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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/324,053	03/17/2015	8984228	ITL.2523US (P39131)	5133

47795 7590 02/25/2015
INTEL CORPORATION
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402

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 595 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):

Yen-Cheng Liu, Portland, OR;
Robert G. Blankenship, Tacoma, WA;
Geeyarpuram N. Santhanakrishnan, Mercer Island, WA;
Ganapati N. Srinivasa, Portland, OR;
Kenneth C. Creta, Gig Harbor, WA;
Sridhar Muthrasanallur, Bangalore, INDIA;
Bahaa Fahim, San Jose, CA;

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 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)

47795 7590 11/12/2014
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

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.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL2523US (P39131)	5133

TITLE OF INVENTION: Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

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	02/12/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
DUDEK JR, EDWARD J	2136	711-130000

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 Trop, Pruner & Hu, P.C.

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

Intel Corporation

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

Santa Clara, CA

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 50-4238 (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 /Mark J. Rozman/

Date 2015-02-09

Typed or printed name Mark J. Rozman

Registration No. 42,117

"FEE ADDRESS" INDICATION FORM

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

Fax to:
571-273-6500

- OR -

INSTRUCTIONS: The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. **When to check the first box below:** If you have a Customer Number to represent the fee address. **When to check the second box below:** If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see the Manual of Patent Examining Procedure (MPEP) § 403.

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☒ Customer Number: 00197

OR

☐ The attached Request for Customer Number (PTO/SB/125) form.

PATENT NUMBER (if known)	APPLICATION NUMBER
	13/324,053

Completed by (check one):

☐ Applicant/Inventor	/Mark J. Rozman/ Signature
☒ Attorney or Agent of record <u>42,117</u> (Reg. No.)	Mark J. Rozman Typed or printed name
☐ Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)	<u>512-418-9944</u> Requester's telephone number
☐ Assignee recorded at Reel _____ Frame _____	<u>2015-02-09</u> Date

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

☒ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.363. 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 5 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 COMPLETE D FORMS TO THIS ADDRESS. **SEND TO: Mail Stop M Correspondence, 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 Patent Application Fee Transmittal				
Application Number:		13324053		
Filing Date:		13-Dec-2011		
Title of Invention:		Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module		
First Named Inventor/Applicant Name:		Yen-Cheng Liu		
Filer:		Mark J. Rozman/David Hopper		
Attorney Docket Number:		ITL.2523US (P39131)		
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:	21436388
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/David Hopper
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	09-FEB-2015
Filing Date:	13-DEC-2011
Time Stamp:	12:57:38
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	10641
Deposit Account	504238
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 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

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)	ITL2523_Fee_Trans.pdf	1722245	no	1
			c6852a1a355bec19889f345b9a3b6d79a7c9c1a88		

Warnings:

Information:

2	Miscellaneous Incoming Letter	ITL2523Fee_Address.pdf	204788	no	2
			0f72756a29ec05b0889f2b37f995d26c362d0725		

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30616	no	2
			d669c2fde409285d553f50fab22ca020e260b13		

Warnings:

Information:

Total Files Size (in bytes):

1957649

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.

Issue Classification CPC	Application_ID
	13324053
Document Date: 2/6/2015	Document Code: IIFW

APPLICATION_ID	SUBCLASS	MAINGROUP	SLASH	SUBGROUP	TYPE	VERSION
13324053	G06F	12	/	0815	F	20130101
13324053	G06F	12	/	084	I	20130101
13324053	Y02B	60	/	1225	A	20130101



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)	5133
47795 7590 12/22/2014 TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., SUITE 750 HOUSTON, TX 77057-2631			EXAMINER DUDEK JR, EDWARD J	
			ART UNIT 2136	PAPER NUMBER
			MAIL DATE 12/22/2014	DELIVERY MODE PAPER

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

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

Notice of Allowability	Application No. 13/324,053	Applicant(s) LIU ET AL.	
	Examiner EDWARD DUDEK JR	Art Unit 2136	AIA (First Inventor to File) Status No

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

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

1. ☒ This communication is responsive to the reply filed on 08 October 2014.
☐ 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 1-3 and 5-20. 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)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/EDWARD DUDEK JR/ Primary Examiner, Art Unit 2136	
--	--

Issue Classification 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.	
	Examiner EDWARD DUDEK JR	Art Unit 2136	

CPC					
Symbol				Type	Version

CPC Combination Sets						
Symbol			Type	Set	Ranking	Version

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	19	
/EDWARD DUDEK JR/ Primary Examiner. Art Unit 2136	12/19/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Issue Classification 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2136

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION										
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED					
711			130			G	0	6	F	13 / 00 (2006.0)						
CROSS REFERENCE(S)						G	0	6	F	13 / 28 (2006.0)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)															
711	E12.038															

NONE		Total Claims Allowed:	
		19	
(Assistant Examiner)	(Date)		
/EDWARD DUDEK JR/ Primary Examiner. Art Unit 2136	12/19/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Issue Classification 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2136

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	16	17												
2	2	17	18												
3	3	18	19												
	4	19	20												
4	5														
5	6														
6	7														
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8	9														
9	10														
10	11														
11	12														
12	13														
13	14														
14	15														
15	16														

NONE		Total Claims Allowed:	
		19	
(Assistant Examiner)	(Date)		
/EDWARD DUDEK JR/ Primary Examiner. Art Unit 2136	12/19/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6



UNITED STATES PATENT AND TRADEMARK OFFICE

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

47795 7590 11/12/2014
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

EXAMINER

DUDEK JR, EDWARD J

ART UNIT

PAPER NUMBER

2136

DATE MAILED: 11/12/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL2523US (P39131)	5133

TITLE OF INVENTION: Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

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	02/12/2015

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
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or Fax (571)-273-2885

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(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)	5133

TITLE OF INVENTION: Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

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	02/12/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
DUDEK JR, EDWARD J	2136	711-130000

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

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

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☐ Publication Fee (No small entity discount permitted)
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- ☐ 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.

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)	5133
47795 7590 11/12/2014 TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., SUITE 750 HOUSTON, TX 77057-2631			EXAMINER DUDEK JR, EDWARD J	
			ART UNIT	PAPER NUMBER
			2136	
DATE MAILED: 11/12/2014				

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.

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

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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. 13/324,053 Examiner EDWARD DUDEK JR	Applicant(s) LIU ET AL. Art Unit 2136 AIA (First Inventor to File) Status No
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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

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

1. ☒ This communication is responsive to the reply filed on 08 October 2014.
☐ 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 _____	

/EDWARD DUDEK JR/ Primary Examiner, Art Unit 2136	
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Search Notes 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2186

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
711	130, E12.038	06-27-2014	EJD

SEARCH NOTES		
Search Notes	Date	Examiner
Text search in EAST	06-27-2014	EJD
Inventor name search in EAST	06-27-2014	EJD
Assignee search in EAST - limited by text	06-27-2014	EJD
Text search in EAST	06-28-2014	EJD
Updated search in EAST	11-03-2014	EJD
Text search in EAST	11-06-2014	EJD
Text search in Google Scholar, see search history	11-06-2014	EJD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	Text search in EAST (USPGPUB, USPAT, UPAD).clm.	11-06-2014	EJD

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Streamlined **cache** coherency protocol system and method for a multiple **processor** single chip device

SO Siu, S Venkataraman, PI Venkitakrishnan - US Patent 6,919,012, 2005 - Google Patents

... the address bits (eg, OcsbAddr[35:0]). The **cache** coherency protocol **associates** states with ... types each **cache** line has a memory type determined by the **processor core associated** with the ... For **caching** purposes, the memory type can be writeback (WB), write-through (WT), write ...

Cited by 29 Related articles All 4 versions Cite Save

Method and apparatus for maintaining **cache** coherency in a computer system with a highly pipelined bus and multiple conflicting snoop requests

AA Merchant - US Patent 5,893,151, 1999 - Google Patents

... be the same, yet they have a unique relationship to allow **agents** to correctly **associate** one with ... reply via information stored in the snoop type bits 512 of the entry **associated** with the ... of the problems that arise in computer systems that include a plurality of **caching agents** and a ...

Cited by 68 Related articles All 2 versions Cite Save

A 48-core IA-32 **processor** in 45 nm CMOS using on-die message-passing and DVFS for performance and power scaling

J Howard, S Dighe, SR Vangal, G Ruhi... - Solid-State Circuits, ..., 2011 - IEEE Xplore

... Finally, there is no allocate-on-write capability in L1 **caches** of the **core**. ... generation time Packetization of **core** requests and responses into FLITs is handled by the **associated un-core** ... a **core** reads a message, it begins by invalidating all message passing data **cache** lines ...

Cited by 182 Related articles All 5 versions Cite Save

Apparatus for maintaining multilevel **cache** hierarchy coherency in a multiprocessor computer system

JM Bauer, AK Gupta, MS Joshi, KK Lal... - US Patent ..., 1998 - Google Patents

... The invention **associates** states with lines and defines rules governing state transitions. ... In the field of computer memories, a "line" refers to the basic unit of **caching**. ... Each line has **associated** with it a state for each of the **caches** illustrated in FIG. ...

Cited by 52 Related articles All 2 versions Cite Save

Nehalem-ex **cpu** architecture

S Kottapalli, J Baxter - Hot chips, 2009 - cse.psu.edu

... Ring stops shared by **core/cache** - Ring stops tagged as "even"/"odd" polarities - Ring stops only sink from a single ... QPI source snoop protocol - CA 0/CA1 act as **caching agent** hubs to the ... System coherence manager for memory **associated** with the adjacent memory ...

Cited by 23 Related articles All 2 versions Cite Save More

A 32 nm, 3.1 Billion Transistor, 12 Wide Issue Itanium® **Processor** for Mission-Critical Servers

R Riedlinger, R Arnold, L Biro, B Bowhill... - Solid-State Circuits, ..., 2012 - IEEE Xplore

... Cbox: Fig. 15 shows eight Cboxes in Poulson. Each of the Cbox manages its **associated** Last Level **Cache** and interfaces with a Poulson **Core**. A Cbox and a Sbox together form a QPI **caching agent**, handling cacheable address space. ...

Cited by 53 Related articles All 3 versions Cite Save

Method and apparatus for shared **cache** coherency for a chip multiprocessor or multiprocessor system

V Garg, NS Iyer, J Keshava, V Pentkovski - US Patent 6,976,131, 2005 - Google Patents

... Some embodiments implement a **caching** protocol having two different modified states. ... Often, a single private **cache** may be **associated** with a single **core** as is the case in ... including a chip multiprocessor having a snoop bus and implementing a shared **cache** coherency protocol ...

Cited by 65 Related articles All 4 versions Cite Save

Apparatus and method for caching lock conditions in a multi-processor system

MA Fisch, MS Joshi, KK Lai, NV Sarangdhar... - US Patent ..., 1999 - Google Patents

... Note that any or all of the components of system 100 and **associated** hardware may ... 6 shows a flowchart describing the steps for performing the **cache** lock process for one ... More specifically, the present invention pertains to an apparatus and method for **caching** lock conditions in ...

Cited by 38 Related articles All 2 versions Cite Save

Method and apparatus for maintaining cache coherency in a computer system with a highly pipelined bus and multiple conflicting snoop requests

AA Merchant - US Patent 5,737,759, 1998 - Google Patents

... be the same, yet they have a unique relationship to allow **agents** to correctly **associate** one with ... reply via information stored in the snoop type bits 512 of the entry **associated** with the ... of the problems that arise in computer systems that include a plurality of **caching agents** and a ...

Cited by 43 Related articles All 4 versions Cite Save

Method and apparatus for maintaining cache coherency in a computer system with a highly pipelined bus and multiple conflicting snoop requests

AA Merchant - US Patent 5,875,467, 1999 - Google Patents

... Data Phase, a number of bus lines are driven, namely those bus lines **associated** with D ... MESI **cache** protocol requires that each **caching agent** on the system bus **associate** one of ... a "locked" state such that neither the **processor core** 438 nor another **caching agent** could access ...

Cited by 33 Related articles All 2 versions Cite Save

Method and apparatus for maintaining **cache** coherency in a computer system with a highly pipelined bus and **multiple** conflicting snoop requests

AA Merchant - US Patent 5,893,151, 1999 - Google Patents

... Main memory satisfies the demands of **caches** and vector units and often serves as the interface for ... of the problems that arise in computer systems that include a plurality of **caching agents** and a ... **Cache** coherency refers to the problem wherein--due to the use of **multiple**, or **multi** ...

Cited by 68 Related articles All 2 versions Cite Save

Streamlined **cache** coherency protocol system and method for a **multiple processor** single chip device

SC Siu, S Venkataraman, PI Venkitakrishnan - US Patent 6,918,012, 2005 - Google Patents

... For **caching** purposes, the memory type can be writeback (WB), write-through (WT ... CMP systems with respect to increasing computer system performance while enabling **cache** coherency for ... system with a plurality of active **agents** and memories (eg, **caches**, embedded memories ...

Cited by 29 Related articles All 4 versions Cite Save

A family of 45nm IA **processors**

R Kumar, G Hinton - Solid-State Circuits Conference-Digest of ..., 2009 - IEEE Xplore

... 3 levels of on die **caches**: L1 32KB instruction and writeback data **caches**, 256KB private L2 with 10-cycle latency and shared L3 **cache**. ... low-latency FIFO that allows effectively arbitrary voltage/frequency combinations between communicating **agents** is implemented to ...

Cited by 239 Related articles Cite Save

Larrabee: a many-**core** x86 architecture for visual computing

L Seiler, D Carmean, E Sprang, T Forsyth... - ACM Transactions on ..., 2008 - dl.acm.org

... For example, each **agent** can accept a message from one direction ... However, before allocating a new line in the L2 **cache**, the ring network is used to check for data sharing, in order to ... The inter-**processor** network also provides a path for the L2 **caches** to access memory. ...

Cited by 847 Related articles All 46 versions Cite Save

Clearpath: highly parallel collision avoidance for **multi-agent** simulation

SJ Guy, J Chhugani, C Kim, N Satish, M Lin... - Proceedings of the ..., 2009 - dl.acm.org

... obstacle based formulation that can be combined with any underlying **multi-agent** simulation. ... optimization problem that minimizes the change in underlying velocity of each **agent** subject to ... constraints (Section 3). We present a polynomial-time algorithm for **agents** to compute ...

Cited by 128 Related articles All 12 versions Cite Save

The implementation of POWER7 TM: A highly parallel and scalable **multi-core** high-end server **processor**

D Wendel, R Kalla, R Cargoni, J Clabes... - Solid-State Circuits ..., 2010 - IEEE Xplore

... **Multi**-port register files and SRAM arrays are key enablers to employ **multiple** execution units ... is based upon work supported by the Defense Advanced Research Projects **Agency** under its ... DRAM macro for the POWER7TM **Processor** 32MByte On-Chip L3 **Cache**", ISSCC 2010 ...

Cited by 62 Related articles All 2 versions Cite Save

A fully integrated **multi-CPU**, GPU and memory controller 32nm **processor**

M Yaffe, E Knoll, M Mehaie, J Shor... - Solid-State Circuits ..., 2011 - IEEE Xplore

... ring") that connects between the CPUs, the GPU, the L3 **cache** and the system **agent** (SA) unit ... 5 includes 13 PLLs driving independent clock domains for the **core** and **cache** slices, the ... a debug bus that allows monitoring the traffic between the IA cores, GPU, **caches** and SA on ...

Cited by 63 Related articles All 2 versions Cite Save

Nehalem-ex **cpu** architecture

S Kottapalli, J Baxter - Hot chips, 2009 - cse.psu.edu

... Hot Chips 2009 Cores and Last Level **Caches** • Start with 8 Nehalem Cores – Modular and high throughput ... Ring stops shared by **core/cache** – Ring stops tagged as "even"/"odd" polarities ... 48 requests from any single **caching agent** – **Multiple** modes for flexible topologies ...

Cited by 23 Related articles All 2 versions Cite Save More

Method and apparatus for **processing multiple cache** misses using reload folding and store merging

BY Kikuta, NG Samra - US Patent 5,809,530, 1998 - Google Patents

... Memory unit 45 includes two levels of on-chip **caching**. ... for maintaining **multi-level cache** coherency in a **processor** with non-inclusive **caches** and **processor** ... Jul 9, 2002, International Business

Machines Corporation, Queue-less and state-less layered local data **cache** mechanism. ...

Cited by 105 Related articles All 2 versions Cite Save

A 65 nm 2-billion transistor quad-**core** Itanium **processor**

B Stackhouse, S Bhimji, C Bostak... - Solid-State Circuits, ..., 2009 - ieeexplore.ieee.org

... Associated with each home **agent** is a 1 MB directory **cache** in support of a directory-based **cache** coherence protocol. ... Yield results for the **caches** have been good, and **cache** repair has successfully salvaged much of the fallout. ...

Cited by 127 Related articles All 7 versions Cite Save



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BIB DATA SHEET

CONFIRMATION NO. 5133

SERIAL NUMBER 13/324,053	FILING or 371(c) DATE 12/13/2011 RULE	CLASS 711	GROUP ART UNIT 2136	ATTORNEY DOCKET NO. ITL.2523US (P39131)		
APPLICANTS INVENTORS Yen-Cheng Liu, Portland, OR; Robert G. Blankenship, Tacoma, WA; Geeyarpuram N. Santhanakrishnan, Mercer Island, WA; Ganapati N. Srinivasa, Portland, OR; Kenneth C. Creta, Gig Harbor, WA; Sridhar Muthrasanallur, Bangalore, INDIA; Bahaa Fahim, San Jose, CA;						
** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 12/22/2011						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and /EDWARD J DUDEK JR/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY OR	SHEETS DRAWINGS 7	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., SUITE 750 HOUSTON, TX 77057-2631 UNITED STATES						
TITLE Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module						
FILING FEE RECEIVED 1380	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S35	1855	((multi or multiple or plural or plurality) with core with processor) same (share\$ near3 cache)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S36	3514	((multi or multiple or plural or plurality) with core with processor) same ("input/ouput" or "I/O" or "IIO")	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S37	269	S35 and S36	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S38	86	S37 and (cache near3 coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S39	608	((multi or multiple or plural or plurality) with core with processor) same (cache with coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S40	4765	("input/ouput" or "I/O" or "IIO" or external or interface) same (cache with coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S41	376	S39 and S40	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S42	1867	cache with pending with request	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S43	114	cache with posted with transaction	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S44	18	S42 and S43	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29

S45	582	(share\$ near3 cache) same ((partition or portion or assign or associate) with core)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S46	186	S35 and S45	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S47	42	(share\$ near3 cache) with (write near3 back) with ((system or main) near3 memory)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S48	18	((("input/ouput" or "I/O" or "IIO" or external or interface) with (processor or CPU)) same (share\$ near3 cache) same prefetch	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:29
S49	76	(S37 S38 S39 S41 S43 S44 S46 S47 S48) and @pd> "20140627"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2014/11/03 13:29
S50	362	distributed with (cache or caching) with agent	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2014/11/03 13:34
S51	71323	((multi or multiple or plural or plurality) with core with processor)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:35
S52	80	S50 and S51	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/11/03 13:35
S53	1	("20090276581").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/11/03 13:39
S54	739	distributed with cache with controller	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2014/11/06 10:09
S55	22	(distributed near3 cache near3 controller) with (CPU or core)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2014/11/06 10:11
S56	10232	(cache near4 (controller or agent)) same ((associate or associated or connect or connected or link or linked) with (CPU or core or processor))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2014/11/06 10:15
S57	196	S54 and S56	US-PGPUB; USPAT;	OR	ON	2014/11/06 10:15

EAST Search History

			USOCR; EPO; JPO; DERWENT			
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11/ 6/ 2014 2:33:50 PM

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An adaptive peer-to-peer network for distributed caching of olap results

P Kainis, WS Ng, BC Ooi, D Papadias... - Proceedings of the 2002 ..., 2002 - dl.acm.org

... Except from LIGLO servers, the PeerOLAP network is fully **distributed** without any central- ized administration point. ... Al- though our **caching** algorithm is similar to ClockBenefit, the metric is not suitable, since we ... c in the future it can find it in P and its available **cache** space can be ...

Cited by 153 Related articles All 24 versions Cite Save

JADE-A FIPA-compliant agent framework

F Bellifemine, A Poggi, G Rimassa - Proceedings of PAAM, 1999 - dia.fi.upm.es

... then composed of several **agent** containers as shown in Figure 2. **Distribution** of containers ... ACL message is sent using Java Remote Method Invocation framework for **distributed** object computing. ... Besides, address **caching** is used on each container to avoid looking up platform ...

Cited by 1783 Related articles All 13 versions Cite Save More

Access control subsystem and method for distributed computer system using locally cached authentication credentials

M Abadi, A Birrell, B Lampson, E Wobber - US Patent 5,235,642, 1993 - Google Patents

... System for controlling access and **distribution** of digital property. ... US6006018 *, Oct 3, 1995, Dec 21, 1999, International Business Machines Corporation, **Distributed** file system ... Feb 1, 2000, Oracle Corporation, Method and apparatus for selective data **caching** implemented with ...

Cited by 369 Related articles All 2 versions Cite Save

PPFS: A high performance portable parallel file system

JV Huber Jr, AA Chien, CL Elford... - Proceedings of the 9th ..., 1995 - dl.acm.org

... behavior. c Second, we are using PPFS to explore a variety of data **distribution**, **distributed caching** and prefetching strategies via both direct execution of input/output- intensive applications and via trace-driven simulation. q ...

Cited by 241 Related articles All 5 versions Cite Save

Distributed read and write caching implementation for optimized input/output applications

KC Creta, M Bell, R George, BB Congdon... - US Patent ..., 2004 - Google Patents

... 1 and 2 as being on a single component (ie, on the **caching** I/O hub 100), the read **caches** may be **distributed** and separated on one or more different components. A **cache** directory 120 is provided in the **caching** I/O hub 100 according to an embodiment of the present ...

Cited by 145 Related articles All 3 versions Cite Save

Distributed caching algorithms for content distribution networks

S Borst, V Gupta, A Walid - INFOCOM, 2010 Proceedings IEEE, 2010 - ieeexplore.ieee.org

... well as large-scale information systems and web-oriented content **distribution** networks (CDN's ... focus on **distributed** algorithms with provable performance ratios for maximizing the metric of ... x0n, we can assume without loss of generality the following **caching** behavior: • Subcase ...

Cited by 177 Related articles All 6 versions Cite Save

PeerDB: A P2P-based system for distributed data sharing

WS Ng, BC Ooi, KL Tan, A Zhou - Data Engineering, 2003. ..., 2003 - ieeexplore.ieee.org

... This flexibility is also an important distinction between PeerDB and existing **distributed** DBMS. ... For every relation that the user retrieved (in phase II of the query process- ing strategy), we **cache** the answers. **Caching** raises Figure 3. PeerDB interface. many complicated issues. ...

Cited by 407 Related articles All 33 versions Cite Save

Scalable, Distributed Data Mining-An Agent Architecture.

H Kargupta, I Hamzaoglu, B Stafford - KDD, 1997 - aaai.org

... **distributed** machines with MPI and Unix file I/O. Par- allel access, and analysis by **agents** is covered ... Striped and blocked algorithms are used to **distribute** documents among **agents**. ... In addition we only used striped data **distribution** and write-back **caches**, and we didn't perform ...

Cited by 183 Related articles All 10 versions Cite Save More

Distributed mechanism for resolving **cache** coherence conflicts in a multi-node computer architecture

M Khare, LP Looi, A Kumar, FA Briggs - US Patent 6,615,319, 2003 - Google Patents

... Therefore, a **distributed** mechanism for resolving **cache** coherence conflicts in a multiple processing node architecture is desired. BRIEF DESCRIPTION OF THE DRAWINGS ... Thus, a **caching agent** does not have a copy of a **cache** line that is not present in the snoop filter. ...

Cited by 46 Related articles All 3 versions Cite Save

Method and apparatus for **caching** credentials in proxy servers for wireless user **agents**

H Liao, PF King, RS Greer - US Patent 6,606,663, 2003 - Google Patents

... Jul 21, 1992, Aug 10, 1993, Digital Equipment Corporation, Access control subsystem and method for **distributed** computer system ... Apr 15, 1994, Mar 4, 1997, Microsoft Corporation, Method and system for **caching** presentation data of a source object in a presentation **cache**. ...

Cited by 113 Related articles All 3 versions Cite Save

Issue Classification 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2136

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION									
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED				
711			130			G	0	6	F	13 / 00 (2006.0)					
CROSS REFERENCE(S)						G	0	6	F	13 / 28 (2006.01.01)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)														
711	E12.038														

NONE		Total Claims Allowed:	
		20	
(Assistant Examiner)	(Date)		
/EDWARD DUDEK JR/ Primary Examiner.Art Unit 2136	11/07/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Issue Classification 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2136

[illegible]

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/EDWARD DUDEK JR/ Primary Examiner.Art Unit 2136	11/07/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	6

Did you mean:

A 65 nm 2-billion transistor **quad-core** Itanium **processor**

B Stackhouse, S Bhimji, C Bostak... - Solid-State Circuits, ..., 2009 - [ieeexplore.ieee.org](#)

... physical layer, Tukwila implements a synchro- nizer and routing architecture that is **distributed** across the ... Yield results for the **caches** have been good, and **cache** repair has successfully salvaged much ... The **distribution** of failures from stability at low voltage has been in line with ...

Cited by 127 Related articles All 7 versions Cite Save

Method and apparatus for maintaining **cache coherency** in a computer system with a highly pipelined bus and **multiple** conflicting snoop requests

AA Merchant - US Patent 5,893,151, 1999 - Google Patents

... Main memory satisfies the demands of **caches** and vector units and often serves ... Jun 11, 1990, Dec 1, 1992, Supercomputer Systems Limited Partnership, **Distributed** architecture for ... US5325503 *, Feb 21, 1992, Jun 28, 1994, Compaq Computer Corporation, **Cache** memory system ...

Cited by 68 Related articles All 2 versions Cite Save

The 48-core SCC **processor**: the programmer's view

TG Mattson, M Riepen, T Lehnig, P Brett... - Proceedings of the ..., 2010 - [dl.acm.org](#)

... 2 L1 **cache** (8 KB), 3/2 L1 **cache** (24 KB), and L2 **cache** (256 KB ... into larger numbers of blocks that are assigned to the cores using a cyclic **distribution**. ... Furthermore, MPI was designed for general applications programming for large **distributed multi-** computers such as clusters or ...

Cited by 187 Related articles All 14 versions Cite Save

Method for reducing the number of **coherency** cycles within a directory-based **cache coherency** memory system utilizing a memory state **cache**

LC James, RM Stevens, GF Young - US Patent 5,809,536, 1998 - Google Patents

... 08/762,636, entitled "Method and Apparatus for **Caching** State Information Within a ... based **cache coherency** system supporting **multiple** instruction **processor** and input/output **caches**. ... Business Machines Corporation, Data storage management using a **distributed cache** scheme. ...

Cited by 21 Related articles All 2 versions Cite Save

Intel® quickpath interconnect architectural features supporting scalable system architectures

D Ziakas, A Baum, RA Maddox... - ... (HOTI), 2010 IEEE 18th ..., 2010 - [ieeexplore.ieee.org](#)

... The **distributed** nature of the memory and **CPU caches** is vital to keeping the **multiple** cores running at their peak rates, but this **distribution** requires careful ... May Transition To' column indicates what a **caching agent** is allowed to do internally to its own **cache** structure without ...

Cited by 18 Related articles All 4 versions Cite Save

Disaggregated memory for expansion and sharing in blade servers

K Lim, J Chang, T Mudge, P Ranganathan... - ACM SIGARCH ..., 2009 - [dl.acm.org](#)

... Note that providing shared- memory communications among client blades (as in **distributed** shared memory) is beyond the scope of this paper. ... per-core dedicated 64KB L1 and 512 KB L2 **caches**, and a 2 MB L3 shared **cache**. ...

Cited by 82 Related articles All 4 versions Cite Save

A 32 nm, 3.1 Billion Transistor, 12 Wide Issue Itanium® **Processor** for Mission-Critical Servers

R Riedlinger, R Arnold, L Biro, B Bowhill... - Solid-State Circuits, ..., 2012 - [ieeexplore.ieee.org](#)

... provides a high bandwidth, low latency interface between the Poulson cores, **distributed** Last Level ... QPI protocols, in-flight request tracking, read/write ordering, and the **caching agent** interface ... Each **controller** is supported by 1.1 MB of directory **cache** to improve response latency ...

Cited by 53 Related articles All 3 versions Cite Save

Nehalem-ex **cpu** architecture

S Koitapalli, J Baxter - Hot chips, 2009 - cse.psu.edu

... Hot Chips 2009 Cores and Last Level **Caches** • Start with 8 Nehalem Cores ... reduction • **Distributed**, partitioned LLC for high BW – One **cache** slice per **core** ... Ring stops shared by **core/cache** – Ring stops tagged as “even”/“odd” polarities – Ring stops only sink from a single ...

Cited by 23 Related articles All 2 versions Cite Save More

Ring interconnect with **multiple coherence** networks

B Tsien - US Patent 7,406,566, 2008 - Google Patents

... 12, 2003, Jan 17, 2006, International Business Machines Corporation, Bus protocol for a switchless **distributed** shared memory ... Method and apparatus for implementing **cache coherency** of a **processor**. ... Advanced **processor** with mechanism for packet **distribution** at high line rate. ...

Cited by 19 Related articles All 4 versions Cite Save

Method and apparatus for dynamically controlling power management in a **distributed** system

SR Hutsell, YC Liu, K Sistla - US Patent 7,644,293, 2010 - Google Patents

... and reduce the number of active chunks associated with the tracker for this **caching agent**. ... and Apparatus to Dynamically Adjust Resource Power Usage in a **Distributed** System" Hutsell et ... May 1, 2012, Intel Corporation, System and method for aggregating **core-cache** clusters in ...

Cited by 15 Related articles All 4 versions Cite Save

Did you mean to search for:

EAST Search History**EAST Search History (Interference)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S58	29	(cache with coherency with (core or cpu or processor) with ("I/O" or "input/output" or "I/O")).clm.	USPAT; UPAD	OR	ON	2014/11/06: 10:40
S59	5	(cache with coherency with (distributed or single) with agent).clm.	USPAT; UPAD	OR	ON	2014/11/06: 10:40
S60	13	(cache with dedicated with entry).clm.	USPAT; UPAD	OR	ON	2014/11/06: 10:41
S61	0	(pending with dedicated with entry).clm.	USPAT; UPAD	OR	ON	2014/11/06: 10:41

11/6/2014 2:34:09 PM**C:\Users\edudek\Documents\EAST\Workspaces\13324053.wsp**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Yen-Cheng Liu, et al.	§	Group Art Unit:	2186
		§		
Serial No.:	13/324,053	§		
		§	Examiner:	Edward J. Dudek, Jr.
Filed:	December 13, 2011	§		
		§		
For:	Providing Common Caching	§	Atty. Dkt. No.:	ITL.2523US (P39131)
	Agent For Core And Integrated	§		
	Input/Output (IO) Module	§		

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

REPLY TO OFFICE ACTION MAILED JULY 8, 2014

Sir:

In response to the Office Action mailed July 8, 2014, please amend the above-referenced patent application as follows:

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Amendments to the Claims:

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

Listing of Claims:

Claim 1 (currently amended): An apparatus comprising:
a multicore processor including a plurality of cores, a shared cache memory, an integrated input/output (IIO) module to interface between the multicore processor and at least one IO device coupled to the multicore processor, and a caching agent to perform cache coherency operations for the plurality of cores and the IIO module, the caching agent a single caching agent for the multicore processor and including a plurality of distributed portions each associated with a corresponding one of the plurality of cores.

Claim 2 (original): The apparatus of claim 1, wherein the caching agent includes a table of requests to store pending requests for the plurality of cores and the IIO module.

Claim 3 (original): The apparatus of claim 2, wherein the table of requests includes at least one dedicated entry to store a posted transaction.

Claim 4 (canceled)

Claim 5 (currently amended): The apparatus of claim [[4]] 1, wherein the shared cache memory comprises a last level cache (LLC) including a plurality of distributed portions each associated with a corresponding one of the plurality of cores.

Claim 6 (original): The apparatus of claim 5, wherein the plurality of distributed portions of the caching agent are coupled via a ring interconnect.

Claim 7 (original): The apparatus of claim 1, wherein the caching agent is to receive an allocation transaction from the IIO module, the allocation transaction received in the IIO module from an IO device coupled to the multicore processor.

Claim 8 (original): The apparatus of claim 7, wherein the caching agent is to directly store data of the allocation transaction into the shared cache memory and to not initiate a memory transaction to a system memory coupled to the multicore processor.

Claim 9 (original): The apparatus of claim 1, wherein the caching agent is to send a drop ownership indication to the IIO module for a cache line owned by the IIO module for an IO device coupled to the multicore processor responsive to receipt of a snoop request in the caching agent for the cache line from another agent.

Claim 10 (original): The apparatus of claim 9, wherein the IO device prefetched the cache line.

Claim 11 (original): The apparatus of claim 9, wherein the another agent is one of the plurality of cores.

Claim 12 (currently amended): A method comprising:
receiving an allocation transaction in an integrated input/output (IIO) module of a multicore processor from an IO device coupled to the multicore processor, the allocation transaction comprising a request to directly store data of the allocation transaction into a shared cache memory of the multicore processor;

forwarding the allocation transaction to a caching agent of the multicore processor, the caching agent shared by a plurality of cores of the multicore processor and the IIO module; and
directly storing the data of the allocation transaction into [[a]] the shared cache memory of the multicore processor.

Claim 13 (original): The method of claim 12, further comprising accessing the data in the shared cache memory via at least one of the plurality of cores of the multicore processor a number of times, without sending a transaction to a system memory coupled to the multicore processor.

Claim 14 (original): The method of claim 13, further comprising sending data of the

cache line to the system memory from the shared cache memory if the cache line is evicted from the shared cache memory, when the cache line includes modified data.

Claim 15 (original): The method of claim 13, further comprising directly storing the data of the allocation transaction into the shared cache memory without communicating with the system memory.

Claim 16 (original): The method of claim 12, further comprising sending a drop ownership indication to the IIO module for a cache line owned by the IIO module responsive to receipt of a snoop request in the caching agent for the cache line from another agent.

Claim 17 (original): A system comprising:

a first multicore processor including a first plurality of cores, a first shared cache memory, a first integrated input/output (IIO) module to interface between the first multicore processor and a first plurality of IO devices coupled to the first multicore processor, and a first caching agent to perform cache coherency operations for the first plurality of cores and the first IIO module, wherein the first caching agent includes a table of requests having a plurality of entries each to store a pending request for one of the first plurality of cores or the first IIO module, including at least one dedicated entry to store a pending request corresponding to a posted transaction;

a second multicore processor including a second plurality of cores, a second shared cache memory, a second IIO module to interface between the second multicore processor and a second plurality of IO devices coupled to the second multicore processor, and a second caching agent to perform cache coherency operations for the second plurality of cores and the second IIO module; and

a peripheral controller coupled to at least one of the first and second multicore processors.

Claim 18 (currently amended): The system of claim 17, wherein the first caching agent is to receive an allocation transaction from the first IIO module, the allocation transaction comprising a request to directly store data of the allocation transaction into the first shared

cache memory, and directly store the data of the allocation transaction into the first shared cache memory.

Claim 19 (original): The system of claim 18, wherein the data in the shared cache memory is to be accessed via at least one of the first plurality of cores a number of times, without sending a transaction to a system memory coupled to the first multicore processor.

Claim 20 (original): The system of claim 17, wherein the first caching agent is a single caching agent for the first multicore processor and includes a plurality of distributed portions each associated with a corresponding one of the first plurality of cores, the first shared cache memory comprises a last level cache (LLC) including a plurality of distributed portions each associated with a corresponding one of the first plurality of cores, and wherein the plurality of distributed portions of the first caching agent are coupled via a ring interconnect.

REMARKS/ARGUMENTS

Pending claims 1-3, 5-7, 9, 11, 17 and 20 stand rejected under 35 U.S.C. §102(b) over U.S. Publication No. 2004/0139283 (Arimilli). Applicants respectfully traverse the rejection. Regarding claim 1, Arimilli fails to anywhere disclose or even suggest that a multicore processor include a single caching agent that includes multiple distributed portions each associated with a corresponding one of multiple cores of the multicore processor.

Here, contended support is from paragraph 40 of Arimilli. However, neither here nor anywhere else in the reference is there any disclosure of distributed portions of a single caching agent. Rather, regarding paragraph 40, all that is described is that a processing unit includes a cache hierarchy that may include separate level one (L1) caches for each processor core, and a level two (L2) cache shared by multiple processor cores. The L1 caches thus do not meet the recited subject matter regarding a caching agent to perform cache coherency operations for an integrated IO module. And clearly, the shared L2 cache disclosure fails to anywhere address that this be in the form of distributed portions. Nor is there any disclosure of distributing a caching agent as set forth in the claim. Rather, all that Arimilli discloses is that each cache (namely the L1 and L2 cache) includes cache array, directory and controller. Nonetheless, nothing here nor anywhere else discloses the distributed arrangement. Accordingly claim 1 and the claims depending therefrom are patentable over the cited art.

Regarding independent claim 17 Arimilli fails to disclose the arrangement set forth, in which a first caching agent includes a table of requests with multiple entries each to store pending requests for a core or an integrated IO module. Further, there is absolutely no disclosure that this agent includes at least one dedicated entry to store a pending request corresponding to a posted transaction. Regarding the table of requests, the Office Action refers to paragraphs 40-42 and 48 of Arimilli. But this subject matter is nowhere present here. Regarding paragraph 40, a simple disclosure of a cache hierarchy is presented. Paragraph 41 simply teaches that this cache hierarchy couples to an integrated memory controller that in turn couples to a memory. Paragraph 42 simply teaches the presence of an integrated fabric interface to enable communication between different processing units via a switching fabric. Finally, paragraph 48 simply describes presence of an external communication adapter that includes a data queue to store entries for buffering inbound and outbound I/O data. Yet this fails to disclose the recited

caching agent-included table of requests. This is especially so, as this storage of I/O data in this adapter is not storage of pending requests for a given core or integrated I/O module.

Still further, there is nothing anywhere in Arimilli that addresses a dedicated entry whatsoever, and certainly not a dedicated entry to store a request corresponding to a posted transaction. Here, reference is made to paragraph 72 of Arimilli. But all that Arimilli discloses here is that the external communication adapter provides indication of completions of I/O data to a requesting process. But a completion indication clearly is not a posted transaction. In fact, requiring a completion means that there are not any posted transactions available, as a posted transaction does not require a completion. *See* Exhibit A (Wikipedia “Posted Write”). Thus the presence of completions fails to provide disclosure of a dedicated entry for storage of an entirely different type of transaction – namely a posted transaction.

Regarding independent claim 12, which stands rejected under 35 U.S.C. §103(a) over Arimilli in view of U.S. Publication No. 2008/0320236 (Ueda), Applicants respectfully traverse the rejection. Here, nothing in the art anywhere teaches or suggests the recited allocation transaction or its receipt and handling as set forth in the claim. Here the Office Action concedes that Arimilli says nothing regarding any such transaction and accordingly relies on Ueda.

But Ueda is also silent in this regard. That is, all that the contended support of Ueda shows is that write back or write through transactions can be used to send data from a core to a cache memory (and possibly further through to a memory). But there is nothing in the reference to anywhere teach or suggest the arrangement set forth in claim 12 in which an allocation transaction is received in an integrated I/O module from an I/O device coupled to a multicore processor. This is particularly so, as claim 12 recites that this allocation transaction comprises a request to directly store data into a shared cache memory. The conventional storage of data from a core into a cache memory says nothing regarding such allocation transaction from an I/O device to directly store data into a cache memory of a processor. Accordingly, claim 12 and the claims depending therefrom are patentable over the cited art.

In view of these remarks, the application is now in condition for allowance and the Examiner's prompt action in accordance therewith is respectfully requested. The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 20-1504.

Respectfully submitted,

Date: October 8, 2014

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Customer No.: 47795

Exhibit A

Posted write

From Wikipedia, the free encyclopedia

A **posted write** is a computer bus write transaction that does not wait for a write completion response to indicate success or failure of the write transaction. For a posted write, the CPU assumes that the write cycle will complete with zero wait states, and so doesn't wait for the done. This speeds up writes considerably. For starters, it doesn't have to wait for the done response, but it also allows for better pipelining of the datapath without much performance penalty.

A non-posted write requires that a bus transaction responds with a write completion response to indicate success or failure of the transaction, and is naturally much slower than a posted write since it requires a round trip delay similar to read bus transactions.

In reference to memory bus accesses, a posted write is referred to as a posted memory write (PMW).

See also

- CPU cache
- Computer memory

References

- PCI System Architecture, Don Anderson, Tom Shanley, MindShare, Inc - 1999
([http://www.mindshare.com/files/ebooks/PCI%20System%20Architecture%20\(4th%20Edition\).pdf](http://www.mindshare.com/files/ebooks/PCI%20System%20Architecture%20(4th%20Edition).pdf))

External links

- Computer hardware buses (<http://www.dmoz.org/Computers/Hardware/Buses/>) at DMOZ
- Computer hardware buses and slots pinouts with brief descriptions
(http://pinouts.ru/pin_Slots.shtml)

Retrieved from "http://en.wikipedia.org/w/index.php?title=Posted_write&oldid=594179682"

Categories: Computer buses | Digital electronics | Motherboard

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Electronic Acknowledgement Receipt	
EFS ID:	20363938
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/Stephanie Petreas
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	08-OCT-2014
Filing Date:	13-DEC-2011
Time Stamp:	15:31:28
Application Type:	Utility under 35 USC 111(a)

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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	ITL2523USROA7-8-14.pdf	138443 1a99baf3377bd68d8168a773119a256ed3e94eb5	no	8

Warnings:

Information:

2	Miscellaneous Incoming Letter	ITL2523USExhibitA.pdf	86375	no	2
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Information:					
Total Files Size (in bytes):				224818	
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.					

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 13/324,053		Filing Date 12/13/2011		☐ 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			
☐ SEARCH FEE (37 CFR 1.16(k), (l), 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(j))		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			
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	10/08/2014	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	x \$80 =		0	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 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.
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)	5133
47795 7590 07/08/2014 TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., SUITE 750 HOUSTON, TX 77057-2631			EXAMINER DUDEK JR, EDWARD J	
			ART UNIT 2186	PAPER NUMBER
			MAIL DATE 07/08/2014	DELIVERY MODE PAPER

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

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

Office Action Summary	Application No. 13/324,053	Applicant(s) LIU ET AL.	
	Examiner EDWARD DUDEK JR	Art Unit 2186	AIA (First Inventor to File) Status No

-- 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 13 December 2011.
☐ 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) _____ is/are allowed.

7) ☒ Claim(s) 1-20 is/are rejected.

8) ☐ Claim(s) _____ 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 13 December 2011 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 10-10-13, 07-25-13, 12-13-11.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

This Office Action is responsive to the application filed on 13 December 2011.

Claims 1-20 are pending and have been presented for examination.

Claim Rejections - 35 USC § 102

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

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-7, 9, 11, 17 and 20 are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Arimilli (**U.S. Patent Application Publication #2004/0139283**).

Claim 1: Arimilli discloses an apparatus comprising: a multicore processor including a plurality of cores (**see [0040]**), a shared cache memory (**see [0040]**), an integrated input/output (I/O) module to interface between the multicore processor and at

least one IO device coupled to the multicore processor (**see [0044]**), and a caching agent to perform cache coherency operations for the plurality of cores and the IIO module (**see [0040]-[0041] and [0052]**).

Claim 2: wherein the caching agent includes a table of requests to store pending requests for the plurality of cores and the IIO module (**see [0040]-[0042] and [0048]**).

Claim 3: wherein the table of requests includes at least one dedicated entry to store a posted transaction (**see [0072]**).

Claim 4: wherein the caching agent is a single caching agent for the multicore processor and includes a plurality of distributed portions each associated with a corresponding one of the plurality of cores (**see [0040]**).

Claim 5: wherein the shared cache memory comprises a last level cache (LLC) including a plurality of distributed portions each associated with a corresponding one of the plurality of cores (**see [0040]**).

Claim 6: wherein the plurality of distributed portions of the caching agent are coupled via a ring interconnect (**see figure 3, elements 106 and 150**).

Claim 7: wherein the caching agent is to receive an allocation transaction from the IIO module, the allocation transaction received in the IIO module from an IO device coupled to the multicore processor (**see [0045]**).

Claim 9: wherein the caching agent is to send a drop ownership indication to the IIO module for a cache line owned by the IIO module for an IO device coupled to the multicore processor responsive to receipt of a snoop request in the caching agent for

the cache line from another agent **(see [0040] and [0053], the MESI protocol supports an invalidate instruction)**.

Claim 11: wherein the another agent is one of the plurality of cores **(see [0042]-[0044])**.

Claim 17: Arimilli discloses a system comprising: a first multicore processor including a first plurality of cores **(see [0040])**, a first shared cache memory **(see [0040])**, a first integrated input/output (IIO) module to interface between the first multicore processor and a first plurality of IO devices coupled to the first multicore processor **(see [0044])**, and a first caching agent to perform cache coherency operations for the first plurality of cores and the first IIO module **(see [0040]-[0041] and [0052])**, wherein the first caching agent includes a table of requests having a plurality of entries each to store a pending request for one of the first plurality of cores or the first IIO module **(see [0040]-[0042] and [0048])**, including at least one dedicated entry to store a pending request corresponding to a posted transaction **(see [0072])**; a second multicore processor **(see figure 3, the system can have multiple processors)** including a second plurality of cores **(see [0040])**, a second shared cache memory **(see [0040])**, a second IIO module to interface between the second multicore processor and a second plurality of IO devices coupled to the second multicore processor **(see [0044])**, and a second caching agent to perform cache coherency operations for the second plurality of cores and the second IIO module **(see [0040]-[0041] and [0052])**;

and a peripheral controller coupled to at least one of the first and second multicore processors (**see [0043]**).

Claim 20: wherein the first caching agent is a single caching agent for the first multicore processor and includes a plurality of distributed portions each associated with a corresponding one of the first plurality of cores (**see [0040]**), the first shared cache memory comprises a last level cache (LLC) including a plurality of distributed portions each associated with a corresponding one of the first plurality of cores (**see [0040]**), and wherein the plurality of distributed portions of the first caching agent are coupled via a ring interconnect (**see figure 3, elements 106 and 150**).

Claim Rejections - 35 USC § 103

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

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

Claims 8 and 18-19 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Arimilli (**U.S. Patent Application Publication #2004/0139283**) as applied to claims 1-7, 9, 11, 17 and 20 above, and further in view of Ueda (**U.S. Patent Application Publication #2008/0320236**).

Claim 8: Arimilli discloses all the limitations of claim 7 as discussed above.

Arimilli fails to disclose the caching agent is to directly store data of the allocation transaction into the shared cache memory and to not initiate a memory transaction to a system memory coupled to the multicore processor.

Ueda discloses different configurations for writing to a cache memory. One of these techniques is a “write-back” where data is written to the cache without accessing the system memory. When the data is flushed from the cache, then the data is written to the system memory (**see [0003] and [0022]**). This is a well-known technique for storing data to a cache memory. “When there is a design need for market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *KSR*, 82 USPQ2d at 1397.

It would have been obvious to a person having ordinary skill in the art to which said subject matter pertains to have modified the teachings of Arimilli to use a “write-back” caching technique as it is one of a limited number of solutions for caching data and would have been obvious to try.

Claim 18: Arimilli discloses wherein the first caching agent is to receive an allocation transaction from the first I/O module (**see [0045]**).

Arimilli fails to disclose directly store data of the allocation transaction into the first shared cache memory.

Ueda discloses different configurations for writing to a cache memory. One of these techniques is a “write-back” where data is written to the cache without accessing

the system memory. When the data is flushed from the cache, then the data is written to the system memory (**see [0003] and [0022]**). This is a well-known technique for storing data to a cache memory. "When there is a design need for market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp." *KSR*, 82 USPQ2d at 1397.

It would have been obvious to a person having ordinary skill in the art to which said subject matter pertains to have modified the teachings of Arimilli to use a "write-back" caching technique as it is one of a limited number of solutions for caching data and would have been obvious to try.

Claim 19: wherein the data in the shared cache memory is to be accessed via at least one of the first plurality of cores a number of times, without sending a transaction to a system memory coupled to the first multicore processor (**see Ueda [0022] and [0029], in write-back mode the line can be access a number of times without sending a transaction to the system memory, only when the line is evicted from the cache is a transaction sent to the system memory**).

Claim 10 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Arimilli (**U.S. Patent Application Publication #2004/0139283**) as applied to claims 1-7, 9, 11, 17 and 20 above, and further in view of Huggahalli (**U.S. Patent Application Publication #2006/0085602**).

Claim 10: Arimilli discloses all the limitations of claim 9 as discussed above.

Arimilli fails to disclose wherein the IO device prefetched the cache line.

Huggahalli discloses a system where an IO device external to the CPU can initiate prefetches (**see [0013]**). Allowing an external device to initiate the prefetch improves the performance of an application running on the computer (**see [0016]**).

It would have been obvious to a person having ordinary skill in the art to which said subject matter pertains to have modified the teachings of Arimilli to allow the IO device to prefetch data into the cache to improve the performance of applications running on the computer, as taught by Huggahalli.

Claims 12-16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Arimilli (**U.S. Patent Application Publication #2004/0139283**) in view of Ueda (**U.S. Patent Application Publication #2008/0320236**).

Claim 12: Arimilli discloses a method comprising: receiving an allocation transaction in an integrated input/output (IIO) module of a multicore processor from an IO device coupled to the multicore processor (**see [0045]**); forwarding the allocation transaction to a caching agent of the multicore processor (**see [0052]-[0053]**), the caching agent shared by a plurality of cores of the multicore processor and the IIO module (**see [0040]-[0041] and [0052]**).

Arimilli fails to disclose directly storing data of the allocation transaction into a shared cache memory of the multicore processor.

Ueda discloses different configurations for writing to a cache memory. One of these techniques is a “write-back” where data is written to the cache without accessing

the system memory. When the data is flushed from the cache, then the data is written to the system memory (**see [0003] and [0022]**). This is a well-known technique for storing data to a cache memory. “When there is a design need for market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *KSR*, 82 USPQ2d at 1397.

It would have been obvious to a person having ordinary skill in the art to which said subject matter pertains to have modified the teachings of Arimilli to use a “write-back” caching technique as it is one of a limited number of solutions for caching data and would have been obvious to try.

Claim 13: further comprising accessing the data in the shared cache memory via at least one of the plurality of cores of the multicore processor a number of times, without sending a transaction to a system memory coupled to the multicore processor (**see Ueda [0022] and [0029], in write-back mode the line can be access a number of times without sending a transaction to the system memory, only when the line is evicted from the cache is a transaction sent to the system memory**).

Claim 14: further comprising sending data of the cache line to the system memory from the shared cache memory if the cache line is evicted from the shared cache memory, when the cache line includes modified data (**see [0022]**).

Claim 15: further comprising directly storing the data of the allocation transaction into the shared cache memory without communicating with the system memory (**see [0003] and [0022], “write-back” mode**).

Claim 16: further comprising sending a drop ownership indication to the IIO module for a cache line owned by the IIO module responsive to receipt of a snoop request in the caching agent for the cache line from another agent **(see [0040] and [0053], the MESI protocol supports an invalidate instruction).**

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDWARD DUDEK JR whose telephone number is (571)270-1030. The examiner can normally be reached on Mon thru Thur 7:30-5:00pm Sec. Fri 7:30-4 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Rones can be reached on 571-272-4085. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

Application/Control Number: 13/324,053
Art Unit: 2186

Page 11

/EDWARD DUDEK JR/
Primary Examiner, Art Unit 2186
July 1, 2014

Notice of References Cited	Application/Control No. 13/324,053	Applicant(s)/Patent Under Reexamination LIU ET AL.	
	Examiner EDWARD DUDEK JR	Art Unit 2186	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2004/0139283 A1	07-2004	Arimilli et al.	711/146
*	B	US-2006/0085602 A1	04-2006	Huggahalli et al.	711/137
*	C	US-2008/0320236 A1	12-2008	Ueda et al.	711/146
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Search Notes 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2186

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
711	130, E12.038	06-27-2014	EJD

SEARCH NOTES		
Search Notes	Date	Examiner
Text search in EAST	06-27-2014	EJD
Inventor name search in EAST	06-27-2014	EJD
Assignee search in EAST - limited by text	06-27-2014	EJD
Text search in EAST	06-28-2014	EJD

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

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Receipt date: 12/13/2011

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

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.

13324053 - GAI: 2186

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

U.S.PATENTS								
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	6009488		1999-12-28	KAVIPURAPU			
	2	7689778		2010-03-30	Liu, et al.			
	3	7210000		2007-04-24	Creta			
	4	7165131		2007-01-16	Creta			
If you wish to add additional U.S. Patent citation information please click the Add button.								
U.S.PATENT APPLICATION PUBLICATIONS								
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	20060053258		2006-03-09	Liu			
If you wish to add additional U.S. Published Application citation information please click the Add button.								
FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13324053 - GAU: 2186	
	Filing Date		2011-12-13	
	First Named Inventor	Yen-Cheng Liu, et al.		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		ITL.2523US (P39131)	

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	INTEL CORPORATION, "An Introduction to the Intel QuickPath Interconnect," January 2009, pages 1-22	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature	/Edward Dudek Jr/	Date Considered	06/27/2014
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

Receipt date: 12/13/2011 INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13324053 - GAU: 2186
	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Rozman/	Date (YYYY-MM-DD)	2011-12-13
Name/Print	Mark J. Rozman	Registration Number	42117

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour 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.**

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:

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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.
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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)).
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.
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /E.J.D.

<i>Index of Claims</i> 	Application/Control No. 13324053	Applicant(s)/Patent Under Reexamination LIU ET AL.
	Examiner EDWARD DUDEK JR	Art Unit 2186

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

☐ Claims renumbered in the same order as presented by applicant				☐ CPA				☐ T.D.				☐ R.1.47			
CLAIM			DATE												
Final	Original	07/01/2014													
	1	✓													
	2	✓													
	3	✓													
	4	✓													
	5	✓													
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	18	✓													
	19	✓													
	20	✓													

Receipt date: 10/10/2013

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

13324053 - GAI: 2186

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13324053	
	Filing Date		2011-12-13	
	First Named Inventor	Yen-Cheng Liu, et al.		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		ITL.2523US (P39131)	

U.S.PATENTS								
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	7937534		2011-05-03	Madukkarumukumana			
If you wish to add additional U.S. Patent citation information please click the Add button.								
U.S.PATENT APPLICATION PUBLICATIONS								
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Published Application citation information please click the Add button.								
FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1							☐
If you wish to add additional Foreign Patent Document citation information please click the Add button								
NON-PATENT LITERATURE DOCUMENTS								
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.						T ⁵

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	Filing Date		2011-12-13	
	First Named Inventor	Yen-Cheng Liu, et al.		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		ITL.2523US (P39131)	

	1		☐
If you wish to add additional non-patent literature document citation information please click the Add button			
EXAMINER SIGNATURE			
Examiner Signature	/Edward Dudek Jr/		Date Considered 06/27/2014
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			
¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.			

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Signature	/Mark J. Rozman/	Date (YYYY-MM-DD)	2013-10-10
Name/Print	Mark J. Rozman	Registration Number	42,117

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	10	((("7937534") or ("20070150664") or ("20110191542") or ("20110153924") or ("20100274975") or ("6009488") or ("7689778") or ("7210000") or ("7165131") or ("20060053258")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/06/27 12:09
S2	63060	(multi or multiple or plural or plurality) with core with processor	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 12:12
S3	1688	((multi or multiple or plural or plurality) with core with processor) same (share\$ near3 cache)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 12:13
S4	3057	((multi or multiple or plural or plurality) with core with processor) same ("input/ouput" or "I/O" or "IIO")	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 12:13
S5	254	S3 and S4	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 12:13
S6	83	S5 and (cache near3 coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 12:13
S7	562	((multi or multiple or plural or plurality) with core with processor) same (cache with coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:00
S8	4543	("input/ouput" or "I/O" or "IIO" or external or interface) same (cache with coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:01
S9	352	S7 and S8	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:01
S10	1810	cache with pending with request	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:37

S11	111	cache with posted with transaction	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:37
S12	18	S10 and S11	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:37
S13	504	(share\$ near3 cache) same ((partition or portion or assign or associate) with core)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:38
S14	173	S3 and S13	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:39
S15	613	711/E12.038.ccls.	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 13:55
S16	975	(711/130).OCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/06/27 13:55
S17	60465	intel.as.	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:05
S18	2	S17 and (multicore with processor with cache with coherency)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:05
S19	0	S17 and (multicore with processor with "input/output" with module)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:05
S20	6	S17 and (multicore with processor with "input/output")	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:05
S21	15	S17 and (cache with coherency with "input/output")	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:06
S22	29	S17 and (distributed with caching with agent)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/27 14:06
S23	5	S17 and (caching with agent with	US-PGPUB;	OR	ON	2014/06/27

		pending with request)	USPAT; USOCR; EPO; DERWENT; IBM_TDB			14:07
S24	34	((Yen-Cheng) near2 (Liu)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:10
S25	148	((Robert) near2 (Blankenship)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:10
S26	12	((Geeyarpuram) near2 (Santhanakrishnan)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:17
S27	38	((Ganapati) near2 (Srinivasa)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:18
S28	71	((Kenneth) near2 (Greta)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:19
S29	64	((Sridhar) near2 (Muthrasanallur)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:21
S30	8	((Bahaa) near2 (Fahim)).INV.	US-PGPUB; USPAT	OR	ON	2014/06/27 14:22
S31	42	(share\$ near3 cache) with (write near3 back) with ((system or main) near3 memory)	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/28 07:22
S32	2430	("input/ouput" or "I/O" or "IIO" or external or interface) same cache same prefetch	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/28 07:28
S33	804	((("input/ouput" or "I/O" or "IIO" or external or interface) with (processor or CPU)) same cache same prefetch	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/28 07:28
S34	18	((("input/ouput" or "I/O" or "IIO" or external or interface) with (processor or CPU)) same (share\$ near3 cache) same prefetch	US-PGPUB; USPAT; USOCR; EPO; DERWENT; IBM_TDB	OR	ON	2014/06/28 07:29

7/ 1/2014 1:48:11 PM

C:\Users\edudek\Documents\EAST\Workspaces\13324053.wsp

Receipt date: 07/25/2013

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

13324053 - GAI: 2186

Approved for use through 07/31/2012. OMB 0651-0031

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	Examiner Name			
	Attorney Docket Number		ITL.2523US (P39131)	

U.S.PATENTS								
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Patent citation information please click the Add button.								
U.S.PATENT APPLICATION PUBLICATIONS								
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	20070150664		2007-06-28	Dombrowski, et al.			
	2	20110191542		2011-08-04	Vash, et al.			
	3	20110153924		2011-06-23	Vash, et al.			
	4	20100274975		2010-10-28	Sistla, et al.			
If you wish to add additional U.S. Published Application citation information please click the Add button.								
FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	INTERNATIONAL SEARCHING AUTHORITY, "Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority," mailed May 1, 2013, in International application no. PCT/US2012/069018.	☐

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EXAMINER SIGNATURE

Examiner Signature	/Edward Dudek Jr/	Date Considered	06/27/2014
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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Signature	/Mark J. Rozman/	Date (YYYY-MM-DD)	2013-07-25
Name/Print	Mark J. Rozman	Registration Number	42,117

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /E.J.D.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13324053	
	Filing Date		2011-12-13	
	First Named Inventor	Yen-Cheng Liu, et al.		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	ITL.2523US (P39131)		

U.S.PATENTS								
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	7937534		2011-05-03	Madukkarumukumana			
If you wish to add additional U.S. Patent citation information please click the Add button.								
U.S.PATENT APPLICATION PUBLICATIONS								
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Published Application citation information please click the Add button.								
FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1							☐
If you wish to add additional Foreign Patent Document citation information please click the Add button								
NON-PATENT LITERATURE DOCUMENTS								
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.						T ⁵

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	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		ITL.2523US (P39131)

	1		☐
If you wish to add additional non-patent literature document citation information please click the Add button			
EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			
¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.			

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	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

CERTIFICATION STATEMENT

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OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Rozman/	Date (YYYY-MM-DD)	2013-10-10
Name/Print	Mark J. Rozman	Registration Number	42,117

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Electronic Acknowledgement Receipt	
EFS ID:	17092526
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/Stephanie Petreas
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	10-OCT-2013
Filing Date:	13-DEC-2011
Time Stamp:	13:19:30
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	Information Disclosure Statement (IDS) Form (SB08)	ITL2523USIDSToFile.pdf	36507 40e33d7e04f9c172b7d3ed67ed02c90b1b166742	no	4

Warnings:

Information:

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Total Files Size (in bytes):

36507

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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		13324053	
	Filing Date		2011-12-13	
	First Named Inventor	Yen-Cheng Liu, et al.		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		ITL.2523US (P39131)	

U.S.PATENTS								
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1							
If you wish to add additional U.S. Patent citation information please click the Add button.								
U.S.PATENT APPLICATION PUBLICATIONS								
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	20070150664		2007-06-28	Dombrowski, et al.			
	2	20110191542		2011-08-04	Vash, et al.			
	3	20110153924		2011-06-23	Vash, et al.			
	4	20100274975		2010-10-28	Sistla, et al.			
If you wish to add additional U.S. Published Application citation information please click the Add button.								
FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵

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	Examiner Name			
	Attorney Docket Number	ITL.2523US (P39131)		

	1							☐
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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	INTERNATIONAL SEARCHING AUTHORITY, "Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority," mailed May 1, 2013, in International application no. PCT/US2012/069018.	☐

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EXAMINER SIGNATURE

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

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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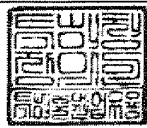
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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: ROZMAN MARK J. TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., STE. 750 HOUSTON TX 77057-2631 USA		PCT NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION (PCT Rule 44.1)	
		Date of mailing (day/month/year) 01 May 2013 (01.05.2013)	
Applicant's or agent's file reference P39131PCT <i>ITL 2523000</i>		FOR FURTHER ACTION See paragraphs 1 and 4 below	
International application No. PCT/US2012/069018		International filing date (day/month/year) 11 December 2012 (11.12.2012)	
Applicant INTEL CORPORATION			

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.
Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):
When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.
Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70
For more detailed instructions, see PCT Applicant's Guide, International Phase, paragraphs 9.004 - 9.011.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Reminders**
 The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.
 Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90bis.1 and 90bis.3).
 Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.
 In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.
 For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the PCT Applicant's Guide, National Chapters.

Name and mailing address of the ISA/KR  Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer COMMISSIONER Telephone No. 82-42-481-8753	
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Form PCT/ISA/220 (July 2010)

* Attention

Copies of the documents cited in the international search report can be searched in the following Korean Intellectual Property Office English website for three months from the date of mailing of the international search report.

<http://www.kipo.go.kr/en/> => PCT Services => PCT Services

ID : PCT international application number

PW : **JNEGWCCP**

Inquiries related to PCT International Search Report or Written Opinion prepared by KIPO as an International Searching Authority can be answered not only by KIPO but also through IPKC (Intellectual Property Korea Center), located in Vienna, VA, which functions as a PCT Help Desk for PCT applicants.

Homepage: <http://www.ipkcenter.com>

Email: ipkc@ipkcenter.com

Phone: +1 703 388 1066

Fax: +1 703 388 1084

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference P39131PCT	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2012/069018	International filing date (<i>day/month/year</i>) 11 December 2012 (11.12.2012)	(Earliest) Priority Date (<i>day/month/year</i>) 13 December 2011 (13.12.2011)
Applicant INTEL CORPORATION		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. I
☐ as suggested by the applicant.
☒ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figure is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/069018**A. CLASSIFICATION OF SUBJECT MATTER***G06F 9/46(2006.01)i, G06F 12/08(2006.01)i, G06F 9/06(2006.01)i*

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F 9/46; G06F 12/00; G06F 13/28; G06F 12/08

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: "cache agent, integrated IO module"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US:2007-0150664 A1 (CHRIS DOMBROWSKI et al.) 28 June 2007 See abstract, paragraphs [0047]-[0058], claim 1, and figures 4-5.	1-20
A	US:2011-0191542 A1 (VASH JAMES R. et al.) 04 August 2011 See abstract, paragraphs [0017]-[0020], and figures 2, 7-8.	1-20
A	US:2011-0153924 A1 (VASH JAMES R. et al.) 23 June 2011 See abstract, paragraphs [0026]-[0027], and figure 2.	1-20
A	US:2010-0274975 A1 (SISTLA KRISHNAKANTH et al.) 28 October 2010 See abstract, paragraphs [0012]-[0014], claim 1, and figures 1-2.	1-20

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

* Special categories of cited documents:

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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

30 April 2013 (30.04.2013)

Date of mailing of the international search report

01 May 2013 (01.05.2013)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

JI, Jeong Hoon

Telephone No. 82-42-481-5688



Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/069018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007-0150664 A1	28.06.2007	CN 100474270 C CN 1991795 A CN 1991795 C0 JP 05-064753 B2 JP 2007-179528 A TW 200809497 A	01.04.2009 04.07.2007 04.07.2007 17.08.2012 12.07.2007 16.02.2008
US 2011-0191542 A1	04.08.2011	None	
US 2011-0153924 A1	23.06.2011	None	
US 2010-0274975 A1	28.10.2010	None	

Form PCT/ISA/210 (patent family annex) (July 2009)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

ROZMAN MARK J.

TROP, PRUNER & HU, P.C. 1616 S. VOSS RD., STE. 750
HOUSTON TX 77057-2631 USA

PCT

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) **01 May 2013 (01.05.2013)**

Applicant's or agent's file reference
P39131PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2012/069018

International filing date (day/month/year)

11 December 2012 (11.12.2012)

Priority date(day/month/year)

13 December 2011 (13.12.2011)

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

G06F 9/46(2006.01)i, G06F 12/08(2006.01)i, G06F 9/06(2006.01)i

Applicant

INTEL CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis I(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon
Metropolitan City, 302-701,
Republic of Korea
Facsimile No. 82-42-472-7140

Date of completion of this opinion

30 April 2013 (30.04.2013)

Authorized officer

JI, Jeong Hoon

Telephone No.82-42-481-5688



Form PCT/ISA/237 (cover sheet) (July 2011)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2012/069018

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

a. a sequence listing filed or furnished

- ☐ on paper
- ☐ in electronic form

b. time of filing or furnishing

- ☐ contained in the international application as filed.
- ☐ filed together with the international application in electronic form.
- ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2012/069018

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-20	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2007-0150664 A1 (CHRIS DOMBROWSKI et al.) 28 June 2007
D2: US 2011-0191542 A1 (VASH JAMES R. et al.) 04 August 2011
D3: US 2011-0153924 A1 (VASH JAMES R. et al.) 23 June 2011
D4: US 2010-0274975 A1 (SISTLA KRISHNAKANTH et al.) 28 October 2010

1. Novelty and Inventive Step

1.1. Claims 1-11

The subject matter of claim 1 differs from these prior art documents D1-D4 in an apparatus comprising: a multicore processor including a plurality of cores, a shared cache memory, an integrated input/output(IIO) module to interface between the multicore processor and at least one IO device coupled to the multicore processor, and a caching agent to perform cache coherency operations for the plurality of cores and the IIO module.

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 1 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claims 2-11 are dependent on claim 1 and therefore meet the requirements of PCT Article 33(2) and (3).

1.2. Claims 12-16

The subject matter of claim 12 differs from these prior art documents D1-D4 in a method comprising: receiving an allocation transaction in an integrated input/output (IIO) module of a multicore processor from an IO device coupled to the multicore processor; forwarding the allocation transaction to a caching agent of the multicore processor, the caching agent shared by a plurality of cores of the multicore processor and the IIO module; and directly storing data of the allocation transaction into a shared cache memory of the multicore processor.

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 12 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claims 13-16 are dependent on claim 12 and therefore meet the requirements of PCT Article 33(2) and (3).

Continued on Supplemental Box

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2012/069018

Supplemental Box

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

Continuation of:

Box V

1.3. Claims 17-20

The subject matter of claim 17 differs from these prior art documents D1-D4 in a system comprising: a first multicore processor including a first plurality of cores, a first shared cache memory, a first integrated input/output (IIO) module to interface between the first multicore processor and a first plurality of IO devices coupled to the first multicore processor, and a first caching agent to perform cache coherency operations for the first plurality of cores and the first IIO module, wherein the first caching agent includes a table of requests having a plurality of entries each to store a pending request for one of the first plurality of cores or the first IIO module, including at least one dedicated entry to store a pending request corresponding to a posted transaction; a second multicore processor including a second plurality of cores, a second shared cache memory, a second IIO module to interface between the second multicore processor and a second plurality of IO devices coupled to the second multicore processor, and a second caching agent to perform cache coherency operations for the second plurality of cores and the second IIO module; and a peripheral controller coupled to at least one of the first and second multicore processors.

And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claim 17 meets the requirements of PCT Article 33(2) and (3) with respect to novelty and inventive step.

Claims 18-20 are dependent on claim 17 and therefore meet the requirements of PCT Article 33(2) and (3).

2. Industrial Applicability

Claims 1-20 are industrially applicable under PCT Article 33(4).

Electronic Acknowledgement Receipt	
EFS ID:	16420114
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/Stephanie Petreas
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	25-JUL-2013
Filing Date:	13-DEC-2011
Time Stamp:	17:32:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	ITL2523USSRCHREPORTToFile.pdf	67812 727515a3451551cb67f35c8808e4d036d7c32652	no	4

Warnings:

Information:

This is not an USPTO supplied IDS fillable form

2	Non Patent Literature	NPLSearchReport.pdf	672618	no	9
			ba1c6567dca428ab168af9eab9108d9c37a c6e9		

Warnings:

Information:

Total Files Size (in bytes):	740430
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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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)

CONFIRMATION NO. 5133

PUBLICATION NOTICE



OC000000061927291

47795
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

Title:Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

Publication No.US-2013-0151782-A1

Publication Date:06/13/2013

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 publicly 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

PATENT APPLICATION FEE DETERMINATION RECORD						Application or Docket Number 13/324,053				
Substitute for Form PTO-875										
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380			
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250			
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*				x 60 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	0.00			
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			
			TOTAL			TOTAL	1250			
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR 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	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
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	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			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.										



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
13/324,053	12/13/2011	2189	1380	ITL.2523US (P39131)	20	3

CONFIRMATION NO. 5133

UPDATED FILING RECEIPT



OC00000053649616

47795
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

Date Mailed: 04/11/2012

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**

Applicant(s)

Yen-Cheng Liu, Portland, OR;
Robert G. Blankenship, Tacoma, WA;
Geeyarpuram N. Santhanakrishnan, Mercer Island, WA;
Ganapati N. Srinivasa, Portland, OR;
Kenneth C. Creta, Gig Harbor, WA;
Sridhar Muthrasanallur, Bangalore, INDIA;
Bahaa Fahim, San Jose, CA;

Power of Attorney: The patent practitioners associated with Customer Number 47795

Domestic Priority data as claimed by applicant

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

If Required, Foreign Filing License Granted: 12/22/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/324,053**

Projected Publication Date: 06/13/2013

Non-Publication Request: No

Early Publication Request: No

Title

Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

Preliminary Class

711

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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, facilitate, and accelerate 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.

Response To Notice To File Missing Parts Of Application Filing Date Granted (PTO-1533)(Large Entity)				Docket No. ITL.2523US (P39131)	
In Re Application Of: Yen-Cheng Liu, et al.					
Application No. 13/324,053	Filing Date 12/13/2011	Examiner Unassigned	Customer No. 21906	Group Art Unit Unassigned	Confirmation No. 5133
Invention: Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module					
<u>Mail Stop Missing Parts</u> <u>COMMISSIONER FOR PATENTS:</u> This is a response to the Notice to File Missing Parts of Application - Filing Date Granted (PTO-1533) mailed on <u>12/27/2011</u> <i>Date</i> Enclosed herewith for filing are the following: ☒ A copy of the Notice to File Missing Parts of Application - Filing Date Granted (PTO-1533). (REQUIRED) ☐ An oath or declaration in compliance with 37 CFR 1.63, including residence information and identifying the application by the above Application Number and Filing Date. ☐ A properly signed oath or declaration in compliance with 37 CFR 1.63. ☒ An oath or declaration in compliance with 37 CFR 1.63 listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Filing Date. ☐ A verified English translation of the non-English language application papers as originally filed. It is requested that this translation be used as the copy for examination purposes in the United States Patent and Trademark Office. ☐ Other (list):					

Response To Notice To File Missing Parts Of Application Filing Date Granted (PTO-1533)(Large Entity)				Docket No. ITL.2523US (P39131)	
In Re Application Of: Yen-Cheng Liu, et al.					
Application No. 13/324,053	Filing Date 12/13/2011	Examiner Unassigned	Customer No. 21906	Group Art Unit Unassigned	Confirmation No. 5133
Invention: Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module					
<u>TO THE COMMISSIONER FOR PATENTS:</u> <u>Mail Stop Missing Parts</u>					
☒ Completion of application fees as calculated below:					
☐ Utility application basic fee					
☐ Design application basic fee					
☐ Search Fee					
☐ Examination Fee					
☐ Total number of independent claims = _____					
☐ Total number of claims = _____					
☐ Multiple dependent claims					
☒ Surcharge for late payment of filing fee and/or late filing of original declaration or oath					\$130.00
☐ Petition and fee for filing by other than all the inventors or a person not the inventor					
☐ Fee for processing an application filed with a non-English language specification					
☐ Fee for processing and retention of application					
Total completion of application fees					\$130.00
This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the above-identified Notice to File Missing Parts of Application. The requested extension is as follows (check time period desired). If an additional time extension is required, please consider this a petition therefor.					
☐ One month ☒ Two months ☐ Three months ☐ Four months ☐ Five months					
from: February 27, 2012		until: April 27, 2012			
<i>Date</i>		<i>Date</i>			
Total time extension fees					\$560.00
Total fees due					\$690.00

**Response To Notice To File Missing Parts Of Application
Filing Date Granted (PTO-1533) (Large Entity)**

Docket No.
ITL.2523US (P39131)

In Re Application Of:

Yen-Cheng Liu, et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
13/324,053	12/13/2011	Unassigned	21906	Unassigned	5133

Invention:

Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

TO THE COMMISSIONER FOR PATENTS:

Mail Stop Missing Parts

The fee of \$690.00 is to be paid as follows:

- ☐ A check in the amount of the fee is enclosed.
- ☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. 20-1504
- ☒ If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. 20-1504
- ☒ Payment by credit card. Form PTO-2038 is attached.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.


Signature

Dated:

4/5/12

Mark J. Rozman, Reg. No. 42,117
TROP, PRUNER & HU, P.C.
1616 S. Voss Road, Suite 750
Houston, TX 77057

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

(Date)

Filed Via EFS

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below, next to my name.

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

**PROVIDING COMMON CACHING AGENT FOR CORE AND
INTEGRATED INPUT/OUTPUT (IO) MODULE**

the specification of which (check one):

_____ is attached hereto.
 X was filed on 12/13/2011 as
United States Application Number 13/324,053
or PCT International Application Number _____
and was amended on _____
(if applicable)

I hereby authorize and request my attorney, associated with Customer Number 47795, to insert on the designated lines above, the filing date, application number, PCT International Application Number and amendment date, as applicable, of the patent application should this Declaration be filed after filing the specification.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed?</u>		<u>Certified Copy Attached?</u>	
<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>

I hereby appoint practitioners associated with the Customer Number: 47795
as my/our attorney(s) or agents(s), with full power of substitution and revocation, to prosecute this application and to
transact all business in the United States Patent and Trademark Office connected therewith.

Please direct all correspondence to the address associated with the Customer Number: 47795

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

Full Name of Sole/First Inventor YEN-CHENG LIU

Inventor's Signature _____ Date _____

Residence Portland, OR Citizenship USA
(City, State) (Country)

Post Office Address 5240 NW Primino Avenue, Portland, OR 97229

Full Name of Second/Joint Inventor ROBERT G. BLANKENSHIP

Inventor's Signature [Signature] Date 3/8/12

Residence Tacoma, WA Citizenship USA
(City, State) (Country)

Post Office Address 3115 N. 20th Street, Tacoma, WA 98406

Full Name of Third/Joint Inventor GEEYARPURAM N. SANTHANAKRISHNAN

Inventor's Signature _____ Date _____

Residence Mercer Island, WA Citizenship INDIA
(City, State) (Country)

Post Office Address 9011 W Shorewood Drive, Apt 1308, Mercer Island, WA 98040

I hereby appoint practitioners associated with the Customer Number: 47795
as my/our attorney(s) or agents(s) with full power of substitution and revocation, to prosecute this application and to
transact all business in the United States Patent and Trademark Office connected therewith.

Please direct all correspondence to the address associated with the Customer Number: 47795

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

Full Name of Sole/First Inventor YEN-CHENG LIU

Inventor's Signature _____ Date _____

Residence Portland, OR _____ Citizenship USA _____
(City, State) (Country)

Post Office Address 5240 NW Primino Avenue, Portland, OR 97229

Full Name of Second/Joint Inventor ROBERT G. BLANKENSHIP

Inventor's Signature _____ Date _____

Residence Tacoma, WA _____ Citizenship USA _____
(City, State) (Country)

Post Office Address 3115 N. 20th Street, Tacoma, WA 98406

Full Name of Third/Joint Inventor GEEYARPURAM N. SANTHANAKRISHNAN

Inventor's Signature G. Krishnan _____ Date Apr 6, 2012

Residence Mercer Island, WA _____ Citizenship INDIA _____
(City, State) (Country)

Post Office Address 9011 W Shorewood Drive, Apt 1308, Mercer Island, WA 98040

Full Name of Fourth Joint Inventor GANAPATHI S. SRINIVASA

Inventor's Signature 

Date March 21, 2012

Residence Portland, OR Citizenship USA
(City, State) (Country)

Post Office Address 12559 NW Hartford Street, Portland, OR 97229

Full Name of Fifth Joint Inventor KENNETH C. CRETA

Inventor's Signature _____ Date _____

Residence Olig Harbor, WA Citizenship USA
(City, State) (Country)

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Full Name of Sixth Joint Inventor SRITHARAN MUTHURASANALLUR

Inventor's Signature  Date 4/4/2012

Residence Bangalore, K.A. IN Citizenship USA
(City, State) (Country)

Post Office Address #211, Embassy Tranquil, 3rd Block, 8th Main, Karamangala, Bangalore, K.A. IN 560034

Full Name of Seventh Joint Inventor BAHAA FAHIM

Inventor's Signature _____ Date _____

Residence San Jose, CA Citizenship CANADA
(City, State) (Country)

Post Office Address 412 Victoria Court, San Jose, CA 95136

Docket No.: ITL22523US (P39131)
PATENT

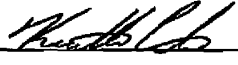
Full Name of Fourth/Joint Inventor GANAPATI N. SRINIVASA

Inventor's Signature _____ Date _____

Residence Portland, OR Citizenship USA
(City, State) (Country)

Post Office Address 12559 NW Hartford Street, Portland, OR 97229

Full Name of Fifth/Joint Inventor KENNETH C. CRETA

Inventor's Signature  Date 2/13/12

Residence Gig Harbor, WA Citizenship USA
(City, State) (Country)

Post Office Address 13714 47th Ave Ct NW, Gig Harbor, WA 98332

Full Name of Sixth/Joint Inventor SRIDHAR MUTHRASANALLUR

Inventor's Signature _____ Date _____

Residence Bangalore, KA, IN Citizenship USA
(City, State) (Country)

Post Office Address #211, Embassy Tranquil, 3rd Block, 8th Main, Koramangala, Bangalore, KA, IN 560034

Full Name of Seventh/Joint Inventor BAHAA FAHIM

Inventor's Signature _____ Date _____

Residence San Jose, CA Citizenship CANADA
(City, State) (Country)

Post Office Address 412 Violeta Court, San Jose, CA 95136

Full Name of Fourth/Joint Inventor GANAPATI N. SRINIVASA

Inventor's Signature _____ Date _____

Residence Portland, OR _____ Citizenship USA _____
(City, State) (Country)

Post Office Address 12559 NW Hartford Street, Portland, OR 97229

Full Name of Fifth/Joint Inventor KENNETH C. CRETA

Inventor's Signature _____ Date _____

Residence Gig Harbor, WA _____ Citizenship USA _____
(City, State) (Country)

Post Office Address 13714 47th Ave Ct NW, Gig Harbor, WA 98332

Full Name of Sixth/Joint Inventor SRIDHAR MUTHRASANALLUR

Inventor's Signature _____ Date _____

Residence Bangalore, KA, IN _____ Citizenship USA _____
(City, State) (Country)

Post Office Address #211, Embassy Tranquil, 3rd Block, 8th Main, Koramangala, Bangalore, KA, IN 560034

Full Name of Seventh/Joint Inventor BAHAA FAHIM

Inventor's Signature Bahaa Fahim Date 2/8/2012

Residence San Jose, CA _____ Citizenship CANADA _____
(City, State) (Country)

Post Office Address 412 Violeta Court, San Jose, CA 95136

Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

(e) In any continuation-in-part application, the duty under this section includes the duty to disclose to the Office all information known to the person to be material to patentability, as defined in paragraph (b) of this section, which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Electronic Patent Application Fee Transmittal				
Application Number:		13324053		
Filing Date:		13-Dec-2011		
Title of Invention:		Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module		
First Named Inventor/Applicant Name:		Yen-Cheng Liu		
Filer:		Mark J. Rozman/Stephanie Petreas		
Attorney Docket Number:		ITL.2523US (P39131)		
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	1051	1	130	130
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 2 months with \$0 paid	1252	1	560	560
Miscellaneous:				
Total in USD (\$)				690

Electronic Acknowledgement Receipt	
EFS ID:	12478068
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/Stephanie Petreas
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	05-APR-2012
Filing Date:	13-DEC-2011
Time Stamp:	14:38:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$690
RAM confirmation Number	959
Deposit Account	201504
Authorized User	ROZMAN,MARK J.
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 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	ITL2523USReplyNFMP.pdf	183516	no	3
			d5419bdad851654f9436c7e7611ac5d4ea4c3896		
Warnings:					
Information:					
2	Oath or Declaration filed	ITL2523USExDec.pdf	452613	no	7
			3df1190db34a9a8c4a4a86579f45846b0cfc6769		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32369	no	2
			d92de9c139db24cfb3e10cc1f7f763278ef8a510		
Warnings:					
Information:					
Total Files Size (in bytes):			668498		
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.					



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
13/324,053	12/13/2011	2189	1250	ITL.2523US (P39131)	20	3

CONFIRMATION NO. 5133

FILING RECEIPT



OC00000051649645

47795
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

Date Mailed: 12/27/2011

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**

Applicant(s)

Yen-Cheng Liu, Portland, OR;
Robert G. Blankenship, Tacoma, WA;
Geeyarpuram N. Santhanakrishnan, Mercer Island, WA;
Ganapati N. Srinivasa, Portland, OR;
Kenneth C. Creta, Gig Harbor, WA;
Sridhar Muthrasanallur, Bangalore, INDIA;
Bahaa Fahim, San Jose, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

If Required, Foreign Filing License Granted: 12/22/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/324,053**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

Title

Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

Preliminary Class

711

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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PATENT APPLICATION FEE DETERMINATION RECORD						Application or Docket Number 13/324,053						
Substitute for Form PTO-875												
APPLICATION AS FILED - PART I												
		(Column 1)	(Column 2)		SMALL ENTITY		OR	OTHER THAN SMALL ENTITY				
FOR		NUMBER FILED		NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A	N/A			N/A	380			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A		N/A	N/A			N/A	620			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A	N/A			N/A	250			
TOTAL CLAIMS (37 CFR 1.16(i))		20	minus 20 =	*			OR	x 60 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))		3	minus 3 =	*				x 250 =	0.00			
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	1250			
APPLICATION AS AMENDED - PART II												
		(Column 1)		(Column 2)		(Column 3)	SMALL ENTITY		OR	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	
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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/324,053	12/13/2011	Yen-Cheng Liu	ITL.2523US (P39131)

CONFIRMATION NO. 5133

FORMALITIES LETTER



OC000000051649646

Date Mailed: 12/27/2011

47795
TROP, PRUNER & HU, P.C.
1616 S. VOSS RD., SUITE 750
HOUSTON, TX 77057-2631

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The signature of the following inventor(s) is missing from the oath or declaration:
Robert G. Blankenship, Geeyarpuram N. Santhanakrishnan, Ganapati N. Srinivasa, Kenneth C. Creta, Sridhar Muthrasanallur, and Bahaa Fahim

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- A surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of **\$130** for a non-small entity, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is **\$130** for a non-small entity

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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
ITL2523US (P39131)

Total Pages in this Submission

COMMISSIONER FOR PATENTS

P.O. Box 1450
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Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

Providing Common Caching Agent For Core And Integrated Input/Output (IO) Module

and invented by:

Yen-Cheng Liu; Robert G. Blankenship; Geeyarpuram N. Santhanakrishnan; Ganapati N. Srinivasa; Kenneth C. Creta; Sridhar Muthrasanallur; Bahaa Fahim

If a CONTINUATION APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Which is a:

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Which is a:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 15 pages and including the following:
 - a. ☒ Descriptive Title of the Invention
 - b. ☐ Cross References to Related Applications *(if applicable)*
 - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
 - d. ☐ Reference to Sequence Listing, a Table, or a Computer Program Listing Appendix
 - e. ☒ Background of the Invention
 - f. ☐ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings *(if filed)*
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
ITL2523US (P39131)

Total Pages in this Submission

Accompanying Application Parts (Continued)

17. ☐ Additional Enclosures *(please identify below):*

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Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

18. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this 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 of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

19. ☐ Other:

**UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
ITL2523US (P39131)

Total Pages in this Submission

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
- a. ☒ Formal Number of Sheets 7
- b. ☐ Informal Number of Sheets _____
4. ☒ Oath or Declaration
- a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
- b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☒ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ CD ROM or CD-R in duplicate, large table or Computer Program (Appendix)
7. ☐ Application Data Sheet (See 37 CFR 1.76)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
- a. ☐ Computer Readable Form (CRF)
- b. ☐ Specification Sequence Listing on:
- i. ☐ CD-ROM or CD-R (2 copies); or
- ii. ☐ Paper
- c. ☐ Statement(s) Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

9. ☐ Assignment Papers *(cover sheet & document(s))*
10. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
11. ☐ English Translation Document *(if applicable)*
12. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☐ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☐ Certificate of Mailing
- ☐ First Class ☐ Express Mail *(Specify Label No.):* Filed Via EFS

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
ITL2523US (P39131)

Total Pages in this Submission

Fee Calculation and Transmittal

CLAIMS AS FILED						
For	#Filed	#Allowed	#Extra	Rate		Fee
Total Claims	20	- 20 =	0	x	\$60.00	\$0.00
Indep. Claims	3	- 3 =	0	x	\$250.00	\$0.00
Multiple Dependent Claims (check if applicable) ☐						\$0.00
Total # of Pages in Specification		15	Total # of Drawing Sheets		7	
Total # of Sheets	22	Application Size Fee				\$0.00
Basic Fee						\$380.00
Search Fee						\$620.00
Examination Fee						\$250.00
OTHER FEE (specify purpose)						\$0.00
TOTAL FILING FEE						\$1,250.00

- ☐ A check in the amount of _____ to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge and credit Deposit Account No. 20-1504 as described below.
- ☐ Charge the amount of _____ as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

- ☒ Payment by credit card. Form PTO-2038 is attached.

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Dated:

12/13/11

Signature

Mark J. Rozman, Reg. No. 42,117
TROP, PRUNER & HU, P.C.
1616 S. Voss Road, Suite 750
Houston, TX 77057

Customer Number: 47795

CC:

**APPLICATION
FOR
UNITED STATES LETTERS PATENT**

**TITLE: PROVIDING COMMON CACHING AGENT FOR CORE
AND INTEGRATED INPUT/OUTPUT (IO) MODULE**

**INVENTORS: YEN-CHENG LIU; ROBERT G. BLANKENSHIP;
GEEYARPURAM N. SANTHANAKRISHNAN;
GANAPATI N. SRINIVASA; KENNETH C. CRETA;
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Filed Via EFS

Date: December 13, 2011

Prepared by: Trop, Pruner & Hu, P.C., Mark J. Rozman
1616 S. Voss Road, Suite 750, Houston, TX 77057
713/468-8880 [Office], 713/468-8883 [Fax]

PROVIDING COMMON CACHING AGENT FOR
CORE AND INTEGRATED INPUT/OUTPUT (IO) MODULE

Background

[0001] In modern multiprocessor (MP)-socket computer systems, various topologies are possible. Such systems often include many different semiconductor components realized as integrated circuits (ICs). The ICs include processors, memories, chipsets, input/output hubs (IOHs) and so forth.

[0002] As process nodes advance, greater amounts of functionality can be incorporated into a single semiconductor die. One integration trend is to integrate an IO component such as functionality of an IOH into a central processing unit (CPU) die. The main motivation for doing so is to reduce the bill of material (BOM) cost of a computer system, and enable small form factors while reducing overall power consumption.

[0003] But problems arise once an IO component is integrated on the same chip with a multiprocessor. Traditional IO integration treats the IO component as a separate caching agent, meaning that dedicated logic is associated with the IO component to handle cache coherency operations. When an IO agent is performing read/write operations to main memory, it has to snoop the CPU side cache to maintain cache coherency. In MP systems, this becomes a major scaling problem. For example, in an 8 socket system, there are effectively 16 caching agents in the system, which can degrade performance. And the efforts to scale up a system to support these many caching agents are not trivial.

Brief Description of the Drawings

[0004] FIG. 1 is a block diagram of a portion of a multiprocessor system in accordance with an embodiment of the present invention.

[0005] FIG. 2 is a block diagram of a caching agent in accordance with an embodiment of the present invention.

[0006] FIG. 3 is a flow diagram of a method in accordance with an embodiment of the present invention.

[0007] FIG. 4 is a flow diagram of a method in accordance with another embodiment of the present invention.

[0008] FIG. 5 is a block diagram of an example of a possible deadlock scenario that can be avoided according to various embodiments.

[0009] FIG. 6 is a block diagram of a multicore processor in accordance with an embodiment of the present invention.

[0010] FIG. 7 is a block diagram of a multiprocessor system in accordance with an embodiment of the present invention.

Detailed Description

[0011] In various embodiments, an IO agent can be integrated into a multiprocessor socket such as a multicore processor for use in a MP server system, while avoiding scaling issues. More specifically, a CPU caching agent can be configured to support both CPU traffic and IO traffic as well, thereby resolving the scaling issue. Performance can be enhanced by bringing the IO agent and CPU core(s) closer. This IO agent includes functionality to provide an interface between one or more peripheral devices coupled to the processor by off-chip links such as Peripheral Component Interconnect Express (PCIe™) links, and may take the place of a separate chipset component such as an IOH.

[0012] Referring to FIG. 1, shown is a block diagram of a portion of a multiprocessor system in accordance with an embodiment of the present invention. As shown in FIG. 1, system 100 includes a pair of processor sockets 110₀ and 110₁. In the embodiment shown, each socket 110 (generally) corresponds to a multicore processor. For ease of discussion, reference will be made to the components within socket 110₀. In the embodiment of FIG. 1, socket 110₁ may be identically configured. However, understand that in other embodiments, heterogeneous processor sockets may be present.

[0013] As seen, socket 110₀ includes a plurality of cores 120₀₀ – 120_{0n}. As examples, socket 110₀ can include 4, 8, or another such number of cores. Each of the cores can include various components including a processor pipeline having multiple stages such as a front end unit, one or more execution units, and a back end unit. In addition, one or more levels of cache memories can be present within the cores. Each of cores 120 may be coupled to a shared cache memory 130₀, which may be a last level cache (LLC). As seen, LLC 130 can include a caching agent 135₀. In various embodiments, this caching agent may be a combined caching agent both for the CPU as well as for an integrated IO agent. More specifically, socket 110₀ may include an IO module (hereafter an integrated IO module or IIO module). This IIO

module may act as an interface to one or more off-chip peripheral or IO devices (not shown in FIG. 1) coupled to the processor, e.g., via PCIe™ links. Examples of such IO devices include storage devices, network interfaces, graphics cards, and so forth.

[0014] As further seen, socket 110₀ may include an integrated memory controller (IMC) 145₀ to provide an interface to a system memory (not shown for ease of illustration) via a memory interconnect. Socket 110₁ includes similar components and can be coupled to socket 110₀ via an interconnect 150, which in one embodiment can be a point-to-point (PtP) link in accordance with a Intel® Quick Path Interconnect (QPI) protocol.

[0015] Referring now to FIG. 2, shown is a block diagram of a caching agent in accordance with an embodiment of the present invention. As shown in FIG. 2, caching agent 200 may be logic interposed between one or more cores of a processor and a LLC 230. In addition, caching agent 200 may also provide an interface between an IIO module within a multicore processor and the LLC. As seen, caching agent 200 can include an ingress port 210 that includes multiple ingress queues 211 – 213. As seen, ingress port 210 may be coupled to an arbiter 215 which can arbitrate amongst incoming requests and provide them to a table of requests (TOR) 220. As seen, TOR 220 may be a buffer or other temporary storage for holding incoming requests. In the embodiment shown, TOR 220 may include at least one dedicated resource 225 for posted transactions. In one embodiment, dedicated resource 225 may be a single entry of the queue, although the scope of the present invention is not limited in this regard.

[0016] Still referring to FIG. 2, TOR 220 interfaces with LLC 230. More specifically, this LLC may be a bank or other portion of the LLC associated with the caching agent. To provide access to other locations within the processor via a ring interconnect 260, an ingress queue 240 and an egress queue 250 may be provided. Thus via caching agent 200, cores of the processor and an IIO module can maintain coherency without the need for additional caching agents. Although not shown for ease of illustration, understand that caching agent 200 may further include various coherency logic to perform cache coherency operations on behalf of the cores and IIO module, and to enable coherent access with regard to both the core transactions and IO device transactions as described herein.

[0017] Note that although a single structure is shown in FIG. 2 for ease of illustration, understand that a caching agent can be distributed such that each of different portions of the caching agent can be associated with a corresponding core and LLC bank or slice.

[0018] With this approach, the IIO module proxies through the CPU caching agent to access memory or other IO devices, therefore reducing the overhead of allocating dedicated resources for an integrated IO caching agent. This also reduces the amount of snoop traffic needed since a reduced number of caching agents per system can be realized. Thus in various embodiments, a system can include a single caching agent per multicore processor socket, where each socket includes multiple cores and an IIO module.

[0019] Embodiments also provide an IO performance enhancement. More specifically, since this IIO module is much closer to an internal CPU cache such as a LLC, an IO device supported by the IIO module can directly “push” coherent data into this cache where any processor core within the same socket can have a very fast path to access the data. This is opposed to the conventional approach where an off-chip IO device must issue a direct cache access (DCA) hint to a processor core to cause a cache line to be brought into the LLC. To this end, an IO device coupled to an IIO module in accordance with an embodiment of the present invention can generate an allocating transaction that can lodge data directly into the LLC.

[0020] In this way IO data can be brought closer to the CPU cache, providing a more efficient mechanism to lodge data from an IO device directly into a LLC of a processor and without the need for first storing the data in a system memory, reducing bandwidth consumption. Still further, the need for a direct cache hint from the IO device to a core to cause a read request to obtain the data can be avoided.

[0021] Referring now to FIG. 3, shown is a flow diagram of a method in accordance with an embodiment of the present invention. As shown in FIG. 3, method 300 may be used to perform allocation of data from an IO device coupled to a multicore processor directly into a cache memory of the processor. More specifically, method 300 of FIG. 3 can be used to insert data into the cache in a manner that avoids both: first providing the data to a system memory coupled to the processor (such as a dynamic random access memory (DRAM)) via an integrated memory controller of the processor; and the need for sending a hint to a core of the processor to cause the data to be requested and stored into the cache.

[0022] As seen in FIG. 3, method 300 may begin by receiving an allocation transaction in an IIO module from an IO device (block 310). For example, this allocation transaction can be a request to write data directly into a cache memory, e.g., a LLC of the processor, and it can be received from an IO device such as a peripheral device coupled to the processor via a PCIe™ link, for example. As seen, this allocation transaction can be forwarded from the IIO to a CPU caching agent (block 320). Because in various embodiments there is no separate caching agent for the IIO, this transaction can be directed to a common caching agent that performs caching agent functionality both for processor cores and the IIO.

[0023] Responsive to this request, control passes to block 330 where the data can be directly stored into the LLC. In one embodiment, a least recently used (LRU) algorithm can be used to place the data, along with a way mask to restrict the LLC ways that can be allocated to IIO data. More specifically the data can be stored coherently in accordance with a given cache coherency protocol (e.g., a modified exclusive shared invalid (MESI) protocol).

[0024] With the data now present in the LLC, it can be accessed a number of times for read and write operations by any of the cores of the processor as well as the initiating IO device or other IO devices coupled to the processor (block 340). Conventional cache coherency protocol operations and compliance with ordering rules can be performed when accessing this data to maintain coherency. During normal cache operation, it can be determined whether the data of this cache line is to be evicted (diamond 350). If so, the data can be written back to memory (block 360). Using method 300 in this way, embodiments provide the ability to efficiently load data from an IO device directly into a processor cache, without the need for consuming any memory bandwidth. Instead it is only upon an eviction from the cache that the data is written to system memory. Although shown with this particular implementation in the embodiment of FIG. 3, understand the scope of the present invention is not limited in this regard.

[0025] Various elements both within an IIO module and CPU caching agent can be configured to avoid deadlocks and ensure reasonable performance. First, for PCIe™ ordering rule compliance and in order to sustain performance, a drop ownership indication can be provided by a CPU caching agent to send an indication back to the IIO to drop ownership of a cache line in the case that an external snoop request to an existing ownership request is detected. In contrast, conventional IIO implementation prefetches ownership of a cache line long prior to when the IIO device is read to retire and meet write ordering. Thus the way a

conventional IIO works, ownership of a line is acquired before the write of the cache line is ready to commit to the system. Only when write ordering is met will a write to the system occur. During this time, any incoming snoops to the same line will cause the IIO to lose ownership of the line and a request for ownership must be re-issued to obtain the ownership again.

[0026] Referring now to FIG. 4, shown is a flow diagram of a method in accordance with another embodiment of the present invention. As shown in FIG. 4, method 375 can be used to prevent deadlocks by causing an IIO to drop ownership of a given cache line when a conflicting request is received. Specifically as shown in FIG. 4, method 375 may begin by determining that a snoop request is received in a caching agent for a cache line that is owned by an IIO module (diamond 380). This ownership can be based on state information associated with the cache line, e.g., an ownership indicator as well as cache coherency state information, in some embodiments. When such request is received, the caching agent can send a drop ownership indication to the IO module to cause the module to drop ownership of the cache line (block 385). Note that this indication may be because it is likely that the ownership of the cache line by the IIO module is responsive to a prefetch by a coupled IO device and thus the data with regard to the IO device is of a speculative nature and is not yet needed.

[0027] As further shown in FIG. 4, control next passes to block 390 where the ownership of the cache line can be granted to the initiator of the snoop. In this way, this requestor can perform desired operations on the data. Then the data may later be accessed by the IO device. Although shown with this particular implementation in the embodiment of FIG. 4, understand the scope of the present invention is not limited in this regard.

[0028] Thus by using the above-described mechanism to relinquish the ownership, deadlocks can be avoided. Instead in a conventional system, one can easily imagine that two IIOs in the system may both acquire ownership for the non-oldest transaction and both are bidding for the oldest transaction in order to retire. Unless either side relinquishes the ownership, the system will result in a deadlock.

[0029] There are two types of IIO traffic that will be seen by CPU agents, namely posted and non-posted requests, according to a PCIe™ specification, e.g., the PCI Express™ Specification Base Specification version 2.0 (published January 17, 2007) (hereafter the

PCIe™ specification). Generally, a posted transaction is a transaction which when sent by a source is considered complete by the source and the source does not receive a completion or other confirmation message regarding the transaction. One such example of a posted transaction may be a write transaction. In contrast, a non-posted transaction is not considered completed by the source until a return message is received, namely a completion. One example of a non-posted transaction is a read transaction in which the source agent requests a read of data. Accordingly, the completion message provides the requested data. Posted requests must not be blocked by non-posted requests in the fabrics otherwise a deadlock concern exists. For example, if IIO posted requests that are proxying through the CPU caching agent cannot obtain access to a requested resource to send requests to memory or to a remote IIO, it will prevent any non-posted requests either from the core or IIO from completing, thus creating a deadlock.

[0030] Referring now to FIG. 5, shown is a block diagram of an example of a possible deadlock scenario that can be avoided according to various embodiments. As seen in FIG. 5, system 400 includes a first multicore processor 410₀ coupled to a second multicore processor 410₁. As seen, each processor includes a corresponding core 420 and an IIO module 430. Of course, multiple cores can be present in different embodiments. In addition, each processor includes a caching agent 440, which acts as the caching agent for both the core and the IIO module. As seen, core 420₀ may be issuing non-posted requests, such as core memory mapped IO (MMIO) read requests from a non-posted queue 422₀ to a TOR 444₀ of caching agent 440₀. If these non-posted reads are in front of posted requests, deadlocks may occur.

[0031] As further seen, IIO module 430₀ includes a posted queue 432₀ used to store pending posted requests such as inbound (inbound to the processor) memory write requests as well as a non-posted queue 434₀ which may store non-posted requests such as outbound non-posted read requests, e.g., from the processor or another IO agent to the IO device. Thus as seen transactions in write queue 434₀ may be ordered after transactions in write queue 432₀. By providing a dedicated posted resource within TOR 444, a deadlock situation can be avoided. Note that the PCIe™ ordering rules dictate that posted requests are not blocked by non-posted requests and thus in general write transactions proceed ahead of read transactions.

[0032] To avoid such deadlocks, embodiments can configure CPU caching agents appropriately. This configuration includes enabling the CPU caching agent to perform resource reservation and ordering, conflict bypass, and arbitration policy in accordance with

an embodiment of the present invention. To this end the CPU caching agent preserves dedicated resources for posted requests, e.g., reserving at least one resource such as an entry of a TOR for a posted request. Embodiments may also ensure the reserved resource is consumed by the “oldest” posted request from the IIO, otherwise a younger request may take up the resource but cannot retire while waiting for the oldest request, which may be stuck in a fabric.

[0033] A CPU caching agent in accordance with an embodiment of the present invention can also detect and bypass address conflicts if a posted request were to match an older non-posted request that has the same address, thus providing a conflict bypass. Embodiments may further provide an arbitration policy such that where there is an anti-starvation mechanism in the arbitration scheme within the CPU caching agent, it ensures that the oldest posted request still can make it through the arbitration to avoid a deadlock.

[0034] With the above-mentioned configuration of a CPU caching agent, an IIO can be coupled behind a CPU caching agent and benefit from reduced complexity and component count. That is by proxying IIO-related transactions through a CPU caching agent as opposed to having separate dedicated IO agents coupled to a socket via an off-chip link, a better scaling profiling and performance advantages can be realized. Embodiments also potentially increase the possibility of more platform configurations that can be supported. This integration along with low latency route-through (using ring resources) can accommodate various platform configurations.

[0035] By reducing the number of caching agents, much less resource division in the system such as home agent tracker entries etc. occurs, and by reducing the amount of snoop overhead due to the number of caching agents in a system, improved scaling/performance can be achieved.

[0036] Referring now to FIG. 6, shown is a block diagram of a multicore processor in accordance with an embodiment of the present invention. As shown in the embodiment of FIG. 6, processor 700 includes a distributed configuration having partitions or slices each including a core 710 and a partition of a caching agent 715 and a LLC 720. Note that while distributed caching agents are shown, understand that these distributed portions form a single caching agent, and which is configured to handle cache coherency operations both for the cores as well as an IIO module 750.

[0037] In general, each core 710₀-710_n may include low level caches in addition to various execution units and additional processing elements. In turn, the various cores may be coupled to each other and to a shared cache memory formed of a plurality of units of a LLC 740₀ – 740_n via caching agent 715₀-715_n. In various embodiments, LLC 740 may be shared amongst the cores and IIO module 750. As seen, a ring interconnect 730 thus couples the cores together, and provides interconnection between the cores, caching agent 715 and IIO module 750.

[0038] As seen in FIG. 6, IIO module 750 can provide an interface to various off-chip IO/peripheral devices (not shown for ease of illustration in FIG. 6). To this end, IIO module 750 can include various interfaces including multiple PCIe™ interfaces 752₀-752_n, a direct media interface (DMI) 754, and an IO advance programmable interrupt controller (IO APIC) 755. As seen, IIO module 750 also can be coupled to a power control unit (PCU) 760.

[0039] To provide communications with other components of a system, ring interconnect 730 may couple to a home agent 770 that in turn guards an integrated memory controller (IMC) 775. In turn, IMC 775 can communicate, e.g., via DDR links, to a system memory coupled to the processor. Furthermore, a Intel® Quick Path Interconnect (QPI) interface 780 can couple to ring interconnect 730 to act as an interface to another agent (such as another processor in a multiprocessor system) coupled to the processor via a QPI™ link. Although shown with this particular configuration in the embodiment of FIG. 6, understand the scope of the present invention is not limited in this regard.

[0040] FIG. 7 is a block diagram of a multiprocessor system 800 coupled with point-to-point (PtP) system interconnects in accordance with an embodiment of the present invention. In the embodiment shown, each processor 810 includes one instance of an integrated memory controller 815 that in turn is coupled to a corresponding local portion of a system memory 820, e.g., via various memory links such as double data rate (DDR) channels. As seen, one of the processors is connected to a peripheral controller hub (PCH) 830 via, e.g., DMI and PCIe™ links. In the embodiment shown, a QPI™ link 825 is used to connect the two processors. Note that each of the processors can include an IIO module to provide an interface to one or more off-chip peripheral devices and a single caching agent shared by the IIO module and the cores of the processor. As further seen in FIG. 7, PCH 830 may communicate with various devices including a basic input/output system (BIOS) storage 835

such as a flash memory, a serial advanced technology attach (SATA) device 840 such as a disk drive, and a network interface 850, e.g., an Ethernet device.

[0041] Embodiments may be implemented in code and may be stored on a non-transitory storage medium having stored thereon instructions which can be used to program a system to perform the instructions. The storage medium may include, but is not limited to, any type of disk including floppy disks, optical disks, solid state drives (SSDs), compact disk read-only memories (CD-ROMs), compact disk rewritables (CD-RWs), and magneto-optical disks, semiconductor devices such as read-only memories (ROMs), random access memories (RAMs) such as dynamic random access memories (DRAMs), static random access memories (SRAMs), erasable programmable read-only memories (EPROMs), flash memories, electrically erasable programmable read-only memories (EEPROMs), magnetic or optical cards, or any other type of media suitable for storing electronic instructions.

[0042] While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is:

- 1 1. An apparatus comprising:
2 a multicore processor including a plurality of cores, a shared cache memory, an
3 integrated input/output (IIO) module to interface between the multicore processor and at least
4 one IO device coupled to the multicore processor, and a caching agent to perform cache
5 coherency operations for the plurality of cores and the IIO module.
- 1 2. The apparatus of claim 1, wherein the caching agent includes a table of requests to
2 store pending requests for the plurality of cores and the IIO module.
- 1 3. The apparatus of claim 2, wherein the table of requests includes at least one dedicated
2 entry to store a posted transaction.
- 1 4. The apparatus of claim 1, wherein the caching agent is a single caching agent for the
2 multicore processor and includes a plurality of distributed portions each associated with a
3 corresponding one of the plurality of cores.
- 1 5. The apparatus of claim 4, wherein the shared cache memory comprises a last level
2 cache (LLC) including a plurality of distributed portions each associated with a
3 corresponding one of the plurality of cores.
- 1 6. The apparatus of claim 5, wherein the plurality of distributed portions of the caching
2 agent are coupled via a ring interconnect.
- 1 7. The apparatus of claim 1, wherein the caching agent is to receive an allocation
2 transaction from the IIO module, the allocation transaction received in the IIO module from
3 an IO device coupled to the multicore processor.
- 1 8. The apparatus of claim 7, wherein the caching agent is to directly store data of the
2 allocation transaction into the shared cache memory and to not initiate a memory transaction
3 to a system memory coupled to the multicore processor.

- 1 9. The apparatus of claim 1, wherein the caching agent is to send a drop ownership
2 indication to the IIO module for a cache line owned by the IIO module for an IO device
3 coupled to the multicore processor responsive to receipt of a snoop request in the caching
4 agent for the cache line from another agent.
- 1 10. The apparatus of claim 9, wherein the IO device prefetched the cache line.
- 1 11. The apparatus of claim 9, wherein the another agent is one of the plurality of cores.
- 1 12. A method comprising:
2 receiving an allocation transaction in an integrated input/output (IIO) module of a
3 multicore processor from an IO device coupled to the multicore processor;
4 forwarding the allocation transaction to a caching agent of the multicore processor,
5 the caching agent shared by a plurality of cores of the multicore processor and the IIO
6 module; and
7 directly storing data of the allocation transaction into a shared cache memory of the
8 multicore processor.
- 1 13. The method of claim 12, further comprising accessing the data in the shared cache
2 memory via at least one of the plurality of cores of the multicore processor a number of
3 times, without sending a transaction to a system memory coupled to the multicore processor.
- 1 14. The method of claim 13, further comprising sending data of the cache line to the
2 system memory from the shared cache memory if the cache line is evicted from the shared
3 cache memory, when the cache line includes modified data.
- 1 15. The method of claim 13, further comprising directly storing the data of the allocation
2 transaction into the shared cache memory without communicating with the system memory.
- 1 16. The method of claim 12, further comprising sending a drop ownership indication to
2 the IIO module for a cache line owned by the IIO module responsive to receipt of a snoop
3 request in the caching agent for the cache line from another agent.

1 17. A system comprising:
2 a first multicore processor including a first plurality of cores, a first shared cache
3 memory, a first integrated input/output (IIO) module to interface between the first multicore
4 processor and a first plurality of IO devices coupled to the first multicore processor, and a
5 first caching agent to perform cache coherency operations for the first plurality of cores and
6 the first IIO module, wherein the first caching agent includes a table of requests having a
7 plurality of entries each to store a pending request for one of the first plurality of cores or the
8 first IIO module, including at least one dedicated entry to store a pending request
9 corresponding to a posted transaction;
10 a second multicore processor including a second plurality of cores, a second shared
11 cache memory, a second IIO module to interface between the second multicore processor and
12 a second plurality of IO devices coupled to the second multicore processor, and a second
13 caching agent to perform cache coherency operations for the second plurality of cores and the
14 second IIO module; and
15 a peripheral controller coupled to at least one of the first and second multicore
16 processors.

1 18. The system of claim 17, wherein the first caching agent is to receive an allocation
2 transaction from the first IIO module, and directly store data of the allocation transaction into
3 the first shared cache memory.

1 19. The system of claim 18, wherein the data in the shared cache memory is to be
2 accessed via at least one of the first plurality of cores a number of times, without sending a
3 transaction to a system memory coupled to the first multicore processor.

1 20. The system of claim 17, wherein the first caching agent is a single caching agent for
2 the first multicore processor and includes a plurality of distributed portions each associated
3 with a corresponding one of the first plurality of cores, the first shared cache memory
4 comprises a last level cache (LLC) including a plurality of distributed portions each
5 associated with a corresponding one of the first plurality of cores, and wherein the plurality of
6 distributed portions of the first caching agent are coupled via a ring interconnect.

PROVIDING COMMON CACHING AGENT FOR
CORE AND INTEGRATED INPUT/OUTPUT (IO) MODULE

Abstract of the Disclosure

In one embodiment, the present invention includes a multicore processor having a plurality of cores, a shared cache memory, an integrated input/output (IIO) module to interface between the multicore processor and at least one IO device coupled to the multicore processor, and a caching agent to perform cache coherency operations for the plurality of
5 cores and the IIO module. Other embodiments are described and claimed.

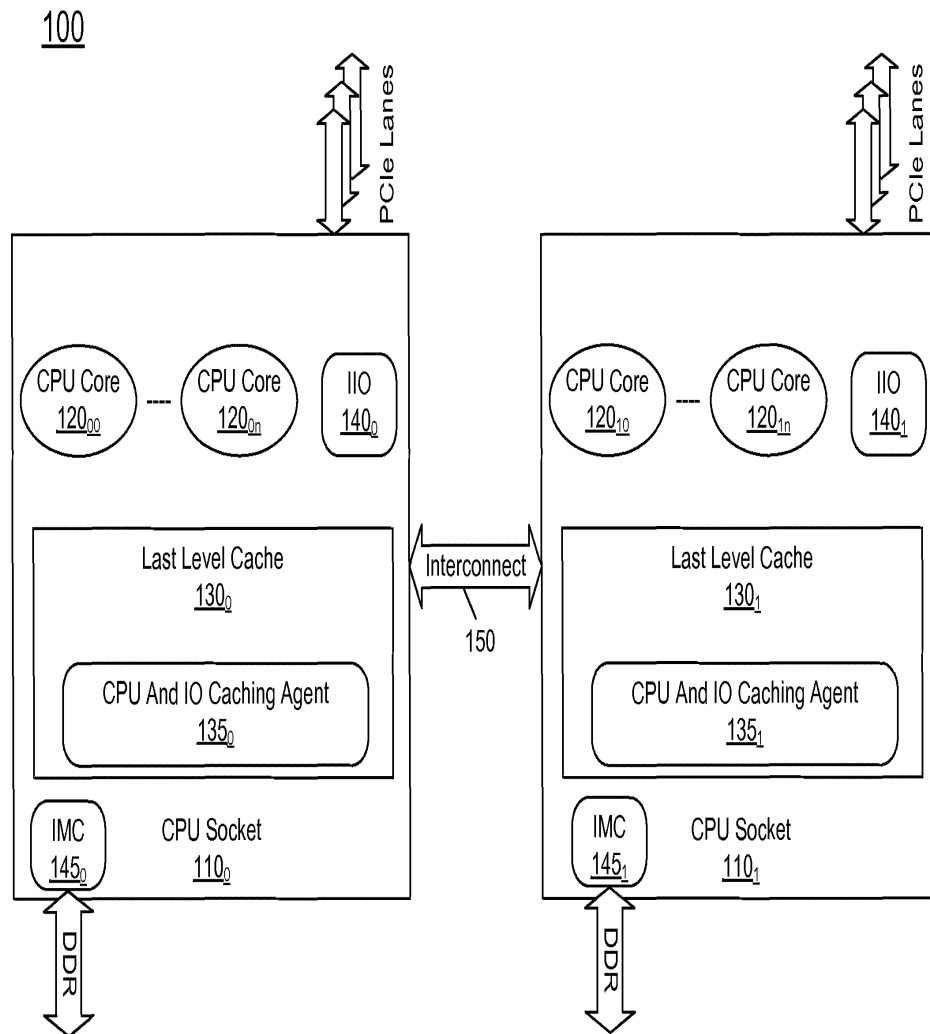


FIG. 1

200

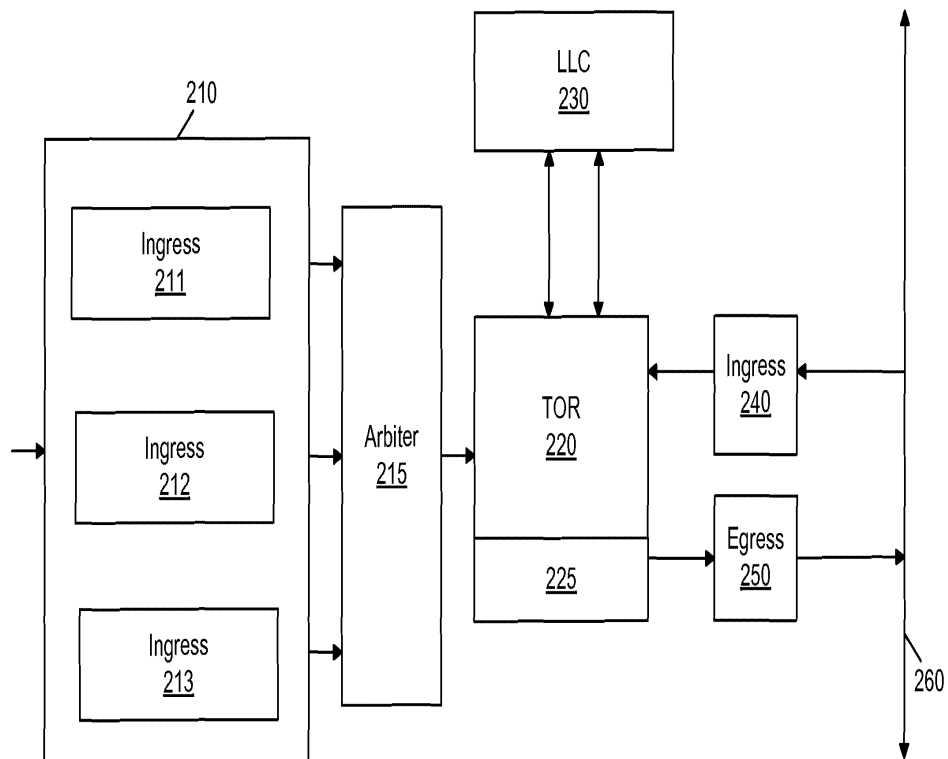


FIG. 2

300

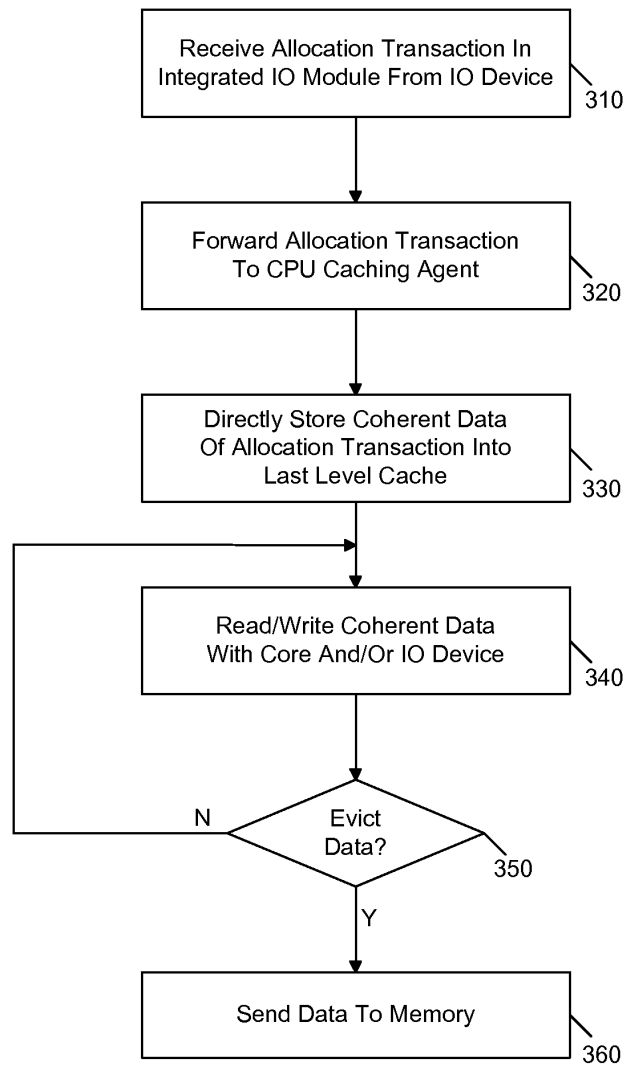


FIG. 3

375

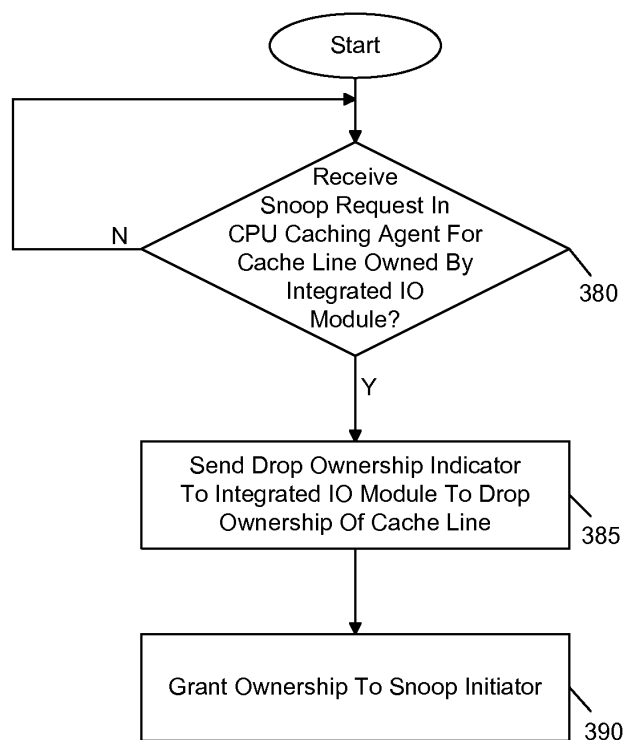


FIG. 4

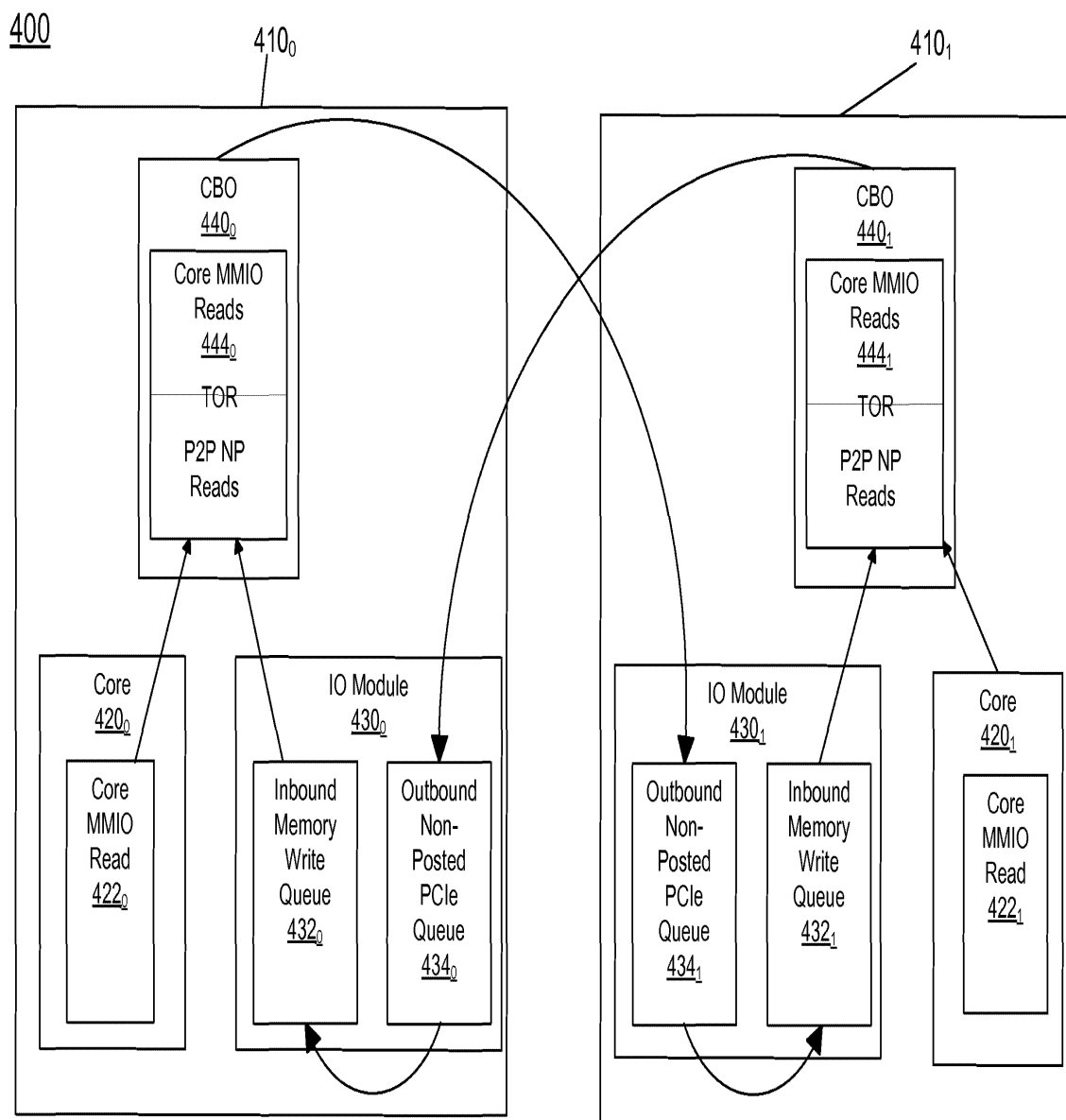


FIG. 5

700

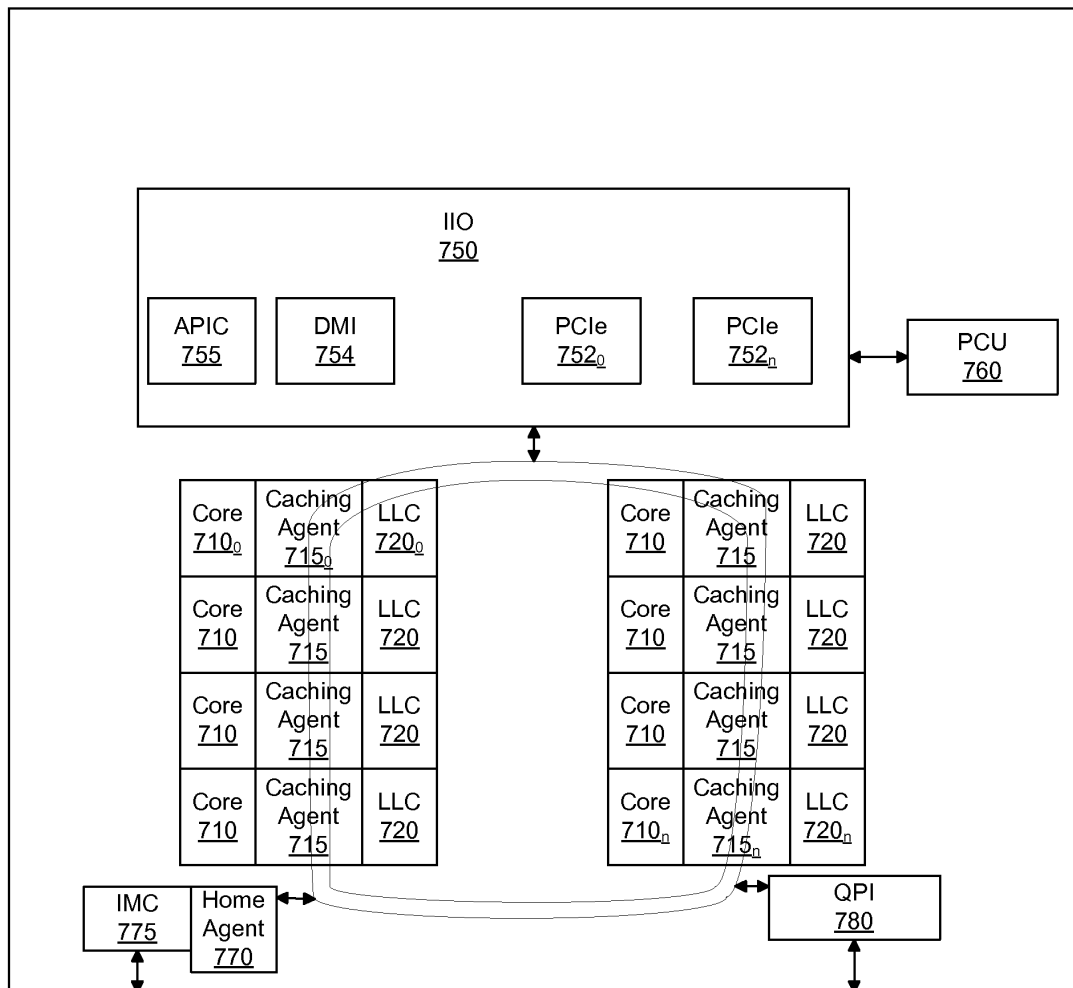


FIG. 6

800

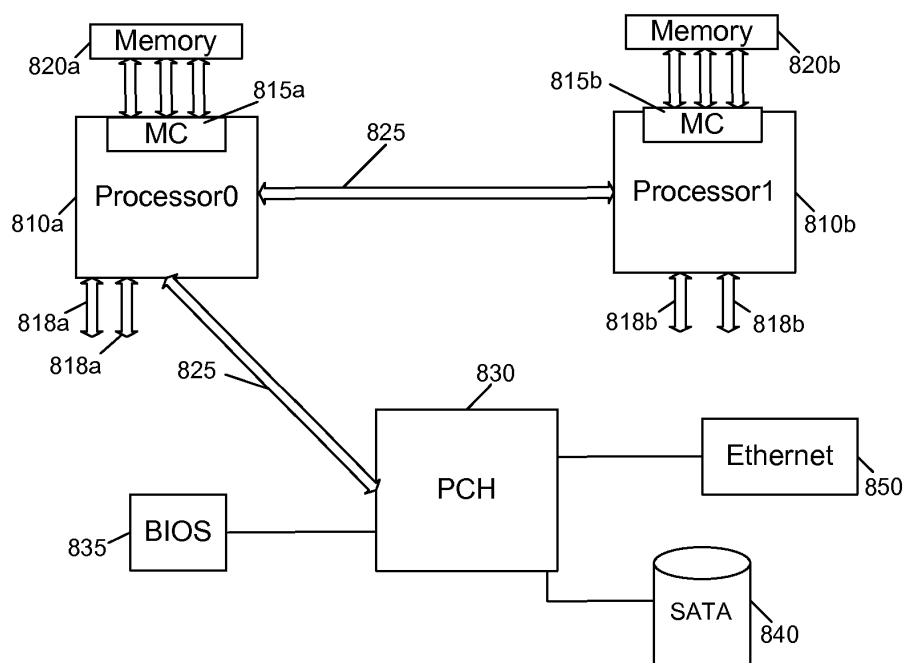


FIG. 7

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As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below, next to my name.

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

**PROVIDING COMMON CACHING AGENT FOR CORE AND
INTEGRATED INPUT/OUTPUT (IO) MODULE**

the specification of which (check one):

 X is attached hereto.
 was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____
(if applicable)

I hereby authorize and request my attorney, associated with Customer Number 47795, to insert on the designated lines above, the filing date, application number, PCT International Application Number and amendment date, as applicable, of the patent application should this Declaration be filed after filing the specification.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

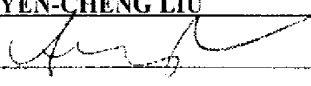
I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed:

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(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No	Yes	No
_____	_____	_____	_____	_____	_____	_____
(Number)	(Country)	(Foreign Filing Date - MM/DD/YYYY)	Yes	No	Yes	No
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under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize
the validity of the application or any patent issued thereon.

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Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) Prior art cited in search reports of a foreign patent office in a counterpart application, and
 - (2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
 - (2) It refutes, or is inconsistent with, a position the applicant takes in:
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 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
 - (2) Each attorney or agent who prepares or prosecutes the application; and
 - (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
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- (e) In any continuation-in-part application, the duty under this section includes the duty to disclose to the Office all information known to the person to be material to patentability, as defined in paragraph (b) of this section, which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

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	1	6009488		1999-12-28	KAVIPURAPU			
	2	7689778		2010-03-30	Liu, et al.			
	3	7210000		2007-04-24	Creta			
	4	7165131		2007-01-16	Creta			
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	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

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	1	INTEL CORPORATION, "An Introduction to the Intel QuickPath Interconnect," January 2009, pages 1-22	☐

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	Filing Date		2011-12-13
	First Named Inventor	Yen-Cheng Liu, et al.	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	ITL.2523US (P39131)	

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Rozman/	Date (YYYY-MM-DD)	2011-12-13
Name/Print	Mark J. Rozman	Registration Number	42117

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Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Providing Common Cache Agent For Core And Integrated Input/Output (IO) Module		
First Named Inventor/Applicant Name:		Yen-Cheng Liu		
Filer:		Mark J. Rozman/Stephanie Petreas		
Attorney Docket Number:		ITL.2523US (P39131)		
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	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1250

Electronic Acknowledgement Receipt	
EFS ID:	11603435
Application Number:	13324053
International Application Number:	
Confirmation Number:	5133
Title of Invention:	Providing Common Cache Agent For Core And Integrated Input/Output (IO) Module
First Named Inventor/Applicant Name:	Yen-Cheng Liu
Customer Number:	47795
Filer:	Mark J. Rozman/Stephanie Petreas
Filer Authorized By:	Mark J. Rozman
Attorney Docket Number:	ITL.2523US (P39131)
Receipt Date:	13-DEC-2011
Filing Date:	
Time Stamp:	12:37:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1250
RAM confirmation Number	10588
Deposit Account	201504
Authorized User	ROZMAN,MARK J.
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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	ITL2523USPatentApplicationTrans.pdf	256028	no	4
			cdd205ecd877c17e8e7ca096f06877d32bb17e91		
Warnings:					
Information:					
2		ITL2523USPatentApplication.pdf	94386	yes	15
			137c69fedde34e4538ccf884b2106a2dab9ad763		
	Multipart Description/PDF files in .zip description				
	Document Description	Start	End		
	Specification	1	11		
	Claims	12	14		
	Abstract	15	15		
Warnings:					
Information:					
3	Drawings-only black and white line drawings	ITL2523USDrawings.pdf	41348	no	7
			c8cb31bd73b9f148b17ad5ef077dbec5677b0b00		
Warnings:					
Information:					
4	Oath or Declaration filed	ITL2523USDec.pdf	286251	no	4
			c6d099021ae32e86327654ed87c40fced84614f4		
Warnings:					
Information:					
5	Information Disclosure Statement (IDS) Form (SB08)	ITL2523USIDSToFile.pdf	37685	no	4
			c338e7b05f5602bbca444aa16fe1f6cda97e197		
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
6	Non Patent Literature	QuickPathJanuary2009.pdf	746376	no	22
			32e71360f3fe7e639e8925d8f71037e46bbe6a0a		
Warnings:					
Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	32999 6a4998261d149dc0b0b11c8101452d971f cabad	no	2
Warnings:					
Information:					
Total Files Size (in bytes):				1495073	
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