FOR TCP IN DATA CENTER NETWORKS", IEEE ICC 2012- COMMUNICATION QOS, RELIABILITY AND MODELING SYMPOSIUM, 2012, PGS. 1292-1296.		
	CD	WILSON, C. ET AL. "BETTER NEVER THAN LATE: MEETING DEADLINES IN DATACENTER NETWORKS", SIGCOMM'11, 2011, PGS. 50-61, TORONTO, ONTARIO, CANADA.		

*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.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

2161989.1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /S.C./

Examiner Signature	/Sai Ming Chan/	Date Considered	12/06/2015
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3930	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (total sum)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:49
L2	3703	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) and (weight with (ports devices nodes flow) with (total sum)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:49
L3	170	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow) with (total sum)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:50
L4	3703	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) and ((total sum) with weight with (ports devices nodes flow)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:54
L5	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:54
L6	674	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow)) and ((total sum) with weight))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:55
L7	227	((@rlad<"20140611" or @ad<"20140611") and (fair shar\$3) same (weight with (ports devices nodes flow)) same ((total sum) with weight))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:55
L8	12	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with allocat\$3) same (weight with (ports devices nodes flow)) same ((total sum) with weight))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 11:56
L10	61	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:44
L11	0	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply\$3))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:45

L12	3	((@rlad<"20140611" or @ad<"20140611") and ((fair\$shar\$3) with rtt) same (((link near3 capacity) bandwidth) with rtt)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:45
L13	1164	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:53
L14	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply43)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:53
L15	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 12:53
L16	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same ((capacity bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:03
L17	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same ((capacity link) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:37
L18	10	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) same ((capacity bandwidth) with rtt with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:37
L19	23	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) same ((capacity bandwidth) with (rtt (round adj trip adj time)) with multiply\$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:38
L20	2533	((@rlad<"20140611" or @ad<"20140611") and (bandwidth same time\$out)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:50
L21	76	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with time\$out)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:50
L22	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timeer)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51
L23	232	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51

L24	23	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) with expiration	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:51
L25	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) with expir\$5 with event	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:57
L26	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) same expir\$5 with event	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
L27	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with timer) same expir\$5 with timeout	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
L28	0	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expir\$5 with timeout	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
L29	26	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with timer) same expir\$5 with timeout	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 13:58
L30	37	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expiration	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:03
L31	1	"20150365325"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:29
L32	24	((@rlad<"20140611" or @ad<"20140611") and (bandwidth near5 allocat\$3 with time\$out) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
L33	9	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with timer) same expir\$5 with timeout and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
L34	15	((@rlad<"20140611" or @ad<"20140611") and (bandwidth with allocat\$3 with timer) same expiration and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36
L35	13	((@rlad<"20140611" or @ad<"20140611") and ((fair shar\$3 with rtt) same (((link near3 capacity) bandwidth) with rtt) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:36

L36	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) with rtt) same (((link near3 capacity) bandwidth) with rtt with multiply\$3) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
L37	0	((@rlad<"20140611" or @ad<"20140611") and ((bandwidth) same ((capacity bandwidth) with rtt (round adj trip adj time)) with multiply\$3) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
L38	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes flow)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
L39	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:37
L40	4	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (weight with (ports devices nodes flow)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38
L41	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (ports devices nodes flow) with (total sum)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38
L42	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (total sum)) and (H04l12/\$ ho4l47/\$).cpc.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 14:38
S1	2	"20140362789"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:02
S2	3	"20130028293"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:11
S3	3	wo near2 "2010" near2 "025348"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:50
S4	4	wo near2 "2010/025348"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/22 17:51
S5	3	"20100054219"	US-PGPUB; USPAT; EPO; JPO; DERWENT;	OR	ON	2015/10/22 17:54

			IBM_TDB			
S6	0	hwang near5 ("j." jae) and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:21
S7	0	hwang near5 ("j." jae) and bandwidth near5 allocation	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S8	0	hwang with ("j." (jae hyun)) and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S9	10	hwang and fair\$share	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:22
S10	25	((@rlad<"20140620" or @ad<"20140620") and fair\$share same band\$width near8 allocat\$3	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:24
S11	20	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and (determin\$3 same band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:34
S12	19	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and (determin\$3 with band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:34
S13	5	((@rlad<"20140620" or @ad<"20140620") and (fair\$share same band\$width near8 allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:49
S14	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width near8 allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/06 23:55
S15	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/07 00:00
S16	7	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3 measur\$3) with (currnet existing available) near5 band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/12/07 00:01
S17	10	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2015/12/07 00:01

		((determin\$3 monitor\$3 measur\$3) with (currnet existing available) with band\$width)	DERWENT; IBM_TDB			
S18	11	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same band\$width with allocat\$3) and ((determin\$3 monitor\$3 measur\$3) with (current existing available) with band\$width)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:32
S19	3	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
S20	2	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
S21	2	((@rlad<"20140620" or @ad<"20140620") and (fair\$shar\$3 same (band\$width with allocat\$3) same weight) and (total near5 weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:33
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S26	1	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same (band\$width) same weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:54
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S28	2	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 with weight) and (total with weight)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 00:56
S29	0	((@rlad<"20140611" or	US-PGPUB;	OR	ON	2016/01/04

		@ad<"20140611") and (fair\$shar\$3 same weight) same (total with weight)	USPAT; EPO; JPO; DERWENT; IBM_TDB			00:58
S30	36	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (total with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:02
S31	21	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (total with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:02
S32	21	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:04
S33	23	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:04
S34	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and ((total sum) with weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:06
S35	26	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3 same weight) and (weight with (ports devices nodes flow))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:07
S36	30	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (ports devices nodes flow) with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:11
S37	43	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) and (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:16
S38	0	((@rlad<"20140611" or @ad<"20140611") and (fair\$shar\$3) same (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:16
S39	375	((@rlad<"20140611" or @ad<"20140611") and (fair with shar\$3) and (weight with (total sum))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:23
S40	29	((@rlad<"20140611" or @ad<"20140611") and (fair with shar\$3 same weight) and ((total sum) with weight with (ports devices nodes))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/01/04 01:24

EAST Search History (Interference)

< This search history is empty >

1 / 4 / 2016 2:38:52 PM

C:\Users\schan1\Documents\EAST\Workspaces\14302052 Congestion Control.wsp



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BIB DATA SHEET

CONFIRMATION NO. 9013

SERIAL NUMBER 14/302,052	FILING or 371(c) DATE 06/11/2014 RULE	CLASS 370	GROUP ART UNIT 2462	ATTORNEY DOCKET NO. 29250-002735-US		
APPLICANTS INVENTORS Jae Hyun HWANG, Anyang, KOREA, REPUBLIC OF; Thierry KLEIN, Fanwood, NJ; ** CONTINUING DATA ***** None. S.C. 1/4/2016 ** FOREIGN APPLICATIONS ***** None. S.C. 1/4/2016 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 06/20/2014						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/SAI-MING CHAN/</u> Examiner's Signature		☐ Met after Allowance SC Initials	STATE OR COUNTRY KOREA, REPUBLIC OF	SHEETS DRAWINGS 7	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 4
ADDRESS HARNESS, DICKEY & PIERCE, P.L.C. P.O. BOX 8910 RESTON, VA 20195 UNITED STATES						
TITLE SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL						
FILING FEE RECEIVED 2160	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			

Search Notes 	Application/Control No. 14302052	Applicant(s)/Patent Under Reexamination HWANG ET AL.
	Examiner SAI-MING CHAN	Art Unit 2462

CPC- SEARCHED		
Symbol	Date	Examiner
Ho4L12/801, H04L12/911, H04L47/12, H04L47/70	1/4/2016	SC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	230	1/4/2016	SC

SEARCH NOTES		
Search Notes	Date	Examiner
EAST image and keyword search in USPAT, US-PGPUB, DERWENT, EPO, JPO, and IBM_TDB (see attached search strategy)	1/4/2016	SC
Inventor name and Assignee search in PALM EXPO and EAST	1/4/2016	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US

CONFIRMATION NO. 9013

30594

HARNESS, DICKEY & PIERCE, P.L.C.

P.O. BOX 8910

RESTON, VA 20195

PUBLICATION NOTICE



OC000000079444701

Title:SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL

Publication No.US-2015-0365325-A1

Publication Date:12/17/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

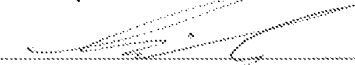
The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

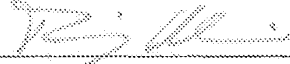
Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

DECLARATION

Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
As a below named inventor, I hereby declare that:	
This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT International application number <u>14/302,052</u> filed on <u>June 11, 2014</u> .	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby state that I have reviewed and understand the contents of the above-identified application.	
I acknowledge that I am aware of the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
NOTE: This form requires the use of an Application Data Sheet	
Inventor:	Jae Hyun HWANG
Signature:	 Date: <u>12 Sep. 2014</u>
Inventor:	Thierry E. KLEIN
Signature:	_____ Date: _____
Inventor:	
Signature:	_____ Date: _____

2244444 1

DECLARATION

Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
As a below named inventor, I hereby declare that:	
This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT International application number <u>14/302,052</u> filed on <u>June 11, 2014</u> .	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby state that I have reviewed and understand the contents of the above-identified application.	
I acknowledge that I am aware of the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
NOTE: This form requires the use of an Application Data Sheet	
Inventor: Jae Hyun HWANG	
Signature: _____	Date: _____
Inventor: Thierry E. KLEIN	
Signature: <u></u>	Date: <u>09/11/2014</u>
Inventor: _____	
Signature: _____	Date: _____

2244444.1

Electronic Acknowledgement Receipt	
EFS ID:	20187219
Application Number:	14302052
International Application Number:	
Confirmation Number:	9013
Title of Invention:	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL
First Named Inventor/Applicant Name:	Jae Hyun HWANG
Customer Number:	30594
Filer:	Gary Daniel Yacura/Patricia Sandoval
Filer Authorized By:	Gary Daniel Yacura
Attorney Docket Number:	29250-002735-US
Receipt Date:	19-SEP-2014
Filing Date:	11-JUN-2014
Time Stamp:	11:52:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	2014_09_19_DECLARATION. PDF	1626717 67bcef6d67d86e58f2636b799df07344edacaf92	no	2

Warnings:

Information:

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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/302,052				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		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	280			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	600			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720			
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *			OR	x 80 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4	minus 3 = *	1		OR	x 420 =	420			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 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).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	2020			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY		
AMENDMENT A		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))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
TOTAL ADD'L FEE								OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY		
AMENDMENT B		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))							OR		
	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 found in the appropriate box in column 1.										



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
14/302,052	06/11/2014	2414	2160	29250-002735-US	20	4

CONFIRMATION NO. 9013

30594

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

FILING RECEIPT



OC000000069163626

Date Mailed: 06/23/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Jae Hyun HWANG, Anyang, KOREA, REPUBLIC OF;
Thierry KLEIN, Fanwood, NJ;

Applicant(s)

Jae Hyun HWANG, Anyang, KOREA, REPUBLIC OF;
Thierry KLEIN, Fanwood, NJ;

Power of Attorney: None

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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If Required, Foreign Filing License Granted: 06/20/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/302,052**

Projected Publication Date: 12/17/2015

Non-Publication Request: No

Early Publication Request: No
Title

SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL

Preliminary Class

370

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/302,052	06/11/2014	Jae Hyun HWANG	29250-002735-US

CONFIRMATION NO. 9013

30594
HARNESSE, DICKEY & PIERCE, P.L.C.
P.O. BOX 8910
RESTON, VA 20195

NOTICE



Date Mailed: 06/23/2014

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
Jae Hyun HWANG
Thierry KLEIN

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.

UTILITY PATENT APPLICATION TRANSMITTAL (ONLY FOR NEW NONPROVISIONAL APPLICATIONS UNDER 37 CFR 1.53(B))		Attorney Docket No. 29250-002735-US First Named Inventor Jae Hyun HWANG Title SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL Express Mail Label No.
APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.		ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☒ Fee Transmittal Form (PTO/SB/17 or equivalent) 2. ☐ Applicant asserts small entity status. See 37 CFR 1.27 3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent 4. ☒ Specification [Total Pages <u>51</u>] Both the claims and abstract must start on a new page. (See MPEP § 508.01(a) for information on the preferred arrangement) 5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>7</u>] 6. Inventor's Oath or Declaration [Total Pages _____] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☐ A copy from a prior application (37 CFR 1.63(d)) 7. ☒ Application Data Sheet *See note below See 37 CFR 1.75 (PTO/AIA/14 or equivalent) 8. ☐ CD-ROM or CD-R In duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. - c. are required) a. ☐ Computer Readable Form (CRF) b. Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies		ACCOMPANYING APPLICATION PARTS 10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee 11. ☐ 37 CFR 3.73(c) Statement ☐ Power of Attorney (when there is an assignee) 12. ☐ English Translation Document (if applicable) 13. ☒ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☒ Copies of citations attached 14. ☐ Preliminary Amendment 15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. ☐ Nonpublication Request Under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent 18. ☐ Other:
*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 must be included in an Application Data Sheet (ADS). (2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).		
18. CORRESPONDENCE ADDRESS		
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Name		
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City	State	Zip Code
Country	Telephone	Email
Signature		Date
Name (Print/Type) <u>Gary D. Yacura</u>		June 11, 2014
Registration No. (Attorney/Agent)		35,416

2161974.1

FEE TRANSMITTAL		Complete if known	
		Application Number	New Application
		Filing Date	June 11, 2014
		First Named Inventor	Jae Hyun HWANG
		Examiner Name	Not Yet Assigned
☐ Applicant asserts small entity status. See 37 CFR 1.27 ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously		Art Unit	Not Yet Assigned
		Practitioner Docket No.	29250-002735-US
TOTAL AMOUNT OF PAYMENT		(\$ 2,160.00	

METHOD OF PAYMENT (check all that apply)

☐ Check
 ☐ Credit Card
 ☐ Money Order
 ☐ None
 ☐ Other (please identify): _____

☒ Deposit Account
 Deposit Account Number: 08-0750
 Deposit Account Name: Harness, Dickey & Pierce, P.L.C.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

Application Type	FILING FEES			SEARCH FEES			EXAMINATION FEES			Fees Paid (\$)
	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	
Utility	280	140*	70	600	300	150	720	360	180	1,600.00
Design	180	90	45	120	60	30	460	230	115	
Plant	180	90	45	380	190	95	580	290	145	
Reissue	280	140	70	600	300	150	2,160	1,080	540	
Provisional	260	130	65	0	0	0	0	0	0	

* The \$140 small entity status filing fee for a utility application is further reduced to \$70 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	Undiscounted Fee (\$)	Small Entity Fee (\$)	Micro Entity Fee (\$)
Each claim over 20 (including Reissues)	80	40	20
Each independent claim over 3 (including Reissues)	420	210	105
Multiple dependent claims	780	390	195

Total Claims	Extra Claims	Fee (\$)	Fee Paid (\$)	Multiple Dependent Claims	Fee (\$)	Fee Paid (\$)
20	- 20 or HP =	x	=			
HP = highest number of total claims paid for, if greater than 20.						
Indep. Claims	Extra Claims	Fee (\$)	Fee Paid (\$)			
4	- 3 or HP =	1 x 420.00	= 420.00			
HP = highest number of independent claims paid for, if greater than 3.						

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$400 (\$200 for small entity) (\$100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fee Paid (\$)
44	- 100 =	/50 =	(round up to a whole number) x	=

4. OTHER FEE(S)

Non-English specification, \$130 fee (no small or micro entity discount)

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small or micro entity)

Other (e.g., late filing surcharge): Late Declaration Surcharge 140.00

SUBMITTED BY			
Signature	Registration No. (Attorney/Agent)	35,416	Telephone (703) 668-8000
Name (Print/Type)	Gary D. Yacura		Date June 11, 2014

2161985.1

Docket No.: 29250-002735-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Jae Hyun HWANG et al.

Application No.: New Application

Confirmation No.: Not Yet Assigned

Filed: June 11, 2014

Art Unit: Not Yet Assigned

For: SOFTWARE DEFINED NETWORKING
BASED CONGESTION CONTROL

Examiner: Not Yet Assigned

**INFORMATION DISCLOSURE STATEMENT
(SUBMISSION CONCURRENT WITH THE
FILING OF A NEW PATENT APPLICATION)**

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

Sir:

Pursuant to 37 C.F.R. §§ 1.97 and 1.98, applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on PTO/SB/08, attached hereto.

II. COPIES

- ☐ Submitted herewith is a legible copy of (i) each U.S. and foreign patent; (ii) each publication or that portion which caused it to be listed; and (iii) all other information or that portion which caused it to be listed.
- ☒ Because the present application was/is being filed after June 30, 2003, no copies of the U.S. patents or U.S. patent application publications which are listed on the attached Form PTO/SB/08 are enclosed pursuant to the waiver of 37 C.F.R. § 1.98(a)(2)(i). Any foreign patent documents or non-patent literature listed on the attached Form PTO/SB/08 are enclosed herewith.

GDY/jr

- ☐ This application is a National Phase of a PCT application. Some or all of the documents listed on the PTO/SB/08 are not enclosed because they were cited in the International Search Report and copies should be forwarded from the International Search Authority. If copies are needed, please contact the undersigned.

III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

- a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**

The attached patents, publications, or other information in the English language do not require a statement of relevancy.

- b. ☐ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

A concise explanation of the relevance of all patents, publications, or other information listed that is not in the English language is as follows:

- c. ☐ **OTHER**

FEES

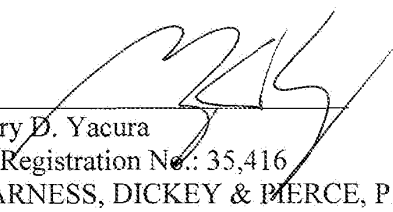
This Information Disclosure Statement is being filed concurrently with the filing of a new patent application; therefore, no fee is required.

If the Examiner has any questions concerning this IDS, he/she is requested to contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 08-0750.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17; particularly, extension of time fees.

Dated: June 11, 2014

Respectfully submitted,

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Enclosures: ☒ Form PTO/SB/08
☒ Documents
☐ Fee

2161980.1

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Application Number	New Application
				Filing Date	June 11, 2014
				First Named Inventor	Jae Hyun HWANG
				Art Unit	Not Yet Assigned
				Examiner Name	Not Yet Assigned
Sheet	1	of	1	Attorney Docket Number	29250-002735-US

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

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

*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.

NON PATENT LITERATURE DOCUMENTS				
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.		T ²
	CA	Alizadeh, M. et al. "DATA CENTER TCP (DCTCP)", SIGCOM'10, 2010, PGS. 1-12, NEW DELHI, INDIA.		
	CB	BENSON, T. ET AL. " NETWORK TRAFFIC CHARACTERISTICS OF DATA CENTERS IN THE WILD", IMC'10, 2010, MELBOURNE, AUSTRALIA, PGS. 1-14.		
	CC	HWANG, J. ET AL. "IA-TCP: A RATE BASED INCAST-AVOIDANCE ALGORITHM FOR TCP IN DATA CENTER NETWORKS", IEEE ICC 2012- COMMUNICATION QOS, RELIABILITY AND MODELING SYMPOSIUM, 2012, PGS. 1292-1296.		
	CD	WILSON, C. ET AL. "BETTER NEVER THAN LATE: MEETING DEADLINES IN DATACENTER NETWORKS", SIGCOMM'11, 2011, PGS. 50-61, TORONTO, ONTARIO, CANADA.		

*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.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

2161069.1

Examiner Signature	Date Considered
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**SOFTWARE DEFINED NETWORKING BASED CONGESTION
CONTROL**

BACKGROUND

[0001] Data centers are facilities that contain computing and storage resources for enabling online services, such as website hosting, cloud computing, cloud storage, telecommunications, and the like. Currently, many online service providers are aggressively building their own data centers in order to provide one or more online services. In the meantime, many hardware manufacturers are also developing cost-effective and high-performance data center switches to meet the service demands of the data centers.

[0002] In addition, Software Defined Networking (SDN) enabled switches have emerged as an important building block in managing the data centers. SDN is an approach to computer networking that allows network administrators to manage network services by decoupling network control functions from data forwarding functions. This allows network administrators to define the network control functions and to define an abstraction of the underlying network infrastructure for desired applications and desired network services.

[0003] However, most data center switches do not address network congestion, which may result in packet losses and may affect a quality of service (QoS) of some data flows. In data centers, packet loss mainly occurs due to momentary data bursts rather than high link utilization. Packet loss due to data bursts can be explained by the bursty nature of traffic in data center networks. Because packet loss can be attributed to data bursts instead of high link utilization, increasing switch capacity may not provide a solution for addressing network congestion in data centers. Some switch-side solutions utilize

Explicit Congestion Notification (ECN) functionality, but such solutions may not be scalable in terms of the number of concurrent data flows. For example, Data Center TCP (DCTCP), which controls a server's sending rate by exploiting the ECN, can endure up to thirty five (35) connections without suffering any packet loss. However, most data centers may have a number of concurrent flows that frequently exceeds thirty five (35) flows per server.

SUMMARY

[0004] At least one example embodiment relates to a method for adjusting bandwidth allocation by a network element in a communications network.

[0005] According to an example embodiment, a method for adjusting bandwidth allocation by a network element in a communications network is provided. The network element includes a target port. The method includes monitoring a data flow traversing the target port. The method includes determining a bandwidth allocation for the target port. The bandwidth allocation for the target port is a bandwidth that is currently allocated for the data flow. The method includes determining a fair-share bandwidth allocation for the target port. The fair-share bandwidth allocation is a proportional allocation of a total bandwidth of the network element. The method includes adjusting the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

[0006] Example embodiments provide that the network element includes a plurality of ports, the plurality of ports includes the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation. Example embodiments provide that the determining the fair-share bandwidth allocation includes determining

a weight value for each of the plurality of ports; determining a total weight value based on the weight value of each of the plurality of ports; and determining the fair-share bandwidth allocation based on the weight value of the target port and the total weight value.

[0007] Example embodiments provide that the monitoring includes receiving a data packet associated with the data flow; determining whether the received data packet is one of a flow termination packet and a flow initiation packet; increasing the total weight value by the weight of the target port if the received data packet is a flow initiation packet; and decreasing the total weight value by the weight of the target port if the received data packet is a flow termination packet.

[0008] Example embodiments provide that the determining the bandwidth allocation for the target port includes determining a link capacity for the target port, where the link capacity is a highest amount of bandwidth that may be allocated to the target port; determining a round trip time (RTT) associated with the data flow; and determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

[0009] Example embodiments provide that the determining the fair-share bandwidth allocation further includes determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and determining a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

[0010] Example embodiments provide that the monitoring includes defining a time out value for a timer, the timer being associated with the bandwidth allocation for the target port; and determining that a timeout event has occurred with respect to the data flow based on expiration of the timer.

[0011] Example embodiments provide that the monitoring further includes receiving a data packet associated with the data flow; resetting the timer to be equal to the timeout value if the timeout event does not occur before the data packet is received; and decreasing the total weight by the weight of the target port if the timeout event does occur before the data packet is received.

[0012] Example embodiments provide that the monitoring further includes increasing the total weight by the weight of the target port when a subsequent data packet is received after the timeout event occurs.

[0013] Example embodiments provide that the monitoring further includes determining a timeout fraction based on a number of times that the total weight is increased by the weight of the target port when the subsequent data packet is received after the timeout event occurs; determining a target fraction based on the timeout fraction; and adjusting the timeout value based on the target fraction.

[0014] Example embodiments provide that the time out value is based on a desired minimum timeout value and a desired maximum timeout value, and the desired minimum timeout value is larger than a RTT associated with the data flow.

[0015] At least one example embodiment relates to a method of adjusting bandwidth allocation by a network controller in a communications network.

[0016] According to an example embodiment, a method of adjusting bandwidth allocation by a network controller in a communications network, where the network controller is configured to control a network element, and the network element includes a target port. The method includes receiving data flow information from the network element. The data flow information includes information about data flows traversing of the target port. The method includes

determining a bandwidth allocation of the target port based on the data flow information. The bandwidth allocation of the target port is a bandwidth that is currently allocated for each of the data flows traversing the target port. The method includes determining an over-subscription ratio. The over-subscription ratio is a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port. The method includes transmitting the over-subscription ratio to the network element based on the over-subscription ratio and a threshold value. The method includes determining a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value. The fair-share bandwidth allocation is a proportional allocation of a total bandwidth of the network element. The method includes adjusting the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

[0017] Example embodiments provide that the network element includes a plurality of ports, the plurality of ports includes the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation. Example embodiments provide that the determining the fair-share bandwidth allocation for the target port includes determining the bandwidth allocation for each of the plurality of ports; determining a weight value for each of the plurality of ports; determining a total weight value based on the weight value for each of the plurality of ports; and determining the fair-share bandwidth allocation for the target port based on the weight value of the target port and the total weight value.

[0018] Example embodiments provide that the determining the bandwidth allocation for each of the plurality of ports includes determining a link capacity for the target port, where the link capacity is a highest amount of bandwidth that is able to be allocated to of the

target port; determining a RTT for one of the data flows traversing the target port; and determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

[0019] Example embodiments provide that the determining the fair-share bandwidth allocation for the target port includes determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and determining a network fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation of the target port.

[0020] Example embodiments provide that the network element is associated with a secondary network element. The secondary network element includes a secondary set of ports, and the secondary network element determines a weighted fair-share bandwidth allocation for each of the secondary set of ports.

[0021] Example embodiments provide that the adjusting the bandwidth allocation for the target port includes determining a data flow traversing the target port and a secondary target port, where the secondary target port is one of secondary set of ports; determining the weighted fair-share bandwidth allocation for the target port and the secondary target port; determining the network fair-share bandwidth allocation for the data flow traversing the target port and the secondary target port; adjusting the bandwidth allocation for the target port based on the weighted fair-share bandwidth allocation when the weighted fair-share bandwidth allocation is less than the network fair-share bandwidth allocation; and adjusting the bandwidth allocation for the target port based on the network fair-share bandwidth allocation when the network fair-share bandwidth allocation is less than the weighted fair-share bandwidth allocation.

[0022] At least one example embodiment relates to an edge switch for adjusting bandwidth allocation in a communications network.

[0023] According to an example embodiment, an edge switch for adjusting bandwidth allocation in a communications network is provided. The edge switch includes a target port. The edge switch configured to monitor a data flow traversing the target port. The edge switch configured to determine a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow. The edge switch configured to determine a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element. The edge switch configured to adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

[0024] Example embodiments provide that the edge switch includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and in the determining the fair-share bandwidth allocation. Example embodiments provide that the edge switch is configured to determine a weight value for each of the plurality of ports. The edge switch is configured to determine a total weight value based on the weight value of each of the plurality of ports. The edge switch is configured to determine the fair-share bandwidth allocation based on the weight value for the target port and the total weight value.

[0025] Example embodiments provide that, in the determining the bandwidth allocation for the target port, the edge switch is configured to determine a link capacity for the target port, the link capacity being a highest amount of bandwidth that is able to be

allocated to the target port; determine a RTT associated with the data flow; determine the bandwidth allocation for the target port by multiplying the link capacity by the RTT; determine a fair-share weight value by dividing the weight value for the target port by the total weight value; and determine a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

[0026] At least one example embodiment relates to a Software Defined Networking (SDN) controller for adjusting bandwidth allocation in a communications network, where the SDN controller is configured to control a core/aggregation switch.

[0027] According to an example embodiment, a SDN controller for adjusting bandwidth allocation in a communications network is provided. The SDN controller is configured to control a core/aggregation switch, and the core/aggregation switch includes a target port. The SDN controller is configured to receive data flow information from the network element. The data flow information includes information about data flows traversing of the target port. The SDN controller is configured to determine a bandwidth allocation of the target port based on the data flow information. The bandwidth allocation of the target port is a bandwidth that is currently allocated for each of the data flows traversing the target port. The SDN controller is configured to determine an over-subscription ratio. The over-subscription ratio is a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port. The SDN controller is configured to transmit the over-subscription ratio to the aggregation switch based on the over-subscription ratio and a threshold value. The SDN controller is configured to determine a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value. The fair-share bandwidth

allocation is a proportional allocation of a total bandwidth of the network element. The SDN controller is configured to adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

BRIEF SUMMARY OF THE DRAWINGS

[0028] The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings, wherein like elements are represented by like reference numerals, which are given by way of illustration only and thus are not limiting of the present invention and wherein:

[0029] FIG. 1 illustrates an example of a data center communications network, according to an example embodiment; and

[0030] FIG. 2 illustrates the components of network devices being employed by a communications network according to an example embodiment;

[0031] FIG. 3 illustrates the components of a network controller being employed by a data center communications network according to an example embodiment;

[0032] FIG. 4 illustrates an operation diagram for operating SDN-based congestion management, according to an example embodiment;

[0033] FIG. 5 shows a weight counting routine, according to an example embodiment;

[0034] FIG. 6 shows a congestion management routine, according to an example embodiment; and

[0035] FIG. 7 shows a timeout handling routine, according to an example embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0036] Various example embodiments will now be described more fully with reference to the accompanying drawings in which some example embodiments of the invention are shown.

[0037] Detailed illustrative embodiments are disclosed herein. However, specific structural and functional details disclosed herein are merely representative for purposes of describing example embodiments of the present invention. This invention may, however, may be embodied in many alternate forms and should not be construed as limited to only the embodiments set forth herein.

[0038] It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first element could be termed a second element, and, similarly, a second element could be termed a first element, without departing from the scope of example embodiments of the present invention. As used herein, the term “and/or,” includes any and all combinations of one or more of the associated listed items.

[0039] It will be understood that when an element is referred to as being “connected,” or “coupled,” to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being “directly connected,” or “directly coupled,” to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., “between,” versus “directly between,” “adjacent,” versus “directly adjacent,” etc.).

[0040] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of example embodiments of the invention. As used herein, the singular forms “a,” “an,” and “the,” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises,” “comprising,” “includes,” and/or “including,” when used herein, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0041] It should also be noted that in some alternative implementations, the functions/acts noted may occur out of the order noted in the figures. For example, two figures shown in succession may in fact be executed substantially concurrently or may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

[0042] Specific details are provided in the following description to provide a thorough understanding of example embodiments. However, it will be understood by one of ordinary skill in the art that example embodiments may be practiced without these specific details. For example, systems may be shown in block diagrams in order not to obscure the example embodiments in unnecessary detail. In other instances, well-known processes, structures and techniques may be shown without unnecessary detail in order to avoid obscuring example embodiments.

[0043] Also, it is noted that example embodiments may be described as a process depicted as a flowchart, a flow diagram, a data flow diagram, a structure diagram, or a block diagram. Although a flowchart may describe the operations as a sequential process, many

of the operations may be performed in parallel, concurrently or simultaneously. In addition, the order of the operations may be rearranged. A process may be terminated when its operations are completed, but may also have additional steps not included in the figure. A process may correspond to a method, a function, a procedure, a subroutine, a subprogram, etc. When a process corresponds to a function, its termination may correspond to a return of the function to the calling function or the main function.

[0044] Moreover, as disclosed herein, the term “memory” may represent one or more devices for storing data, including random access memory (RAM), magnetic RAM, core memory, and/or other machine readable mediums for storing information. The term “storage medium” may represent one or more devices for storing data, including read only memory (ROM), random access memory (RAM), magnetic RAM, core memory, magnetic disk storage mediums, optical storage mediums, flash memory devices and/or other machine readable mediums for storing information. The term “computer-readable medium” may include, but is not limited to, portable or fixed storage devices, optical storage devices, wireless channels, and various other mediums capable of storing, containing or carrying instruction(s) and/or data.

[0045] Furthermore, example embodiments may be implemented by hardware, software, firmware, middleware, microcode, hardware description languages, or any combination thereof. When implemented in software, firmware, middleware or microcode, the program code or code segments to perform the necessary tasks may be stored in a machine or computer readable medium such as a storage medium. A processor(s) may perform the necessary tasks.

[0046] A code segment may represent a procedure, a function, a subprogram, a program, a routine, a subroutine, a module, a software

package, a class, or any combination of instructions, data structures, or program statements. A code segment may be coupled to another code segment or a hardware circuit by passing and/or receiving information, data, arguments, parameters, or memory contents. Information, arguments, parameters, data, etc. may be passed, forwarded, or transmitted via any suitable means including memory sharing, message passing, token passing, network transmission, etc.

[0047] As used herein, the term “user agent” may be considered synonymous to, and may hereafter be occasionally referred to, as a client, mobile, mobile unit, mobile station, mobile user, user equipment (UE), subscriber, user, remote station, access agent, user agent, receiver, etc., and may describe a remote user of network resources in a communications network. Furthermore, the term “user agent” may include any type of wireless/wired device such as consumer electronics devices, smart phones, tablet personal computers, personal digital assistants (PDAs), desktop computers, and laptop computers, for example.

[0048] As used herein, the term “network device”, may be considered synonymous to and/or referred to as a networked computer, networking hardware, network equipment, router, switch, hub, bridge, gateway, or other like device. The term “network device” may describe a physical computing device of a wired or wireless communication network and configured to host a virtual machine. Furthermore, the term “network device” may describe equipment that provides radio baseband functions for data and/or voice connectivity between a network and one or more users.

[0049] Exemplary embodiments are discussed herein as being implemented in a suitable computing environment. Although not required, exemplary embodiments will be described in the general context of computer-executable instructions, such as program

modules or functional processes, being executed by one or more computer processors or CPUs. Generally, program modules or functional processes include routines, programs, objects, components, data structures, etc. that performs particular tasks or implement particular data types. The program modules and functional processes discussed herein may be implemented using existing hardware in existing communication networks. For example, program modules and functional processes discussed herein may be implemented using existing hardware at existing network elements or control nodes (e.g., an edge switch, aggregation switch, or core switch as shown in FIG. 1). Such existing hardware may include one or more digital signal processors (DSPs), application-specific-integrated-circuits, field programmable gate arrays (FPGAs) computers or the like.

[0050] Example embodiments provide methods and systems for Software Defined Networking (SDN)-based congestion management. The example embodiments operate on a software-based virtual switch in a hypervisor, virtual machine monitor (VMM), or other like network controller. Example embodiments allow for multiple concurrent flows per physical server, while reducing packet losses as well as requiring few specific switch capacity upgrades. The example embodiments also support quality of service (QoS)-awareness such that premium and/or high-priority data flows receive more bandwidth than non-premium and/or lower-priority data flows.

[0051] FIG. 1 illustrates an example of a data center communications network, according to an example embodiment. Communications network 100 includes core switch 105, aggregation switches 110, edge switches 115, and server stacks 120.

[0052] Edge switches 115, aggregation switches 110, and core switch 105 ("the switches") may be configured to provide communication services to user agents and/or user devices operating

within a computer network (e.g., an enterprise private network, virtual private network, local area network (LAN), or other like computer network). The switches may also link network segments or other network devices within a computer network. Additionally, in some embodiments, the switches may be configured as virtual local area networks (VLAN). In such embodiments, one or more of the switches may be partitioned to create multiple distinct broadcast domains, which are logically isolated from one another while remaining on the same physical switch.

[0053] The switches may be configured to process and route data (or data packets) at the data link layer (layer 2) of the OSI model, and/or process data (or data packets) at the network layer (layer 3) (i.e., the switches may be considered “multilayer switches”). The switches may employ multiple connection interfaces in order to allow different user agents and/or user devices to connect to a communications network, including Ethernet, Fibre Channel, ATM, ITU-T, G.hn, 802.11, and/or other like connection interfaces. According to various embodiments, where the switches utilize L2/L3 connections to connect two or more devices at the datalink layer (L2) and/or the network layer (L3) of the OSI model, the L2/L3 connections may operate as an enterprise private network, virtual private network, local area network (LAN), or other like computer network.

[0054] An L2 connection may employ a protocol for providing the functional and procedural means to transfer data between network entities. Such protocols may include Ethernet, Point-to-Point Protocol (PPP), High Level Data Link Control (HDLC), or other like protocols already known in the art. An L3 connection may employ a protocol for providing the functional and procedural means of transferring variable length data sequences from a source to a

destination host via one or more networks while maintaining quality of service (QoS) functions. Such protocols may include Internet Protocol version 4 (IPv4), Internet Protocol version 6 (IPv6), or other like protocols already known in the art.

[0055] According to various embodiments, the switches may utilize a WLAN connection to link two or more devices using a wireless distribution method, such as spread-spectrum, orthogonal frequency-division multiplexing (OFDM), or other like wireless distribution method. The WLAN connection may be configured to provide a connection to the Internet for various network elements (e.g., one or more user agents via edge switches 115, aggregation switches 110, and core switch 105). In various embodiments, the WLAN connection may be a Wide Area Network (WAN) or other like network that covers a broad area, such as a personal area network (PAN), local area network (LAN), campus area network (CAN), metropolitan area network (MAN), and the like.

[0056] The switches may include one or more processors, a network interface including one or more transmitters/receivers connected to one or more antennas, a computer readable medium, and (optionally) a display device. The one or more transmitters/receivers may be configured to transmit/receive data signals to/from one or more user agents.

[0057] Server stacks 120 may include one or more servers (i.e., a physical computer hardware system) that is configured to provide services for users connected to a network. The one or more servers of the server stacks 120 may employ connection-oriented protocols such as Session Initiation Protocol (SIP), HTTP, and TCP/IP, and includes servers that use connectionless protocols such as User Datagram Protocol (UDP) and Internet Packet Exchange (IPX). The one or more servers of the server stacks 120 may be configured to establish,

manage, and terminate communications sessions between user agents, user devices, virtual machines, and/or other like computing entities. To this end, the one or more servers of the server stacks 120 may be configured to receive/send communication requests from/to computing entities, as well as correlate the unique IDs of the computing entities with an IP address of the computing entities, and once a communication session is setup, allowing two computing entities to transfer data using a direct communications session.

[0058] FIG. 2 illustrates the components of network devices 205 being employed by the communications network 100, according to an example embodiment. In various embodiments, the network devices 205 may be a server, such as one or more servers of the server stacks 120, or other like computing entities. In various embodiments, the SDN controller 230 may be a network controller that is capable of obtaining data packets associated with one or more data flows, controlling one or more characteristics of data flows (e.g., alter the data flow's path, adjusting the bandwidth allocated data flows, and the like), collecting statistics and/or other like information about data flows, and the like. In most embodiments, the SDN controller 230 resides on any one of the switches (e.g., edge switches 115, aggregation switches 110, and/or core switch 105). However, in alternate embodiments, the SDN controller 230 may reside on separate physical computing device (not shown).

[0059] As shown, network devices 205 include virtual machines (VMs) 210-11, 210-12, 210-21, and 210-22 ("the VMs 210"); virtual network interface cards (vNICs) 215-11, 215-12, 215-21, and 215-22 ("the vNICs 215"); virtual switches (VSs) 220-1, 220-2 ("the VSs 220"); and physical network interface cards (pNICs) 225-11, 225-12, 225-21, and 225-22 ("the pNICs 225"). During operation, the network devices 205 may communicate with SDN controller 230 and/or one or more of

the switches of communications network 100. In various embodiments, the network devices 205 may include many more components than those shown in FIG. 2. However, it is not necessary that all of these generally conventional components be shown in order to disclose the illustrative embodiments.

[0060] It should be noted that, although not shown, network devices 205 may include one or more processors and one or more memory devices. The memory devices may be computer readable storage media that generally includes a random access memory (RAM), read only memory (ROM), and a permanent mass storage device, such as a disk drive. The memory may also store an operating system and/or program code. The one or more processors may be configured to carry out instructions of the operating system and/or program code by performing the basic arithmetical, logical, and input/output operations of the system. Instructions may be provided to the one or more processors by the memory, or via the pNIC and/or vNIC.

[0061] The VMs 210 may be any software implementation and/or emulation of a computing environment that executes programs and/or applications like a physical computing device that is being emulated. The VMs 210 may request processor and/or memory resources via a virtualization layer (not shown), which translates requests to the underlying physical hardware. The virtualization layer may include a hypervisor, VMM, and/or other like virtualization platform that runs on top of an operating system of the network devices 205.

[0062] The vNICs 215 may be any software implementation and/or emulation of a network interface card, such that the vNICs 215 may function as conventional network interface cards. The vNICs 215 may be designed to operate with one or more operating systems,

hypervisors, VMMs, and/or other like applications. The vNICs 215 connects the VMs 210 to a computer network (e.g., communications network 100) via a virtualized wired or virtualized wireless connection.

[0063] The VSs 220 may be any software implementation and/or emulation of a computing device that allows one or more VMs (e.g., VMs 210) to communicate with each other by monitoring and forwarding one or more data packets from one virtual machine to another. In various embodiments, the VSs 220 allow the VMs 210 to communicate with one another using the same or similar communications protocols that would be used over one or more physical switches, without the need for additional networking hardware. The VSs 220 may enable communication between one or more virtual machines residing on the same physical device (e.g., between VM 210-12 and VM 210-11) and/or between one or more virtual machines residing on different physical devices (e.g., between VM 210-12 and VM 210-21).

[0064] The pNICS 225 are physical computer hardware components that connect the network devices 205 to a computer network via a wired or wireless connection. In embodiments utilizing a wireless connection, the pNICs 225 may operate in conjunction with a wireless transmitter/receiver and/or transceiver (not shown) that is configured to operate in accordance with the IEEE 802.11-2007 standard (802.11), the Bluetooth standard, and/or any other like wireless standards. In embodiments utilizing a wired connection, pNICs 225 may be configured to operate in accordance with a wired communications protocol, such as a serial communications protocol (e.g., the Universal Serial Bus (USB), FireWire, Serial Digital Interface (SDI), and/or other like serial communications protocols), a parallel communications protocol (e.g., IEEE 1284, Computer Automated Measurement And Control (CAMAC), and/or other like parallel

communications protocols), and/or a network communications protocol (e.g., Ethernet, token ring, Fiber Distributed Data Interface (FDDI), and/or other like network communications protocols).

[0065] During operation, a VM 210 may transmit data to a corresponding VS 220 via a corresponding vNIC 215, where the VS 220 is managed by the SDN controller 230. Each VM 210 communicates with an underlying VS 220 through its vNIC 215. The VS 220 forwards data packets to the data center network through the pNIC 225. A hypervisor and/or VMM (not shown) converts commands and/or operations issued by the VMs 210 into a format suitable for the underlying physical hardware, and controls and manages the physical resources of the physical machine for each VM 210. The VSs 220 may convert data packets and/or data flows being sent by the VMs 210 into a format suitable for a corresponding pNIC 225.

[0066] For example, VM 210-12 may communicate with VM 210-21 by transmitting data packets to VS 220-1 via vNIC 215-12. VS 220-1 converts and forwards the data packets to pNIC 225-1, which then forwards the data packets to pNIC 225-2 through the communications network 100. Once received, the data packets are forwarded from the pNIC 225-2 to VS 220-2, which then converts the data packets into a suitable format for VM 210-21, if necessary. The converted data packets are then transmitted to VM 210-21 via vNIC 215-21.

[0067] By way of another example, VM 210-12 may communicate with VM 210-11 by transmitting data packets to VS 220-1 via vNIC 215-12. Because VM 210-12 and VM 210-11 reside on the same physical device, VS 220-1 converts the data packets into a format suitable for VM 210-11, and forwards the data packets to VM 210-11 via vNIC 215-11.

[0068] It should be noted that, in both of the aforementioned examples, the data packets may be associated with a data flow and/or data stream. In both of the aforementioned examples, the SDN controller 230 may manage the allocation of physical resources for each data flow based on a packet type of a given data flow and a round-trip delay time (RTD), a round-trip time (RTT), a timeout event, or other like transmission timing of the data packets associated with a data flow.

[0069] In many data communications networks (e.g., communications network 100), network congestion may occur at the physical network switches. Generally, physical network switches consist of multiple input and output ports, where each port is shared by multiple data flows. The output-port (hereinafter, “port”) is where network congestion in data centers mainly occurs. Therefore, example embodiments provide for congestion management and/or congestion avoidance schemes for (i) edge switches (e.g., edge switches 115) and (ii) Aggregation/Core switches (e.g., aggregation switches 110 and core switch 105). To this end, the SDN controller 230 may be configured to monitor the ports of the VSs 220, detect and/or identify which ports are being used for transmitting data flows, and control the VSs 220 to allocate more or less resources to the data flows based on the characteristics and/or timing of the data flows. In various embodiments, the VSs 220 may monitor their own ports and may send information about data flows traversing their ports to the SDN controller 230.

[0070] FIG. 3 illustrates the components of SDN controller 230 being employed by the communications network 100, according to an example embodiment. It should be noted that any one of the network devices as shown in FIG. 1 (e.g., edge switches 115, aggregation switches 110, and core switch 105) may include the SDN controller

230, and the switches may have a similar configuration of components as shown in FIG. 2. As shown, SDN controller 230 includes processor 310, bus 320, network interface 330, transmitter 340, receiver 350, and memory 355. During operation, memory 355 includes operating system 360, weight counting routine 500, congestion management routine 600, and timeout handling routine 700. In some embodiments, SDN controller 230 may include many more components than those shown in FIG. 3. However, it is not necessary that all of these generally conventional components be shown in order to disclose the illustrative embodiment.

[0071] Memory 355 may be a computer readable storage medium that generally includes a random access memory (RAM), read only memory (ROM), and a permanent mass storage device, such as a disk drive. Memory 355 also stores operating system 360 and program code for weight counting routine 500, congestion management routine 600, and timeout handling routine 700. These software components may also be loaded from a separate computer readable storage medium into memory 355 using a drive mechanism (not shown). Such separate computer readable storage medium may include a floppy drive, disc, tape, DVD/CD-ROM drive, memory card, or other like computer readable storage medium (not shown). In some embodiments, software components may be loaded into memory 355 via network interface 330, rather than via a computer readable storage medium.

[0072] Processor 310 may be configured to carry out instructions of a computer program by performing the basic arithmetical, logical, and input/output operations of the system. Instructions may be provided to processor 310 by memory 355 via bus 320.

[0073] Bus 320 enables the communication and data transfer between the components of SDN controller 230. Bus 320 may comprise a high-speed serial bus, parallel bus, storage area network (SAN), and/or other suitable communication technology.

[0074] Network interface 330 is a computer hardware component that connects SDN controller 230 to a computer network via a wired or wireless connection.

[0075] Transmitter 340 may be any type of hardware device that may generate, or otherwise produce, radio waves in order to communicate with one or more other devices. Transmitter 340 may be coupled with an antenna (not shown) in order to transmit data to one or more other devices. Transmitter 340 may be configured to receive digital data from one or more components of BPS 120 via bus 220, and convert the received digital data into an analog signal for transmission over an air interface.

[0076] Receiver 350 may be any type of hardware device that can receive and convert a signal from a modulated radio wave into usable information, such as digital data. Receiver 350 may be coupled with an antenna (not shown) in order to capture radio waves. Receiver 350 may be configured to send digital data converted from a captured radio wave from one or more other network elements (e.g., one or more servers of the server stacks 120, edge switches 115, aggregation switches 110, and core switch 105) to one or more other component via bus 220. In various embodiments, a transceiver (not shown) may be included with SDN controller 230. A transceiver may be a single component configured to provide the functionality of transmitter 340 and receiver 350 as discussed above.

[0077] FIG. 4 illustrates an operation diagram for operating SDN-based congestion management, according to an example embodiment. In the example illustrated by FIG. 4, it is assumed that

communication occurs between VM 210-21 and VM 210-12 in communications network 100, via edge switch 115-11, aggregation switch 110-1, and edge switch 115-12. In the example embodiment illustrated by FIG. 4, it is assumed that the uplink capacity for the edge switches is 1 Gbps and the uplink capacity for aggregate and/or core switches is 10 Gbps.

[0078] According to various embodiments, congestion management and/or congestion avoidance schemes may operate differently for edge switches (e.g., edge switches 115) and aggregation/core switches (e.g., aggregation switches 110 and core switch 105).

[0079] In order to manage network congestion at each edge switch 115, the SDN controller 230 monitors all data flows that traverse each port of each edge switch 115. Because each server is directly connected to each port of edge switch 105 through a corresponding pNIC 225, the SDN controller 230 may keep track of each data flow that traverses each port of each edge switch 115. In various embodiments, the SDN controller 230 may monitor each port of each VS 220 in order to obtain data flow information. In such embodiments, the SDN controller 230 obtains or otherwise determines data flow information for data flows that traverse each port of each edge switch 115. Additionally, in such embodiments the SDN controller 230 computes, calculates, or otherwise determines a fair-share bandwidth allocation and/or weighted fair-share bandwidth allocation for each data flow. The fair-share bandwidth allocation is a proportional allocation of a total bandwidth, such that each port of an edge switch is allocated a proportional amount of bandwidth. The weighted fair-share bandwidth allocation is a proportional allocation of a total bandwidth, such that each port of an edge switch is allocated a proportional amount of bandwidth based on a weight value

associated with data flows traversing each port. The weight values may be based on a QoS required for a data flow, a premium status and/or priority status associated with a data flow, a round trip time (RTT) and/or delay associated with a data flow, and the like. The fair-share and/or weighted fair-share bandwidth allocations are determined in order to limit a total utilization of each edge switch 115 according to a bandwidth-delay product (BDP) of each data flow. The BDP is the product of a data link's capacity (in bits per second) and its end-to-end delay and/or RTT.

[0080] Once the SDN controller 230 determines the bandwidth allocation for each edge switch 115, the SDN controller 230 sends fair-share information to a corresponding edge switch 115. In various embodiments, the SDN controller 230 sends the fair-share information to each edge switch 115 by utilizing and modifying an advertisement window field in a TCP header. Thus, in order to avoid or otherwise reduce network congestion at each port of each edge switch 115, each edge switch 115 may be informed of an appropriate data size and/or an appropriate bandwidth allocation for transmitting data packets of a data flow over a target port based on the RTT of the data packets of the data flow.

[0081] In order to manage network congestion at each aggregation switch 110 and/or core switch 105, the SDN controller 230 may obtain data flow information from each aggregation switch in order to determine a network fair-share bandwidth allocation for each port of each aggregation switch 110 and/or each port of core switch 105. The network fair-share bandwidth allocation is a proportional allocation of a total bandwidth, such that each port of an aggregation/core switch is allocated a proportional amount of bandwidth based on a total weight value associated with all data flows traversing each port. The weight values may be based on a QoS

required for a data flow, a premium status and/or priority status associated with a data flow, a round trip time (RTT) and/or delay associated with a data flow, and the like.

[0082] Using the data flow information of each VS 220, the SDN controller 230 may deduce or otherwise determine each port of each VS 220 where a data flow traverses based on the source and/or destination of the data flow. The SDN controller 230 may periodically gather or otherwise obtain the data flow information from each VS 220 in the communications network 100, and sum a number of all the data flows traversing each port of each VS 220. In other words, the SDN controller 230 has a global view for all data flows in the communications network 100. Since the SDN controller 230 has a global view for all data flows, the SDN controller 230 can compute an over-subscription ratio for each port of each VS 220. The over-subscription ratio is transmitted from the SDN controller 230 to the network element when the over-subscription ratio is less than one (1). If the over-subscription ratio is less than one (1), the SDN controller 230 reports over-subscription related information to the corresponding VS 220 so that each aggregation/core switch can determine a fair-share bandwidth allocation for each data flow. The fair-share bandwidth allocation determined by each aggregation/core switch is based on a network fair-share bandwidth allocation calculated by the SDN controller 230 and the weighted network fair-share bandwidth allocation.

[0083] In various embodiments, to keep track of the total weight of active data flows, the SDN controller 230 creates a local flow table for each VS 220. A flow table is a set of data elements associated with a data flow. The flow table is used to match incoming packets to a particular data flow and to specify the functions that are to be performed on the data packets. The open flow tables include various

fields, such as a “match” field comprising of MAC/IP addresses, TCP port, and the like; a “weight” and/or “priority” field; a “timeout” field; a “path” field; a “reported_sum_weight” field; and/or other like fields. In various embodiments, the SDN controller 230 may use data flow initiation packets (e.g., a TCP SYN packet) to detect new data flows and data flow termination packets (e.g., a TCP FIN packet) to detect expired data flows. Whenever a new data flow is created (e.g., when a TCP-SYN packet is received), the SDN controller 230 inserts a new flow entry to the local flow table associated with the VS 220. The SDN controller 230 then increases a total weight value each data flow traversing the VS 220 (W_i) by a weight value associated with the data flow traversing a target port (w_k). On the other hand, whenever a flow is closed, expired, and/or terminated (e.g., a TCP-FIN packet is received), the SDN controller 230 decreases W_i by w_k and deletes the corresponding flow entry from the local flow table.

[0084] In various embodiments, the SDN controller 230 may also decrease W_i by w_k if a timer associated with a data flow entry expires. In such embodiments, the SDN controller 230 may decrease W_i by w_k even if a data flow termination packet is not received. However, when the SDN controller 230 receives a data packet of a data flow that exists in the local flow table, a timer associated with the data flow is refreshed to a desired timeout value. If the timeout value is zero (0), which may indicate that the timer has previously expired, the the SDN controller 230 increases W_i by w_k and restores the timeout value to the desired timeout value.

[0085] Furthermore, in various embodiments, each data flow may be associated with a priority level. A priority level may be any type of indication by which data flows are given access to network resources, where data flows with a higher priority are given access to, or a preference for, network resources before lower priority data

flows. Thus, the SDN controller 230 may allocate a larger share of the bandwidth for a higher priority data flow than a lower priority data flow. A data flow may be assigned or otherwise associated with a priority level based on whether the data flow originates from a trusted domain, a service type of the data flow, an application type associated with the data flow, a source or destination of the data flow, a subscription status associated with a source or destination of the data flow, and/or other like criteria associated with the data flow. The priority levels may be used to influence the weight values assigned or otherwise associated with a data flow.

[0086] Referring to FIG. 4, a data flow traverses port 4 of edge switch 115-12, port 3 of aggregation switch 110-1, and port 1 of edge switch 115-11. As discussed above, the uplink capacity for the edge switches is 1 Gbps and the uplink capacity for aggregate and/or core switches is 10 Gbps. When the first packet of the data flow arrives in the VS 220-1 of the network device 205-1, the SDN controller 230 determines a number of data flows that traverse a target port (e.g., port 1) of edge switch 115-11. The SDN controller 230 then determines an uplink capacity (or alternatively, a “link capacity”) of edge switch 115-11 and a RTT of the data flows traversing the target port. The BDP can be calculated using equation 1 shown below:

$$\text{BDP} = \text{link_capacity}_i \times \text{RTT} \quad [\text{Equation 1}]$$

[0087] In equation 1, link_capacity_i is the link capacity of a target port of an i th pNIC. RTT is the round trip time of at least one data flow traversing a target port of the i th pNIC. In the example embodiment illustrated by FIG. 4, when the first packet of a data flow arrives in the VS 220-1 of the network device 205-1, the SDN controller 230 determines that the port 1 (i.e., the target port) of edge

switch 115-11 is shared by five (5) data flows by counting a number of data flows traversing port 1 of edge switch 115-11. For the example embodiment illustrated by FIG. 4, it is assumed that each data flow traversing port 1 of edge switch 115-11 has an equal weight value. Because the link capacity of edge switch 115-11 is 1 Gbps, and assuming a RTT of the data flows traversing port 1 of edge switch 115-11 is 200µs, the BDP for port 1 of edge switch 115-11 is 25,000 bytes.

[0088] The SDN controller 230 then determines a weighted fair-share bandwidth allocation for data flows that traverse the port 1 of edge switch 115-11. The weighted fair-share bandwidth allocation of a data flow is computed using the BDP shown in equation 2:

$$\text{weighted_fair_share}_{ki} = \text{BDP} \times (w_k / W_i) \quad [\text{Equation 2}]$$

[0089] In equation 2, $\text{weight_fair_share}_{ki}$ is the weighted fair-share bandwidth allocation of a data flow k traversing a target port of the i th pNIC. The BDP is calculated using the link capacity of the target port of the i th pNIC and the RTT associated with data packets of the data flow k as shown in equation 1. w_k is a weight value assigned to or otherwise associated with the data flow k and W_i is a total weight value of the i th pNIC. The total weight value W_i is a sum of all the weight values for each of the ports of the i th pNIC.

[0090] The bandwidth allocated to the data flow k is weighted by the priorities assigned to the data flow k . In various embodiments, the weight value of the data flow k may be obtained from the “weight” field of a local flow table associated with VS 220-1. It should be noted that, in the instance that each of the data flows are treated equally (i.e., where each w_k has an equal value, such as 1), then W_i will indicate a number of active data flows traversing a virtual switch through the i th pNIC.

[0091] Referring back to FIG. 4, the SDN controller 230 determines that the weight value assigned to or otherwise associated with the data flow k is 5 (W_1 as shown in FIG. 4). Using equation 2, and because the weights for each data flow traversing port 1 are equal, the weighted fair-share bandwidth allocation for port 1 of edge switch 115-11 is 5,000 bytes.

[0092] For the aggregation switch 110-1, the SDN controller 230 computes a network fair-share bandwidth allocation of the data flow k . The network fair-share bandwidth allocation is a weighted fair-share for a target port at a aggregation/core switch. In various embodiments, the aggregation switch 110-1 periodically reports (e.g., every one second) data flow information to the SDN controller 230. The data flow information includes the weight value of the data flow k and the end-to-end path of the data flow k .

[0093] Referring to FIG. 4, the data flow traverses port 4 of edge switch 115-12, port 3 of aggregation switch 110-1 (i.e., A(1,3) as shown in FIG. 4), and port 1 of edge switch 115-11. In various embodiments, the data flow information is obtained from the “path” field of a local flow table associated with aggregation switch 110-1. With the data flow information, the SDN controller 230 computes an over-subscription ratio for each port of aggregation switch 110-1.

[0094] As discussed above, the over-subscription ratio is a ratio of the bandwidth allocation of a target port to a number of data flows traversing the target port. Over-subscription occurs when a total bandwidth assigned to a target port is greater than a highest possible bandwidth that the target port can be allocated. When a target port is oversubscribed, network congestion is likely to occur.

[0095] The over-subscription ratio is expressed as 1:N, where the number N represents (i) a number of network devices that are connected to a target port of an aggregation/core switch, and (ii) a

bandwidth allocation for each of the network devices that are connected to the target port of the aggregation/core switch. The number N increases or decreases whenever network devices using the target port of the aggregation/core switch are added or removed.

[0096] Referring to FIG. 4, when the first packet of a data flow arrives in the aggregation switch 110-1, aggregation switch 110-1 determines that port 3 of aggregation switch 110-1 is shared by twenty (20) data flows by counting a number of data flows traversing port 3 of aggregation switch 110-1. The aggregation switch 110-1 then sends data flow information to the SDN controller 230, where the data flow information indicates that port 3 of aggregation switch 110-1 is shared by twenty (20) data flows. Since the link capacity of aggregation switch 110-1 is 10 Gbps and the link capacity for edge switch 115-11 is 1 Gbps, the number N for aggregation switch 110-1 increases or decreases by one (1) whenever ten (10) network devices using the port 3 of the aggregation switch 110-1 are added or removed. Since the twenty (20) data flows are traversing port 3 of aggregation switch 110-1 and the link capacity of aggregation switch 110-1 is 10 Gbps, the SDN controller 230 calculates the over-subscription ratio to be 1:2, and thus, the SDN controller 230 determines that aggregation switch 110-1 is over-subscribed.

[0097] In various embodiments, the SDN controller 230 stores the over-subscription ratio in the “reported_sum_weight” field of each local flow table that includes a data flow that traverses a target port. In most embodiments, the over-subscription ratio is stored in the “reported_sum_weight” field when the new value for the “reported_sum_weight” field is larger than the existing value in the “reported_sum_weight” field. In this way, a target port experiencing an over-subscription or a “bottleneck” may be determined by obtaining information from the “reported_sum_weight” field of a local flow table.

[0098] Once the over-subscription ratio is determined, the SDN controller 230 calculates or otherwise determines the network fair-share bandwidth allocation of a data flow k traversing a target port of the i th pNIC using equations 3 and 4:

$$\text{BDP} = \text{link_capacity}_{S(m,n)} \times \text{RTT} \quad [\text{equation 3}]$$

$$\text{network_fair_share}_{ki} = \text{BDP} \times (w_k / W_{S(m,n)}) \quad [\text{equation 4}]$$

[0099] In equation 3, $\text{link_capacity}_{S(m,n)}$ is the link capacity of a target port of the $S(m,n)$ switch, where S indicates a switch type (e.g., an “A” for aggregation switch or “C” for core switch), m is a switch number, and n is a port number of the switch. RTT is the round trip time of the data flow k traversing the target port of the the switch (i.e., the $S(m,n)$ switch). In the example embodiment illustrated by FIG. 4, when the first packet of a data flow arrives in the aggregation switch 110-1 (i.e., A(1,3) as shown in FIG. 4), aggregation switch 110-1 determines that port 3 of aggregation switch 110-1 is shared by twenty (20) data flows by counting a number of data flows traversing port 3 of aggregation switch 110-1. Because the link capacity of aggregation switch 110-1 is 10 Gbps, and assuming a RTT of the data flows traversing port 3 of aggregation switch 110-1 is 200 μ s, the BDP for port 3 of aggregation switch 110-1 is 250,000 bytes.

[00100] In equation 4, $\text{network_fair_share}_{ki}$ is the network fair-share bandwidth allocation of a data flow k traversing a target port of the i th pNIC is determined by the aggregation switch 110-1. The BDP is calculated using the link capacity of the target port of the $S(m,n)$ switch and the RTT associated with data packets of the data flow k as shown in equation 3. w_k is a weight value assigned to or otherwise associated with the data flow k . $W_{S(m,n)}$ is a total weight value of the $S(m,n)$ switch. The total weight value $W_{S(m,n)}$ is a sum of all the weight

values for each of the data flows traversing each of the ports of the $S(m,n)$ switch. As discussed above, the bandwidth allocated to the data flow k is weighted by the priorities assigned to the data flow k , and the weight value of the data flow k may be obtained from the “weight” field of a local flow table.

[00101] Referring back to FIG. 4, the SDN controller 230 determines that the weight value assigned to or otherwise associated with the data flow k is 20 ($W_{A(1,3)}$ as shown in FIG. 4). Using equation 4, and assuming that the weights for each data flow traversing port 3 are equal, the network fair-share bandwidth allocation for port 3 of aggregation switch 110-1 is 12,500 bytes.

[00102] Once the network fair-share bandwidth allocation is determined, the SDN controller 230 sends the network fair-share bandwidth allocation to a corresponding aggregation/core switch (e.g., aggregation switch 110-1). In some embodiments, the SDN controller 230 sends the network fair-share bandwidth allocation with the over-subscription ratio to the corresponding aggregation/core switch. The network fair-share bandwidth allocation is then used by the aggregation/core switch to adjust a bandwidth allocation of the target port.

[00103] Additionally, in various embodiments, an aggregation/core switch may obtain the weighted fair-share bandwidth allocations from each of edge switch, as well as the network fair-share bandwidth allocation from SDN controller 230. In such embodiments, the aggregation/core switch may then determine a fair-share bandwidth allocation for the data flow based on one or both of the weighted fair-share bandwidth allocations and the network fair-share bandwidth allocation. In various embodiments, the aggregation/core switch may adjust a bandwidth allocation for the data flow traversing the target port to be a minimum value between

the weighted fair-share bandwidth allocation and the network fair-share bandwidth allocation.

[00104] Referring back to FIG. 4, because the data flow traverses port 4 of edge switch 115-12, port 3 of aggregation switch 110-1, and port 1 of edge switch 115-11; the aggregation switch 110-1 obtains the weighted fair-share bandwidth allocations from each of edge switch 115-12 and edge switch 115-11, as well as the network fair-share bandwidth allocation from SDN controller 230. The aggregation switch 110-1 may determine a fair-share bandwidth allocation for the data flow based on the weighted fair-share bandwidth allocations and the network fair-share bandwidth allocation. Because the weighted fair-share value is 5,000 bytes and the network fair-share value is 12,500 bytes, the aggregation switch 110-1 may determine the fair-share bandwidth allocation for the data flow to be the weighted fair-share bandwidth allocation.

[00105] Once the fair-share bandwidth allocation is determined, the aggregation/core switch may adjust a current bandwidth allocation for the data flow according to the determined fair-share bandwidth allocation. In various embodiments, an advertisement window value in a TCP header ("awnd" as shown in FIG. 4) may be replaced by the minimum value between the weighted fair-share bandwidth allocation and the network fair-share bandwidth allocation. The advertisement window is used to determine a maximum amount of data that can be sent before a sending entity must wait for an acknowledgement from a receiving entity. Using the advertisement window, the receiving entity may manage data flow control. With the advertisement window value in the TCP header, the receiving entity may continually inform the sending entity of how much data it is prepared to receive. Thus, by altering the advertisement window value in the TCP header, a host and/or virtual

machine may be informed about an appropriate data size to transmit to another host and/or virtual machine. Additionally, by altering the advertisement window value in the TCP header, the bandwidth allocation may be adjusted along an entire path of a data flow (i.e., an end-to-end path), such that each node that a data flow traverses may adjust its bandwidth allocation accordingly.

[00106] In the example embodiment illustrated by FIG. 4, the weighted fair-share value is 5,000 bytes and the network fair-share value is 12,500 bytes, so the advertising window of the TCP header will be altered to indicate that the bandwidth allocation should be limited to 5,000 bytes.

[00107] FIG. 5 shows a weight counting routine 500, according to an example embodiment. According to example embodiments, weight counting routine 500 is operated by SDN controller 230 in communications network 100. Weight counting routine 500 may be used to apply and/or adjust a weight value assigned to a target port associated with a data flow. By adjusting the weight value associated with the target port, the bandwidth allocation of the data flow may be adjusted.

[00108] As shown in operation S505, SDN controller 230 is informed that a data packet of a data flow is received in the VS 220 from the pNIC 205. According to various embodiments, SDN controller 230 may be able to monitor all ports of each VS 220 (referred to as monitoring globally). In such embodiments, SDN controller 230 may be configured to automatically detect and/or identify which ports are being used for transmitting and/or receiving data flows. In other embodiments, SDN controller 230 receive data flow information from each VS 220 in order to determine and/or identify which ports are being used for transmitting and/or receiving data flows. Thus, in various embodiments, SDN controller 230 tracks packets that arrive

in the VS 220 from the pNIC 205 via an output-port of the edge switch 115.

[00109] As shown in operation S510, the SDN controller 230 determines if the received data packet is a flow termination packet. In various embodiments, the flow termination packet may be a TCP packet that has a FIN bit set in the TCP header. In such embodiments, the TCP packet with a set FIN bit may serve as a connection termination request.

[00110] If in operation S510 the SDN controller 230 determines that the received packet is a flow termination packet, the SDN controller 230 proceeds to operation S515 to remove an entry associated with the data flow from a local flow table of VS 220. After the entry associated with the data flow is removed from the local flow table, the SDN controller 230 proceeds to operation S555 to decrease the total weight value of all the active data flows (W_i) by the weight value associated with the data flow traversing the target port (w_k).

[00111] If in operation S510 the SDN controller 230 determines that the received packet is not a flow termination packet, then the SDN controller 230 proceeds to operation S520 to determine if the received data packet is a flow initiation packet. In various embodiments, the flow initiation packet may be a TCP packet that has a SYN bit set in the TCP header. In such embodiments, the TCP packet with a set SYN bit may serve as a session initiation request.

[00112] If in operation S520 the SDN controller 230 determines that the received packet is a flow initiation packet, the SDN controller 230 proceeds to operation S525 to create an entry associated with the data flow in the local flow table of VS 220. A flow table may be a set of data elements that includes information associated with a data flow. The flow table may be used to match incoming data packets to a particular data flow and may specify one or more functions that are to

be performed on the data packets. The open flow table may include various fields, such as a “match” field comprising of MAC/IP addresses, TCP port, and the like; a “weight” and/or “priority” field; a “timeout” field; a “path” field; a “reported_sum_weight” field; and/or other like fields.

[00113] After the entry associated with the data flow is created in the local flow table, the SDN controller 230 proceeds to operation S535 to increase the total weight value of all the active data flows (W_i) by the weight value associated with the given data flow (w_k).

[00114] If in operation S520 the SDN controller 230 determines that the received packet is not a flow initiation packet, then the SDN controller 230 proceeds to operation S530 to determine if a timeout value associated with the data flow is zero (0). A timeout value may be a parameter that specifies a period of time that is allowed to elapse before a specified event is to take place, unless another specified event occurs first. In various embodiments, a timeout value may be a value of a timer, which indicates that a timeout event has occurred when the timer reaches the timeout value. According to various embodiments, when the timer reaches the timeout value, the SDN controller 230 may determine that the data flow is in an idle state. Conversely, if the timeout value is zero (0), then the SDN controller 230 may determine that the data flow is in a streaming state.

[00115] Typically, bandwidth allocated to data flows in an idle state is unused while the data flows remain idle, which may result in wasted bandwidth. Additionally, bursty-type data flows, while not idle, may require less bandwidth than streaming-type data flows. This is because bursty-type data flows and/or idle data flows typically have lower data transmission rates such that the bursty-type data flows and/or idle data flows have longer time periods and/or time intervals between transmitting data packets. Thus, bursty-type data flows

and/or idle data flows typically require less bandwidth than streaming-type data flows. By contrast, streaming-type data flows typically have higher data transmission rates such that the streaming-type data flows have shorter time periods and/or time intervals between transmitting data packets. Thus, streaming-type data flows typically require more bandwidth than bursty-type data flows and/or idle data flows. Thus, in order to reduce wasted bandwidth, the SDN controller 230 may reduce a weight value of a data flow in order to allocate bandwidth away from bursty-type data flows and/or idle data flows.

[00116] Thus, if in operation S530 the SDN controller 230 determines that the timeout value is zero (0), then the SDN controller 230 proceeds to operation S535 to increase the total weight value of all the active data flows (W_i) by the weight value associated with the given data flow (w_k). However, if in operation S530 the SDN controller 230 determines that the timeout value is not zero (0), the SDN controller 230 proceeds to operation S540 to refresh the timer value and to detect whether a timeout event has occurred. The detection of a timeout event is described with respect to FIG. 7.

[00117] As shown in operation S545, the SDN controller performs congestion management routine 600. The congestion management routine 600 is described with respect to FIG. 6.

[00118] As shown in operation S550, the data packet is forwarded to the receiving VM. In various embodiments, a TCP header of the data packet may indicate a destination port, which identifies the port of the receiving pNIC 205. Once the data packet is forwarded to the receiving virtual machine, the SDN controller 230 proceeds back to operation S505 to determine if a data packet of a data flow is received in the VS 220 from the pNIC 205.

[00119] FIG. 6 shows a congestion management routine 600, according to an example embodiment. According to example embodiments, congestion management routine 600 is operated by SDN controller 230 in communications network 100. Congestion management routine 600 is used to adjust the bandwidth allocation for a data flow traversing a target port.

[00120] As shown in operation S605, the SDN controller 230 detects that data packet is received in the VS 220 of the receiving VM.

[00121] As shown in operation S610 the SDN controller 230 calculates the weighted fair-share value and the network fair-share value. The weighted fair-share value and the network fair-share value are calculated as discussed above with respect to FIG. 4.

[00122] As shown in operation S615, the SDN controller 230 adjusts the current bandwidth allocation to a minimum value between the weighted fair-share value and the network fair-share value. In various embodiments, the current bandwidth allocation may be adjusted as discussed above with respect to FIG. 4, for example, by altering or otherwise replacing the advertisement window value in the TCP header with the minimum value between the weighted fair-share bandwidth allocation and the network fair-share bandwidth allocation.

[00123] As shown in operation S620, the data packet is sent to the receiving VM.

[00124] FIG. 7 shows a timeout handling routine 700, according to an example embodiment. According to example embodiments, timeout handling routine 700 is operated by SDN controller 230 in communications network 100. As discussed above, in various embodiments, the SDN controller 230 may adjust the weight value associated with a given data flow based on a RTT of the data flow's data packets. By adjusting the weight value associated with the data

flow based on the timing of the data flow's data packets, the SDN controller 230 may allocate less bandwidth to bursty-type data flows and allocate more bandwidth to streaming-type data flows.

[00125] Referring to FIG. 7, as shown in operation S705, the SDN controller 230 is initiated to detect whether a timeout event. As shown in operation S710, the SDN controller 230 determines whether a timeout event has occurred. A timeout event may be any event that occurs at the end of a desired period of time. As discussed above with respect to FIG. 5, a timeout event may include an expiration of a timer associated with a data flow, where the timer is set with a desired timeout value. According to various embodiments, when the timer reaches the timeout value, the SDN controller 230 may determine that the data flow is in an idle state.

[00126] It should be noted that if the timeout value is relatively large, the SDN controller 230 may be slow to detect idle data flows. In such instances, bandwidth allocated to those data flows may be unused while the data flows remain in the idle state, thereby resulting in wasted bandwidth. However, if the timeout value is relatively small, the SDN controller 230 may determine that a data flow is in an idle state when it is not actually in an idle state (e.g., a "false alarm" or a "false positive"). In such instances, extra overhead may occur as a result of the SDN controller 230 adjusting the weight values more frequently than necessary.

[00127] Therefore, in various embodiments, the timeout value may be dynamically adjusted in order to reduce the chances that bandwidth is allocated to idle data flows and/or to reduce the chances that false positives are detected. The timeout value may be dynamically adjusted between a minimum value $T_{\min}$ and a maximum value $T_{\max}$. The values $T_{\min}$ and $T_{\max}$ may be set differently for each virtual switch. In various embodiments, values $T_{\min}$ and $T_{\max}$ may be

any value, however, in many embodiments, $T_{\min}$ is set to a value that is larger than a RTT for a data flow traversing the target port.

[00128] In various embodiments, the timeout value may be set by the SDN controller 230 based on a timeout fraction. The timeout fraction may be based on a number of times that the total weight (W_i) is increased by the weight of the target port (w_k) when a subsequent data packet is received after the timeout event occurs. When the total weight is increased after a timeout event occurs (i.e., after the timeout value is refreshed to zero (0)) the data flow may not have been an idle data flow (i.e. a false positive).

[00129] The number of false positives may be used to adjust the timeout values $T_{\min}$ and $T_{\max}$. For example, if a data flow having a RTT of $200\mu s$ is determined to be in an idle state, and the total weight of the switch is increased when a subsequent data packet of the data flow is received after the timeout event occurs, then the SDN controller may increase $T_{\max}$ to be greater than or equal to $200\mu s$.

[00130] Referring back to FIG. 7, if at operation S710, the SDN controller determines that a timeout event has not occurred, the SDN controller 230 proceeds to operation S705 to detect a timeout event. However, if at operation S710, the SDN controller determines that a timeout event has occurred, the SDN controller 230 proceeds to operation S715 to set the timeout value of the timer to zero (0). Once the SDN controller 230 sets the timeout value of the timer to zero (0), the SDN controller 230 proceeds to operation S720 to decrease W_i by w_k .

[00131] After the SDN controller 230 decreases W_i by w_k , the SDN controller 230 proceeds to operations S725 to return to operation S505 of the weight counting routine 500.

[00132] As will be appreciated, the method and apparatus according the example embodiments has several advantages. First,

example embodiments allow a data center operator to easily manage network congestion that may occur within the data center, which may significantly improve the quality of services of data flows regardless of application-types or traffic patterns. Second, the example embodiments allow for network congestion to be managed without any SDN-enabled switches, but rather the SDN controller of the example embodiments may be employed on a virtual switch that works on a hypervisor of a server. Third, the example embodiments may be implemented in already existing data centers without the need for hardware upgrades.

[00133] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the invention, and all such modifications are intended to be included within the scope of the present invention.

WE CLAIM:

1. A method of adjusting bandwidth allocation by a network element in a communications network, the network element including a target port, the method comprising:

monitoring, by the network element, a data flow traversing the target port;

determining, by the network element, a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow;

determining, by the network element, a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element; and

adjusting, by the network element, the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

2. The method of claim 1, wherein the network element includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and the determining the fair-share bandwidth allocation comprises:

determining a weight value for each of the plurality of ports;

determining a total weight value based on the weight value of each of the plurality of ports; and

determining the fair-share bandwidth allocation based on the weight value of the target port and the total weight value.

3. The method of claim 2, wherein the monitoring comprises:

receiving a data packet associated with the data flow;

determining whether the received data packet is one of a flow termination packet and a flow initiation packet;

increasing the total weight value by the weight of the target port if the received data packet is a flow initiation packet; and

decreasing the total weight value by the weight of the target port if the received data packet is a flow termination packet.

4. The method of claim 2, wherein the determining the bandwidth allocation for the target port comprises:

determining a link capacity for the target port, the link capacity being a highest amount of bandwidth that may be allocated to the target port;

determining a round trip time (RTT) associated with the data flow; and

determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

5. The method of claim 4, wherein the determining the fair-share bandwidth allocation further comprises:

determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and

determining a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

6. The method of claim 2, wherein the monitoring comprises:

defining a time out value for a timer, the timer being associated with the bandwidth allocation for the target port; and

determining that a timeout event has occurred with respect to the data flow based on expiration of the timer.

7. The method of claim 6, wherein the monitoring further comprises:
 - receiving a data packet associated with the data flow;
 - resetting the timer to be equal to the timeout value if the timeout event does not occur before the data packet is received; and
 - decreasing the total weight by the weight of the target port if the timeout event does occur before the data packet is received.
8. The method of claim 7, wherein the monitoring further comprises:
 - increasing the total weight by the weight of the target port when a subsequent data packet is received after the timeout event occurs.
9. The method of claim 8, wherein the monitoring further comprises:
 - determining a timeout fraction based on a number of times that the total weight is increased by the weight of the target port when the subsequent data packet is received after the timeout event occurs;
 - determining a target fraction based on the timeout fraction; and
 - adjusting the timeout value based on the target fraction.
10. The method of claim 6, wherein the timeout value is based on a desired minimum timeout value and a desired maximum timeout value, and the desired minimum timeout value is larger than a round trip time (RTT) associated with the data flow.
11. A method of adjusting bandwidth allocation by a network controller in a communications network, the network controller being configured to control a network element, the network element including a target port, the method comprising:
 - receiving, by the network controller, data flow information from the network element, the data flow information including information about data flows traversing of the target port;

determining, by the network controller, a bandwidth allocation of the target port based on the data flow information, the bandwidth allocation of the target port being a bandwidth that is currently allocated for each of the data flows traversing the target port;

determining, by the network controller, an over-subscription ratio, the over-subscription ratio being a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port;

transmitting, by the network controller, the over-subscription ratio to the network element based on the over-subscription ratio and a threshold value;

determining, by the network controller, a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element; and

adjusting, by the network controller, the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

12. The method of claim 11, wherein the network element includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and the determining the fair-share bandwidth allocation for the target port comprises:

determining the bandwidth allocation for each of the plurality of ports;

determining a weight value for each of the plurality of ports;

determining a total weight value based on the weight value for each of the plurality of ports; and

determining the fair-share bandwidth allocation for the target port based on the weight value of the target port and the total weight value.

13. The method of claim 12, wherein the determining the bandwidth allocation for each of the plurality of ports comprises:

determining a link capacity for the target port, the link capacity being a highest amount of bandwidth that is able to be allocated to of the target port;

determining a round trip time (RTT) for one of the data flows traversing the target port; and

determining the bandwidth allocation for the target port by multiplying the link capacity by the RTT.

14. The method of claim 13, wherein the determining the fair-share bandwidth allocation for the target port comprises:

determining a fair-share weight value by dividing the weight value of the target port by the total weight value; and

determining a network fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation of the target port.

15. The method of claim 14, wherein the network element is associated with a secondary network element, the secondary network element including a secondary set of ports, and the secondary network element determines a weighted fair-share bandwidth allocation for each of the secondary set of ports.

16. The method of claim 15, wherein the adjusting the bandwidth allocation for the target port comprises:

determining a data flow traversing the target port and a secondary target port, the secondary target port being one of secondary set of ports;

determining the weighted fair-share bandwidth allocation for the data flow traversing the target port and the secondary target port;

determining the network fair-share bandwidth allocation for the data flow traversing the target port and the secondary target port;

adjusting the bandwidth allocation for the target port based on the weighted fair-share bandwidth allocation when the weighted fair-share bandwidth allocation is less than the network fair-share bandwidth allocation; and

adjusting the bandwidth allocation for the target port based on the network fair-share bandwidth allocation when the network fair-share bandwidth allocation is less than the weighted fair-share bandwidth allocation.

17. An edge switch for adjusting bandwidth allocation in a communications network, the edge switch including a target port, the edge switch configured to:

monitor a data flow traversing the target port;

determine a bandwidth allocation for the target port, the bandwidth allocation for the target port being a bandwidth that is currently allocated for the data flow;

determine a fair-share bandwidth allocation for the target port, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element; and

adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

18. The edge switch of claim 17, wherein the edge switch includes a plurality of ports, the plurality of ports including the target port, and each of the plurality of ports is assigned a corresponding bandwidth allocation, and in the determining the fair-share bandwidth allocation, the edge switch is configured to:

- determine a weight value for each of the plurality of ports;
- determine a total weight value based on the weight value of each of the plurality of ports; and
- determine the fair-share bandwidth allocation based on the weight value for the target port and the total weight value.

19. The edge switch of claim 18, wherein, in the determining the bandwidth allocation for the target port, the edge switch is configured to:

- determine a link capacity for the target port, the link capacity being a highest amount of bandwidth that is able to be allocated to the target port;
- determine a round trip time (RTT) associated with the data flow;
- determine the bandwidth allocation for the target port by multiplying the link capacity by the RTT;
- determine a fair-share weight value by dividing the weight value for the target port by the total weight value; and
- determine a weighted fair-share bandwidth allocation by multiplying the fair-share weight value by the bandwidth allocation for the target port.

20. A Software Defined Networking (SDN) controller for adjusting bandwidth allocation in a communications network, the SDN controller being configured to control an aggregation switch, the

aggregation switch including a target port, the SDN controller is configured to:

- receive data flow information from the network element, the data flow information including information about data flows traversing of the target port;

- determine a bandwidth allocation of the target port based on the data flow information, the bandwidth allocation of the target port being a bandwidth that is currently allocated for each of the data flows traversing the target port;

- determine an over-subscription ratio, the over-subscription ratio being a ratio of the bandwidth allocation of the target port to a number of data flows traversing the target port; and

- transmit the over-subscription ratio to the aggregation switch based on the over-subscription ratio and a threshold value;

- determine a fair-share bandwidth allocation for the target port based on the over-subscription ratio and the threshold value, the fair-share bandwidth allocation being a proportional allocation of a total bandwidth of the network element; and

- adjust the bandwidth allocation for the target port based on the fair-share bandwidth allocation.

**SOFTWARE DEFINED NETWORKING BASED CONGESTION
CONTROL**

ABSTRACT

Methods and systems of adjusting bandwidth allocation by a network element in a communications network includes monitoring a data flow traversing a target port, determining a bandwidth allocation for the target port, determining a fair-share bandwidth allocation for the target port, and adjusting the bandwidth allocation for the target port based on the fair-share bandwidth allocation. The bandwidth allocation for the target port is a bandwidth that is currently allocated for the data flow. The fair-share bandwidth allocation is a proportional allocation of a total bandwidth of the network element.

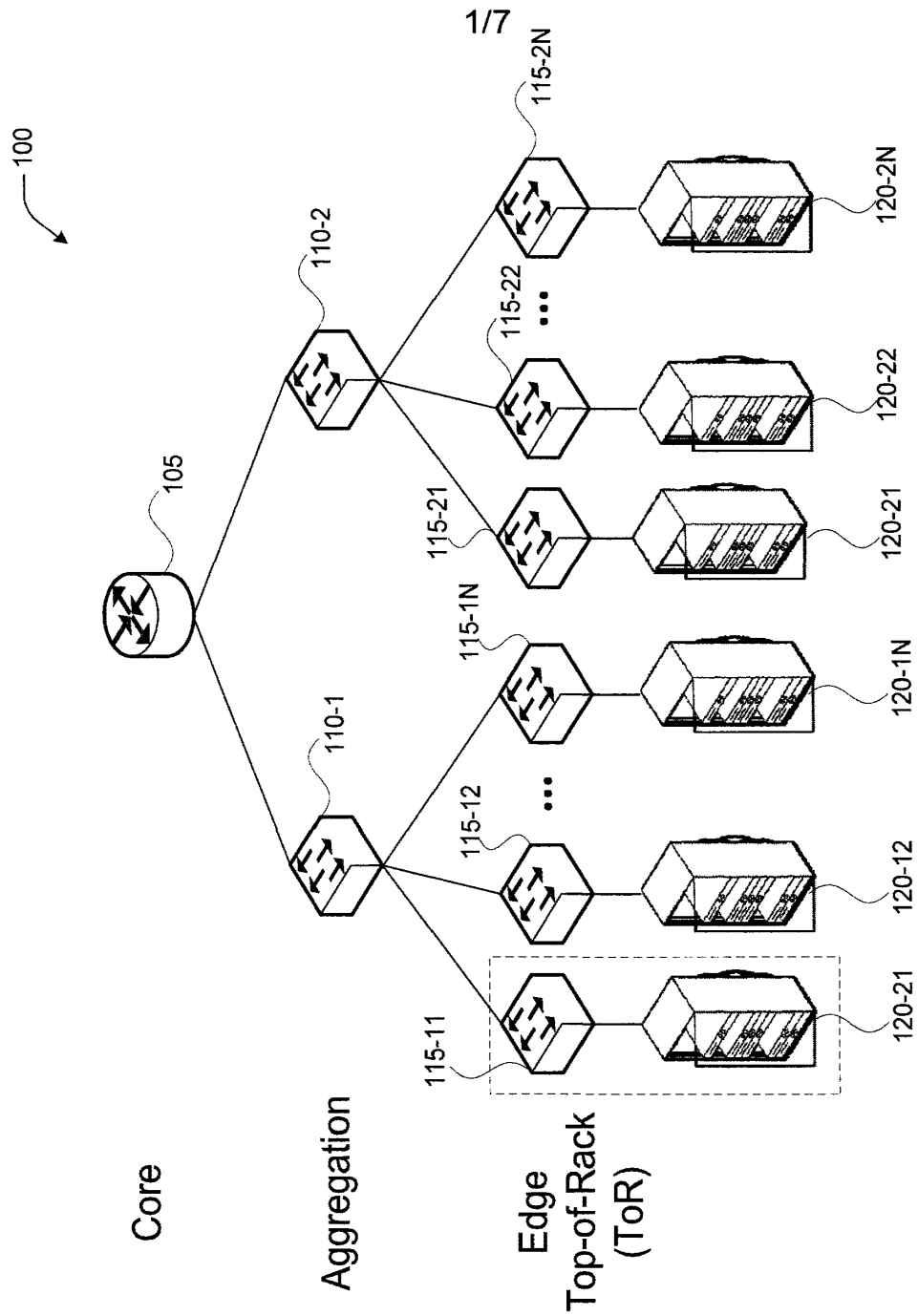


Fig.1

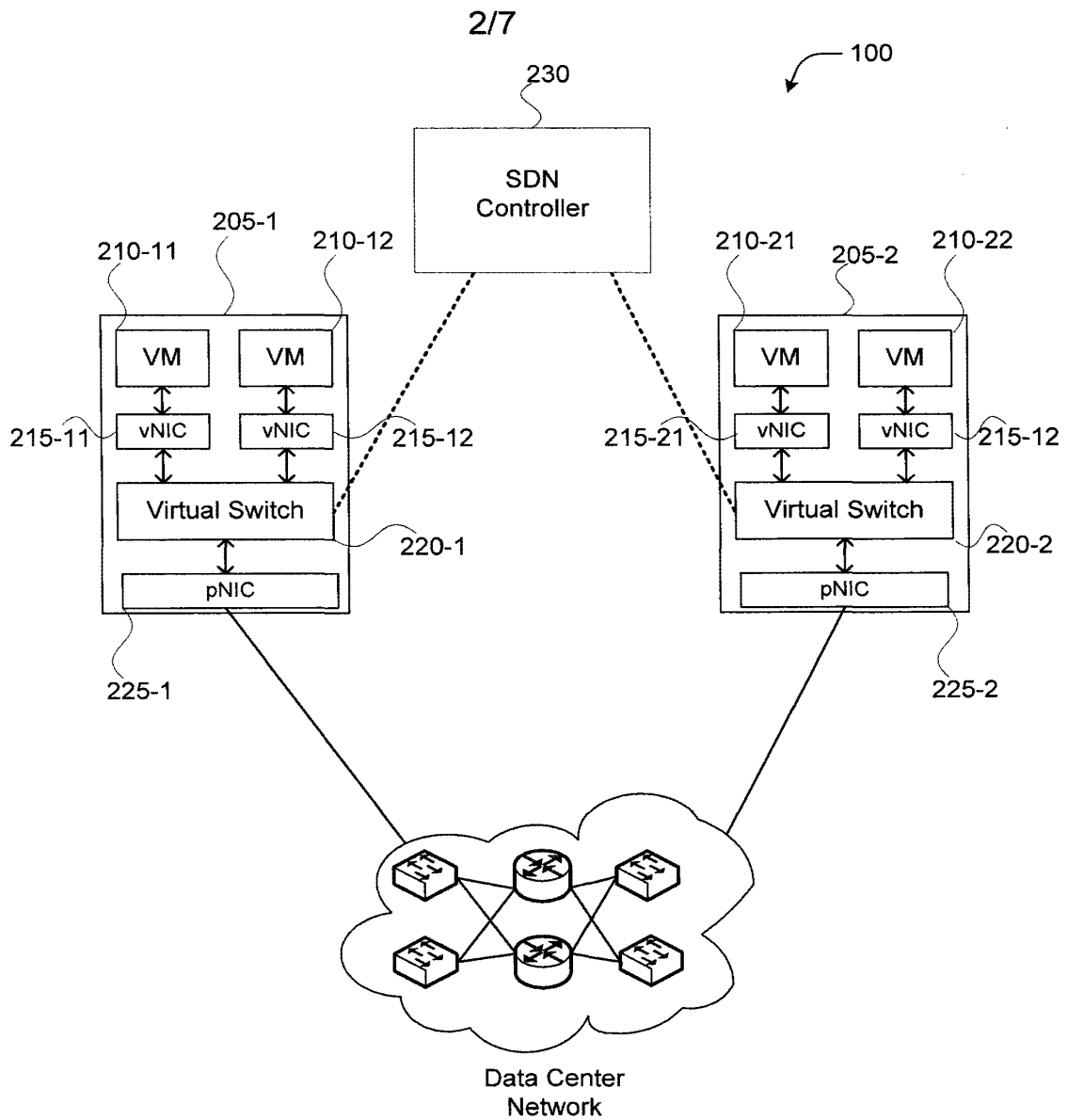


Fig.2

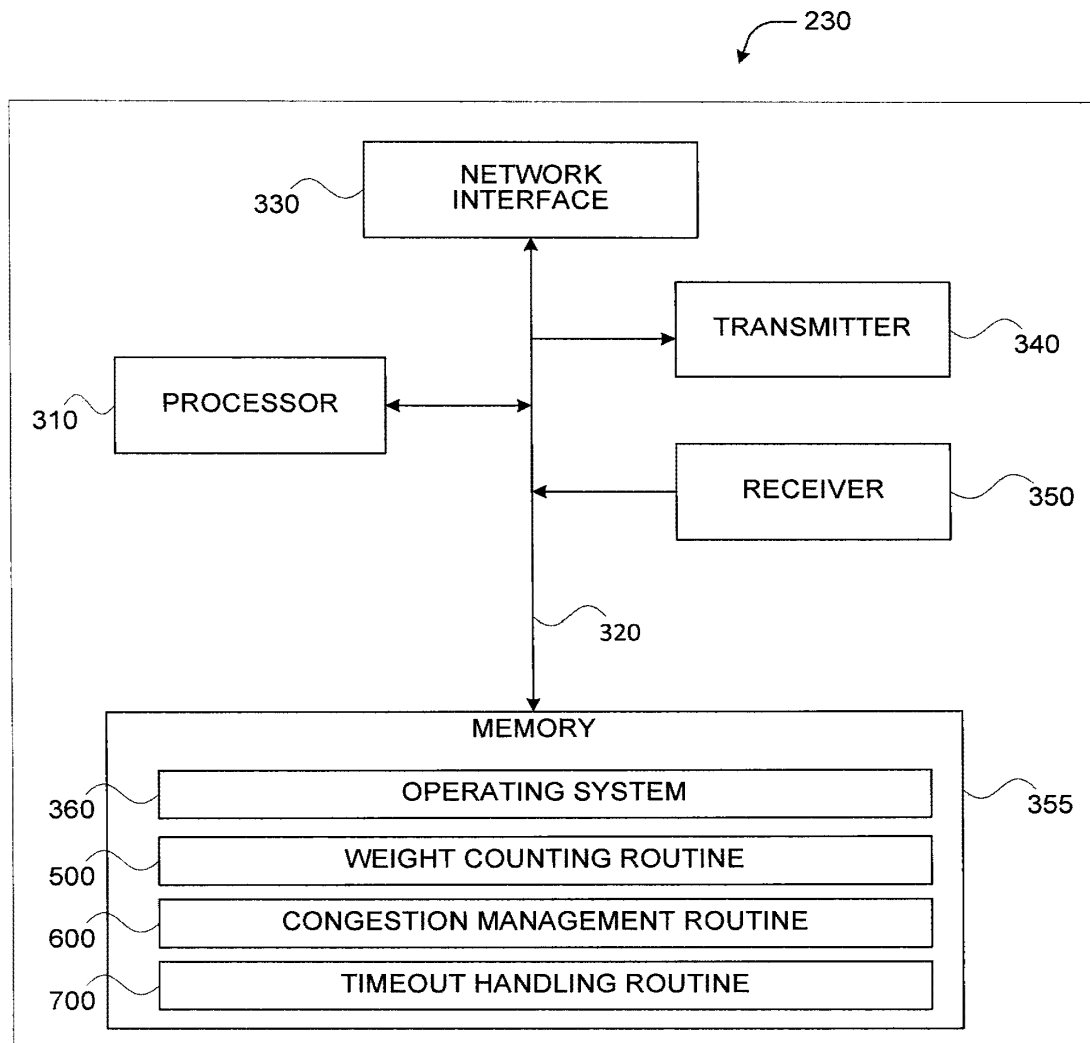


Fig.3

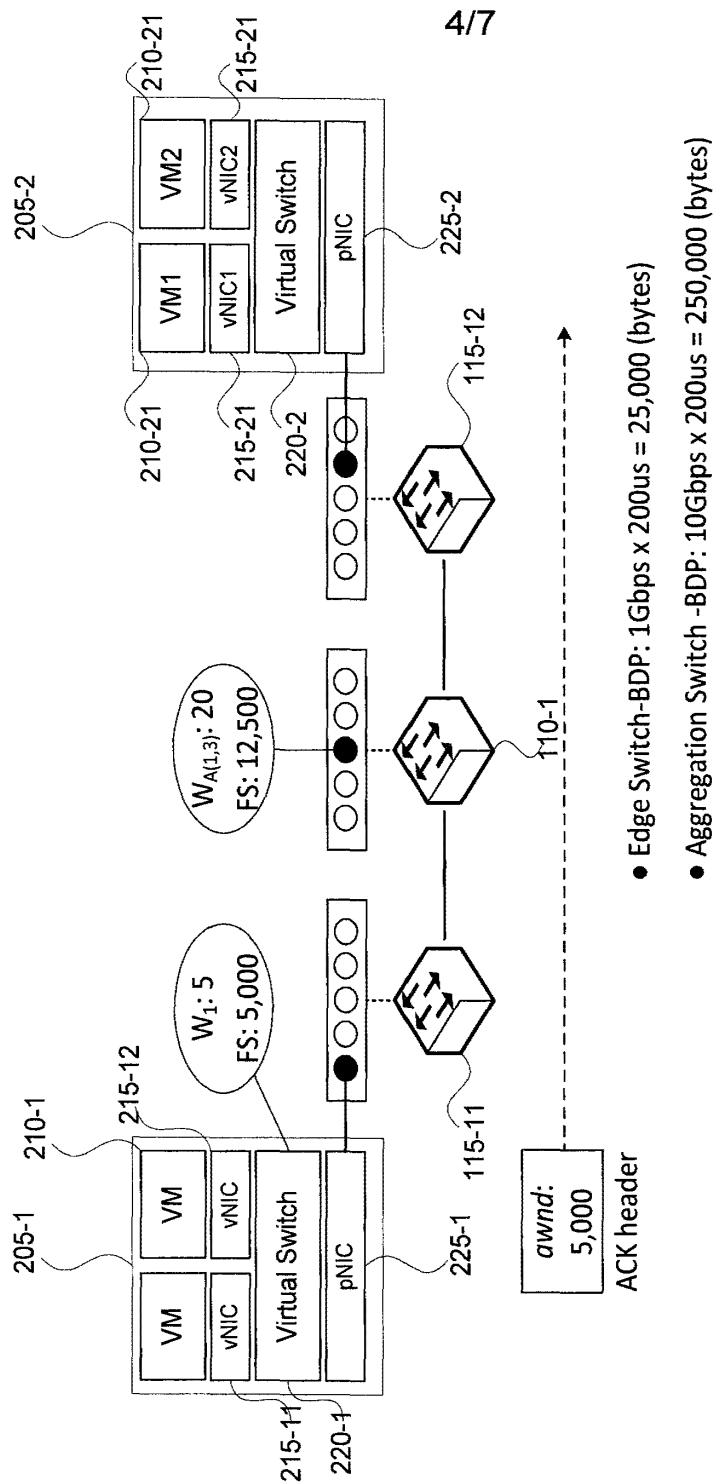


Fig.4

5/7

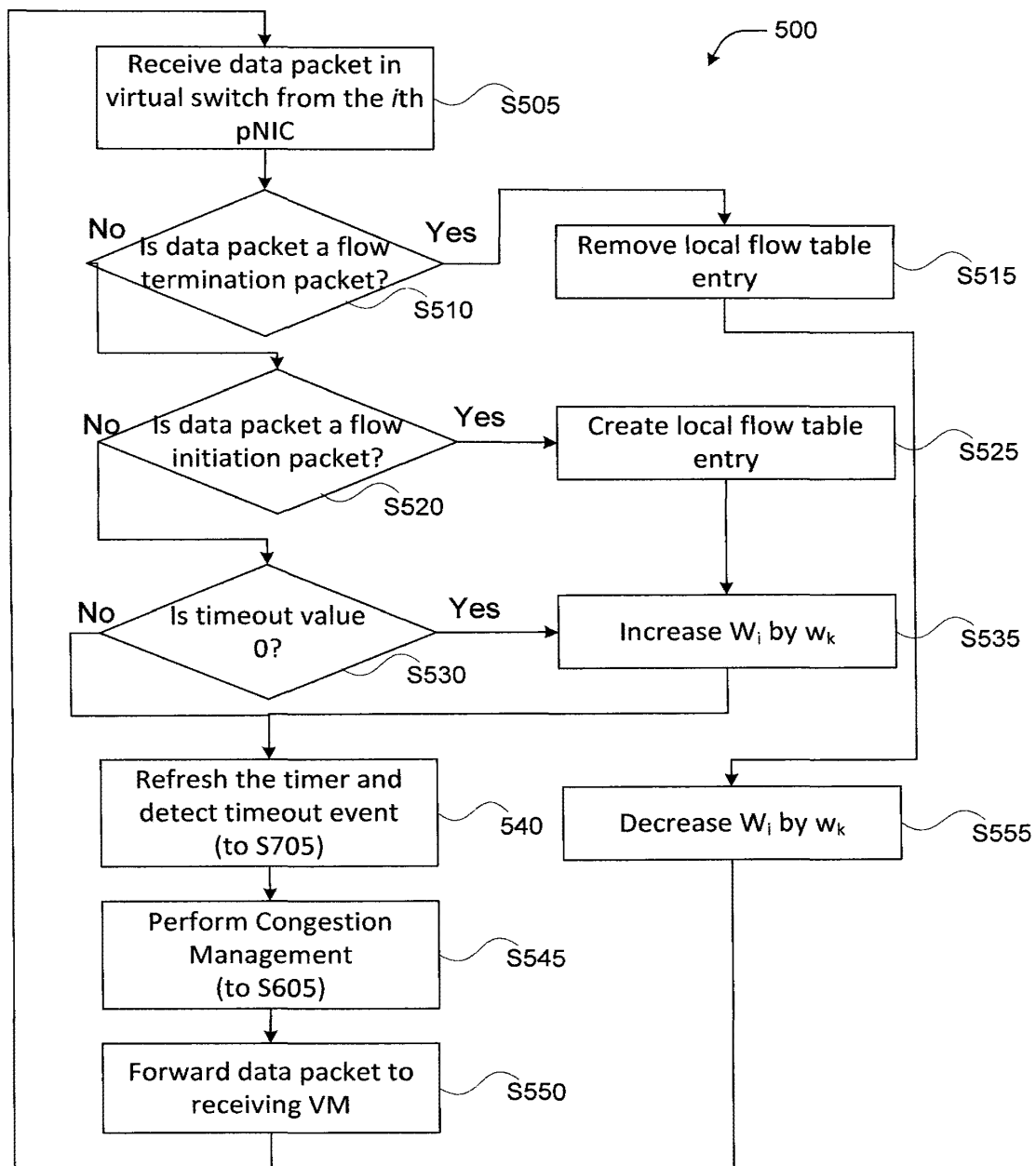


Fig.5

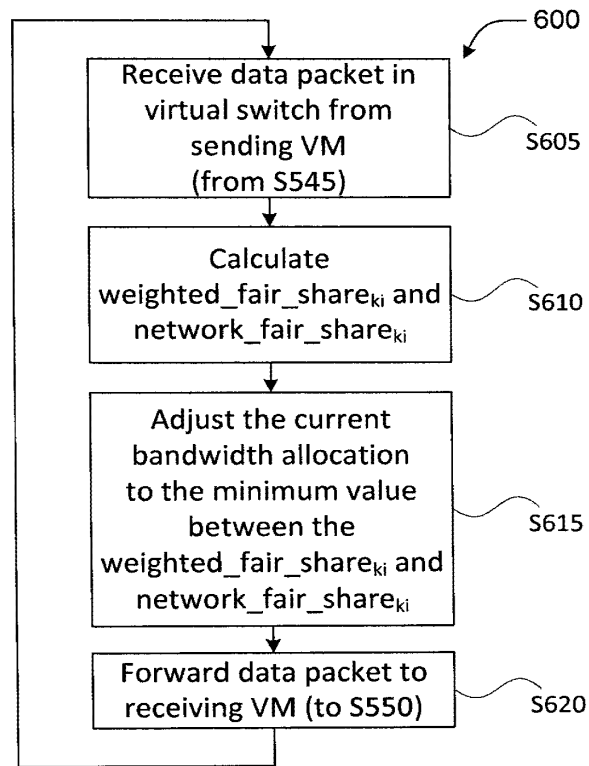


Fig.6

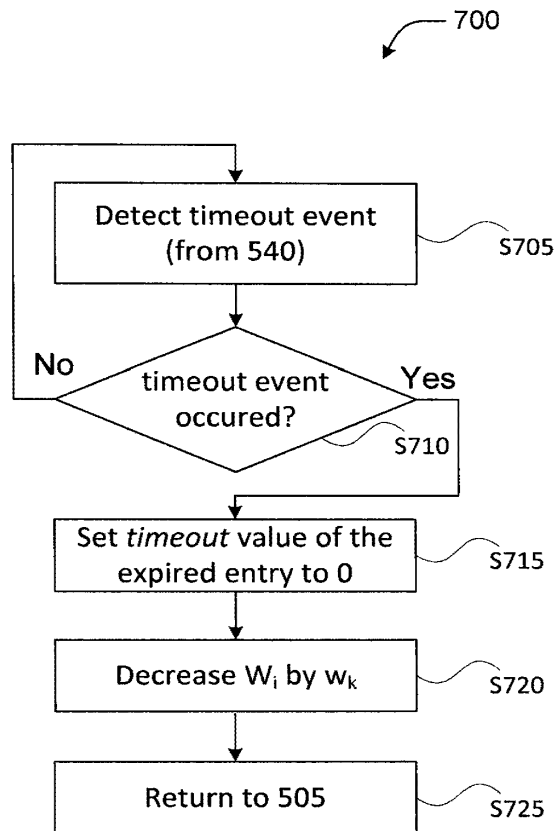


Fig.7

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		
First Named Inventor/Applicant Name:		Jae Hyun HWANG		
Filer:		Gary Daniel Yacura/Jeremy Ryan		
Attorney Docket Number:		29250-002735-US		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	420	420
Miscellaneous-Filing:				
Late Filing Fee for Oath or Declaration	1051	1	140	140

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2160

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First Named Inventor/Applicant Name:	Jae Hyun HWANG
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Deposit Account	080750
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. Section 1.16 (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)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)					
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	UTILITY.PDF	597774	no	1
			4c0405aed741b03e19333195553e78a1834bd001		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	FEE.PDF	617878	no	1
			215dc16dd91b245b74dd397999ac22d3857adff5d		
Warnings:					
Information:					
3	Application Data Sheet	ADS1.PDF	1571628	no	7
			ab519439642bd3afcc7d11903b91d49f583f5c56		
Warnings:					
Information:					
4		IDS.PDF	1678213	yes	4
			37bb0ba7d3d6521e6e91f1d605a13b483df0f9c3		
	Multipart Description/PDF files in .zip description				
	Document Description	Start	End		
	Transmittal Letter	1	3		
	Information Disclosure Statement (IDS) Form (SB08)	4	4		
Warnings:					
Information:					
5	Non Patent Literature	NPL_DATACENTER.PDF	1005506	no	12
			ee043bb656551d5ee18edbf08b0a450ea6ed026		
Warnings:					
Information:					
6	Non Patent Literature	NPL_BETTERNEVER.PDF	1543659	no	12
			f036d1560f334df96f4cddb251886951e51aed4b		
Warnings:					
Information:					

7	Non Patent Literature	NPL_IATCP.PDF	568417 020c6fc710dced61ffd1071e453bb3112f0326c9	no	5
Warnings:					
Information:					
8	Non Patent Literature	NPL_NETWORKTRAFFIC.PDF	1013919 5fc95cbd23b6478404b8bcde0a234905afaeb2b4	no	14
Warnings:					
Information:					
9		2014_06_11_application.PDF	368892 feb1be2f7112f0b3b737ae50497857aca094fb5a	yes	51
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	42	
	Claims		43	50	
	Abstract		51	51	
Warnings:					
Information:					
10	Drawings-only black and white line drawings	2014_06_11_drawings.PDF	109020 45360bfc1da89d04d50189dd23d6139b500b37f6	no	7
Warnings:					
Information:					
11	Fee Worksheet (SB06)	fee-info.pdf	38175 8375c090842e695a94043953079ba8e294697dcd	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			9113081		

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.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Jae Hyun		HWANG		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Anyang	Country of Residence¹	KR		
Mailing Address of Inventor:					
Address 1	c/o Bell Labs Seoul Ltd.				
Address 2	7fl., DMC Rd Center,, E3-2, Sangam-Dong, Mapo-Gu				
City	Seoul	State/Province			
Postal Code	121-270	Country	KR		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Thierry		KLEIN		
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service					
City	Fanwood	State/Province	NJ	Country of Residence	US
Mailing Address of Inventor:					
Address 1	600-700 Mountain Avenue				
Address 2					
City	Murray Hill	State/Province	NJ		
Postal Code	07974	Country	US		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					

Correspondence Information:

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence Information of this application.

Customer Number	30594		
Email Address	dcmalroom@hdp.com	Add Email	Remove Email

Application Information:

Title of the Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		
Attorney Docket Number	29250-002735-US	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	7	Suggested Figure for Publication (if any)	

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	30594		

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)¹ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove			
Application Number	Country ¹	Filing Date (YYYY-MM-DD)	Access Code ¹ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices
If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.				
Applicant 1				
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.				
Clear				
☐ Assignee	☐ Legal Representative under 35 U.S.C. 117		☐ Joint Inventor	
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest		
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:				
Name of the Deceased or Legally Incapacitated Inventor :				
If the Applicant is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		

Mailing Address Information For Applicant:			
Address 1			
Address 2			
City		State/Province	
Country		Postal Code	
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button.			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	29250-002735-US
		Application Number	
Title of Invention	SOFTWARE DEFINED NETWORKING BASED CONGESTION CONTROL		

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Signature	/Gary D. Yacura/		Date (YYYY-MM-DD)	2014-06-11	
First Name	Gary	Last Name	Yacura	Registration Number	35416
Additional Signature may be generated within this form by selecting the Add button.					

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

Privacy Act Statement

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

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

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