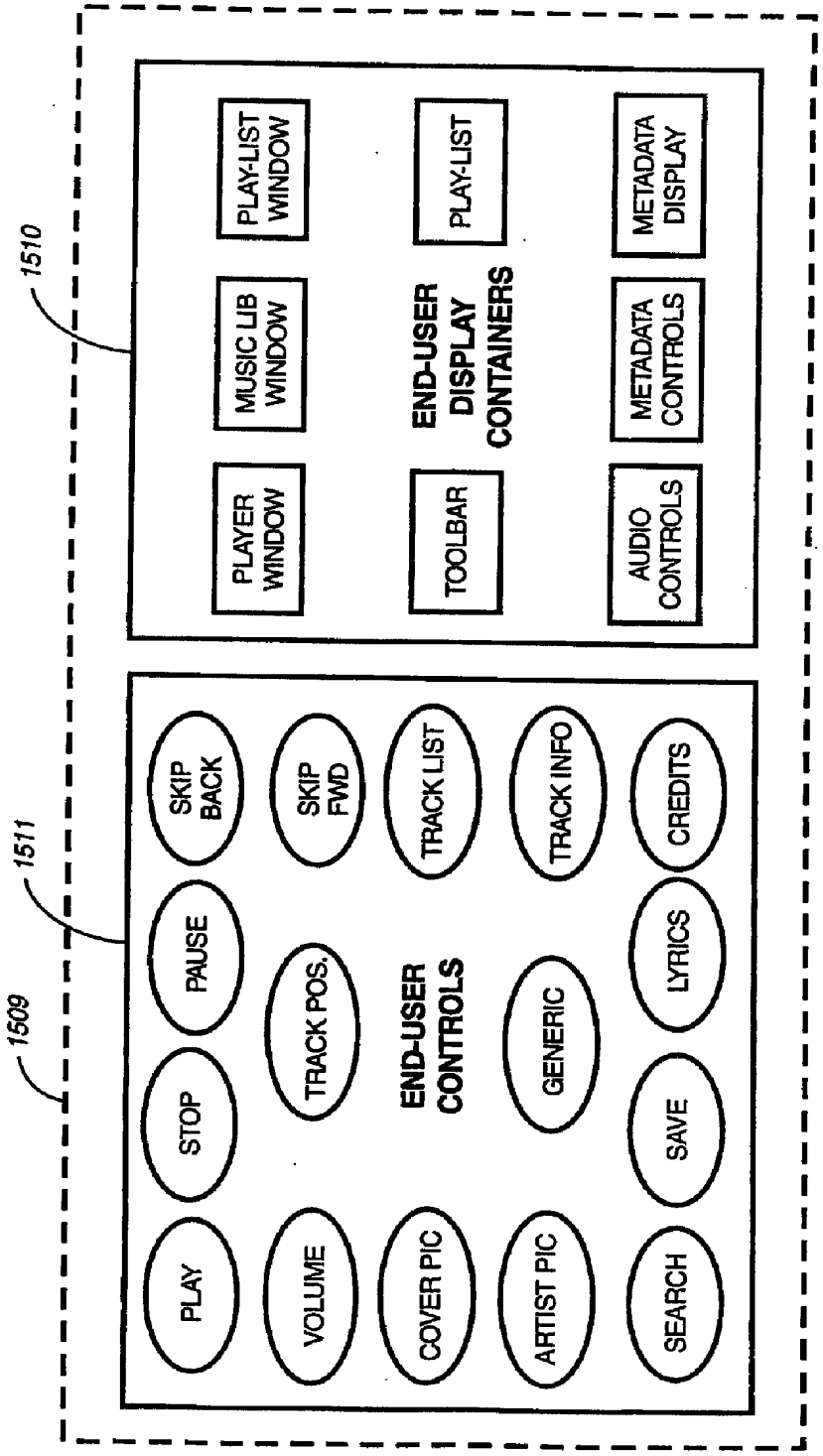

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PAUSE
SKIP BACK
VOLUME
TRACK POS.
SKIP FWD
COVER PIC
ARTIST PIC
GENERIC
TRACK LIST
TRACK INFO
SEARCH
SAVE
LYRICS
CREDITS
END-USER DISPLAY CONTAINERS
PLAYER WINDOW
MUSIC LIB WINDOW
PLAY-LIST WINDOW
TOOLBAR
PLAY-LIST
AUDIO CONTROLS
METADATA CONTROLS
METADATA DISPLAY

FIG. 15A

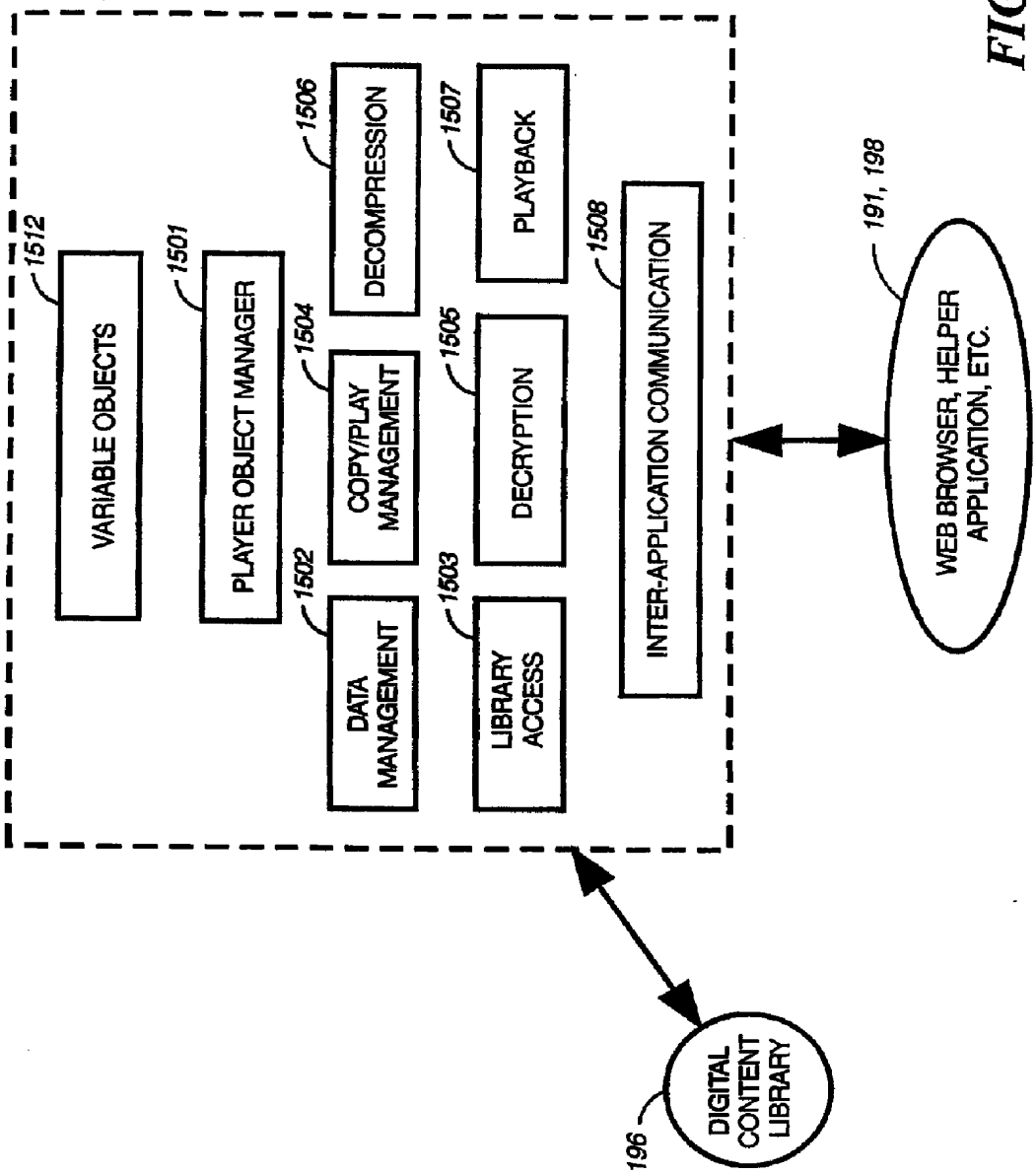

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PLAYER OBJECT MANAGER
1501
DATA MANAGEMENT
1502
COPY/PLAY MANAGEMENT
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LIBRARY ACCESS
1503
DECRYPTION
1505
DECOMPRESSION
1506
PLAYBACK
1507
INTER-APPLICATION COMMUNICATION
1508
DIGITAL CONTENT LIBRARY
196
WEB BROWSER, HELPER APPLICATION, ETC.
191, 198

FIG. 15B

Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Kathleen McInnish
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt

EFS ID:	20473682
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	21-OCT-2014
Filing Date:	21-MAR-2009
Time Stamp:	14:19:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1200
RAM confirmation Number	617
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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2	Transmittal Letter	137USU1_SIDS.pdf	51026 46566461fb57566c026c410d1f9202d555367e1d	no	6
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3	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	225232 52f8eefae326735d3667bbf255cdf555ec4a7bd4	no	21
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New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
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Electronic Acknowledgement Receipt

EFS ID:	20474245
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	21-OCT-2014
Filing Date:	21-MAR-2009
Time Stamp:	14:43:03
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.)
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41	Non Patent Literature	Kwan_1995_NCSAs_World_Wide_Web.pdf	1202877 f8312c3ada7f9213de1c83d354d713b5caf23181	no	23
Warnings:					
Information:					
42	Non Patent Literature	Little_1995_Selection_and_Dissemination.pdf	3089464 e91f18433491e9f4313efbe3d72d2d6f5a3edd53	no	30
Warnings:					
Information:					
43	Non Patent Literature	Luotonen_1994_WorldWide_Web_Proxies.pdf	448223 61f08d0496a7f0911b625cc9196623fb4d66b43b	no	8
Warnings:					
Information:					
44	Non Patent Literature	Malkin_1993_RIP_Version_2.pdf	2250882 caa3abde114265e86019c6901eef525a8909743d	no	62
Warnings:					
Information:					
45	Non Patent Literature	Malpani_1995_Making_World_Wide_Web.pdf	728752 f48b97e981e26a88321e84ec0f9f47482a6d1d66	no	10
Warnings:					
Information:					
46	Non Patent Literature	Mockapetris_RFC_1034_Domain_Names_Concepts_Nov_1997.pdf	1982985 e7a5dbc88bdecd2d41570c6d9dd2aa37a0bc0308	no	55
Warnings:					
Information:					

47	Non Patent Literature	Mockapetris_1987_RFC_1035.pdf	1861779 c2adbe6b7c26d8c8cb032c58ce10de9d6912f4e7	no	55
Warnings:					
Information:					
48	Non Patent Literature	Mourad_1997_Scalable_Web_Server.pdf	440029 0b1c1d86519d6cdfa11ea84c1387f97ab759fa25	no	5
Warnings:					
Information:					
49	Non Patent Literature	Moy_1994_OSPF_Version_2.pdf	6572246 cb3e47724a7b3eab5e2137e54ab479af093cbe00	no	132
Warnings:					
Information:					
50	Non Patent Literature	Niki_2001_COMPUTOPIA_Storage_Network.pdf	816952 e0b3d704f5406df696294c01df195d98a3055b59	no	20
Warnings:					
Information:					
51	Non Patent Literature	Oguchi_1996_A_Study_Caching_Proxy.pdf	464107 eb6fb6969529a39b8daa772e0e663cfc86138beb	no	7
Warnings:					
Information:					
52	Non Patent Literature	Palmer_1991_Fido_A_Cache_That_Learns.pdf	906592 7b8e940265b3d1f8cc9bad068df98ebf896f4f02	no	10
Warnings:					
Information:					
53	Non Patent Literature	Panigrahy_1997_Relieving_Hot_Spots.pdf	2414326 2f231b717791cbfd138b11b1e70cb8bcb4f900a3	no	66
Warnings:					
Information:					
54	Non Patent Literature	Parris_1993_A_Dynamic_Connection.pdf	2385656 9c34b98c4a160897271cc86b3b64f28272eca03b	no	37
Warnings:					
Information:					
55	Non Patent Literature	Parris_1994_Dynamic_Mgmt_Guaranteed.pdf	662508 851a954dab1542653acfb4bc832fdd3c91f1e5ce	no	145
Warnings:					
Information:					

56	Non Patent Literature	Partridge_1993_Host_Anycasting.pdf	403093 5912cb1633a7aa105b93140fe58985a5b3279184	no	9
Warnings:					
Information:					
57	Non Patent Literature	Petri_1995_Load_Balancing.pdf	746176 75643ca174b83088e3dc8295c182afc2509a7413	no	12
Warnings:					
Information:					
58	Non Patent Literature	Plaxton_1996_Fast_Fault_Tolerant.pdf	905732 45abeffef4556d77d3b970ca8f049ff9278c6037	no	10
Warnings:					
Information:					
59	Non Patent Literature	Povey_1997_A_Distributed_Internet_Cache.pdf	767033 0a80265564533fec8424fb4659111f2b1066831c	no	10
Warnings:					
Information:					
60	Non Patent Literature	Rabin_1989_Efficient_Dispersal.pdf	845314 d4916d5a360932e63b6111595f0f3ffdaac9a6e4	no	14
Warnings:					
Information:					
		Total Files Size (in bytes):	84368829		

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.

Electronic Acknowledgement Receipt

EFS ID:	20474418
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	21-OCT-2014
Filing Date:	21-MAR-2009
Time Stamp:	14:49:42
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	Non Patent Literature	Rabinovich_1998_Dynamic_Replication.pdf	1927268 ccbf419b495262102b536e774f37e4b7a79c0646	no	35

Warnings:	
Information:	

2	Non Patent Literature	Rabinovich_1999_Scalable_Architecture.pdf	1132475 cad55bda6b937c5d554b250071a092da320fc87c	no	17
Warnings:					
Information:					
3	Non Patent Literature	Reisslein_2000_Interactive_video_streaming.pdf	1315020 2e526e84e913122e45ba6ad878018b74f0e9aa6c	no	16
Warnings:					
Information:					
4	Non Patent Literature	Rodriguez_1998_Improving_the_WWW.pdf	1379808 728901cd7c6715aa5684efde061f505b6c723654	no	23
Warnings:					
Information:					
5	Non Patent Literature	Ross_1997_HashRouting_for_Collections.pdf	1012980 036b21093fa09b9ea9b62d57863d33054fcbbed7	no	21
Warnings:					
Information:					
6	Non Patent Literature	Sen_1999_Proxy_prefix_caching.pdf	1046115 0f8d46c985e89582b93f2776a8f392b10ed047a4	no	10
Warnings:					
Information:					
7	Non Patent Literature	Smith_1994_What_Can_Archives_Offer.pdf	742818 6fd11afe4a871015dd9ef0fa3137f46e0f41e764	no	12
Warnings:					
Information:					
8	Non Patent Literature	Takahashi_1999_How_to_Customize_Apache.pdf	373192 51c53cfca53f590348986e53db9ba370143c0708	no	13
Warnings:					
Information:					
9	Non Patent Literature	Thaler_1998_Using_Name_Based_mappings.pdf	1290755 ffddc4cd66fb0abe3e396cc30979dbd0c1aa3fe7	no	14
Warnings:					
Information:					
10	Non Patent Literature	Topolcic_1990_Experimental_Internet.pdf	5246034 0c39da5f1f705e80f91fba6c6e6fdb96f0c64a8f	no	148
Warnings:					
Information:					

11	Non Patent Literature	Touch_1998_The_XBone.pdf	724658 74263a4e5d612c552e4faf48a046471f3b09c6ac	no	9
Warnings:					
Information:					
12	Non Patent Literature	Traina_BGP4_Protocol_Analysis_Mar_1995.pdf	409348 64ce119c237bce6ff7d2770bfaf551a3b1d0a5b1	no	10
Warnings:					
Information:					
13	Non Patent Literature	Vin_1998_Multimedia_Broadcasting.pdf	684283 a4bfc8ec5c1ec93bc6faafabc0c0f1ad0ad701ef	no	5
Warnings:					
Information:					
14	Non Patent Literature	Vitter_1991_Optimal_Prefetching.pdf	1261990 ebbf91c77a8ed47cca7e3aa75d9235e96c87f418	no	21
Warnings:					
Information:					
15	Non Patent Literature	Wessels_1997_Configuring_hierarchical.pdf	2629635 4f9c21a484eb702f0c6e13683f1a153746bf3070	no	62
Warnings:					
Information:					
16	Non Patent Literature	Wessels_1995_Intelligent_Caching.pdf	2639652 c9f06e7e65cfb4f9261bb03e198a8ebb3e3f6117	no	93
Warnings:					
Information:					
17	Non Patent Literature	Wessels_1997_RFC_2186_Internet_cache.pdf	279750 836ad2037a703396f238c78787f8bb164c05ecac	no	9
Warnings:					
Information:					
18	Non Patent Literature	Wolfson_1997_An_Adaptive_Data.pdf	3355747 17387f3c70d01c6d3a8ad5b5f47ee44aaacac645	no	56
Warnings:					
Information:					
19	Non Patent Literature	Xiao_and_Zhang_2001_Exploiting_neglected.pdf	192087 b6b5e9c7e2a232d746bd069296330ace2b3b3a8f	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	27643615

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

83579 7590 10/07/2014

LEVEL 3 COMMUNICATIONS, LLC
Attn: Patent Docketing
1025 Eldorado Blvd.
Broomfield, CO 80021

EXAMINER
DAILEY, THOMAS J

ART UNIT	PAPER NUMBER
2452	

DATE MAILED: 10/07/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

TITLE OF INVENTION: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

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	01/07/2015

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
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)

83579 7590 10/07/2014
LEVEL 3 COMMUNICATIONS, LLC
Attn: Patent Docketing
1025 Eldorado Blvd.
Broomfield, CO 80021

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.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

TITLE OF INVENTION: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

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	01/07/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
DAILEY, THOMAS J	2452	709-226000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

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

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

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29
  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.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27
  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.
- ❑ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

83579 7590 10/07/2014

LEVEL 3 COMMUNICATIONS, LLC
Attn: Patent Docketing
1025 Eldorado Blvd.
Broomfield, CO 80021

EXAMINER	
DAILEY, THOMAS J	
ART UNIT	PAPER NUMBER
2452	

DATE MAILED: 10/07/2014

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.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 12/408,681	Applicant(s) FULLAGAR ET AL.	
	Examiner THOMAS DAILEY	Art Unit 2452	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 *Appeal Brief entered 6/23/2014*.
   ☐ 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 *1-29*. 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 10/29/2013
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 _____.

/THOMAS DAILEY/
Primary Examiner, Art Unit 2452

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

DETAILED ACTION

1. Claims 1-29 are pending.

Allowable Subject Matter

1. Claims 1-29 are allowed.
2. The following is an examiner's statement of reasons for allowance:
3. The prior art of record does not explicitly disclose or make obvious the claimed invention as a whole when interpreted in light of the Specification with particular emphasis on the arguments presented in the Appeal Brief dated 6/23/2014, see pages 8-20.
4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas J. Dailey whose telephone number is 571-270-1246. The examiner can normally be reached on Monday thru Friday;

9:00am - 5:00pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thu Nguyen can be reached on 571-272-6967. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

6. 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.

/Thomas J Dailey/
Primary Examiner, Art Unit 2452

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	214	popular$5 with (certain or particul$5) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:24
L2	887	(CDN or content delivery network) same (popula$6)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:26
L3	115	(CDN or content delivery network) same (popula$6) with deter$6	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:26
L4	60	("20040205162" | "20010027491" | "7103645" | "20050060493" | "20030140111" | "6212565" | "20080147866" | "6859840" | "7274658" | "20100312861" | "20050240966" | "7219153" | "20020016835" | "20030149581" | "20060015574" | "20080065724" | "6591288" | "6594260" | "6839758" | "6999988" | "7254645" | "20060112176" | "20080071859" | "20020040404" | "20110145386" | "7562153" | "20040064832" | "20040162871" | "20030031176" | "20050021863" | "7024466" | "7185052" | "6157648" | "20100257258" | "20070055764" | "20020198953" | "6094680" | "6463454" | "6785704" | "7373644" | "20020010798" | "20020174168" | "20110099290" | "20020016831" | "20020087797" | "20020116444" | "20020133537" | "20030112792" | "6085193" | "6598121" | "6732237" | "6976090" | "7577754" | "20040010588" | "20020184357" | "20050010653" | "5777988" | "5815662" | "6741990" | "20100169772" | "7024466").PN.	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L5	1916	popular$5 with (check$6 or determin$6) same (server)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L6	391	popular$5 with (check$6 or determin$6) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L7	0	L6 and ("709" or "725" or "370").ccls.	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L8	271	L6 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L9	91	popular$5 with (option$7) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L10	69	L9 and ("709" or "725" or "370").clas.	US-PGPUB;	ADJ	ON	2014/09/26 11:59

			USPAT			
L11	22	L9 not L10	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L12	214	popular$5 with (certain or particul$5) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L13	143	L12 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L14	1	"20070233820"	US-PGPUB; USPAT	ADJ	ON	2014/09/26 11:59
L20	40288	709/219,223,226.ccls.	US-PGPUB; USPAT	ADJ	ON	2014/09/26 12:47
L21	200	5 and 20	US-PGPUB; USPAT	ADJ	ON	2014/09/26 12:47
S1	60	("20040205162" | "20010027491" | "7103645" | "20050060493" | "20030140111" | "6212565" | "20080147866" | "6859840" | "7274658" | "20100312861" | "20050240966" | "7219153" | "20020016835" | "20030149581" | "20060015574" | "20080065724" | "6591288" | "6594260" | "6839758" | "6999988" | "7254645" | "20060112176" | "20080071859" | "20020040404" | "20110145386" | "7562153" | "20040064832" | "20040162871" | "20030031176" | "20050021863" | "7024466" | "7185052" | "6157648" | "20100257258" | "20070055764" | "20020198953" | "6094680" | "6463454" | "6785704" | "7373644" | "20020010798" | "20020174168" | "20110099290" | "20020016831" | "20020087797" | "20020116444" | "20020133537" | "20030112792" | "6085193" | "6598121" | "6732237" | "6976090" | "7577754" | "20040010588" | "20020184357" | "20050010653" | "5777988" | "5815662" | "6741990" | "20100169772" | "7024466").PN.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 11:23
S2	1371	popular$5 with (check$6 or determin$6) same (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:30
S3	240	popular$5 with (check$6 or determin$6) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:30
S4	0	S3 and ("709" or "725" or "370").ccls.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:31
S5	162	S3 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:31
S6	78	popular$5 with (option$7) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:53
S7	60	S6 and ("709" or "725" or "370").clas.	US-	ADJ	ON	2013/07/05

			PGPUB; USPAT			14:53
S8	18	S6 not S7	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:58
S9	164	popular$5 with (certain or particul$5) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 15:04
S10	114	S9 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 15:05
S11	1	"20070233820"	US-PGPUB; USPAT	ADJ	ON	2013/07/05 16:33

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L15	41	((CDN or content delivery network) same (popula$6)).clm.	US-PGPUB; USPAT; UPAD	ADJ	ON	2014/09/26 12:46
L16	7	15 and 709/226.ccls.	US-PGPUB; USPAT; UPAD	ADJ	ON	2014/09/26 12:46
L17	6	15 and 709/219.ccls.	US-PGPUB; USPAT; UPAD	ADJ	ON	2014/09/26 12:47
L18	4	15 and 709/223.ccls.	US-PGPUB; USPAT; UPAD	ADJ	ON	2014/09/26 12:47
L19	40366	709/219,223,226.ccls.	US-PGPUB; USPAT; UPAD	ADJ	ON	2014/09/26 12:47

9/26/2014 1:36:07 PM
C:\Users\tdailey\Documents\EAST\Workspaces\12-408681.wsp

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

BIB DATA SHEET

CONFIRMATION NO. 9965

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/408,681	03/21/2009	709	2452	0137-US-U1

APPLICANTS

INVENTORS

David Fullagar, Boulder, CO;
Christopher Newton, Thousand Oaks, CA;
Laurence R. Lipstone, Calabasas, CA;

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

This appln claims benefit of 61/042,412 04/04/2008

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

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

04/01/2009

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /NEERAJ K UTREJA/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CO	6	12	4

ADDRESS

LEVEL 3 COMMUNICATIONS, LLC
Attn: Patent Docketing
1025 Eldorado Blvd.
Broomfield, CO 80021
UNITED STATES

TITLE

HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

FILING FEE RECEIVED	FEES: Authority has been given in Paper	☐ All Fees
1752	No._____ to charge/credit DEPOSIT ACCOUNT	☐ 1.16 Fees (Filing)
	No._____ for following:	☐ 1.17 Fees (Processing Ext. of time)
		☐ 1.18 Fees (Issue)
		☐ Other _____
		☐ Credit

BIB (Rev. 05/07).

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	**Art Unit**
	THOMAS DAILEY	2452

CPC						
Symbol					**Type**	**Version**
H04N		7	/	17354	F	2013-01-01
H04N		21	/	222	I	2013-01-01
H04N		21	/	23106	I	2013-01-01
H04N		21	/	25891	I	2013-01-01
H04N		21	/	472	I	2013-01-01
H04L		67	/	2814	I	2013-01-01
H04L		67	/	2842	I	2013-01-01
			/			
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			/			

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/THOMAS DAILEY/ Primary Examiner.Art Unit 2452	09/26/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	**Art Unit**
	THOMAS DAILEY	2452

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION												
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED							
709	226	G	0	6	F	15 / 173 (2006.01.01)								
CROSS REFERENCE(S)														
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)													
709	219	223												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/THOMAS DAILEY/ Primary Examiner.Art Unit 2452	09/26/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	**Art Unit**
	THOMAS DAILEY	2452

☐ 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	17	17												
2	2	18	18												
3	3	19	19												
4	4	20	20												
5	5	21	21												
6	6	22	22												
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8	8	24	24												
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10	10	26	26												
11	11	27	27												
12	12	28	28												
13	13	29	29												
14	14														
15	15														
16	16														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	29	
/THOMAS DAILEY/ Primary Examiner.Art Unit 2452	09/26/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No. 20140926

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
709	219, 223, 226	9/26/2014	TJD

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	3/23/2011	NU
Google Patents search	3/23/2011	NU
double patenting / inventor search	3/23/2011	NU
EAST text search updated	11/10/2011	NU
double patenting / inventor search	11/10/2011	NU
Google Patents search: "long tail popular cdn"	11/10/2011	NU
Keyword searching in EAST for amended subject matter	7/5/2013	TJD
Updated search	9/26/2014	TJD
NPL search utilizing Google	9/26/2014	TJD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
709	219,223,226	9/26/2014	TJD

/NEERAJ UTREJA/ Examiner.Art Unit 2452	

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Thomas J. Dailey

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS					
Examiner Initial *	**Cite No**	**Document Number**	**Publication Date**	**Name of Patentee or Applicant of Cited Document**	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	**Cite No**	**Foreign Patent Document**	**Publication Date**	**Name of Patentee or Applicant of cited Document**	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	**Cite No [1]**	**Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.**	T[2]
		Canada Examination Report, dated August 16, 2013, Application No. 2,720,353, filed March 21, 2009; Dkt. No. 0137-CA-01, 3 pgs.	

EXAMINER /Thomas Dailey/ **DATE CONSIDERED** 09/26/2014

Substitute Disclosure Statement Form (PTO-1449)

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.D

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF:	Attorney Docket: **0137-US-U1**
Fullagar et al.	Group Art Unit: 2452
Application Serial No.: **12/408,681**	Examiner: Dailey, Thomas J.
Application Filing Date: 03/21/2009	Confirmation No.: 9965
Title: **Handling Long-Tail Content In A Content Delivery Network (CDN)**	

AMENDMENT AND RESPONSE AFTER FINAL OFFICE ACTION

Via EFS-Web
Hon. Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Madam:

In response to the non-final office action mailed July 18, 2013, please amend this application as follows.

A **Petition for Extension of Time** is on page **2** hereof

Amendments to the claims begin on page **3** hereof.

Remarks begin on page **10** hereof.

PETITION FOR EXTENSION OF TIME

Petition is hereby made to extend by **three months** the due date for filing the Appeal Brief – based on the filing of the Notice of Appeal dated January 21, 2014. Applicant is electronically submitting the required fee with this filing. The Commissioner is authorized to deduct any additional fees from or credit any over-payment to the undersigned's Deposit Account No. 50-5063.

IN THE CLAIMS

Please amend the claims as follows. This listing of the claims replaces all prior claim listings.

1. (Currently amended) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is available at said first server or at a peer of said first server, serving the resource to the client from the first server;

(C) otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on [[its]] popularity <u>of the resource</u>; and

(D) when ~~it is not determined~~ <u>a determination is not made</u> that said resource is to be served based on [[its]] popularity <u>of the resource</u>, obtaining the resource at said first server and serving the resource to the client from the first server; and

(E) when ~~it is determined~~ <u>the determination is made</u> that said resource is to be served based on [[its]] popularity <u>of the resource</u>,

(E)(1) determining whether said resource is popular, and

(E)(2) if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise,

(E)(3) if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and

(E)(4) said second server serving the resource to the client.

2. (Original) The method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers.

3. (Original) The method of claim 1 wherein the second server is a content provider's origin server.

4. (Original) The method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

5. (Currently amended) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on whether or not said resource is to be served based on [[its]] popularity <u>of the resource</u> and on a current popularity value for said resource.

6. (Original) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers.

7. (Previously presented) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server.

8. (Currently amended) A content delivery framework comprising:

a plurality of edge servers forming a first tier of servers; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and

at least one popularity service, implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of said edge servers about requests for content that has been specifically designated to be handled based on [[its]] popularity <u>of the content</u>, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making [[its]] determinations based, at least in part, on a measure of popularity of requested content.

9. (Currently amended) A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on [[its]] popularity of the resource, and (ii) a current popularity value for said resource.

10. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier.

11. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier.

12. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier.

13. (Previously presented) The method of claim 1 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource.

14. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is

popular is based at least in part on whether the resource is an initial part of the object.

15. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

16. (Previously presented) The method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers.

17. (Previously presented) The method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service.

18. (Previously presented) The method of claim 17 wherein the popularity service runs on a popularity server.

19. (Previously presented) The method of claim 18 wherein the popularity server maintains information on relative popularity of content being served.

20. (Previously presented) The method of claim 19 wherein the popularity server maintains information on relative popularity of content being served in a region comprising the first server.

21. (Previously presented) The method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource.

22. (Previously presented) The method of claim 21 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource in a region comprising the first server.

23. (Previously presented) The method of claim 5 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

24. (Previously presented) The method of claim 9 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

25. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is an initial part of the object.

26. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

27. (Currently amended) The method of claim 1 wherein the act of determining whether said resource is to be served based on [[its]] popularity <u>of the resource</u> comprises:

determining whether said resource is designated to be served based on [[its]] popularity <u>of the resource</u>.

28. (Currently amended) The method of claim 5 wherein whether or not said resource is to be served based on [[its]] popularity <u>of the resource</u> is based

at least in part on whether or not said resource is designated to be served based on [[its]] popularity of the resource.

29. (Currently amended) The method of claim 9 wherein whether or not said resource is to be served based on [[its]] popularity of the resource is based at least in part on whether or not said resource is designated to be served based on [[its]] popularity of the resource.

REMARKS

Claim Rejections - 35 USC § 112, ¶2

The Examiner rejected claims 1-29 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. According to the Examiner "[t]he independent claims recite 'it' and 'its' multiple times.

Claims 1, 5, 8, 9, 27, 28, and 29 are amended to remove the use of the word "it" and "its" from the claims. Because these amendments are made merely to remove the use of the words "it" and "its" so as to clarify the claims, the amendments are considered minor in nature. No new matter is added by the amended claim language.

This Amendment is being submitted so that the remaining issues addressed by the Final Office Action can be argued in the Applicant's Appeal Brief.

CONCLUSION

Applicant respectfully submits that this application is in condition for allowance, as will be noted by the Applicant's Appeal Brief.

The Examiner is kindly requested to contact the undersigned at the number provided to schedule a personal interview to resolve any outstanding issues in this application.

Date: June 23, 2014

/JCS/

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re the Application of:

Applicant:	David Fullagar	Confirmation No:	9965
Serial No.:	12/408,681	Group Art Unit:	2452
Filed:	21 March 2009	Examiner:	DAILEY, Thomas J.
Title:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)	Docket No.	0137-US-U1
Customer No.:	83579		

APPEAL BRIEF

Via EFS-Web

Dear Commissioner:

As required under 37 C.F.R. § 41.37(a), this brief is filed within six months of the Notice of Appeal filed in this case on 21 January 2014.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1203.

I. Real Party In Interest....page 3
II. Related Appeals, Interferences, and Judicial Proceedings....page 3
III. Status of Claims....page 3
IV. Status of Amendments....page 3
V. Summary of Claimed Subject Matter....page 3
VI. Grounds of Rejection to be Reviewed on Appeal....page 7
VII. Argument....page 8
VIII. Claims Appendix....page 22
IX. Evidence Appendix....page 28
X. Related Proceedings Appendix....page 29

I. REAL PARTY IN INTEREST (37 C.F.R. § 41.37(c)(1)(i))

The real party in interest in this Appeal is:

Level 3 Communications, LLC.

II. RELATED APPEALS AND INTERFERENCES (37 C.F.R. § 41.37(c)(1)(ii))

A Notice of Appeal was filed on 21 January 2014. No other appeals or interferences are currently known to Appellant that will directly affect, be directly affected by, or have a bearing on the decision to be rendered by the Patent Trial and Appeal Board in the present Appeal.

III. STATUS OF CLAIMS (37 C.F.R. § 41.37(c)(1)(iii))

In view of the Final Office Action issued 18 July 2013, claims 1-29 are pending in the application and claims 1-29 stand rejected, and are the subject of this Appeal. Of these claims 1, 5, 8, and 9 are independent claims.

IV. STATUS OF AMENDMENTS (37 C.F.R. § 41.37(c)(1)(iv))

Appellant filed an amendment after the notice of appeal was filed. The amendment addresses §112 rejections made in the Final Office action. The amendments were made merely to remove the use of the words "it" and "its." Therefore, the amendments are considered minor in nature and merely clarify the claim language. No new matter was added by the amended claim language.

V. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. § 41.37(c)(1)(v))

The following provides a concise explanation of the subject matter defined in each of the separately argued independent claims involved in the Appeal, referring to the specification by page and line number and to the drawings by reference characters, as noted by 37 C.F.R. § 41.37(c)(1)(v).

Each element of the independent claims is identified by a corresponding reference to the specification and drawings where applicable. It should be noted that the citation to passages in the specification and drawings for each claim element does not imply that the limitations from the specification and drawings should be read into the corresponding claim element. Examples in the specification are not intended to limit the scope of the claims in any way. Moreover, the claims do not stand or fall together.

Independent claim 1 relates to a method of content delivery in a content delivery network comprising at least a first tier of servers. The method comprises

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource; (see, e.g., Specification ¶[0039]; Fig. 5, reference characters 500, 502)

(B) if said resource is available at said first server or at a peer of said first server, serving the resource to the client from the first server; (see, e.g., Specification ¶[0039]; FIG. 5, reference characters 502, 504)

(C) otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on popularity of the resource; (see, e.g., Specification ¶[0041]; FIG. 5, reference characters 502, 506)

(D) when a determination is not made that said resource is to be served based on popularity of the resource, obtaining the resource at said first server and serving the resource to the client from the first server; (see, e.g., Specification ¶[0043])

(E) when the determination is made that said resource is to be served based on popularity of the resource, (see, e.g., Specification ¶[0041] and ¶[0042]; reference character 506)

(E)(1) determining whether said resource is popular (see, e.g., Specification ¶[0044]; FIG. 5, reference characters 512, 516) , and

(E)(2) if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client (see, e.g., Specification ¶[0044]; FIG. 5, reference character 520), otherwise,

(E)(3) if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers (see, e.g., Specification ¶[0044]; FIG. 5, reference character 514), and

(E)(4) said second server serving the resource to the client (see, e.g., Specification ¶[0044]; FIG. 5, reference characters 514, 522).

Independent claim 5 relates to a method of content delivery in a content delivery network comprising at least a first tier of servers. The method comprises:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource (see, e.g., Specification ¶[0039]; Fig. 5, reference characters 500, 502);

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource

and on a current popularity value for said resource (see, e.g., Specification ¶[0040]- ¶[0044]; Fig. 5, reference characters 502, 506, 508, 510, 512, 514, and 522).

Independent claim 8 relates to a content delivery framework comprising:

a plurality of edge servers forming a first tier of servers (see, e.g., Specification ¶[0033]; Fig. 3, referring to Edge Server Group 1 through Edge Server Group n) ; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers (see, e.g., Specification ¶[0033]; Fig. 3, referring to Parent Server Group 1 through Parent Server Group m); and

at least one popularity service (see, e.g., Specification ¶[0033]; Fig. 3, reference character 102-1), implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of said edge servers about requests for content that has been specifically designated to be handled based on popularity of the content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making determinations based, at least in part, on a measure of popularity of requested content (see, e.g., Specification ¶[0037,] ¶[0040]- ¶[0044]; Fig. 5, reference characters 502, 506, 508, 510, 512, 514, and 522).

Independent claim 9 relates to a method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers. The method comprises:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource (see, e.g., Specification ¶[0039]; Fig. 5, reference characters 500, 502);

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource (see, e.g., Specification ¶[0040]- ¶[0044]; Fig. 5, reference characters 502, 506, 508, 510, 512, 514, and 522).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. § 41.37(c)(1)(vi))

(1) Whether the Office erred in rejecting claims 1-4, 13-19, 21, and 27 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

(2) Whether the Office erred in rejecting claims 5-7, 23, and 28 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

(3) Whether the Office erred in rejecting claim 8 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

(4) Whether the Office erred in rejecting claims 9, 10-12, 24-26, and 29 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi")

(5) Whether the Office erred in rejecting claims 20 and 22 under 35 U.S.C. § 103(a) over Seed in view of Adrangi and further in view of U.S. Patent Application No. 2010/0312861 A1 to Kolhi et al. ("Kolhi").

VII. ARGUMENT (37 C.F.R. § 41.37(c)(1)(vii))

(1) Whether the Office erred in rejecting claims 1-4, 13-19, 21, and 27 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

The Office rejected claim 1 in view of the combination of Seed and Adrangi. However, the Office erred in its assertion that the claim element "**otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on popularity of the resource**" is taught by the cited combination of references.

In particular, the Office incorrectly characterizes this language by stating on page 4 of the Final Office Action that this claim element is taught by Seed:

> "otherwise, if said resource is not available at said first server or at a peer of said first server, **determining whether said resource is popular** (Fig. 3a, 315 – Check for edge server whether requested object is popular)."
>
> See Final Office Action at page 4, lines 3-5 (emphasis added).

As can be seen by this quoted assertion from the Final Office Action, the Office is mischaracterizing the claim language "**determining whether said resource is to be served**

based on popularity of the resource" by recharacterizing the language to say "determining whether said resource is popular." This recharacterization of the claim language is improper and has led to an incorrect analysis.

Applicant explained the language "**determining whether said resource is to be served based on popularity of the resource**" in the specification. For example, Applicant noted in the specification at paragraph [0041] and Fig. 5 that:

> "If the object is not available on the edge server 108 or on a peer, the edge server 108 ascertains **whether the object is served based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from)**(at 506)."
>
> See Applicant's specification at paragraph [0041] (emphasis added).

As can be seen from this quoted section of the Applicant's specification, an object can be designated in the system so that the object's popularity is used to determine where it will be served from. This is not the same as just testing to see if an object is popular.

Thus, the mischaracterization of the claim language by the Office led to the Office incorrectly citing to the Seed reference as teaching the claim element "**otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on popularity of the resource.**" Indeed, the Final Office Action even later acknowledges that Seed does **not** teach "determining whether said resource is to be served based on popularity of the resource." See Final Office Action at page 5, lines 14-15.

Moreover, the Adrangi reference in combination with the Seed reference does not cure the error by the Office. At one point in the Final Office Action, the Office asserts that "Adrangi discloses determining whether said resource is to be served based on its popularity." See Final Office Action at bottom of page 5. However, the Office goes on to make the same mistake as above. Namely, paragraphs [0035] and [0036] of Adrangi cited by the Office merely describe a situation in which a determination is made as to whether a resource is popular. The cited portion of Adrangi does not teach whether an object has been designated so that the object's popularity will be used to determine where it will be served from. Therefore, Adrangi by itself (or in combination with Seed) does not teach the claim element of "determing whether said resource is to be served based on popularity of the resource."

Thus, the Office has failed to show that the element "**otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on popularity of the resource**" is taught by the cited combination of the Seed and Adrangi references. Because the Office has failed to show how this claim element is taught by the cited combination of references, the Office has failed to show how claim 1 as a whole is taught by the prior art. Therefore, the Office has failed to establish a prima facie case of obviousness for claim 1 under 35 U.S.C. §103. For at least this reason, claim 1 is believed to be in condition for allowance.

Claims 2-4, 13-19, 21, and 27 depend from claim 1 and are in condition for allowance for at least the same reasons that claim 1 should be allowed.

(2) Whether the Office erred in rejecting claims 5-7, 23, and 28 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

The Office rejected claim 5 in view of the combination of Seed and Adrangi. However, the Office erred in its assertion that the claim element "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource**" is taught by the cited combination of references.

First, the Office does not specifically address this claim element, but instead groups the rejection of claim 5 with the rejection of claim 1. The failure of the Office to address this claim language directly is clearly a failure to establish a prima facie case of obviousness under 35 U.S.C. §103.

Second, as can best be determined from the Final Office Action, the rejection of claim 5 includes the same deficiencies pointed out with respect to claim 1, as noted above. In particular, the Office incorrectly characterizes the claim language by stating on page 4 of the Final Office Action that Seed teaches:

> "if said resource is not available at said first server or at a peer of said first server, **determining whether said resource is popular** (Fig. 3a, 315 – Check for edge server whether requested object is popular)."
>
> See Final Office Action at page 4, lines 3-5 (emphasis added).

As can be seen by this quoted assertion from the Final Office Action, the Office is mischaracterizing the claim language "**whether or not said resource is to be served based on popularity of the resource**" by recharacterizing the language to say "determining whether said resource is popular." This recharacterization of the claim language is improper and has led to an incorrect analysis.

Applicant explained the language "**whether said resource is to be served based on popularity of the resource**" in the specification. For example, Applicant noted in the specification at paragraph [0041] and Fig. 5 that:

> "If the object is not available on the edge server 108 or on a peer, the edge server 108 ascertains **whether the object is served based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from)**(at 506)."
>
> See Applicant's specification at paragraph [0041] (emphasis added).

As can be seen from this quoted section of the Applicant's specification, an object can be designated in the system so that the object's popularity is used to determine where it will be served from. This is not the same as just testing to see if an object is popular.

Thus, the mischaracterization of the claim language by the Office led to the Office incorrectly citing to the Seed reference as teaching the claim element "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource.**" Indeed, the Final Office Action even later acknowledges that Seed does **not** teach "determining

whether said resource is to be served based on popularity of the resource." See Final Office Action at page 5, lines 14-15.

Moreover, the Adrangi reference in combination with the Seed reference does not cure the error by the Office. At one point in the Final Office Action, the Office asserts that "Adrangi discloses determining whether said resource is to be served based on its popularity." See Final Office Action at bottom of page 5. However, the Office goes on to make the same mistake as above. Namely, paragraphs [0035] and [0036] of Adrangi cited by the Office merely describe a situation in which a determination is made as to whether a resource is popular. The cited portion of Adrangi does not teach whether an object has been designated so that the object's popularity will be used to determine where it will be served from. Therefore, Adrangi by itself (or in combination with Seed) does not teach the claim element of "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource**."

Thus, the Office has failed to show that the element "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource**" is taught by the cited combination of the Seed and Adrangi references.

In conclusion, the Office has (1) failed to address directly in the Final Office Action the claim language "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current**

popularity value for said resource;" and (2) failed to show that the combination of references when considered as a whole would make claim 5 as a whole obvious.

Because the Office has failed to show how the claim element "**if said resource is not available at said first server . . . then selectively redirecting the request . . . said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource**" is taught by the cited combination of references, the Office has failed to show how claim 5 as a whole is taught by the prior art. Therefore, the Office has failed to establish a prima facie case of obviousness for claim 5 under 35 U.S.C. §103. For at least this reason, claim 5 is believed to be in condition for allowance.

Claims 6, 7, 23, and 28 depend from claim 5 and are in condition for allowance for at least the same reasons that claim 5 should be allowed.

(3) Whether the Office erred in rejecting claim 8 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

The Office rejected claim 8 in view of the combination of Seed and Adrangi. However, the Office erred in its assertion that the claim element "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about requests for content that has been specifically designated to be handled based on popularity of the content" is taught by the cited combination of references.

First, the Office does not specifically address this claim element, but instead groups the rejection of claim 8 with the rejection of claim 1. The failure of the Office to address this claim

language directly is clearly a failure to establish a prima facie case of obviousness under 35 U.S.C. §103.

Second, as can best be determined from the Final Office Action, the rejection of claim 8 includes the same deficiencies pointed out with respect to claim 1, as noted above. As best as can be determined, the Office is interpreting "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about **requests for content that has been specifically designated to be handled based on popularity of the content**" to mean that a determination is merely being made as to whether content is popular.

Applicant noted in the specification at paragraph [0041] and Fig. 5 with respect to similar language that:

> "If the object is not available on the edge server 108 or on a peer, the edge server 108 ascertains whether the object is **served based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from)**(at 506)."
>
> See Applicant's specification at paragraph [0041] (emphasis added).

As can be seen from this quoted section of the Applicant's specification, an object (or with respect to claim 8 – "content") can be designated in the system so that the object's popularity is used to determine where it will be served from. This is <u>not</u> the same as just testing to see if an object is popular.

Thus, the misapplication of the claim language by the Office led to the Office incorrectly citing to the Seed reference as teaching the claim element "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about

requests for content that has been specifically designated to be handled based on popularity of the content."

Moreover, the Adrangi reference in combination with the Seed reference does not cure the error by the Office. At one point in the Final Office Action, the Office asserts that "Adrangi discloses determining whether said resource is to be served based on its popularity." See Final Office Action at bottom of page 5. However, the Office goes on to make the same mistake as above. Namely, paragraphs [0035] and [0036] of Adrangi cited by the Office merely describe a situation in which a determination is made as to whether a resource is popular. The cited portion of Adrangi does not teach whether an object has been designated so that the object's popularity will be used to determine where it will be served from. Therefore, Adrangi by itself (or in combination with Seed) does not teach the claim element of "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about **requests for content that has been specifically designated to be handled based on popularity of the content.**"

Thus, the Office has failed to show that the element "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about **requests for content that has been specifically designated to be handled based on popularity of the content**" is taught by the cited combination of the Seed and Adrangi references.

In conclusion, the Office has (1) failed to address directly in the Final Office Action the claim language "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about **requests for content that has been specifically designated to be handled based on popularity of the content;**" and (2) failed to show that the combination of references when considered as a whole would make claim 8 as a whole obvious.

Because the Office has failed to show how the claim element "at least one popularity service . . . constructed and adapted to obtain information from at least some of the edge servers about **requests for content that has been specifically designated to be handled based on popularity of the content**" is taught by the cited combination of references, the Office has failed to show how claim 8 as a whole is taught by the prior art. Therefore, the Office has failed to establish a prima facie case of obviousness for claim 5 under 35 U.S.C. §103. For at least this reason, claim 8 is believed to be in condition for allowance.

(4) Whether the Office erred in rejecting claims 9, 10-12, 24-26, and 29 under 35 U.S.C. §103(a) over U.S. Patent Application Publication No. 2006/0015574 A1 to Seed et al. ("Seed") in view of U.S. Patent Application No. 2002/0087797 A1 to Adrangi ("Adrangi").

The Office rejected claim 9 in view of the combination of Seed and Adrangi. However, the Office erred in its assertion that the claim element "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource" is taught by the cited combination of references.

First, the Office does not specifically address this claim element, but instead groups the rejection of claim 9 with the rejection of claim 1. The failure of the Office to address this claim language directly is clearly a failure to establish a prima facie case of obviousness under 35 U.S.C. §103.

Second, as can best be determined from the Final Office Action, the rejection of claim 9 includes the same deficiencies pointed out with respect to claim 1, as noted above. As best as

can be determined, the Office is interpreting "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, **said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource**, and (ii) a current popularity value for said resource" to mean that a determination about redirection is being made merely based on whether a resource is popular.

Applicant noted in the specification at paragraph [0041] and Fig. 5 with respect to similar language that:

> "If the object is not available on the edge server 108 or on a peer, the edge server 108 ascertains whether the object is served **based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from)**(at 506)."
>
> See Applicant's specification at paragraph [0041] (emphasis added).

As can be seen from this quoted section of the Applicant's specification, an object (or with respect to claim 9 – "resource") can be designated in the system so that the object's popularity is used to determine where it will be served from. This is <u>not</u> the same as just testing to see if an object is popular.

Thus, the misapplication of the claim language by the Office led to the Office incorrectly citing to the Seed reference as teaching the claim element "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier

containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource."

Moreover, the Adrangi reference in combination with the Seed reference does not cure the error by the Office. At one point in the Final Office Action, the Office asserts that "Adrangi discloses determining whether said resource is to be served based on its popularity." See Final Office Action at bottom of page 5. However, the Office goes on to make the same mistake as above. Namely, paragraphs [0035] and [0036] of Adrangi cited by the Office merely describe a situation in which a determination is made as to whether a resource is popular. The cited portion of Adrangi does not teach whether an object has been designated so that the object's popularity will be used to determine where it will be served from. Therefore, Adrangi by itself (or in combination with Seed) does not teach the claim element of "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource." Thus, the Office has failed to show that the element "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource" is taught by the cited combination of the Seed and Adrangi references.

In conclusion, the Office has (1) failed to address directly in the Final Office Action the claim language "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource;"and (2) failed to show that the combination of references when considered as a whole would make claim 9 as a whole obvious.

Because the Office has failed to show how the claim element "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource" is taught by the cited combination of references, the Office has failed to show how claim 9 as a whole is taught by the prior art. Therefore, the Office has failed to establish a prima facie case of obviousness for claim 9 under 35 U.S.C. §103. For at least this reason, claim 9 is believed to be in condition for allowance.

Claims 10-12, 24-26, and 29 depend from claim 9 and are in condition for allowance for at least the same reasons that claim 9 should be allowed.

(5) Whether the Office erred in rejecting claims 20 and 22 under 35 U.S.C. § 103(a) over Seed in view of Adrangi and further in view of U.S. Patent Application No. 2010/0312861 A1 to Kolhi et al. ("Kolhi").

Claims 20 and 22 depend from claim 1. The addition of the Kolhi reference to the Seed and Adrangi references does not cure the deficiencies noted above with respect to the rejection of claim 1. Since claims 20 and 22 include the elements of claim 1, the cited combination of references fails to teach each and every element of claims 20 and 22 for at least the same reasons articulated above with respect to claim 1. Therefore, the Office has failed to establish a prima facie case of obviousness with respect to claims 20 and 22.

CONCLUSION

In view of the law and facts stated herein, Appellant respectfully submits that the reasoning and the references cited by the Office are insufficient to maintain obviousness and rejection of the claims. The Appellant respectfully urges that the rejections of claims 1-29 under 35 U.S.C 103(a) be withdrawn. Reversal of the rejections and allowance of the claims in this application is respectfully requested.

A representative from the U.S. Patent and Trademark Office is invited to contact the undersigned at the below-listed telephone number regarding any matters relating to the present application.

Respectfully submitted,

Date: June 23, 2014

/JCS/

Jonathan C. Siekmann
Reg. No. 58,259
Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021
Tel:720-888-2140

VIII. CLAIMS APPENDIX (37 C.F.R. §41.37(c)(2)

Listing of Claims:

1. (Previously presented) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is available at said first server or at a peer of said first server, serving the resource to the client from the first server;

(C) otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on popularity of the resource; and

(D) when a determination is not made that said resource is to be served based on [[its]] popularity of the resource, obtaining the resource at said first server and serving the resource to the client from the first server; and

(E) when the determination is made that said resource is to be served based on popularity of the resource,

(E)(1) determining whether said resource is popular, and

(E)(2) if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise,

(E)(3) if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and

(E)(4) said second server serving the resource to the client.

2. (Original) The method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers.

3. (Original) The method of claim 1 wherein the second server is a content provider's origin server.

4. (Original) The method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

5. (Previously presented) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on whether or not said resource is to be served based on popularity of the resource and on a current popularity value for said resource.

6. (Original) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers.

7. (Previously presented) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server.

8. (Previously presented) A content delivery framework comprising:

a plurality of edge servers forming a first tier of servers; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and

at least one popularity service, implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of said edge servers about requests for content that has been specifically designated to be handled based on popularity of the content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making determinations based, at least in part, on a measure of popularity of requested content.

9. (Previously presented) A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on popularity of the resource, and (ii) a current popularity value for said resource.

10. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier.

11. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier.

12. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier.

13. (Previously presented) The method of claim 1 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource.

14. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is an initial part of the object.

15. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

16. (Previously presented) The method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers.

17. (Previously presented) The method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service.

18. (Previously presented) The method of claim 17 wherein the popularity service runs on a popularity server.

19. (Previously presented) The method of claim 18 wherein the popularity server maintains information on relative popularity of content being served.

20. (Previously presented) The method of claim 19 wherein the popularity server maintains information on relative popularity of content being served in a region comprising the first server.

21. (Previously presented) The method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource.

22. (Previously presented) The method of claim 21 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource in a region comprising the first server.

23. (Previously presented) The method of claim 5 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

24. (Previously presented) The method of claim 9 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

25. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is an initial part of the object.

26. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

27. (Previously presented) The method of claim 1 wherein the act of determining whether said resource is to be served based on popularity of the resource comprises:

determining whether said resource is designated to be served based on popularity of the resource.

28. (Previously presented) The method of claim 5 wherein whether or not said resource is to be served based on popularity of the resource is based at least in part on whether or not said resource is designated to be served based on popularity of the resource.

29. (Previously presented) The method of claim 9 wherein whether or not said resource is to be served based on popularity of the resource is based at least in part on whether or not said resource is designated to be served based on popularity of the resource.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.

Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Jonathan Siekmann
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	1253	1	1400	1400

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**1400**

Electronic Acknowledgement Receipt

EFS ID:	19387132
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Jonathan Siekmann
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	23-JUN-2014
Filing Date:	21-MAR-2009
Time Stamp:	20:06:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1400
RAM confirmation Number	6878
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN

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

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

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

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		0137_US_U1_AmendmentAppeal.pdf	46044 5f6c0bada2decf64dbfaf7ae50c9dd4275cb5491	yes	10

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment/Argument after Notice of Appeal	1	1
Extension of Time	2	2
Claims	3	9
Applicant Arguments/Remarks Made in an Amendment	10	10

Warnings:					
Information:					
2	Appeal Brief Filed	0137_US_U1_AppealBrief.pdf	110314 7227b1f1c0f9f62e7d89825fa0de7bfc260e5f2f	no	29
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30788 6cf011707aaa8d965e1a3fe767b8cee80034d950	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	187146		

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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
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PTO/SB/31 (09-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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NOTICE OF APPEAL FROM THE EXAMINER TO THE PATENT TRIAL AND APPEAL BOARD

Docket Number (Optional): 0137-US-U1

I hereby certify that this correspondence is being facsimile transmitted to the USPTO EFS-Web transmitted to the USPTO, or or 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 N/A: via EFS-Web

Signature _____

Typed or printed name _____

In re Application of: David Fullagar et al.

Application Number	Filed
12/408,681	March 21, 2009

For HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Art Unit	Examiner
2452	Thomas J. DAILEY

Applicant hereby **appeals** to the Patent Trial and Appeal Board from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 800

☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ _____

☐ A check in the amount of the fee is enclosed.

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

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 505063 .

☑ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

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.

I am the

☐ applicant/inventor.

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

☑ attorney or agent of record. Registration number 58,259.

☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34. _____

/JCS/
Signature

Jonathan C. Siekmann
Typed or printed name

720-888-2140
Telephone number

January 21, 2014
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 2 forms are submitted.

This collection of information is required by 37 CFR 41.31. 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, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.

PTO/SB/22 (03-13)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 0137-US-U1

Application Number: 12/408,681

Filed: March 21, 2009

For: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Art Unit: 2452

Examiner: Thomas J. DAILEY

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	Micro Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐ Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☑ Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1400
☐ Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐ Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

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

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 505063.

☑ Payment made via EFS-Web.

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.

I am the

☐ applicant/inventor.

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

☑ attorney or agent of record. Registration number 58,259.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/JCS/ — Signature

January 21, 2014 — Date

Jonathan C. Siekmann — Typed or printed name

720-888-2140 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Jonathan Siekmann
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Notice of Appeal	1401	1	800	800
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $0 paid	1253	1	1400	1400
Miscellaneous:				
			Total in USD ($)	**2200**

Electronic Acknowledgement Receipt

EFS ID:	17978837
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Jonathan Siekmann
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	21-JAN-2014
Filing Date:	21-MAR-2009
Time Stamp:	19:55:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2200
RAM confirmation Number	5530
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

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	Notice of Appeal Filed	sb0031.pdf	216589 ca2f43dcc919e95d2aaa6b16443669dee1fe4059	no	2
Warnings:					
Information:					
2	Extension of Time	sb0022.pdf	187157 e1995e50b824804f07178113f697df6d31a77990	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32598 62a2a2de7becd064e3ee73ae3f383143f56a21b3	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	436344		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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

PTO/SB/08a (01-08)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number..

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Thomas J. Dailey

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Canada Examination Report, dated August 16, 2013, Application No. 2,720,353, filed March 21, 2009; Dkt. No. 0137-CA-01, 3 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Kathleen McInnish
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

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

Electronic Acknowledgement Receipt

EFS ID:	17254533
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	29-OCT-2013
Filing Date:	21-MAR-2009
Time Stamp:	14:12:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	523
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	137USU1_SIDS.pdf	36204 517db4b25d8d8d1e31e8da02b4bb8c1d514f36f4	no	5
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	27641 64e2a8aa2683b748edd197c13fe44b7897838b14	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Other Reference-Patent/App/Search documents	CA_2720353_ExRpt_16Aug13_137CA01.pdf	372648 6dd450fb3eceae0b83479fe6532c1f4938ab9c78	no	3
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30598 e2d9118c618e0aff87149d50b9fe9238e89de1e2	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	467091		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Thomas J. Dailey
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☐ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☒ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☒ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on July 18, 2013.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☐ No fee is due.

☒ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☒ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☐ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: October 29, 2013

/JCS/

Jonathan C. Siekmann
Registration No. 58,259
USPTO Customer No. 83579
Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021
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UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

83579 7590 07/18/2013

LEVEL 3 COMMUNICATIONS, LLC
Attn: Patent Docketing
1025 Eldorado Blvd.
Broomfield, CO 80021

EXAMINER	
DAILEY, THOMAS J	
ART UNIT	PAPER NUMBER
2452	

NOTIFICATION DATE	DELIVERY MODE
07/18/2013	ELECTRONIC

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

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

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

patent.docketing@level3.com

Office Action Summary	Application No. 12/408,681	Applicant(s) FULLAGAR ET AL.	
	Examiner THOMAS DAILEY	Art Unit 2452	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* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1)☒ Responsive to communication(s) filed on *30 March 2012*.

☐ 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) *1-29* 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) *1-29* 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 _____ 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/08) Paper No(s)/Mail Date *6/18/2013; 4/30/2013; 3/8/2013*.

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

4) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-29 are pending.

Response to Arguments

2. The 35 USC 112 first paragraph rejections have been withdrawn. However, new 112 second paragraph rejections have been added due to the amendments.

3. The Double Patenting Rejections have been withdrawn in view of the approved Terminal Disclaimer.

4. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. The independent claims recite, “it" and "its" multiple times (e.g. claim 1, lines 10 and 13). "It" is by definition indefinite and the limitations for with “it” is intended to refer should replace “it.”

Claim Rejections - 35 USC § 103

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

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

1. Claims 1-19, 21, and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seed et al. (US 2006/0015574 A1) in view of Adrangi (US Pub. No. 2002/0087797).

Claims 1, 5, 8, 9

Seed discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (Fig. 1), the method comprising:

at a first server in said first tier of servers (Edge Server or Parent Server of Fig. 1), obtaining a request from a client for a resource (Fig. 3a, 300 – Direct client to best or optimal edge server for requested object);

if said resource is available at said first server or at a peer of said first server from the first server (Fig. 3a, 305 – Does the selected best or optimal

edge server have requested object?), serving the resource to the client (Fig. 3a, 310 – Serve requested object to client);

otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular (Fig. 3a, 315 – Check for edge server whether requested object is popular),

and

if the resource is determined to be popular, then said first server obtaining said resource (Fig. 3b, 360 – Pull requested object to edge and/or parent servers), otherwise,

if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers (Fig. 3a, 320 – Re-direct client to a parent (or origin) server), and

said second server serving the resource to the client (Fig. 3a, 345 – Serve requested object to client from parent (or origin) server).

There is a subtle difference between the instant invention and the prior art. It appears as if Seed focuses on the embodiment wherein popular content is replicated to the edge servers after a client requests it and the edge server determines it is popular so that the edge servers carry the popular content in the event of future requests. Seed does not explicitly teach that the edge servers will pull the popular content from the parent or origin server and then serve it to the same client that initially made the request.

However, in Paragraph 27, Seed teaches that the checking of whether the requested object is popular and replicating the popular object to the edge server may be performed in parallel or before the performance of other functions related to the prior art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Seed to serve the client once the replication of the popular content has taken place in order to give the system more flexibility and offer an administrative design choice. Seed teaches in Paragraph 10 that it is "desirable to serve objects from edge servers because the edge servers are typically closer to end-users". By modifying the system as suggested, user performance could be bolstered in the event that serving the requested popular content to the user is faster than serving the content from a higher-level server such as a parent/origin server such that the increased speed gains offset the time required to replicate the content from one of those servers.

Further, Seed does not explicitly disclose or suggest determining whether said resource is to be served based on its popularity, and

when it is not determined that said resource is to be served based on its popularity, obtaining the resource at said first server and serving the resource to the client from the first server.

Rather, Seed discloses the each object is checked whether it is popular or not popular; not necessarily determining *if* it's popularity should be checked at all.

However, Adrangi discloses determining whether said resource is to be served based on its popularity, and

when it is not determined that said resource is to be served based on its popularity, obtaining the resource at said first server and serving the resource to the client from the first server ([0035]-[0036]; popularity is calculated only *after* a certain amount of time and/or a predetermined number of requests, and therefore certain content is determined not to be served based on popularity (particularly new content); that content is served from server to client when requested, see Fig. 2).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Seed and Adrangi in order to provide a method that accounts for content that does not have a known popularity factor making the system available to a greater variety of content, e.g. new content.

Claim 2

Seed further discloses the method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers (Fig. 1 – the parent servers or origin servers can read on second tier of servers).

Claim 3

Seed further discloses the method of claim 1 wherein the second server is a content provider's origin server (Fig. 1, Origin Server 110).

Claim 4

Seed further discloses the method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold (Paragraph 44 teaches that an object is replicated when the popularity P of the object is greater than a threshold.).

Claim 6

Seed further discloses the method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers (Fig. 1, Parent Server or Origin Server reads on second tier).

Claim 7

Seed further discloses the method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server (Fig. 1, Origin Server).

Claim 10

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier (Fig. 1).

Claim 11

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier (Fig. 1).

Claim 12

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier (Fig. 1).

Claims 13, 23, 24

Seed further discloses the methods of claims 1 and 5 and 9 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource (Paragraph 44).

Claims 14, 15, 25, 26

Seed further discloses the method of claims 1 and 9 wherein the resource is part of an object (The resource itself is an object.), but does not explicitly disclose wherein determining whether said resource is popular is based at least in part on whether the resource is an initial part of the object.

However, the use of metadata of header information in a CDN is well-known in the art. In fact, although not specifically addressed by Seed, since Seed teaches of a CDN, it is more than likely that such information is used in the implementation of the system (The customer/client must have some way of identifying content.). Such metadata reads on "initial part of an object" and it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Seed so that the popularity is determined once the content metadata is requested so that Seed can go ahead and replicate said content if it is determined to be popular. The advantage conferred is that Seed's system will be more readily and quickly prepared to serve both the initial and/or future customers.

With regard to claims 15 and 26, the rest of the content aside from the header information or metadata reads on "another part of the object". And

because header information is downloaded before the actual content, this reads on "the initial part of the object having already been served to the client".

Claim 16

Seed further discloses the method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers (Fig. 3a, 315 – edge server checks popularity and reads on popularity server).

Claim 17

Seed further discloses the method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service (Fig. 3a, 315 – edge server checks popularity and reads on popularity server. The code or means on the edge server that allows for this reads on popularity service. Also see e.g., Paragraph 44.).

Claim 18

Seed further discloses the method of claim 17 wherein the popularity service runs on a popularity server (Fig. 3a, 315 – edge server checks popularity and reads on popularity server. The code or means on the edge server that allows for this reads on popularity service. Also see e.g., Paragraph 44.).

Claim 19

Seed further discloses the method of claim 18 wherein the popularity server maintains information on relative popularity of content being served (Paragraph 41 - "more popular than the least popular object currently in storage").

Claim 21

Seed further discloses the method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity of said resource (Paragraph 41 - "more popular than the least popular object currently in storage").

Claims 27, 28, 29

Adrangi further discloses determining whether said resource is designated to be served based on its popularity ([0035]-[0036]).

2. Claims 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seed et al. (US 2006/0015574 A1) in view of Adrangi (US Pub. No. 2002/0087797) and in view of Kolhi et al. (US 2010/0312861 A1).

Claims 20, 22

Seed discloses the method of claims 19 and 21 wherein the popularity server maintains information on relative popularity of content but does not

explicitly state that the information is specific to the relative priority of content served in a region comprising the first server.

This deficiency is cured by Kohli. Kohli is similarly directed toward caching popular content on servers as close to possible to users that have the highest probability of requesting the content (Abstract). In Paragraph 39, Kohli teaches that content may have different popularity levels in different geographical locations, so the invention of the prior art adapts to different viewing patterns in different areas and caches content accordingly.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement Kolhi's features of differentiating popularity among different regions in Seed's system in order to augment the functionality by allowing for content to be more efficiently routed to regions where it is most popular. Based on the combination, an edge server must maintain information on the relative priority of content served in various regions, including the region comprising said edge server. For example, Seed discloses that the edge server determines whether a give object is popular (Seed, Fig. 3a, 315), and Kolhi discloses that popularity information can be differentiated by region (Kolhi, Paragraph 39).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE**

FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

10. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.
11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas J. Dailey whose telephone number is 571-270-1246. The examiner can normally be reached on Monday thru Friday; 9:00am - 5:00pm.
12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thu Nguyen can be reached on 571-272-6967. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

13. 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.

/Thomas J Dailey/
Examiner, Art Unit 2452

Notice of References Cited	Application/Control No. 12/408,681	Applicant(s)/Patent Under Reexamination FULLAGAR ET AL.	
	Examiner THOMAS DAILEY	Art Unit 2452	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2002/0087797	07-2002	Adrangi, Farid	711/133
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
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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)
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	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.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
709	226	3/23/2011	NU

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	3/23/2011	NU
Google Patents search	3/23/2011	NU
double patenting / inventor search	3/23/2011	NU
EAST text search updated	11/10/2011	NU
double patenting / inventor search	11/10/2011	NU
Google Patents search: "long tail popular cdn"	11/10/2011	NU
Keyword searching in EAST for amended subject matter	7/5/2013	TJD

INTERFERENCE SEARCH			
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

	Complete if Known
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Thomas J. Dailey

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		6212565	Apr 3, 2001	Gupta, Amit	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

EXAMINER	/Thomas Dailey/	DATE CONSIDERED	07/14/2013

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Art Unit	2452
Examiner Name	Thu V. Nguyen

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		20020010798	Jan 24, 2002	Ben-Shaul, Israel et al.	
		20020174168	Nov 21, 2002	Beukema, Bruce L., et al.	
		20020184357	Dec 5, 2002	Traversat, Bernard A., et al.	
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		20060112176	May 25, 2006	Liu, Zaide E., et al.	
		20100257258	Oct 7, 2010	Liu, Zaide et al.	
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		KOSTADINOVA, R. , "Peer-to-Peer Video Streaming", [online; retrieved on 25 Jan 2013]; Retrieved from the Internet <URL: http://www.ee.kth.se/php/modules/publications/reports/2008/XR-EE-LCN_2008_004.pdf>, especially section 5.4.1 2008 , 1-53	

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Sheet	1	of	1	Attorney Docket No: 0137-US-U1

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		International Preliminary Report on Patentability, dated March 19, 2013, Int'l Appl. No. PCT/US11/051252, Int'l Filing Date September 12, 2011, Dkt. No. 0137-WO-I1, 6 pgs.	

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1371	popular$5 with (check$6 or determin$6) same (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:30
L3	240	popular$5 with (check$6 or determin$6) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:30
L4	0	3 and ("709" or "725" or "370").ccls.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:31
L5	162	3 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:31
L6	78	popular$5 with (option$7) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:53
L7	60	6 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:53
L8	18	6 not 7	US-PGPUB; USPAT	ADJ	ON	2013/07/05 14:58
L9	164	popular$5 with (certain or particul$5) with (content or file) with (server)	US-PGPUB; USPAT	ADJ	ON	2013/07/05 15:04
L10	114	9 and ("709" or "725" or "370").clas.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 15:05
S1	60	("20040205162" | "20010027491" | "7103645" | "20050060493" | "20030140111" | "6212565" | "20080147866" | "6859840" | "7274658" | "20100312861" | "20050240966" | "7219153" | "20020016835" | "20030149581" | "20060015574" | "20080065724" | "6591288" | "6594260" | "6839758" | "6999988" | "7254645" | "20060112176" | "20080071859" | "20020040404" | "20110145386" | "7562153" | "20040064832" | "20040162871" | "20030031176" | "20050021863" | "7024466" | "7185052" | "6157648" | "20100257258" | "20070055764" | "20020198953" | "6094680" | "6463454" | "6785704" | "7373644" | "20020010798" | "20020174168" | "20110099290" | "20020016831" | "20020087797" | "20020116444" | "20020133537" | "20030112792" | "6085193" | "6598121" | "6732237" | "6976090" | "7577754" | "20040010588" | "20020184357" | "20050010653" | "5777988" | "5815662" | "6741990" | "20100169772" | "7024466").PN.	US-PGPUB; USPAT	ADJ	ON	2013/07/05 11:23

EAST Search History (Interference)

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US PATENT DOCUMENTS					
Examiner Initial *	**Cite No**	**Document Number**	**Publication Date**	**Name of Patentee or Applicant of Cited Document**	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		6212565	Apr 3, 2001	Gupta, Amit	

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Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Kathleen McInnish
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

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

Electronic Acknowledgement Receipt

EFS ID:	16067834
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	18-JUN-2013
Filing Date:	21-MAR-2009
Time Stamp:	11:32:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	10665
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	137USU1_SIDS.pdf	36119 1041f8d0b7d529dd09239b5e276c63d7f74a1d98	no	5
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	27542 46c333ab4441c431e5b1484b858d3c54e625a340	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Fee Worksheet (SB06)	fee-info.pdf	30598 6674b60ca786852b410f2eed85b7536da4f32a10	no	2
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<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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Thomas J. Dailey
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☐ No fee is due.

☒ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☒ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☒ No statement is necessary.

☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☐ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: June 18, 2013

/JCS/

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PTO/SB/08a (01-08)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number..

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Thomas J. Dailey

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		International Preliminary Report on Patentability, dated March 19, 2013, Int'l Appl. No. PCT/US11/051252, Int'l Filing Date September 12, 2011, Dkt. No. 0137-WO-I1, 6 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 0137-WO-I1	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2011/051252	International filing date *(day/month/year)* 12 September 2011 (12.09.2011)	Priority date *(day/month/year)* 13 September 2010 (13.09.2010)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant LEVEL 3 COMMUNICATIONS, LLC		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	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 Article 35(2) 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

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 19 March 2013 (19.03.2013)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Yukari Nakamura e-mail: pt07.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: GREGORY DURBIN
POLSINELLI SHUGHART PC
700 W. 47TH ST., SUITE 1000
KANSAS CITY, MO 64112

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	23 JAN 2012
Applicant's or agent's file reference 0137-WO-I1	FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 11/51252	12 September 2011 (12.09.2011)	13 September 2010 (13.09.2010)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G06F 15/16 (2012.01)
USPC - 709/203

Applicant LEVEL 3 COMMUNICATIONS, LLC

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

- [x] 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
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(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 66.1 *bis*(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 th IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Fom 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/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 January 2012 (08.12.2012)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Box No. I 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 sequence listing filed or furnished:

   a. (means)

      ☐ on paper

      ☐ in electronic form

   b. (time)

      ☐ in the international application as filed

      ☐ together with the international application in electronic form

      ☐ 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/US 11/51252

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

1. Statement

Novelty (N)	Claims	1-22	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-22	NO
Industrial applicability (IA)	Claims	1-22	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1-3, 5, 6, 9-17 and 19-22 lack an inventive step under PCT Article 33(3) as being obvious over US 2004/0064832 A1 to Tsukidate et al. (hereinafter 'Tsukidate') in view of US 2004/0010588 A1 to Slater et al. (hereinafter 'Slater').

Regarding claim 1, Tsukidate teaches a method of content delivery in a content delivery network comprising at least a first tier of servers (Fig. 5, 16; para [0066], [0071]), the method comprising: at a first server in the first tier of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library (available content is requested / subscribed at client terminals; para [0069], [0088]); if the resource is not available at the first server or at a peer of the first server, determining if the resource is popular; if the resource is determined to be popular, then the first server obtaining the resource and the first server serving the resource to the client (a level of servers is allocated to content that becomes most popular, i.e., a first level; para [0069], [0083]), otherwise, if the resource is determined not to be popular, directing the client to a second server in a second tier of servers distinct from the first tier of servers (less popular content is stored on a another level or tier where users are directed by a management / center device; para [0066], [0067], [0083]), and the second server serving the resource to the client (para [0071], [0083]), but fails to disclose the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library. Slater teaches the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library as taught by Slater to enhance efficiency.

Regarding claim 2, Slater further teaches the first portion of the content provider's library is distinct from the second portion (para [0335], [0410]).

Regarding claim 3, Slater further teaches portions of the content provider's library are logically partitioned across servers in the second tier (para [0328], [0335]).

Regarding claim 5, Slater further teaches the content provider's library comprises a plurality of content-types, each resource in the library being associated with one of the plurality of content-types (para [0281], [0335], [0411]).

Regarding claim 6, Slater further teaches storing distinct portions of the content provider's library on two or more servers in the second tier, wherein the proportion of content-types on each of the two or more servers is substantially equal, the content-types comprising at least one of audio content, video content, gaming content, and software content (load-balancing content types / categories; para [0410], [0411]).

Regarding claim 9, Slater further teaches the second tier is any intermediate tier between the first tier and an origin server that stores resources associated with the content provider's library (para [0416], [0419]).

Regarding claim 10, Slater further teaches the step of determining whether the resource is popular comprises determining whether a current popularity value for the resource exceeds a popularity threshold (para [0293], [0324]).

Regarding claim 11, Tsukidate further teaches the first tier of servers comprises a first popularity threshold and the second tier of servers comprises a second popularity threshold, and wherein the first popularity threshold is different from the second popularity threshold (para [0068], [0069], [0083]).

--CONTINUED IN SUPPLEMENTAL BOX--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of
Box No. V. 2. Citations and explanations:

Regarding claim 12, Tsukidate teaches a content delivery framework comprising: a plurality of edge servers forming a first tier of servers (Fig. 5, 16; para [0066], [0071]); a plurality of parent servers forming a second tier of servers, the parent servers being distinct from the edge servers (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071]); and at least one popularity service constructed and adapted to obtain a first set of information from at least some of the edge servers about requests for content (para [0068]), and to provide the edge servers with a second set of information about which tier of servers should handle those requests for content (para [0083]), the popularity service making its determinations based, at least in part, on a measure of popularity of requested content (para [0068], [0083]); and wherein the requested content is available as part of a content provider's library (Fig. 11; para [0068], [0088]), but fails to disclose distinct portions of the content provider's library are logically partitioned across parent servers in the second tier. Slater teaches distinct portions of the content provider's library are logically partitioned across parent servers in the second tier (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include distinct portions of the content provider's library are logically partitioned across parent servers in the second tier as taught by Slater to enhance efficiency.

Regarding claim 13, Slater further teaches a at least one of the parent servers in the second tier comprises a first logically partitioned portion of the content provider's library, the first logically partitioned portion comprising at least the requested content (para [0328], [0335]).

Regarding claim 14, Slater further teaches at least one other parent server in the second tier comprises a second logically partitioned portion of the content provider's library, the second logically partitioned portion being distinct from the first logically partitioned portion (para [0335], [0410]).

Regarding claim 15, Tsukidate further teaches the second set of information further includes identification of a parent server in the second tier that stores a logically partitioned portion of the content provider's library comprising the requested content (para [0071], [0088]).

Regarding claim 16, Slater further teaches the second tier of parent servers is any intermediate tier between the first tier and an origin server that stores the content provider's library (para [0416], [0419]).

Regarding claim 17, Tsukidate teaches a method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers (Fig. 5, 16; para [0066], [0071]), the method comprising: at a first server in one tier of the tiers of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library (Fig. 11; para [0068], [0088]); if the resource is not available at the first server or at a peer of the first server, then selectively redirecting the request from the client to a second tier server, the second tier server being in a tier distinct from the tier containing the first server, the redirecting being based, at least in part, on a current popularity value for the resource (para [0068], [0069], [0083]), but fails to disclose the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion. Slater teaches the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion as taught by Slater to enhance efficiency.

Regarding claim 19, Slater further teaches the second tier of servers is any intermediate tier between the first tier and an origin server that stores the content provider's library (para [0416], [0419]).

Regarding claim 20, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers, and wherein the first server is a parent server in the second tier and the second server is an edge server in the first tier (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071]).

Regarding claim 21, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers, and wherein the first server is an edge server in the first tier and the second server is a parent server in the second tier (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071], [0083]).

Regarding claim 22, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071, [0083]]), and wherein the plurality of tiers of servers further comprises an origin tier, and wherein the first server is a parent server in the second tier and the second server is a server in the origin tier (relocate new content to servers at 0 / origin levels based on expected / adjustable popularity ratings; para [0068], [0069], [0083]).

--CONTINUED IN NEXT SUPPLEMENTAL BOX--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box No. V. 2. Citations and explanations:

Claim 4 lacks an inventive step under PCT Article 33(3) as being obvious over Tsukidate in view of Slater and in further view of US 2010/0169772 A1 to Stallings et al. (hereinafter 'Stallings').

Regarding claim 4, in the combination, Slater further teaches the first portion and the second portion are partitioned across servers in the second tier based on a naming convention associated with each distinct resource in the content provider's library (named category partitioning; para [0330], [0335]), however the combination fails to disclose alphabetically. Stallings teaches parenthetically (to provide more different types of partitioning; para [0046], [0061]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include alphabetically as taught by Stallings for the advantage of providing more flexible storage options.

Claims 7, 8 and 18 lack an inventive step under PCT Article 33(3) as being obvious over Tsukidate in view of Slater and in further view of US 2005/0240966 A1 to Hindle et al. (hereinafter 'Hindle').

Regarding claim 7, in the combination,Tsukidate further teaches resources of the content provider's library are distributed in a manner across servers in the second tier based on values of uniform resource locators (URLs) associated with two or more respective resources in the content provider's library (para [0071], [0335]) and Slater further teaches substantially equal (para [0410]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Regarding claim 8, in the combination, Slater further teaches the step of directing the client to a second server in a second tier is performed in response to a step of using a value to determine which second server in the second tier stores the first portion of the content provider's library (para [0306], [0419]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Regarding claim 18, in the combination, Slater further teaches the step of selectively redirecting the request from the client to a second tier server comprises determining to which second tier server the request should be directed, the determining step using a function to identify a second tier server that stores the first portion of the content provider's library (para [0335], [0411]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Claims 1-22 have industrial applicability as defined by PCT Article 33(4), because the subject matter can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	15652015
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	30-APR-2013
Filing Date:	21-MAR-2009
Time Stamp:	15:23:03
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	Transmittal Letter	137USU1_SIDS.pdf	36107 2f50bce0f2416386dc28b5300e4cb0abcb94dfab	no	5

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	27771 bc2e10f3d3005ea4a3ddcb2aaa57044672baa08c	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Other Reference-Patent/App/Search documents	0137WOI1_IPRP.pdf	3949029 eb63f17e1073d770564ec0dacfb29cd5358c8e39	no	6
Warnings:					
Information:					
		Total Files Size (in bytes):	4012907		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Thomas J. Dailey
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☒ No fee is due.

☐ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☐ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☐ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: April 30, 2013

/JCS/

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USPTO Customer No. 83579
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Broomfield, Colorado 80021
Tel: 720-888-2140
Fax: 720-888-5619

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Thu V. Nguyen

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		20020010798	Jan 24, 2002	Ben-Shaul, Israel et al.	
		20020174168	Nov 21, 2002	Beukema, Bruce L., et al.	
		20020184357	Dec 5, 2002	Traversat, Bernard A., et al.	
		20030140111	Jul 24, 2003	Pace, Charles P., et al.	
		20040162871	Aug 19, 2004	Pabla, Kuldipsingh A., et al.	
		20050010653	Jan 13, 2005	McCanne, Steve	
		20060112176	May 25, 2006	Liu, Zaide E., et al.	
		20100257258	Oct 7, 2010	Liu, Zaide et al.	
		20110099290	Apr 28, 2011	Swildens, Eric S., et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T^2

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T^2
		KOSTADINOVA, R. , "Peer-to-Peer Video Streaming", [online; retrieved on 25 Jan 2013]; Retrieved from the Internet <URL: http://www.ee.kth.se/php/modules/publications/reports/2008/XR-EE-LCN_2008_004.pdf>, especially section 5.4.1 2008 , 1-53	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional) [2] Applicant is to place a check mark here if English language Translation is attached

Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Kathleen McInnish
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

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

Electronic Acknowledgement Receipt

EFS ID:	15158338
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	08-MAR-2013
Filing Date:	21-MAR-2009
Time Stamp:	15:20:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	2363
Deposit Account	505063
Authorized User	SIEKMANN, JONATHAN
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	137_US_U1_Supp_IDS.pdf	36127 5e30b9f2b3a4256a05529edc315bb53377b7dd79	no	5
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	29761 f86837061661f6570f94471e9236492e271cfe6e	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Non Patent Literature	Kostadinova.pdf	7666758 80a87d45bf5cde1f86e00987c02bf0253062091e	no	55
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30593 152e00da9b9632cdd368eedee0549931becf3e39	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7763239		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Thu V. Nguyen
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☐ No fee is due.

☒ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☒ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☒ No statement is necessary.

☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☒ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: March 8, 2013

/JCS/

Jonathan C. Siekmann
Registration No. 58,259
USPTO Customer No. 83579
Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021
Tel: 720-888-2140
Fax: 720-888-5619

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]
		WO-2003088065	Oct 23, 2003	Dilley, John A., et al.		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		Supplemental European Search Report, dated November 5, 2012, Application No. 09727342.9, Dkt. No. 0137-EP-01, 7 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional) [2] Applicant is to place a check mark here if English language Translation is attached

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 October 2003 (23.10.2003)

PCT

(10) International Publication Number
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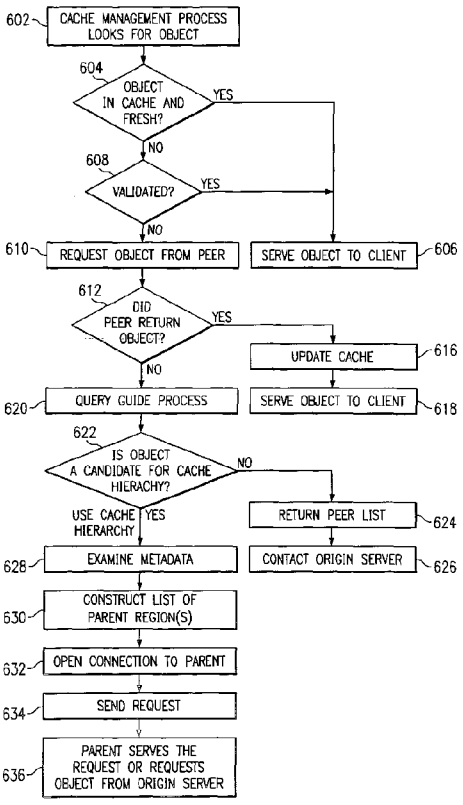
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(54) Title: METHOD AND SYSTEM FOR TIERED DISTRIBUTION IN A CONTENT DELIVERY NETWORK



(57) Abstract: A tiered distribution service is provided in a content delivery network (CDN) having a set of surrogate origin (namely, "edge") servers organized into regions and that provide content delivery on behalf of participating content providers, wherein a given content provider operates an origin server. According to the invention, a cache hierarchy (622) is established in the CDN comprising a given edge server region and either (a) a single parent region, or (b) a subset of the edge server regions. In response to a determination that a given object request cannot be serviced in the given edge region, instead of contacting the origin server, the request is provided to either the single parent region or to a given one of the subset of edge server regions for handling, preferably as a function of metadata associated with the given object request. The given object request is then serviced, if possible, by a given CDN server in either the single parent region or the given subset region. The original request is only forwarded on to the origin server (626) if the request cannot be serviced by an intermediate node.

WO 03/088065 A1

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METHOD AND SYSTEM FOR TIERED DISTRIBUTION IN A CONTENT DELIVERY NETWORK

BACKGROUND OF THE INVENTION

Technical Field

The present invention relates generally to techniques for reducing traffic to origin servers for very popular and large, potentially flash-popular objects.

Description of the Related Art

It is well-known to deliver digital content (e.g., HTTP content, streaming media and applications) using an Internet content delivery network (CDN). A CDN is a network of geographically-distributed content delivery nodes that are arranged for efficient delivery of content on behalf of third party content providers. Typically, a CDN is implemented as a combination of a content delivery infrastructure, a request-routing mechanism, and a distribution infrastructure. The content delivery infrastructure usually comprises a set of "surrogate" origin servers that are located at strategic locations (e.g., Internet network access points, Internet Points of Presence, and the like) for delivering content to requesting end users. The request-routing mechanism allocates servers in the content delivery infrastructure to requesting clients in a way that, for web content delivery, minimizes a given client's response time and, for streaming media delivery, provides for the highest quality. The distribution infrastructure consists of on-demand or push-based mechanisms that move content from the origin server to the surrogates. An effective CDN serves frequently-accessed content from a surrogate that is optimal for a given requesting client. In a typical CDN, a single service provider operates the request-routers, the surrogates, and the content distributors. In addition, that service provider establishes business relationships with content publishers and acts on behalf of their origin server sites to provide a distributed delivery system. A well-known commercial CDN service that provides web content and media streaming is provided by Akamai Technologies, Inc. of Cambridge, Massachusetts.

It is desirable to reduce wide-area network bandwidth and the load on a content provider's origin server as much as possible. To this end, the prior art has proposed a hierarchical proxy cache architecture wherein caches resolve misses through other caches higher in a hierarchy. This architecture is described, for example, in a paper titled A Hierarchical Internet Object Cache, to Danzig et al., 1996 USENIX Technical Conference, January 22-26, 1996, San Diego, California. In this approach, each cache in the hierarchy independently decides whether to fetch a requested reference from the object's home site or from its parent or sibling caches using a resolution protocol. According to the protocol, if the URL identifying the reference contains any of a configurable list of substrings, then the object is fetched directly from the object's home, rather than through the cache hierarchy. This feature is used to force the cache to resolve non-cacheable URLs and local URLs directly from the object's home. If the URL's domain name matches a configurable list of substrings, then the object is resolved through the particular parent bound to that domain. Otherwise, when a cache receives a request for a URL that misses, the cache performs a remote call to all of its siblings and parents, checking if the URL hits any sibling or parent. The cache then retrieves the object from the site with the lowest measured latency.

While the cache hierarchy described in the above-identified publication provides benefits in the form of reduced access latency to the home site, the scheme is overly complex and costly (in terms of network bandwidth) due to the requirement of measuring latency between the cache and all of its siblings and parents upon a cache miss.

BRIEF SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a technique for delivering Internet traffic using tiered distribution, namely, a cache hierarchy, in which requests for content that cannot be serviced in edge servers are funneled through intermediate nodes.

It is another primary object of the present invention to provide a content delivery method and system that insulates a content provider origin server from excessive traffic when requesting end users are unable to be served from edge

servers, e.g., because the requested content is unavailable, is available but stale, or un-cacheable.

It is still another more general object of the invention to enable CDN edge servers operating within a given CDN region to obtain content from one or more intermediate distribution hubs instead of traversing long haul links to fetch such content from content provider origin servers.

Yet another object of the invention is to facilitate control over a tiered distribution of content in a CDN using object-specific metadata.

A still further object of the invention is to provide for a tiered distribution method and system in a content delivery network to ensure that end users can obtain desired content quickly and reliably, while effectively buffering web site infrastructure, thereby ensuring that an origin site is not overwhelmed with requests for popular content or large files.

Another more specific object of the present invention is to enable a cache hierarchy in a content delivery network wherein a given edge server region is associated with either a single parent region or a subset of intermediate regions to buffer the content provider origin server from flash crowds.

These and other objects and technical advantages are provided in a content delivery network (CDN) having a set of surrogate origin (namely, "edge") servers organized into regions and that provide content delivery on behalf of participating content providers, wherein a given content provider operates an origin server. According to the invention, a cache hierarchy is established in the CDN comprising a given edge server region and either (a) a single parent region, or (b) a subset of well-connected "core" parent server regions. In response to a determination that a given object request cannot be serviced in the given edge region, instead of contacting the origin server, the request is provided to either the single parent region or to a given one of the subset of server regions for handling, preferably as a function of metadata associated with the given object request. The given object request is then serviced, if possible, by a given CDN server in either the single parent region

or the given parent region. Preferably, the original request is only forwarded on to the origin server if it cannot be serviced by the intermediate node in the hierarchy.

Preferably, the single parent region is located at, adjacent, or near a data center at which the content provider origin server is located. In addition, a given single parent region may be dedicated to a particular CDN content provider. The edge server regions typically are co-located in large hosting data centers in the well-connected "core" of the Internet web hosting infrastructure. By funneling (i.e., forwarding) edge requests through this smaller subset of regions (or to the single parent region), the CDNSP can significantly reduce the amount of traffic on origin servers and exploit server-to-server optimizations. The tiered distribution service is intended to reduce traffic to origin servers for very popular content and large, potentially flash-popular objects.

As used herein, metadata is information about the content provider's (CP's) content served by the CDN. Typically, metadata is a set of control options and parameters that determine how an edge server handles a request for an object. Preferably, a given metadata tag is used enable the tiered distribution service or feature and to specify a policy or type of hierarchy parent to be used.

The foregoing has outlined some of the more pertinent features of the present invention. These features should be construed to be merely illustrative. Many other beneficial results can be attained by applying the disclosed invention in a different manner or by modifying the invention as will be described.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a known content delivery network in which the present invention may be implemented;

Figure 2 illustrates a typical machine configuration for a CDN content edge server;

Figure 3 is a simplified diagram illustrating a tiered distribution scheme according to the present invention;

Figure 4 is a more detailed representation of the tiered distribution scheme wherein a given edge server may communicate with an intermediate core region or a dedicated parent region; and

Figure 5 is a block diagram of software components that provide the cache hierarchy functionality according to an embodiment of the present invention; and

Figure 6 is a flowchart illustrating how a content server implements the cache hierarchy functionality according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As seen in Figure 1, an Internet content delivery infrastructure usually comprises a set of "surrogate" origin servers 102 that are located at strategic locations (e.g., Internet network access points, and the like) for delivering copies of content to requesting end users 119. A surrogate origin server is defined, for example, in IETF Internet Draft titled "Requirements for Surrogates in the HTTP" dated August 9, 2000, available at the following URL: http://www.mnot.net/papers/draft-nottingham-surrogates-01.txt, which is incorporated herein by reference. The request-routing mechanism 104 allocates servers 102 in the content delivery infrastructure to requesting clients in a way that, for web content delivery, minimizes a given client's response time and, for streaming media delivery, provides for the highest quality. The distribution infrastructure consists of on-demand or push-based mechanisms that move content from the origin server to the surrogates. A CDN service provider (CDNSP) may organize sets of surrogate origin servers as a "region." In this type of arrangement, a CDN region 106 typically comprises a set of one or more content servers that share a common backend, e.g., a LAN, and that are located at or near an Internet access point. Thus, for example, a typical CDN region may be co-located within an Internet Service Provider (ISP) Point of Presence (PoP) 108. A representative CDN content server is a Pentium-based caching appliance running an operating system (e.g., Linux, Windows NT, Windows 2000) and having suitable RAM and disk storage for CDN applications and content delivery

network content (e.g., HTTP content, streaming media and applications). Such content servers are sometimes referred to as "edge" servers as they are located at or near the so-called outer reach or "edge" of the Internet. The CDN typically also includes network agents 109 that monitor the network as well as the server loads. These network agents are typically co-located at third party data centers or other locations. Map maker software 107 receives data generated from the network agents and periodically creates maps that dynamically associate IP addresses (e.g., the IP addresses of client-side local name servers) with the CDN regions.

In one type of service offering, known as Akamai FreeFlow, from Akamai Technologies, Inc. of Cambridge, Massachusetts, content is tagged for delivery from the CDN using a content migrator or rewrite tool 106 operated, for example, at a participating content provider server. Tool 106 rewrites embedded object URLs to point to the CDNSP domain. A request for tagged content is resolved through a CDNSP-managed DNS to identify a "best" region, and then to identify an edge server within the region that is not overloaded and that is likely to host the requested content. Instead of using content provider-side migration (e.g., using the tool 106), a participating content provider may simply direct the CDNSP to serve an entire domain (or subdomain) by a DNS directive (e.g., a CNAME). In either case, the CDNSP may provide object-specific metadata to the CDN content servers to determine how the CDN content servers will handle a request for an object being served by the CDN. Metadata, as used herein, thus refers to the set of all control options and parameters for the object (e.g., coherence information, origin server identity information, load balancing information, customer code, other control codes, etc.), and such information may be provided to the CDN content servers via a configuration file, in HTTP headers, or in other ways. A configuration file is advantageous as it enables a change in the metadata to apply to an entire domain, to any set of directories, or to any set of file extensions. In one approach, the CDNSP operates a metadata transmission system 116 comprising a set of one or more servers to enable metadata to be provided to the CDNSP content servers. The system 116 may comprise at least one control server

118, and one or more staging servers 120a-n, each of which is typically an HTTP server (e.g., Apache). Metadata is provided to the control server 118 by the CDNSP or the content provider (e.g., using a secure extranet application) and periodically delivered to the staging servers 120a-n. The staging servers deliver the metadata to the CDN content servers as necessary.

Figure 2 illustrates a typical machine configuration for a CDN content edge server. Typically, the content server 200 is a caching appliance running an operating system kernel 202, a file system cache 204, CDN software 206, TCP connection manager 208, and disk storage 210. CDN software 206 creates and manages a "hot" object cache 212 for popular objects being served by the CDN. It may also provide other CDN-related functions, such as request routing, in-region load balancing, and the like. In operation as an HTTP cache for example, the content server 200 receives end user requests for content, determines whether the requested object is present in the hot object cache or the disk storage, serves the requested object via HTTP (if it is present) or establishes a connection to another content server or an origin server to attempt to retrieve the requested object upon a cache miss.

Figure 3 illustrates the basic technique for tiered distribution according to the present invention. As the name implies, preferably the CDN (or other distributed delivery system, as the case may be) employs a tiered infrastructure using two or more tiers: a set of edge servers and a hierarchical set of "parent" or hub regions that service the edge servers. In this example, the CDN service provider operates a plurality of CDN edge servers 302a-n and a set of tiered distribution hubs 304a-n. The tiered distribution hubs accelerate content delivery to end users 306a-n and buffer the origin server 308. The tiered distribution hubs ensure that the edge servers have the information requested by the end users. If the edge servers do not have the appropriate file when it is requested, the servers in the tiered distribution hubs will provide the edge servers with the requested content. Preferably, a tiered distribution hub 304 maintains a persistent connection to the origin server 308, although this is not a requirement. The distribution hubs ensure that end users 306 do not flood the

origin site with requests if the site is experiencing high traffic load or if the content is stale, large, or infrequently accessed. In effect, the tiered distribution hubs act as accelerators for the end users, ensuring that the users obtain their desired content quickly and reliably, and the hubs acts as buffers for the origin site's internal infrastructure, guaranteeing that the site is not overwhelmed with requests for popular content or large files.

As illustrated in Figure 4, a given content delivery network 400 may comprise a set of regions 402a-n, each of which comprises a set of content (or "edge") servers 404a-n. CDN customers include a set of content providers (CPs), each of which typically operates a set of one or more origin servers 406. Typically, when a given requested object is not available from a given content server 404, the object may be retrieved from another edge server in the region or, failing that, from the origin server. This known operation is modified according to the present invention. In particular, given content may be marked for distribution from a so-called cache hierarchy that includes a given edge region 402 and either (a) a given subset of the origin server regions (a "multi-region" cache hierarchy) or (b) a dedicated single parent region (a "single-region" cache hierarchy). In the illustrated example, the given subset of parent regions includes regions 408a-n. A given region 408 includes a cluster of "parent" servers, for example, servers 410a-n that, for illustrative purposes only, may be co-located in large hosting data centers in well-connected "core" portions of the Internet web hosting infrastructure. Representative "core" locations include, without limitation, well-connected data centers in the Internet that have high-speed backbones (today these are optical networks running at multiple gigabits per second)
and are connected to at least several (e.g., three (3)) other high-speed optical backbone networks. Connection to multiple backbone networks is very desirable to ensure requests can be routed quickly and reliably within the Internet. The number of parent regions in the given subset is variable and their particular location and configuration (e.g., number of servers, connectivity, etc.) is selectable, however, these machines should be relatively powerful and well-

connected. An alternative to the multi-region cache hierarchy is a "single region" hierarchy that includes a given edge server region 402 and the single parent region 412 having a cluster of servers 414a-n. Again, the location of the parent region and the number of servers within that region and their connectivity are variable. Typically, however, the single parent region 412 is associated with a particular content provider and, as a preference, it would be located nearby the content provider's origin server or server farm. The single parent region may also be located on the same provider network and geographically close.

By funneling requests that cannot be serviced in edge regions (because the object is not in cache or is in cache but needs to be validated) through either the multi-region or single-region parent clusters, the CDNSP significantly reduces the amount of traffic on content provider origin servers for very popular content and large, potentially flash-sensitive objects. As a result, the cache hierarchy protects the content providers from requests for large, popular objects causing the CDN to make more requests than the content provider can handle. In addition, the cache hierarchy reduces average latency and improves connectivity and content access in what might otherwise be poorly-connected edge regions. Preferably, only a relatively small, specific subset of objects are serviced using the hierarchy, while most objects are fetched using a default mechanism where the edge server contacts the origin server to handle a request that cannot be serviced in the edge region. This selectivity is accomplished preferably using object "metadata."

The following is a representative description of CDN metadata that may be used to create the multiple region or single region parent according to an embodiment of the present invention. Metadata is delivered to the CDN edge servers using a convenient transport mechanism such as illustrated in Figure 1. Object metadata may be specified by customer, by directory, by object type, or in any other convenient manner. The syntax described is merely representative.

The metadata tag "use-hierarchy" turns on the cache hierarchy feature, specifies the policy or type of hierarchy parent, and lists the base domain to be used.

The default setting for cache hierarchy is OA:

<md name="use-hierarchy">OA</md>

OA indicates that the edge server is to go direct to the (O)rigin-server specified in the (A)RL), where the ARL is a modified URL (or portion thereof) that points an end user browser to attempt to retrieve the object from the CDN. This setting is essentially the equivalent of turning the cache hierarchy off.

To turn on cache hierarchy for a typical CDN customer, the metadata tag may be of the following format:

<md name="use-hierarchy">coremap</md>

Other possible policy settings include, for example, PS or PD followed by an appropriate domain or IP address.

PS (serial) indicates a parent cache with an object's serial number ("a###.") prepended to a specified domain name. The following is a typical setting, for which "coremap" is established as an alias. For example:

<md name="use-hierarchy">PSch.cdnsp.net</md>

This results in the edge server doing a DNS lookup for aX.ch.cdnsp.net, where X is a serial number. The sub-domain listed may change depending on the customer.

PD (domain) indicates a parent cache with a specified hostname or IP address. For example:

<md name="use-hierarchy">PDmyparent.cdnsp.com</md>

This results in the edge server doing a DNS lookup for myparent.cdnsp.com as a hierarchy parent.

<md name="use-hierarchy">PD204.178.107.233</md>

This results in the edge server using the listed IP as a hierarchy parent.

To provide a concrete example, assume that a content provider object has been tagged for delivery by the CDN (either explicitly or implicitly) using the tag a9.g.aka.net, where a9 is a serial number useful for load balancing purposes. One such technique is described in U.S. Patent No. 6,108,703, which is incorporated herein by reference. An end user browser looking for that object is directed to an optimal CDN edge server in a given region using a dynamic DNS request routing mechanism, again as described in the above-identified patent. Now, assume that

the CDN edge server either does not have the object in cache or that the object in cache is stale. If the CDN edge server has received object metadata, software executing in the edge server changes a9.g.aka.net (the original tag) to a9.c.aka.net for the multi-region approach (for resolution against a core map) or, alternatively, to something like a9.48.aka.net for the single region approach (with "r48" being region 48, presumably somewhere near the origin server). Thus, application of metadata determines the name of the server region through which the request is funneled to fetch or validate the object being requested. This is the origin server by default, but it can also be a cache hierarchy parent, as described above. In the example, a9.c.aka.net then gets resolved, e.g., through a first DNS level in the request routing mechanism (such as described in the '703 patent) to identify a best core region (e.g., a core region closest to the edge region) and then perhaps through a second DNS level to identify the best edge server in that region. If the metadata implements the single region parent, the first level returns second level servers specific to region 48. Of course, the use of multi-level DNS is merely illustrative. Generalizing, while the actual format of the edge server request to its parent varies, it may of the form aSerial.rRegion.cdnsp.net.

Thus, in accordance with an embodiment of the tiered distribution scheme, as edge server region contacts either a core region or a dedicated parent region (edge server region ? core region or single backing region) as a function of given object service metadata. With respect to objects that have been identified to be distributed via the cache hierarchy, the origin server preferably is only contacted when a server in a parent region needs to fetch content, or when the server in the parent region needs to revalidate existing content. While the above description shows an edge server contacting an intermediate core region or a parent region, it should also be appreciated that the core region may be backed up by a single region so that the hierarchy is as follows: edge server region ? core region ? single backing region ? origin server.

Figure 5 illustrates the basic software and data components useful in the cache hierarchy. This software may be implemented as part of the CDN

software running in each edge server as illustrated in Figure 2. The functionality may be implemented on a standalone basis. As noted above, an edge server includes a cache for storing content provider content. The server receives end-user requests for origin server content and serves this content authoritatively if it can do so. A monitor 502 is a software process that monitors and reports edge server performance for load balancing and customer analysis. A guide process 504 preferably is a component of the CDN edge server software (although it may be a standalone process) that directs the edge server to use another CDN server (i.e., an intermediate) instead of the customer's origin server for given content requests that are being managed by the cache hierarchy. A C map 506 is a mapping from a client network address to a nearest CDN region that preferably is used by the CDN's DNS-based request routing mechanism to direct client requests. In an illustrative embodiment, the C map 506 is a map that contains a subset of the regions in a more global G map 508 used by the CDN service provider as part of the request routing mechanism. These subset regions are sometimes referred to herein as "parent" regions.

Figure 6 illustrates a flowchart of a preferred operation of the present invention when a given edge server receives a client request for an object. The routine begins at step 602 with the edge server cache management process looking for the object in the content server's cache. If the requested object is in cache and is fresh as indicated by a positive outcome of the test at step 604, the object is served back to the requesting client at step 606; otherwise, the process attempts to validate the object at step 608. If the object is not in cache or needs to be validated, the edge server makes a request (e.g., via a cache sharing protocol) to other edge servers in the region (each a "peer") to see if one of them has a fresh copy of the object. This is step 610. If the peer then returns a valid object, the edge server continues at step 616 to update its cache and, at step 618, to return the object to the requesting client. This completes the processing. If, however, the outcome of the test at step 612 indicates that a

peer has not returned a hit, i.e., no peer copy of the object is available, the process continues.

At step 620, the edge server queries its associated guide process to identify where to go to get the object. At step 622, the guide process makes a determination whether the object is a candidate for using the hierarchy. As noted above, preferably this determination is made by having the guide process examine object metadata for a given tag, e.g., "use-hierarchy," in a data string. An illustrative data string is a resource locator that has been modified to point to the CDN. Preferably, only objects with a "use-hierarchy" tag in the CDN resource locator are candidates for using the cache hierarchy; candidates that use features inconsistent with the scheme (see below) preferably are not served through the cache hierarchy. If the object is not a candidate for distribution through the hierarchy, the guide process at step 624 returns a peer list that includes just a given directive (e.g., DIRECT), which causes the server, at step 626 to talk to the origin server to obtain the object as usual. If, however, the object is a candidate for tiered distribution, the guide process examines the "use-hierarchy" metadata information at step 628 and, at step 630, the process constructs a list of one or more parent region(s) or a dedicated parent region. At step 632, the server opens a connection (or uses a persistent one) to a parent region on the list and, at step 634, it sends the request to a server in the parent region. The requesting server preferably adds a request header to the request, which serves to nominate the receiving server (in the parent region) as a hierarchy parent.

In the alternative, the edge server generates a DNS query to the CDN request routing mechanism to identify a best core region and best server within that core region per the dual-level DNS scheme described above.

At step 636, the parent serves the request either from its cache if it has it, or by making a request to the origin server. Preferably, a parent will not make a request to another server in the hierarchy; rather, its guide process by default will return only to the origin server as a valid destination. This completes the process.

Preferably, the edge server includes an application programming interface (API) for the guide process to facilitate location of a parent region (from which the object can be fetched). Data may be feed to the guide API by the content serving process, or from other external sources. This data may include, but is not limited to, information from the request received by the content server, and information from object metadata that applies to the requested object. The guide API preferably includes routines that allow the content server to initialize the guide, to shutdown the guide, and to lookup a list of servers that should be contacted to request an object given the data provided to the guide. Each entry in the list of servers preferably includes a DNS name or IP address for each server, and an indication of whether that server is an origin server or a parent server.

As noted above, a defined, specific subset of objects may be serviced using the hierarchy while other objects are fetched using a default mechanism (which could be thought of as a degenerate hierarchy with one root, namely, the content provider origin server). Use of the hierarchy preferably is determined via a metadata component that overrides an edge server default hierarchy mechanism. Preferably, this metadata component is controlled by the CDN service provider. To service the needs of multiple content providers, this metadata preferably is settable on a per-object basis from the outset, but it may be desirable also to enable all of a customer's files to use a non-default. This metadata specifies one of a set of possible mechanisms:

When a particular edge server communicates with another server in the hierarchy, the edge server preferably acts as a proxy. This may necessitate some changes to the HTTP headers in the client request (to indicate that the client is an edge server) and in the server response (so that the edge server receives all of the information it needs to correctly serve the object). In creating its response to a child (an edge server requesting the content from another server in the hierarchy), the parent preferably passes along any information so that the child can correctly construct the metadata and current coherence state of the object. In an illustrative embodiment, the parent should

send the headers it received for object unchanged, possibly with a few exceptions, so that the child sees the object the same way that the serving parent saw it. Some exceptions are that the response should also include an Age header to reflect how long that the object has been in the CDN (replacing the Age header received from an upstream proxy if necessary), and a Date header updated to the current time.

Thus, according to a preferred embodiment, given content is associated with the cache hierarchy functionality using metadata. This functionality thus can be applied to specific paths and extensions. Preferably, the alternate resource locator for the content is unmodified (from what it would be normally in the CDN). Moreover, preferably only edge-of-network content servers (running CDN software) get such content from the parent regions (if they do not already have it), and parent regions get the content (if needed) from the origin server(s). Preferably, servers in parent regions are not dedicated; rather, they run CDN software and may act as edge servers for some requests. Typically, a machine that serves as a parent machine is well-provisioned with good connectivity and a large amount of disk storage. A parent typically sends a child (an edge server running the CDN software) with information about how long (time-to-live or TTL) the content may stay in the child cache and still be deemed fresh.

The present invention provides numerous advantages. Cache hierarchy uses a hierarchy of servers to distribute content closer to the requesting end users. This functionality is particularly advantageous for flash-popular content or for very large content because it allows the CDN edge servers to go to a selected set of machines for the content (as opposed to the origin server). As a consequence, the origin server will be expected to have to fulfill much fewer requests.

Representative content servers running CDN software according to the present invention are Intel Pentium-based computers running a Linux or Linux-variant operating system. One or more of the processes described above are

implemented as computer programs, namely, as a set of computer instructions, for performing the functionality described.

Having described our invention, what we claim is as follows.

5

CLAIMS

1. A method operative in a content delivery network (CDN) having a set of surrogate origin servers organized into regions and that provide content delivery on behalf of participating content providers, wherein a given content provider operates an origin server, comprising:

establishing a cache hierarchy in the CDN comprising a given surrogate origin server region and either (a) a single parent region located in a given location, or (b) a subset of parent regions located in given core Internet locations;

in response to a determination that a given object request cannot be serviced in the given surrogate origin server region, directing the given object request to the single parent region or to a given one of the subset of parent regions, based on metadata associated with the given object request, instead of to an origin server; and

attempting to service the given object request from a given server in the single parent region or the given one of the subset of parent regions.

2. The method as described in Claim 1 further including the step of:

if the given object request cannot be serviced from the given server, forwarding the given object request back to the origin server.

3. The method as described in Claim 1 wherein the metadata associated with the given object request indicates that the given object is a candidate for delivery via the cache hierarchy.

4. The method as described in Claim 1 wherein the metadata is identified by a given entity and further including the step of delivering the metadata to the given surrogate origin server region.

5. The method as described in Claim4 wherein the single parent region is associated with a given content provider.

6. The method as described in Claim 5 wherein the single parent region is co-located with the origin server of the given content provider.

7. The method as described in Claim 1 further including the step of attempting to service the given object request from a peer in the given surrogate origin server region prior to directing the request to the single parent region or to a given one of the subset of parent regions.

8. The method as described in Claim 1 wherein a first participating content provider uses the single parent region and a second participating content provider uses a subset of the parent regions.

9. The method as described in Claim 1 further including the steps of:

if a given object request cannot be serviced in the given surrogate origin server region, rewriting a first data string associated with the given object request into a second data string that points to the cache hierarchy; and

resolving the second data string to identify a best core region and an optimal server in the best core region to service the given object request.

10. In a content delivery network having a set of surrogate origin servers organized into regions and that provide content delivery on behalf of participating content providers, wherein a given content provider operates an origin server, the improvement comprising:

establishing a cache hierarchy in the CDN comprising a given surrogate origin server region and either (a) a single parent region or (b) a subset of the parent server regions;

in response to a determination that a given object request cannot be serviced in the given surrogate origin server region, attempting to service the request from a peer in the given surrogate origin server region;

if the request cannot be serviced from a peer in the given surrogate origin server region, providing the given object request to the single parent region or to a given one of the subset of parent regions, based on metadata associated with the given object request, instead of to an origin server; and

attempting to service the given object request in a server in the single parent region or the given one of the subset of parent regions.

11. A server connectable in a content delivery network having a set of servers organized into regions that provide content delivery on behalf of participating content providers, wherein the content delivery network includes given nodes intermediate the server and a given content provider origin server, comprising:

code executable in the server for determining whether a given object request can be serviced;

code executable in the server and responsive to a determination that the given object request cannot be serviced for evaluating object metadata to determine whether the given object request is to be serviced by an intermediate node;

code executable in the server and responsive to a determination that the given object request is to be serviced by an intermediate node for generating a data string that is resolvable to identify a given node intermediate the server and the given content provider origin server; and

code executable in the server and responsive to resolution of the data string to identify a given intermediate node to which the given object request is then directed for handling.

FIG. 1

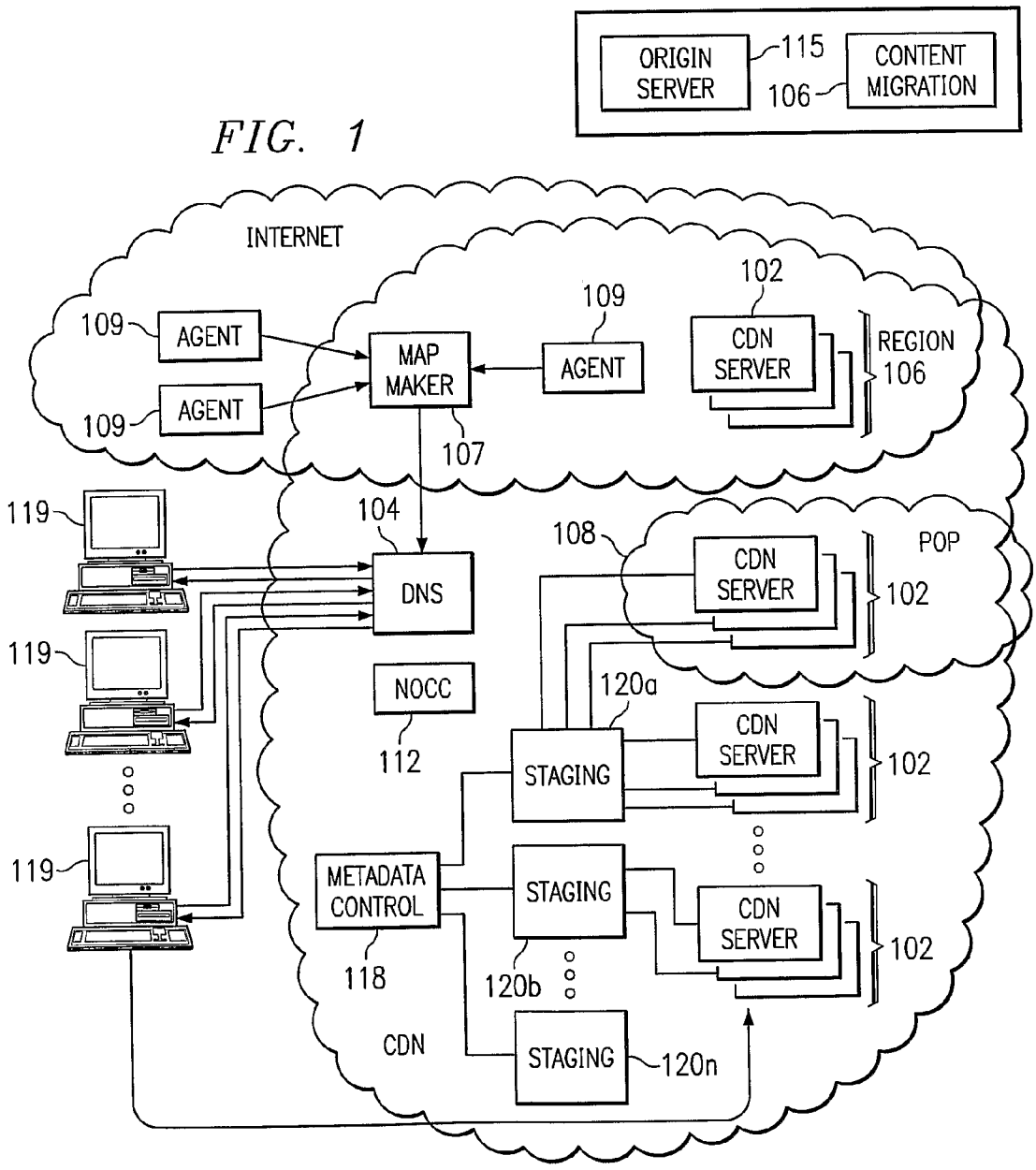

ORIGIN SERVER
115
106
CONTENT MIGRATION
INTERNET
109
AGENT
109
AGENT
MAP MAKER
107
109
AGENT
102
CDN SERVER
REGION 106
104
DNS
119
119
119
NOCC
112
108
CDN SERVER
102
POP
120a
STAGING
CDN SERVER
102
METADATA CONTROL
118
STAGING
120b
CDN SERVER
102
CDN
STAGING
120n

FIG. 2

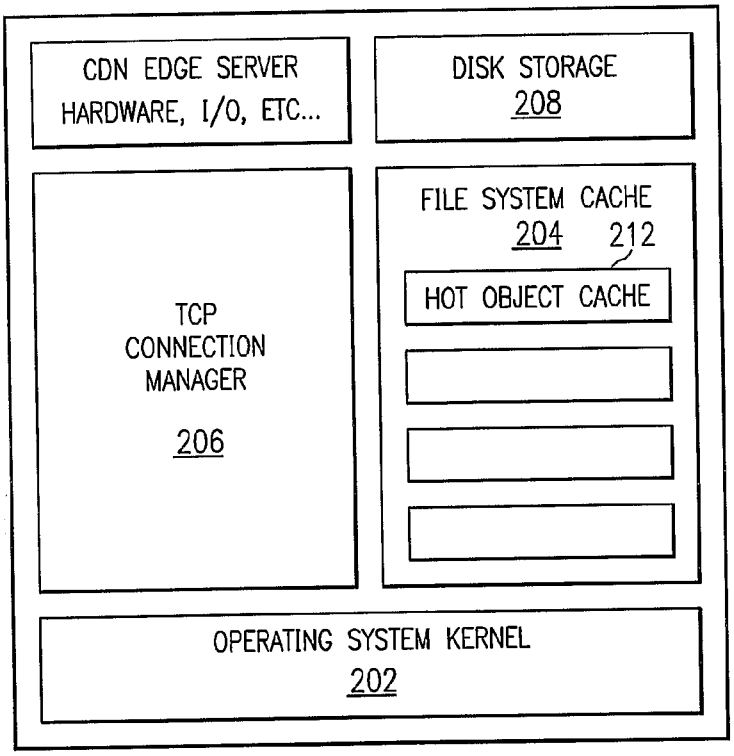
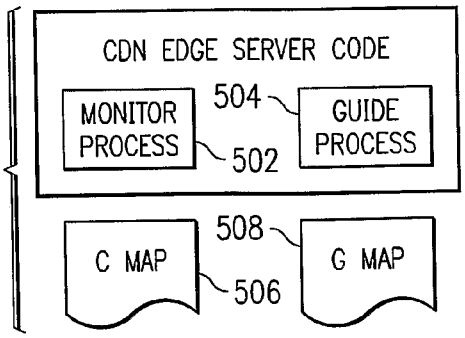

CDN EDGE SERVER
HARDWARE, I/O, ETC...
DISK STORAGE
208
FILE SYSTEM CACHE
204
212
HOT OBJECT CACHE
TCP
CONNECTION
MANAGER
206
OPERATING SYSTEM KERNEL
202

FIG. 5


CDN EDGE SERVER CODE
MONITOR
PROCESS
504
502
GUIDE
PROCESS
C MAP
508
506
G MAP

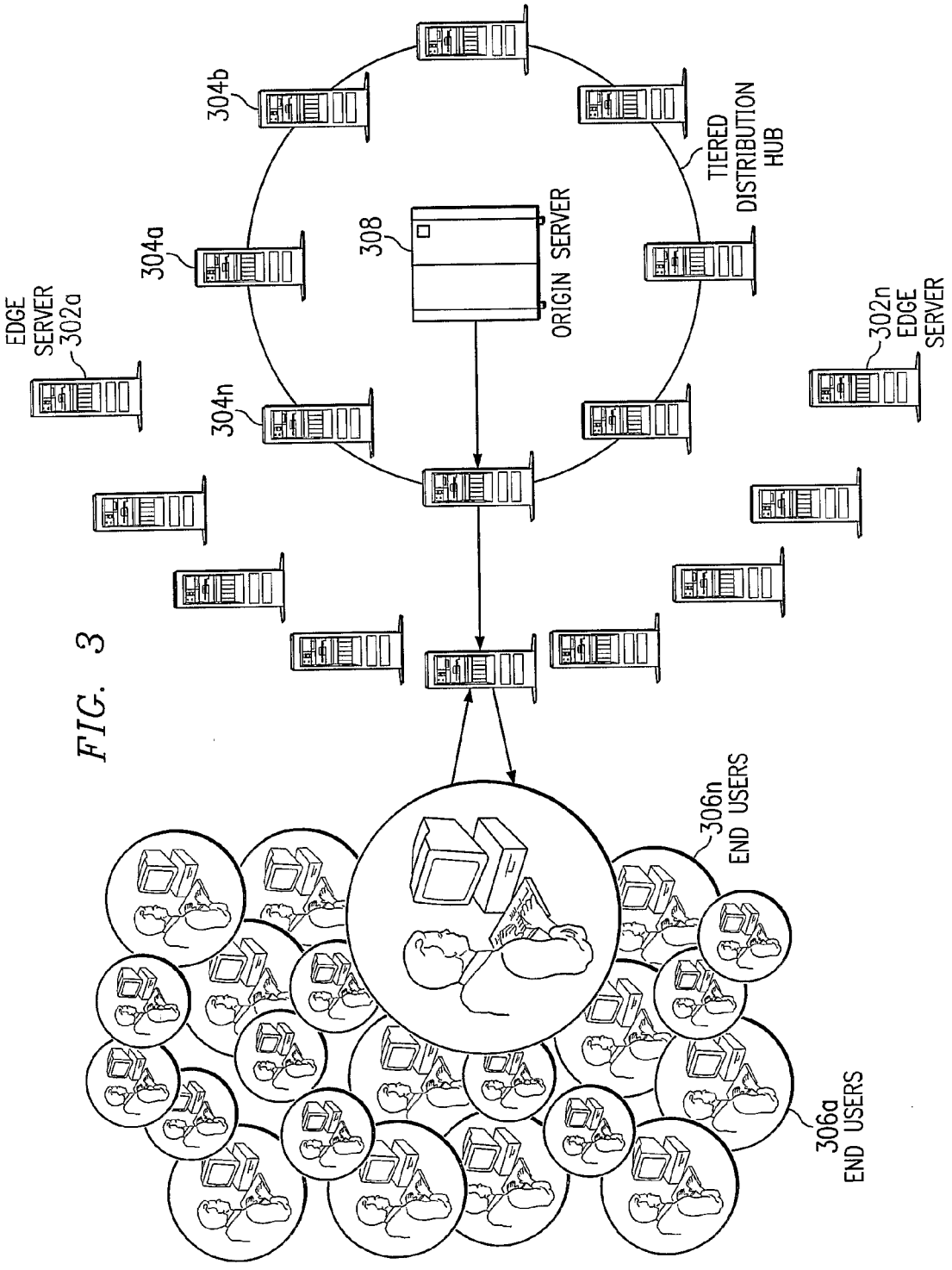

304b
TIERED DISTRIBUTION HUB
308
ORIGIN SERVER
304a
EDGE SERVER 302a
302n EDGE SERVER
304n
306n END USERS
306a END USERS

FIG. 3

FIG. 4

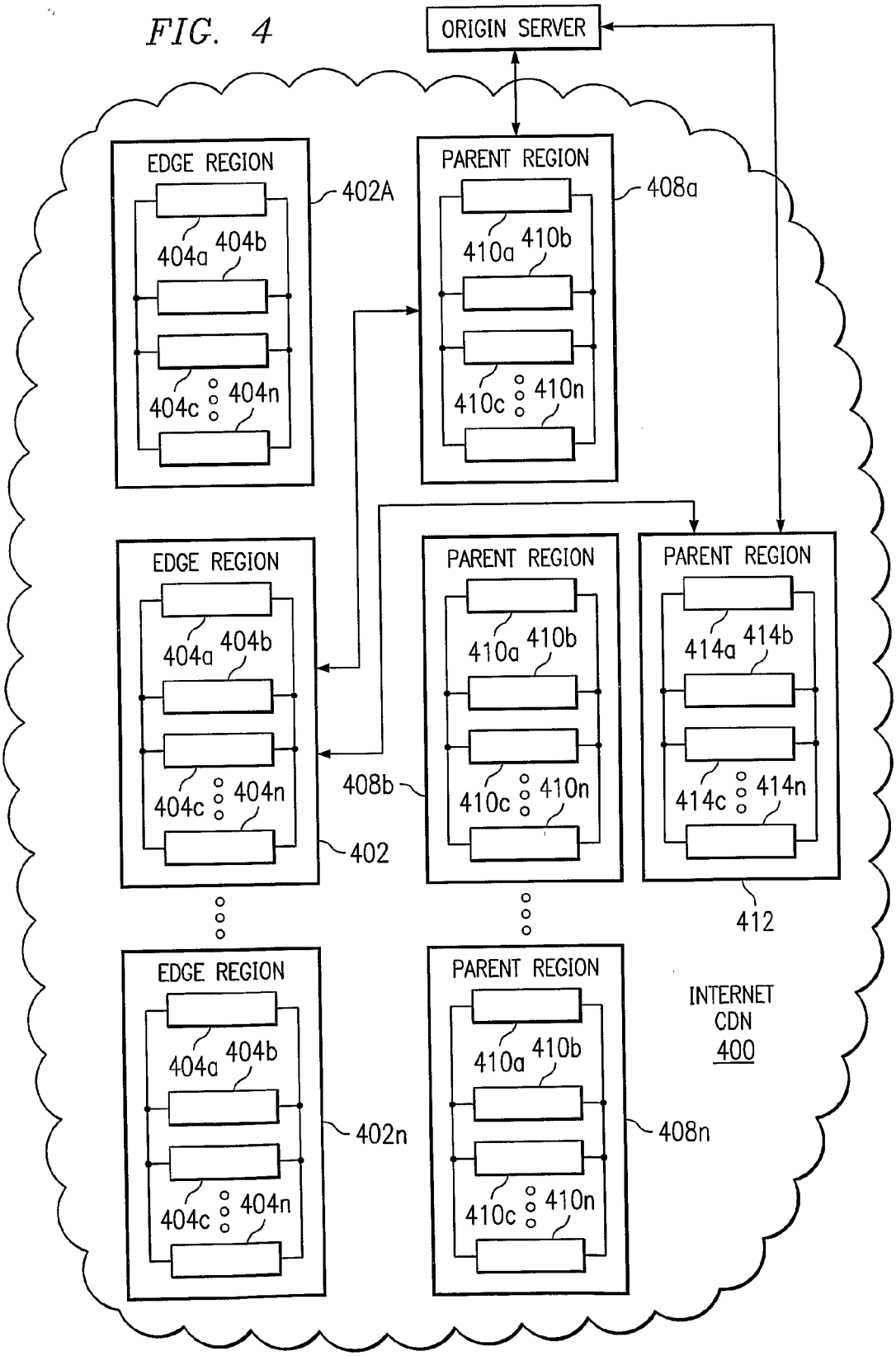
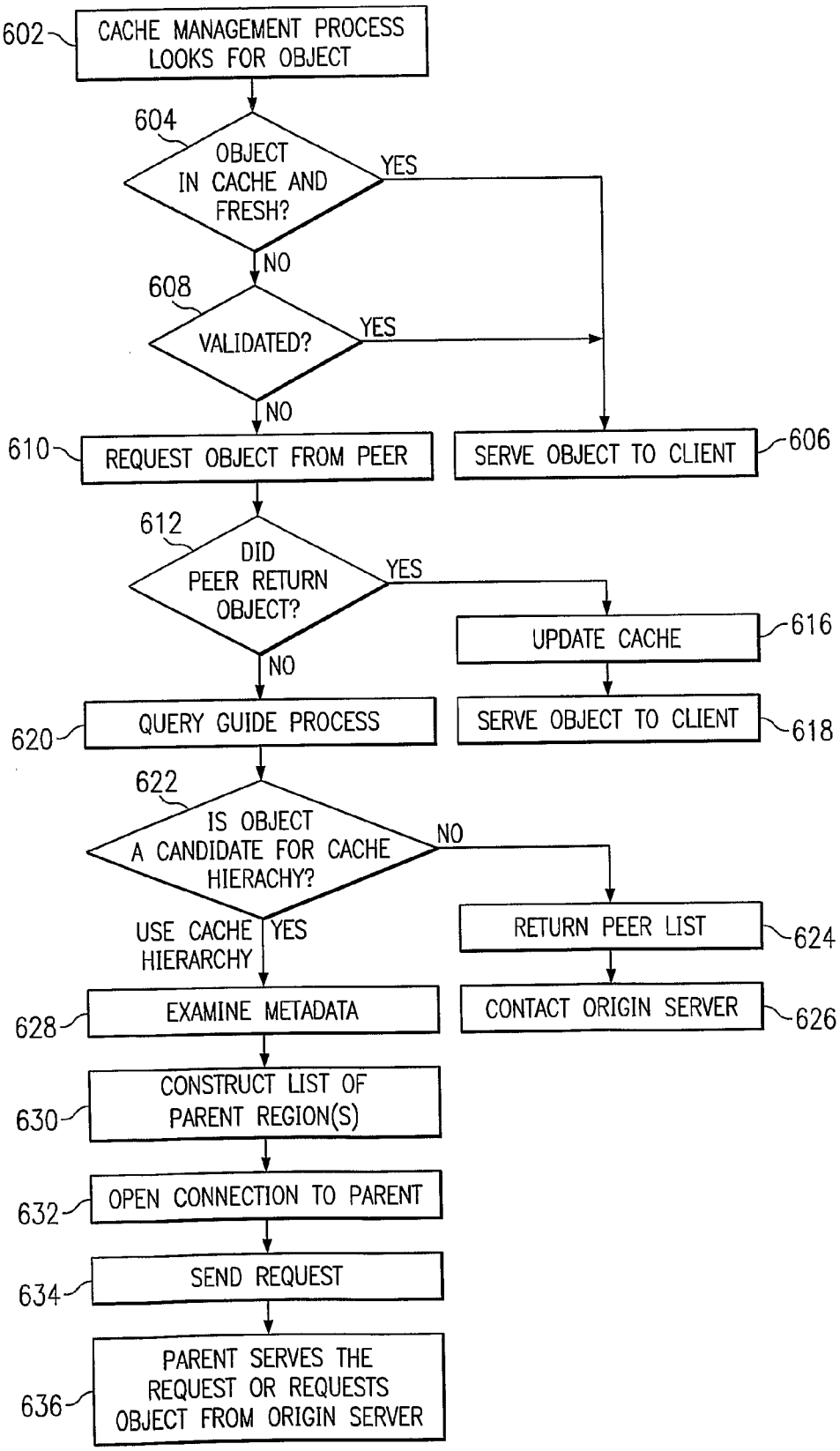

ORIGIN SERVER
EDGE REGION
402A
404a
404b
404c
404n
PARENT REGION
408a
410a
410b
410c
410n
EDGE REGION
404a
404b
404c
404n
402
PARENT REGION
408b
410a
410b
410c
410n
PARENT REGION
414a
414b
414c
414n
412
EDGE REGION
404a
404b
404c
404n
402n
PARENT REGION
410a
410b
410c
410n
408n
INTERNET
CDN
400

FIG. 6 5/5


602
CACHE MANAGEMENT PROCESS LOOKS FOR OBJECT
604
OBJECT IN CACHE AND FRESH?
YES
NO
608
VALIDATED?
YES
NO
610
REQUEST OBJECT FROM PEER
SERVE OBJECT TO CLIENT
606
612
DID PEER RETURN OBJECT?
YES
NO
UPDATE CACHE
616
SERVE OBJECT TO CLIENT
618
620
QUERY GUIDE PROCESS
622
IS OBJECT A CANDIDATE FOR CACHE HIERACHY?
NO
USE CACHE HIERARCHY
YES
RETURN PEER LIST
624
CONTACT ORIGIN SERVER
626
628
EXAMINE METADATA
630
CONSTRUCT LIST OF PARENT REGION(S)
632
OPEN CONNECTION TO PARENT
634
SEND REQUEST
636
PARENT SERVES THE REQUEST OR REQUESTS OBJECT FROM ORIGIN SERVER

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/10882

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G06F 15/16
US CL :709/201
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)

U.S. : 709/201, 238, 217,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

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

WEST & EAST
Search terms : distributed or distribution, cache hierachy, content delivery or routing, traffic, congestion.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US6,298,373 B1 (BURNS et al) 02 October 2001, see the whole reference.	1-11
A	US 6,351,767 B1 (BATCHELDER et al) 26 February 2002, see the whole reference.	1-11
A	US 6,240,461 B1 (CIESLAK et al) 29 May 2001, see the whole reference.	1-11

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

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 24 JUNE 2003	Date of mailing of the international search report 11 JUL 2003
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Peggy Harrod AYAZ R. SHEIKH Telephone No. (703) 305-9648

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

Electronic Acknowledgement Receipt

EFS ID:	14230858
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	14-NOV-2012
Filing Date:	21-MAR-2009
Time Stamp:	18:06:31
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	Transmittal Letter	137USU1_Supp_IDS.pdf	36183 bbe8e608ceece81c5e719c0ea4b7b1e4e846802d	no	5
Warnings:					
Information:					

2	Information Disclosure Statement (IDS) Form (SB08)	137USU1_SB08.pdf	27427 fe185f17c68cde6cc9d16278008166989c523ef2	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	WO03088065A1.pdf	3539014 96c0925d17b112d243ef638a363757b5a6a5ba3a	no	27
Warnings:					
Information:					
4	Non Patent Literature	EP097273429_ExRpt_137EP01_5Nov12.pdf	617062 404154adab088d5ca7445fbf1cd2ada75fff6720	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	4219686		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Neeraj K.Utreja
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☒ No fee is due.

☐ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☐ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☒ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: November 14, 2012

/JCS/

Jonathan C. Siekmann
Registration No. 58,259
USPTO Customer No. 83579
Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021
Tel: 720-888-2140
Fax: 720-888-5619

PTO/SB/08a (01-08)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number..

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS					
Examiner Initial *	**Cite No**	**Document Number**	**Publication Date**	**Name of Patentee or Applicant of Cited Document**	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	**Cite No**	**Foreign Patent Document**	**Publication Date**	**Name of Patentee or Applicant of cited Document**	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T^2

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	**Cite No [1]**	**Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.**	T^2
		Chinese Examination Report, dated June 13, 2012, Application No. 200980120043.0, Dkt No. 0137-CN-01, 6 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional) [2] Applicant is to place a check mark here if English language Translation is attached

Electronic Acknowledgement Receipt

EFS ID:	13167864
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	03-JUL-2012
Filing Date:	21-MAR-2009
Time Stamp:	11:45:32
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	Transmittal Letter	137_US_U1_Supp_IDS.pdf	36209 61b09dd941c1123eaa8fa3b05d85b065a8ba8667	no	5

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	137_US_U1_SB08.pdf	27237 0c5b0893f875cbb2c1015c687fece896e6a1b4e2	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Non Patent Literature	137_CN_01_ExamRpt_200980120043.pdf	55397 4011fb91eb5cfe62ab3c6a6b75038c2f87e34b07	no	6
Warnings:					
Information:					
		Total Files Size (in bytes):	118843		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Neeraj K.Utreja
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☒ No fee is due.

☐ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☐ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☒ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: July 3, 2012

/JCS/

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Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/408,681	FULLAGAR ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 3/30/12	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

Janice Ford

U.S. Patent and Trademark Office

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF:	Attorney Docket: **0137-US-U1**
Fullagar et al.	Group Art Unit: 2452
Application Serial No.: **12/408,681**	Examiner: UTREJA, Neeraj K
Application Filing Date: 03/21/2009	Confirmation No.: 9965
Title: **Handling Long-Tail Content In A Content Delivery Network (CDN)**	Date: 03/29/2012

AMENDMENT/RESPONSE

via EFS-Web
Hon. Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Madam:

In response to the non-final office action mailed November 30, 2011, please amend this application as follows.

A **Petition for Extension of Time** is on page 2 hereof

Amendments to the Specification begin on page 3 hereof.

Amendments to the claims begin on page 7 hereof.

Remarks begin on page 15 hereof.

A **Terminal Disclaimer** is submitted herewith.

PETITION FOR EXTENSION OF TIME

Petition is hereby made to extend the due date for response to the outstanding office action of November 30, 2011. Applicant is electronically submitting the required fee with this filing. The Commissioner is authorized to deduct any additional fees from or credit any over-payment to the undersigned's Deposit Account No. 50-5063.

IN THE SPECIFICATION

Please amend the specification as follows:

Please replace paragraph 0032 with the following:

[0032] In a presently preferred embodiment the server selector **106** is an intelligent traffic manager (ITM) / adaptive traffic controller (ATC) such as described in co-pending U.S. patent application no. 10/259,497, filed 09-30-2002, and titled "Configurable Adaptive Global Traffic Control And Management," (published as US 2003-0065762 A1), issued as U.S. Patent No. 7,822,871 on October 26, 2010; and in U.S. patent application no. 11/976,648, filed 10-26-2007, titled "Policy-based content delivery network selection," issued as U.S. Patent No. 7,860,964 on December 28, 2010 (collectively the "ITM applications"), the entire contents of each of which have been incorporated herein by reference for all purposes. In some embodiments the server selector **106** may include a "best" or "optimal" server selector such as disclosed in U.S. Patent No. 6,185,598 titled, "Optimized Network Resource Location," the entire contents of which are incorporated herein by reference for all purposes. The '598 patent refers to CDN servers as so-called repeater servers, and describes a so-called "Best Repeater Selector (BRS) mechanism".

Please replace **paragraph 0043** with the following:

[0041] If the object is not available on the edge server **108** or on a peer, the edge server **108** ascertains whether this object is served based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from) (at **506**). If so, then the request is sent to the popularity service **102** associated with the edge server **108**, in this case, to the popularity server for ~~the~~ this group (**S3a**).

Please replace **paragraph 0043** with the following:

[0043] It is preferably to allow for a mix of edge servers, some performing popularity checking (as described above), while others do not. For those that are not running the popularity service, the name (hostname) used to request an object will resolve to a parent server (that may or may not provide popularity services). If the parent server does not provide popularity services, then the content will be obtained by the edge server from that parent server, and the content will be served to the client. On the other hand, if that parent server does provide popularity services, it can determine whether or not the edge server is a Longtail coserver based, e.g., on the IP (Internet Protocol) address of the edge server. For non-coservers, the parent server can handle the request without any popularity processing.

Please replace **paragraph 0061** with the following:

[0061] The mapping of requests/content to slots is based on some function of the object name and perhaps other information associated with the request for the object. Preferably the mapping of objects to slots is based on a hash or message digest function (such as MD5 ~~MAD~~ or the like) over the object name (and preferably including some parts of the query string). Each slot may therefore represent one or more resources. Each time a query/request arrives at a popularity server for an object, the hash is computed and the slot in the table 800 (for the appropriate co-server) is determined, and the counts in that slot are used. In event of a hash collision, it is therefore possible that one bucket will be receiving and representing counts for more than one object. Since this result is generally undesirable (since it could result in cache fills and edge caching of unpopular objects), the number of buckets should be chosen to be as large as practical.

Please replace **paragraph 0062** with the following:

[0062] Those of skill in the art will know and understand, upon reading this description, that different and / or other data structures may be used to implement the popularity counting. For example, since in most cases the total number of resources is expected to far exceed the number of popular resources, a balanced b-tree may be preferable to a hash table. In addition, it is possible to reduce the size of the hash slot by using only some part of the ~~of the~~ hash. However, reducing the number of bytes of the hash used can result in more name collisions.

Please replace **paragraph 0076** with the following:

[0076] A ~~servers~~ server's hostnames are also referred to as its aliases. Each Longtail coserver preferably has at least two aliases (three if a parent cache/server tier is used): the published supername, the hostname used for popularity service requests, and (if used) the hostname used for parent cache redirects.

IN THE CLAIMS

Please amend the claims as follows. This listing of the claims replaces all prior claim listings.

1. (currently amended) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is available at said first server or at a peer of said first server, serving the resource to the client from the first server;

(C) otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is to be served based on its popularity; and

(D) when it is not determined that said resource is to be served based on its popularity, obtaining the resource at said first server and serving the resource to the client from the first server; and

(E) when it is determined that said resource is to be served based on its popularity,

(E)(1) determining whether said resource is popular, and

(E)(2) if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise,

(E)(3) if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and

(E)(4) said second server serving the resource to the client.

2. (Original) The method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers.

3. (Original) The method of claim 1 wherein the second server is a content provider's origin server.

4. (Original) The method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

5. (currently amended) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on whether or not said resource is to be served based on its popularity and on a current popularity value for said resource.

6. (Original) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers.

7. (Previously presented) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server.

8. (currently amended) A content delivery framework comprising:

a plurality of edge servers forming a first tier of servers; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and

at least one popularity service, implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of said edge servers about requests for content that

has been specifically designated to be handled based on its popularity, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content.

9. (currently amended) A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on (i) whether or not said resource is to be served based on its popularity, and (ii) a current popularity value for said resource.

10. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier.

11. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers

comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier.

12. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier.

13. (Previously presented) The method of claim 1 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource.

14. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is an initial part of the object.

15. (Previously presented) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

16. (Previously presented) The method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers.

17. (Previously presented) The method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service.

18. (Previously presented) The method of claim 17 wherein the popularity service runs on a popularity server.

19. (Previously presented) The method of claim 18 wherein the popularity server maintains information on relative popularity of content being served.

20. (Previously presented) The method of claim 19 wherein the popularity server maintains information on relative popularity of content being served in a region comprising the first server.

21. (Previously presented) The method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource.

22. (Previously presented) The method of claim 21 wherein determining whether said resource is popular comprises:

determining a relative popularity said resource in a region comprising the first server.

23. (Previously presented) The method of claim 5 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

24. (Previously presented) The method of claim 9 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

25. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is an initial part of the object.

26. (Previously presented) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

27. (New) The method of claim 1 wherein the act of determining whether said resource is to be served based on its popularity comprises:

determining whether said resource is designated to be served based on its popularity.

28. (New) The method of claim 5 wherein whether or not said resource is to be served based on its popularity is based at least in part on whether or not said resource is designated to be served based on its popularity.

29. (New) The method of claim 9 wherein whether or not said resource is to be served based on its popularity is based at least in part on whether or not said resource is designated to be served based on its popularity.

REMARKS

Favorable reconsideration and allowance of this application are respectfully requested.

By this Amendment, the Specification has been amended to correct typographical errors, claims 1, 5, 8, 9 have been amended, and new dependent claims 27-29 have been added.

Support for the claim amendments can be found in the application as filed, e.g., ¶0035, Fig. 5 (506) and related description in ¶¶0038, 0041-0042. These cited portions of the application describe, *inter alia*, that the popularity service may be used by certain, though not necessarily all, content. *Specification* ¶0035. In some embodiments, content should be designated in order to use the popularity service. *Id.* For some content a popularity check is interposed into the fill side of the caching operation. *Id.* ¶0038.

No new matter has been added by these amendments.

It should be appreciated that the Applicant has not invoked 35 U.S.C. §112, paragraph 6, with respect to any term in any claim of the present application. It should further be appreciated that the words "first" and "second" in the claims are used to distinguish or identify within a claim, and not to show a serial or numerical limitation or ordering. Similarly, words such as "particular," "specific," "certain," and "given" are used to distinguish or identify within a claim and are not intended to be otherwise limiting. Furthermore, letter labels (*e.g.*, "(A)", "(B)", "(C)", and so on) and/or numbers (*e.g.*, "(i)", "(ii)", and so on) if in the claims, are used to assist in readability, and are not intended to be otherwise limiting or to impose any serial or numerical limitations or orderings.

Claims 1-29 are pending in this application.

Double Patenting

The Examiner provisionally rejected claims 1, 5, 8, and 9 on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 12, and 17 of copending application no. 12/105,079. Applicant believes that the Examiner intended application no. 12/880,324.

Withdrawal of this provisional rejection is respectfully requested in view of the Terminal Disclaimer filed herewith (with respect to application no. 12/880,324).

Claim Rejections - 35 USC § 112, ¶1

The Examiner rejected claims 13, 23 and 24 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. According to the Examiner "[s]upport for the newly added feature 'dynamic measure of popularity of the resource' could not be found in the specification.

Applicant respectfully submits that the application as filed describes in detail that the popularity of a resource is dynamic and that the popularity is determined dynamically. The application includes an entire section titled "Defining & Measuring Popularity" (starting on page 15, including paragraphs 0058-0067) that describes various dynamic measures of popularity of resources.

In view of the above, withdrawal of this rejection is respectfully requested.

THE PRIOR ART REJECTIONS

Claim Rejections - 35 USC § 103

The Examiner rejected claims 1-19, 21, and 23-26 under 35 USC §103(a) as being unpatentable over Seed et al. (US 2006/0015574 A1 – hereinafter "**Seed**"). The Examiner rejected claims 20 and 22 under 35 USC §103(a) as being

unpatentable over Seed in view of Kohli et al., U.S. Patent Publication 2010/0312861 (hereinafter "**Kolhi**").

The grounds for this rejection are respectfully traversed.

Independent **claim 1** has been amended to recite determining whether said resource is to be served based on its popularity. If the resource is not to be served based on its popularity then the first server obtains the resource and serves it. On the other hand, "when it is determined that said resource is to be served based on its popularity," then it is determined whether or not the resource is popular. These features are not found in Seed, alone or in any proposed combination with Kohli.

For at least these reasons, claim 1 and its dependents are patentable over Seed, alone or in any proposed combination with Kohli.

Similar arguments apply to independent claim 5 which, as amended, recites "if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, … said redirecting being based, at least in part, on whether or not said resource is to be served based on its popularity …"

Similar arguments apply to the other claims.

In view of the above, withdrawal of these rejections is respectfully requested.

Comment on Examiner's "Response to Arguments"

In the Office Action of 11/30/2011 the Examiner stated:

Response to Arguments

5. Applicant's arguments with respect to claims 1-26 have been considered but are moot in view of the new ground(s) of rejection.

Without conceding to Applicant's arguments, Examiner has withdrawn the Dilley reference and replaced it with another pertinent reference (Seed et al.). Because the new ground(s) of rejection were issued but not necessitated by amendment, this action has been made Non-Final. Examiner reserves the right to use the Dilley reference during the remainder of prosecution, if needed. Applicant is directed to claim rejections above for more information.

The Examiner is respectfully reminded that "[p]iecemeal examination should be avoided as much as possible. The examiner ordinarily should reject each claim on all valid grounds available …" MPEP 707.07(g). In this case the Examiner has already once rejected various claims over Dilley and the applicant has fully responded to those rejections. Either those rejections are withdrawn or they are not, but the Examiner cannot keep that reference "in reserve" for later rejections of the same claims on the same grounds. To do so would unduly extend the examination of this application. If the Examiner continues to believe that any of the claims are anticipated by or obvious over the Dilley reference, he must make an appropriate and *prima facie* rejection of those claims and allow applicant to respond to that rejection.

Applicant incorporates its previous arguments against Dilley.

CONCLUSION

Applicant respectfully submits that this application is in condition for allowance. An early action to that effect is earnestly solicited.

The Examiner is kindly requested to contact the undersigned at the number provided to schedule a personal interview to resolve any outstanding issues in this case.

Date: March 29, 2012

/JCS/

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PTO/SB/25 (08-11)
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TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 0137-US-U1

In re Application of: David Fullagar et al.

Application No.: 12/408,681

Filed: March 21, 2009

For: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

The owner*, Level 3 Communications, LLC, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 12/880,324, filed September 13, 2010, as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent: granted on the pending **reference** application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

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

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 58,259

/JCS/	March 30, 2012
Signature	Date
Jonathan C. Siekmann	
Typed or printed name	
720-888-2140	
Telephone Number	

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

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.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this statement. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Jonathan Siekmann
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Statutory or terminal disclaimer	1814	1	160	160
		Total in USD ($)		**310**

Electronic Acknowledgement Receipt

EFS ID:	12441323
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Jonathan Siekmann
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	30-MAR-2012
Filing Date:	21-MAR-2009
Time Stamp:	19:24:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$310
RAM confirmation Number	6970
Deposit Account	505063
Authorized User	SIEKMANN,JONATHAN

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 1.17 (Patent application and reexamination processing 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		0137_US_U1_Response_NFOA.pdf	135745 6acad33a68c5000dca357faf7810ee2d3cea388f	yes	19

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Extension of Time	2	2
	Specification	3	6
	Claims	7	14
	Applicant Arguments/Remarks Made in an Amendment	15	19

Warnings:					
Information:					
2	Terminal Disclaimer Filed	sb0025.pdf	355049 ee21c650df863e7f579d3faa11ff9b6dbc2a23d6	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32390 f917bb85ec996532b809191df16248ff5cfcf11a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	523184		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/408,681	Filing Date 03/21/2009	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/30/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 29	Minus	** 26	= 3	X $ =		OR	X $60=	180
	Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**180**

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

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

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

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

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

Legal Instrument Examiner:
/BONNIE COLE/

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.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		20040010588A1	Jan 15, 2004	Slater, A et al.	
		20040064832A1	Apr 1, 2004	Tsukidate, R et al.	
		20050060493A1	Mar 17, 2005	Krissell, D et al.	
		20050240966A1	Oct 27, 2005	Hindle, J et al.	
		20100169772A1	Jul 1, 2010	Stallings, H et al.	
		7219153B1	May 15, 2007	Day, M	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		, "International Search Report, Intl Appl. No. PCT/US11/51252", Intl Filing Date 9/12/2011, Dkt No. 0137-WO-I1 , 3 pgs.	
		, "Written Opinion, Intl Appl No. PCT/US11/51252", Intl Filing Date 9/12/2011, Dkt No. 0137-WO-I1 , 5 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
GREGORY DURBIN
POLSINELLI SHUGHART PC
700 W. 47TH ST., SUITE 1000
KANSAS CITY, MO 64112

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)* 23 JAN 2012
Applicant's or agent's file reference 0137-WO-I1	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US 11/51252	International filing date *(day/month/year)* 12 September 2011 (12.09.2011)
Applicant LEVEL 3 COMMUNICATIONS, LLC	

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 90*bis*.1 and 90*bis*.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/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450	Authorized officer Lee W. Young PCT Helpdesk: 571-272-4300
Facsimile No. 571-273-3201	Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2010)

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 0137-WO-I1	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 11/51252	International filing date *(day/month/year)* 12 September 2011 (12.09.2011)	(Earliest) Priority Date *(day/month/year)* 13 September 2010 (13.09.2010)
Applicant LEVEL 3 COMMUNICATIONS, LLC		

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 2 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 43.6*bis*(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. 1

☒ 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 figures is to be published with the abstract.

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

International application No.
PCT/US 11/51252

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 15/16 (2012.01)
USPC - 709/203
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: G06F 15/16 (2011.01)
USPC: 709/203

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC: G06F 15/16 (2011.01)
USPC:709/203; 709/218, 220, 223, 229, 249, 250; 725/44, 47, 116; 370/352, 414, 416, 418 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
pubWEST(USPT,PGPB,EPAB,JPAB,USOCR); Google(Web); Search terms used: popular high demand usage statistics metric frequency uncommon rare unpopular edge intermediate tier distributed server host catalog library index hash edge intermediate tier secondary auxiliary source provider origin CDN alphabetic hash

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/0064832 A1 (TSUKIDATE et al.) 01 April 2004 (01.04.2004) entire document, especially Abstract; Figs. 5, 11, 16; para [0066]-[0071], [0083]-[0088]	1-22
Y	US 2004/0010588 A1 (SLATER et al.) 15 January 2004 (15.01.2004) entire document, especially Abstract; para [0293]-[0306], [0335], [0410], [0411]	1-22
Y	US 2010/0169772 A1 (STALLINGS et al.) 01 July 2010 (01.07.2010) entire document, especially Abstract; para [0046], [0061]	4
Y	US 2005/0240966 A1 (HINDLE et al.) 27 October 2005 (27.10.2005) entire document, especially Abstract; para [0016], [0044], [0045]	7, 8, 18
A	US 2005/0060493 A1 (KRISSELL et al.) 17 March 2005 (17.03.2005) entire document	1-22
A	US 7,219,153 B1 (DAY) 15 May 2007 (15.05.2007) entire document	1-22

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 January 2012 (08.12.2012)	23 JAN 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: GREGORY DURBIN
POLSINELLI SHUGHART PC
700 W. 47TH ST., SUITE 1000
KANSAS CITY, MO 64112

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	23 JAN 2012
Applicant's or agent's file reference 0137-WO-I1	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 11/51252	12 September 2011 (12.09.2011)	13 September 2010 (13.09.2010)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G06F 15/16 (2012.01)
USPC - 709/203

Applicant LEVEL 3 COMMUNICATIONS, LLC

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

- [X] 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
- [X] Box No. V Reasoned statement under Rule 43*bis*.1(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 66.1 *bis*(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/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 January 2012 (08.12.2012)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Box No. I 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 sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ 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/US 11/51252

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

1. Statement

Novelty (N)	Claims	1-22	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-22	NO
Industrial applicability (IA)	Claims	1-22	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 1-3, 5, 6, 9-17 and 19-22 lack an inventive step under PCT Article 33(3) as being obvious over US 2004/0064832 A1 to Tsukidate et al. (hereinafter 'Tsukidate') in view of US 2004/0010588 A1 to Slater et al. (hereinafter 'Slater').

Regarding claim 1, Tsukidate teaches a method of content delivery in a content delivery network comprising at least a first tier of servers (Fig. 5, 16; para [0066], [0071]), the method comprising: at a first server in the first tier of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library (available content is requested / subscribed at client terminals; para [0069], [0088]); if the resource is not available at the first server or at a peer of the first server, determining if the resource is popular; if the resource is determined to be popular, then the first server obtaining the resource and the first server serving the resource to the client (a level of servers is allocated to content that becomes most popular, i.e., a first level; para [0069], [0083]), otherwise, if the resource is determined not to be popular, directing the client to a second server in a second tier of servers distinct from the first tier of servers (less popular content is stored on a another level or tier where users are directed by a management / center device; para [0066], [0067], [0083]), and the second server serving the resource to the client (para [0071], [0083]), but fails to disclose the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library. Slater teaches the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library as taught by Slater to enhance efficiency.

Regarding claim 2, Slater further teaches the first portion of the content provider's library is distinct from the second portion (para [0335], [0410]).

Regarding claim 3, Slater further teaches portions of the content provider's library are logically partitioned across servers in the second tier (para [0328], [0335]).

Regarding claim 5, Slater further teaches the content provider's library comprises a plurality of content-types, each resource in the library being associated with one of the plurality of content-types (para [0281], [0335], [0411]).

Regarding claim 6, Slater further teaches storing distinct portions of the content provider's library on two or more servers in the second tier, wherein the proportion of content-types on each of the two or more servers is substantially equal, the content-types comprising at least one of audio content, video content, gaming content, and software content (load-balancing content types / categories; para [0410], [0411]).

Regarding claim 9, Slater further teaches the second tier is any intermediate tier between the first tier and an origin server that stores resources associated with the content provider's library (para [0416], [0419]).

Regarding claim 10, Slater further teaches the step of determining whether the resource is popular comprises determining whether a current popularity value for the resource exceeds a popularity threshold (para [0293], [0324]).

Regarding claim 11, Tsukidate further teaches the first tier of servers comprises a first popularity threshold and the second tier of servers comprises a second popularity threshold, and wherein the first popularity threshold is different from the second popularity threshold (para [0068], [0069], [0083]).

--CONTINUED IN SUPPLEMENTAL BOX--

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box No. V. 2. Citations and explanations:

Regarding claim 12, Tsukidate teaches a content delivery framework comprising: a plurality of edge servers forming a first tier of servers (Fig. 5, 16; para [0066], [0071]); a plurality of parent servers forming a second tier of servers, the parent servers being distinct from the edge servers (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071]); and at least one popularity service constructed and adapted to obtain a first set of information from at least some of the edge servers about requests for content (para [0068]), and to provide the edge servers with a second set of information about which tier of servers should handle those requests for content (para [0083]), the popularity service making its determinations based, at least in part, on a measure of popularity of requested content (para [0068], [0083]); and wherein the requested content is available as part of a content provider's library (Fig. 11; para [0068], [0088]), but fails to disclose distinct portions of the content provider's library are logically partitioned across parent servers in the second tier. Slater teaches distinct portions of the content provider's library are logically partitioned across parent servers in the second tier (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include distinct portions of the content provider's library are logically partitioned across parent servers in the second tier as taught by Slater to enhance efficiency.

Regarding claim 13, Slater further teaches a at least one of the parent servers in the second tier comprises a first logically partitioned portion of the content provider's library, the first logically partitioned portion comprising at least the requested content (para [0328], [0335]).

Regarding claim 14, Slater further teaches at least one other parent server in the second tier comprises a second logically partitioned portion of the content provider's library, the second logically partitioned portion being distinct from the first logically partitioned portion (para [0335], [0410]).

Regarding claim 15, Tsukidate further teaches the second set of information further includes identification of a parent server in the second tier that stores a logically partitioned portion of the content provider's library comprising the requested content (para [0071], [0088]).

Regarding claim 16, Slater further teaches the second tier of parent servers is any intermediate tier between the first tier and an origin server that stores the content provider's library (para [0416], [0419]).

Regarding claim 17, Tsukidate teaches a method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers (Fig. 5, 16; para [0066], [0071]), the method comprising: at a first server in one tier of the tiers of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library (Fig. 11; para [0068], [0088]); if the resource is not available at the first server or at a peer of the first server, then selectively redirecting the request from the client to a second tier server, the second tier server being in a tier distinct from the tier containing the first server, the redirecting being based, at least in part, on a current popularity value for the resource (para [0068], [0069], [0083]), but fails to disclose the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion. Slater teaches the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion (to provide different servers for partitioning resources based on popularity for load balancing and maximizing capacity; para [0293], [0306], [0335], [0410]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate to include the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion as taught by Slater to enhance efficiency.

Regarding claim 19, Slater further teaches the second tier of servers is any intermediate tier between the first tier and an origin server that stores the content provider's library (para [0416], [0419]).

Regarding claim 20, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers, and wherein the first server is a parent server in the second tier and the second server is an edge server in the first tier (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071]).

Regarding claim 21, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers, and wherein the first server is an edge server in the first tier and the second server is a parent server in the second tier (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071], [0083]).

Regarding claim 22, Tsukidate further teaches the first tier of servers comprises a plurality of edge servers and the second tier of servers comprises a plurality of parent servers (0 level, i.e., parent level, servers distinct from the subsequent / child edge servers; para [0071, [0083]]), and wherein the plurality of tiers of servers further comprises an origin tier, and wherein the first server is a parent server in the second tier and the second server is a server in the origin tier (relocate new content to servers at 0 / origin levels based on expected / adjustable popularity ratings; para [0068], [0069], [0083]).

--CONTINUED IN NEXT SUPPLEMENTAL BOX--

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 11/51252

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:
Box No. V. 2. Citations and explanations:

Claim 4 lacks an inventive step under PCT Article 33(3) as being obvious over Tsukidate in view of Slater and in further view of US 2010/0169772 A1 to Stallings et al. (hereinafter 'Stallings').

Regarding claim 4, in the combination, Slater further teaches the first portion and the second portion are partitioned across servers in the second tier based on a naming convention associated with each distinct resource in the content provider's library (named category partitioning; para [0330], [0335]), however the combination fails to disclose alphabetically. Stallings teaches parenthetically (to provide more different types of partitioning; para [0046], [0061]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include alphabetically as taught by Stallings for the advantage of providing more flexible storage options.

Claims 7, 8 and 18 lack an inventive step under PCT Article 33(3) as being obvious over Tsukidate in view of Slater and in further view of US 2005/0240966 A1 to Hindle et al. (hereinafter 'Hindle').

Regarding claim 7, in the combination,Tsukidate further teaches resources of the content provider's library are distributed in a manner across servers in the second tier based on values of uniform resource locators (URLs) associated with two or more respective resources in the content provider's library (para [0071], [0335]) and Slater further teaches substantially equal (para [0410]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Regarding claim 8, in the combination, Slater further teaches the step of directing the client to a second server in a second tier is performed in response to a step of using a value to determine which second server in the second tier stores the first portion of the content provider's library (para [0306], [0419]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Regarding claim 18, in the combination, Slater further teaches the step of selectively redirecting the request from the client to a second tier server comprises determining to which second tier server the request should be directed, the determining step using a function to identify a second tier server that stores the first portion of the content provider's library (para [0335], [0411]), however the combination fails to disclose hash values. Hindle teaches hash values (to quickly find propagated content; para [0016], [0044], [0045]). It would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the method of Tsukidate in view of Slater to include hash values as taught by Hindle for the advantage of finding content faster.

Claims 1-22 have industrial applicability as defined by PCT Article 33(4), because the subject matter can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	12019122
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	07-FEB-2012
Filing Date:	21-MAR-2009
Time Stamp:	15:42:24
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	Transmittal Letter	137_US_U1_Supp_IDS.pdf	36210 1bdb51b51d4234b9b11e8ee8095bc0311b2dae60	no	5

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	137_US_U1_SB08.pdf	28610 d1cd127ea98bcf6858f3a49d3d0c39bd90e02347	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Non Patent Literature	2012_01_23_137WOI1_Search_Report.pdf	183645 b90bd63c465952c0b97988419aa1bb67b662b50e	no	3
Warnings:					
Information:					
4	Non Patent Literature	2012_01_23_137WOI1_Written_Opinion.pdf	300905 79e89efbc40fa2a7d1f6300beab37bbe3a4b6263	no	5
Warnings:					
Information:					
		Total Files Size (in bytes):	549370		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Neeraj K.Utreja
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☒ No fee is due.

☐ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☐ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☒ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: February 7, 2012

/JCS/

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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David Fullagar
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	1	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		6157648	Dec 5, 2000	Volt, Eric A., et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]
		EP-0817444A2	Jan 7, 1998	Ebrahim, Z.		
		WO-2000/052594A2	Sep 8, 2000	LACHMAN, R. et al.		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
		, "Extended European Search Report dated December 6, 2011", App. No. 10178695.2, Dkt. No. 0093-EP-C1, , 7 pgs.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 817 444 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.01.1998 Bulletin 1998/02

(51) Int Cl.[6]: **H04L 29/06**

(21) Application number: **97304697.2**

(22) Date of filing: **30.06.1997**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

(30) Priority: **01.07.1996 US 674561**

(71) Applicant: **SUN MICROSYSTEMS, INC.**
Mountain View, California 94043-1100 (US)

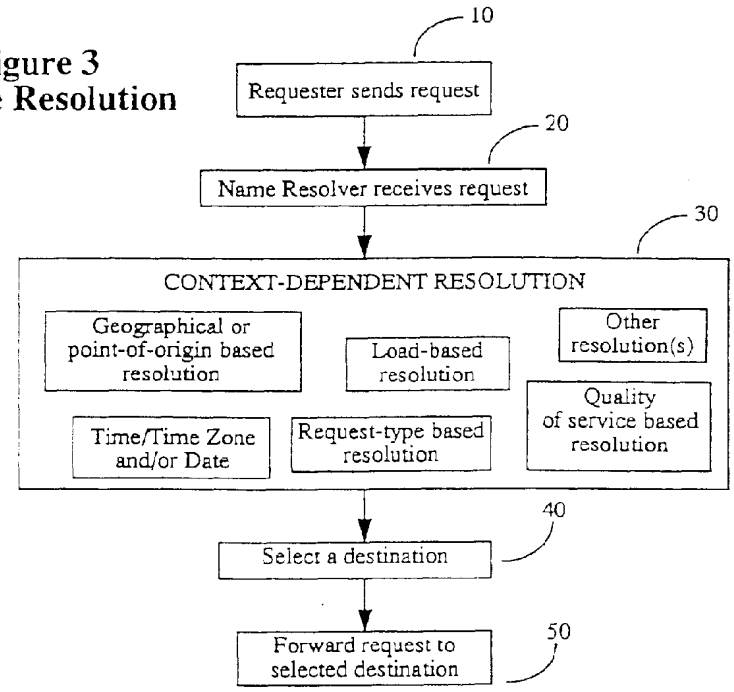
(72) Inventor: **Ebrahim, Zahir**
Mountain View, California 94043 (US)

(74) Representative: **Turner, James Arthur et al**
D. Young & Co.,
21 New Fetter Lane
London EC4A 1DA (GB)

(54) System for context-dependent name resolution

(57) A context-dependent, multiply binding name resolution system. A name resolver is provided, connected to either a requester's system or a receiver's system, or both. Requests to a given service or domain name are resolved to the appropriate IP address. The intended recipient of the request is resolved based upon a combination of one or more predetermined criteria, including: information about the sender (e.g. geographical location, specific requester identity, etc.); information about the intended recipient (e.g. load balance at the receiver, type of service, etc.); information contained within the request itself (e.g. type of service requested); or other information (time of day, date, random selection of recipient, e.g.). The system is implemented in hardware and/or software, and the resolution criteria can be made interdependent or independent.

Figure 3
Service Resolution



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Description

This invention relates to systems for context-dependent name resolution.

In a network (either Intranet or Internet) system, when a host wants to communicate with another host or locate a service or another host on the network, the address is typically resolved in an absolute manner; that is, the naming service of the network resolves a given name to a single IP (Internet Protocol) address. For instance, a domain name service (DNS) call resolves a name to a single IP address or host name on the Internet.

When there are many connections to a given host or service, the resulting congestion degrades the overall performance. The service provider may upgrade the service, e.g. to increase its capacity. In this case, in order to keep the modification of the service transparent to requesting hosts, a demultiplexer may be used, as illustrated by way of example in Figures 1-2. For instance, in Figure 1 a call to Service 3 will be uniquely resolved to that service's IP address and transmitted there accordingly, because there is only a single binding in the DNS name resolver to the host of Service 3. In general, in a conventional system such as that illustrated in Figures 1, 2 and 2A, there will be a single binding between a name and an IP address.

Yet another alternative is for a special type of demultiplexer, which may monitor the traffic, and from the different IP addresses can collect statistics such as response time and/or the load on the corresponding IP hosts, and use this information for load balancing by binding a requested name to an IP address for a host which is less heavily loaded.

If Service 3 is upgraded to include Services 3.1 through 3.Y, then the demultiplexer is added (see Figure 2); the requesting or DNS resolving host resolves the request as usual and sends it out over the (Inter- or Intra-)network, but the demultiplexer is interposed between the network and the service(s), to route the incoming requests to one of the services. Note that in this case, there is still a single binding between the DNS and the demultiplexer.

A problem with this approach is that the demultiplexer acts as a limiting factor on throughput, and additionally represents a single source of failure for all of the services that it serves. A mechanism is needed whereby such a critical point and bottleneck can be avoided, while still providing access to the services for remote users.

An alternative approach to decreasing congestion is through DNS spoofing, where the name resolver is fooled into giving out a different name binding, by keeping the name resolver updated frequently with a new name resolution binding based on some criteria such as load distribution on target servers. An example of DNS spoofing is shown in Figure 2A, in which a requester 2 issues a request using the name "sun.com", and a DNS lookup 4 looks it up. The host (1, 2 or 3) to which the names is bound will depend upon criteria employed at the destination domain, as determined by DNS spoofing service 6. Such criteria may include load on the hosts, their availability, etc. The DNS spoofing service 6 polls the hosts 1-3 periodically or at demand, and binds one of them at a time to the DNS lookup name resolver for the name "sun.com".

In a spoofing service, the criteria used to achieve the binding are not related to the context of the requester; they rely only upon information at the destination. Thus, much information that could be important in making a binding is not utilized. In none of the known systems is caller context used.

It would accordingly be advantageous to have a system which takes into account the context of the requester in the process of name resolution.

Various respective aspects and features of the invention are defined in the appended claims.

A context-dependent name resolution system is presented, which implements predetermined criteria for static or dynamic binding of a "name" to any one of several "objects" of the same type. Which "object" is selected for the binding is determined by a "name resolver" using context information that is explicitly specified by the requestor in a name resolution lookup call to the "name resolver". The "name resolver", which is implemented as a server program, stores a lookup table comprising bindings of a "name" to several different instances of an object, along with "policy" information which defines the criteria for selecting an instance of the object. For instance, the name may be an internet URL of the form "www.sun.com", and the resolved to object may be an IP address of the type 192.146.85.82. Thus the "name resolver" will store the tuple: <www.sun.com> <IP_address_1> <IP_address_2>..., and will store policies on which IP address to bind to www.sun.com when a lookup request specifying "www.sun.com" is received by it.

By enabling multiple binding support in the "name resolver", several advantages are realized. First, the system enables new resources to be added transparently to the caller. When a new server is added to distribute the load for one or more hosts corresponding to the name "sun.com", for instance, the IP address for the new server is simply added to the tuple in the name resolver, along with any desired policy criteria, e.g. to use only between 9 a.m. and 5 p.m.

Secondly, the fundamental limit to scaling which is inherent in today's single binding systems is removed, by enabling multiple destination servers providing the same service to be referenced by the same "name" handle by the caller (for example "sun.com"), and the name to be resolved by the name resolver to different physical computers servers, depending upon caller context. Many instances of the name resolver may be running on different physical computers, and many instances of the services may be running, and the requester will ac-

cess the name resolver closest to him; and the resolved object that is closest to the requester or that can best serve the request (based upon some selected or predetermined criteria) will be bound to the request, all transparently to the requester. Another advantage of the system of the invention is that it allows resources to be easily replicated transparently to the user, eliminating any single point of failure in the network or at the service end point. If one valid destination fails, is not responding or is overloaded, the name resolver is already capable of binding a "name" to multiple destinations, and the unavailable destination can be disabled in the name resolver's internal tables, using administrative means.

The context that may be used as a basis for the binding is variable; it may include information about the requester (e.g. requester IP address, domain name or inferred geographical region), about the destination (with similar alternatives), about the request itself (e.g. type or quality of service requested), or about independent information (e.g. time of day or time zone of the point of origin of the request).

The system may be implemented (eg as part of a computer apparatus) using hardware, software, or combinations thereof.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figures 1-2A are diagrams of present network systems used for destination addresses for requests.

Figure 3 is a flow chart illustrating a method according to an embodiment of the present invention.

Figures 4 and 5 are diagrams of network systems incorporating features of embodiments of the present invention.

Figure 6 in an illustration of the operation of an embodiment of the invention using geography-based resolution criteria.

Figure 7 is a diagram depicting zones in which domain name service resolvers and service location resolvers of the invention may be located.

A method according to the invention is illustrated in Figure 3, and Figures 4-5 shows a suitable systems implementable on the Internet or WorldWide Web, the Internet or an Intranet,, incorporating features of the name resolution system.

Name resolution can include any kind of name resolution lookup for binding one object to another. This includes binding the name of a service to a host computer (or its IP address) that provides that service, and binding the type of service to the name of a service providing that type of service. It also includes resolving a name in one domain to another name in the same domain, and to another name in a different domain. For the purposes of this invention, the terms "service" and "host" can be considered synonymous, as can "service location" and "host location".

The system includes three fundamental features that can be implemented singly or in any combination with one another: multiple binding of destination addresses to names; caller context name resolution in connection with such multiple binding; and name resolution policy considerations, i.e. independent criteria upon which such resolution is based.

Name Resolution : An Example

An example of name resolution occurs, for instance, when a user wishes to view video, e.g.a movie, on his or her computer. An application running on the computer is used to make a procedure call to the name resolver to determine which server can serve a movie, e.g.

service_handle = name_service_lookup("movie")

where the string "movie" is passed to a server, which then returns the name of the service providing that movie (or it may return a linked list of services providing movie services, from which the user may be prompted to select one).

The server may, by way of example, return a single service name (e.g. "quicktime") in the variable called "service_handle". Next, the application must determine which server host can provide this service to this client; to do this, it makes another name resolution call:

host_handle = name_hostname_lookup (service_handle)

and passes it the variable "service_handle" returned by the previous call. This call returns it the name of a server which is listed as offering this service.

The network location of this server must now be determined, so that the user's computer or workstation can connect to it to get the movie service, and so it makes the call:

host_IP_address = nome_hostaddress_lookup (host_handle)

and finally obtains an IP address of an appropriate host that can provide the movie service to the user.

Further calls to this quicktime server may determine a list of movies that are available. Alternatively, a design may be had in which the caller simply specifies the name of the movie he wants to see, and the name lookup returns to the caller the IP address of a host that is currently able to serve the requested movie to the caller.

All of or some of the above steps may be combined in more integrated calls to the name resolver.

In the present invention, in addition to the above, an additional parameter is passed to the name_hostaddress_lookup() function above (or to all the functions above); this parameter may be called the caller_context. This caller_context is used by the name resolver to help it decide which IP address to use. Thus, the calls would look like:

host_IP_address = name_hostaddress_lookup (host_handle, caller_context). Caller_context is a cookie (or structure) that may include information such as the caller's IP address, its point of origin, the quality of the requested service, or any other context that might be

relevant. These contexts must be well specified and their format(s) standardized, so that many different name resolvers can interoperate properly. The particular caller_context formats and contents selected are not themselves crucial,

The present embodiment uses requester context-dependent intelligence to determine which of several destination hosts should be utilized, or in other words, which of several IP addresses should be used to resolve a given "name" request. The context-dependent intelligence, implemented as hardware or software or a combination of both, allows the "name" resolution to be based upon some context information from the requestor, and/or upon the "name" being resolved in a context-free manner, but optionally dependent upon criteria such as load balancing on the destination.

As shown in Figure 4, a requesters 100-120, of which there may be an arbitrary number, each comprise computers or workstations on a local network, served by a server 150. The requesters will typically be conventional workstations, personal computers, or any networkable computing device, with local processors (130, etc.), memory (140, etc.), mass storage (not shown) and network connections. The server 150 also includes a conventional processor 160, memory 170, mass storage and necessary connections and control hardware and software.

A name resolver 180 forms part of the server 150, or may be a separate unit. It may be implemented entirely in software, i.e. as program modules stored in mass storage and/or the memory 170, or it may be a stand-alone device, with its own logic or processor and memory, as desired.

The server 150 is connected to a broader network 170, such as the Internet, an Intranet or WAN (wide-area network), or the WorldWide Web, via a network connection (e.g. a T-line) 260. On this network 170 is optionally another name resolver 200, which may be implemented in the same fashion or differently from the name resolver 180. Name resolvers 180 and 200 may both be used, or either may be used by itself. (See discussion of Figure 7, below.)

Destination hosts 210-230 may also be conventional computers or workstations with processors (such as 240), memory (such as 250), mass storage (not shown), network connections, etc., as needed to implement conventional network functions in addition to the features of the present invention.

Referring to the flow chart of Figure 3, when a requester (such as 100-120) sends a name resolution request to a name resolver 180, instead of the single binding of conventional systems, the name resolver 180 includes multiple binding tables and/or functions (implemented by appropriate logic or program modules) to resolve the request to an appropriate IP address for a destination host (such as 210-230 in Figure 4).

An example of such a multiple binding would be the binding of multiple, geographically disparate destinations to a single domain name. If, for instance, a user in Germany wishes to access www.sun.com (the WWW server for Sun Microsystems, Inc.), he or she can simply use the Uniform Resource Locator (URL) "http://www.sun.com"). Thus, the user sends the request from requester 310 (see Figure 6), and the name resolver 320 determines that the requester is in Germany. (See step 20 in Figure 3). The selected destination may either be in the United States or elsewhere in Europe, since Sun Microsystems in this example has two "sun.com" locations. Since there is a valid European local destination 330, the name resolver 320 resolves the destination address to sun.com (Europe), as indicated at box 30 of Figure 3. This resolved destination is then selected for the request packet(s) (box 40 of Figure 3), and the request is forwarded to sun.com (Europe) (box 50 of Figure 3).

Following are lists of context-dependent resolution criteria applicable to the invention and usable at box 30 of Figure 3, where resolution may be based upon requester information, destination information, request contents, or other information:

A. Resolution Based Upon Requester Information

Examples of manners in which the resolution dependent upon requester information may be carried out include:

1. resolution based upon the domain name of the sender;
2. resolution based upon the inferred (looked-up) actual geographic region of the sender;
3. resolution based upon other geography-related information of the sender:
    4. either directly ascertainable from the request (city/country info, e.g.); and/or
    5. indirectly ascertainable (area code, address, etc.);
6. resolution based upon quality of service desired by the requester; and
7. resolution based upon requester's time of day or time zone.

B. Resolution Based Upon Destination Information

Examples of manners in which the resolution dependent upon a specified or intended destination or receiver information may be carried out include:

1. resolution based upon the load at the receiver;
2. resolution based upon the inferred (looked-up) actual geographic region of the receiver;
3. resolution based upon other geography-related information of the receiver:

4. either directly ascertainable from the request (city/country info, e.g.); and/or
5. indirectly ascertainable (area code, address, etc.).

Criterion B.1 can be resolved either based upon information as perceived at the sender end or based upon information as it exists at the receiver end, and resolved at the sender end. For example, the sender might frequently send requests to a particular server, service, geographical region or organization. In this case, it may be advantageous to regularly poll one or more often-used destinations to determine their level(s) of activity. Alternatively, such polling could automatically be carried out for any destinations for which the sender determines that its number of requests exceeds a certain threshold, or for a top predetermined percentage of requests sent by the requester (e.g. all destinations for which the number of requests exceeds N1%, or the top N2 destinations to which the sender makes requests, where N1 and N2 are appropriate predetermined numbers). Polling can be implemented as program modules integral to the name resolver(s), either entirely in one or in more than one location (e.g. partially in a local name resolver and partially in the destination server).

Alternatively or in addition, criterion B.1 may be based upon information at the receive end at the time of sending the request, and resolved at the receiver.

C. Resolution Based Upon Request Contents

1. type of service requested;
2. specific information (or type of information) requested;
3. any other implicit information inferred from the request; and/or
4. any other explicit information obtained from the request.

D. Resolution Dependent Upon Other Factors

1. randomly generated selection of destination based upon qualified list; and/or
2. other independently developed information.

These resolution criteria can be used singly or in any desired combination with one another, as specified by the requester or the administrator of the destination (e.g. server owner or service provider). For instance, in the example of Figure 6 the resolution of the destination address to sun.com (Europe) could be modified if the load of sun.com (Europe) is larger by some predetermined threshold amount than the load at sun.com (USA) -- in which case the sun.com (USA) resolution could override the default sun.com (Europe) resolution for requesters in Europe, either at all times or only during peak European hours, which correspond to off-peak hours in the United States.

An extension of this system is in the resolution of services provided at the receiver network of a request. For instance, a given organization may have many database servers, and request for access to given information may in conventional systems be routed to the same server, because of the single binding nature of destination resolution. With multiple address resolution binding, multiple database servers (or other destination hosts) such as 210, 270, 280, etc. (see Figure 5) may be made available under a single name, in which case a local service resolution server, such as server 300 in Figure 5, is provided. The server 300 includes tables, program modules or the like as desired to resolve a request to any one of several to many IP addresses. The selection of a given server to receive a request can depend upon, for example, load at each of the servers.

In general, the resolution systems or subsystems will be in one of three "zones" (see Figure 7): the sender's zone 1 (up to, e.g., the sender's firewall or Internet server); the name resolver system's zone 2 (which may be at a server on the Internet, or any place outside zone 1 which is not in the receiver's system; and the receiver's zone 3. Service location name resolvers may be in any of zones 1-3; typically, destination lookup name resolvers, which may comprise multiple-binding domain name services (DNS's), will be in either zone 1 or zone 2. It will be understood that zones, for the purpose of this application, are administrative boundaries, and need not correlate to actual network boundaries.

The present embodiment can interact with existing systems in a number of ways. For instance, in secure systems where the source address is stripped from the request by a firewall (and only, e.g., the domain name remains), then the entire source address would not be used to resolve the destination; the name resolver is provided with the program instructions or circuitry to implement this. Note also that the DNS name resolution may be a distinct operation from service location, and thus the destination can be selected due to a combination of considerations including source address, requested destination address, and request contents, including the type of request made or service requested.

The multiple binding feature of the invention allows a single name, Internet address (e.g. URL address such as http://www.sun.com) or the like to represent as many actual servers (or services) as desired. This has a distinct advantage of allowing modifications, upgrades or replications to be made to the destination server(s) without modification of the destination address or service name as used by the requester. Such modifications may include adding servers or services, or establishing a mirror site at a location geographically near a large source of requests, etc.

There may be security and consistency implications of multiple bindings, with concomitant solutions. If a destination address can be multiply bound, a name resolver may be configured to bind to an incorrect address, either deliberately or otherwise. While this may also be a prob-

lem with existing single binding, multiple binding may complicate detection of the problem. Thus, the system of the invention may be combined with programs and tables for verification that a given binding is valid. Very secure systems may wish to limit their multiple binding to a predetermined, fixed number of resolution possibilities, or even maintain the current system of single binding as far as Internet or Web transmission is concerned, and implement multiple binding only behind a firewall. Alternatively or in addition, encryption and digital signatures may be used to ensure validity of bindings, and of modifications or additions to the bindings.

Variations may be had by designating a given name resolution as a default resolution, and utilizing alternative resolutions only upon the request meeting predetermined criteria (such as load imbalance, geographical distance, specific sources of the request, etc.).

Additional bindings (i.e. additional addresses to which a request may resolve) may be added without the requester being aware of it, and indeed substitutions may be made at any time, again transparently to the requester.

F. Service Selection Based Upon Caller Context

The system of the invention may be applied more generally to the use of caller context for name resolution. Context about the requesting user (e.g. in a variable called "caller_context") can be passed to appropriate functions, such as:

service_handle = name_service_lookup("movie", caller_context)

host_handle = name_hostname_lookup (service_handle, caller_context)

Here, the function service_handle executes a service name lookup based upon the input "movie", as well as the information in the variable caller_context, outputting the value service_handle. Given this output as input, along with (again) caller_context, the function host_handle then returns an appropriate host name.

An example of a possible such situation could result when a user desires an encryption service, and several encryption policies are available. The service_handle function can be configured to return different encryption algorithm services based upon the specified destination (which is specified in caller_context), or there may be an effective override in the caller_context by which the user can select a higher level of security.

In general, as noted above, the invention may be implemented at the sender's system or at the destination system, or indeed at points in between (e.g. at proxy servers). Note that single points of failure and bottlenecks are removed using the present system, and a truly distributed, multiply binding name resolution system is achieved.

Particular and preferred aspects of the invention are set out in the accompanying independent and dependent claims. Features of the dependent claims may be combined with those of the independent claims as appropriate and in combinations other than those explicitly set out in the claims.

Claims

1. A system for name resolution of at least one request directed to a destination name of a receiver and issued from a requester system, including:

   a name resolver connected to the requester service and including

   predetermined information correlating a plurality of destination addresses with said destination name;

   a criteria selection subsystem configured to provide a selection of at least one said destination address based upon at least one predetermined criterion; and

   a destination address binder configured to bind said destination name with said selected destination address.

2. The system of claim 1, wherein said at least one predetermined criterion includes a criterion based upon information explicitly contained within said request.

3. The system of claim 2, wherein said information includes an address of said requester.

4. The system of claim 2, wherein said information is based upon at least a portion of contents of said request.

5. The system of claim 4, wherein said portion of said contents includes at least one of:

   a type of service requested by said request; and

   a quality of service requested by said request.

6. The system of claim 1, wherein said at least one predetermined criterion includes a criterion based upon information not explicitly contained within said request.

7. The system of claim 6, wherein said information pertains to a geographical region of said requester.

8. The system of claim 6, wherein said information pertains to a geographical region of said receiver.

9. The system of claim 6, wherein said information includes load information relating to said receiver.

10. The system of claim 6, wherein said information includes at least one of time and date information.

11. The system of claim 1, wherein said binding is to a port at said destination address.

12. The system of claim 1, wherein said binding is based at least in part upon a random selection of one said destination address.

13. A method for context-dependent binding of a destination name to a destination address in a name resolver having a predetermined set of binding criteria and predetermined correlations of destination names with destination addresses, wherein at least one said correlation is a multiple correlation correlating a plurality of said destination addresses with a single destination name, including the steps of:

(1) receiving said request at said name resolver; and
(2) based upon said multiple correlation, retrieving at least one said destination address from said plurality of destination addresses.

14. The method of claim 13, further including after step 2, the step of:

(3) binding said retrieved destination address to said destination name.

15. The method of claim 14, further including after step 3, the step of:

(4) transmitting said request with said destination address.

16. The method of claim 13, wherein said multiple correlation is based upon information explicitly contained within said request.

17. The system of claim 13, wherein said multiple correlation is based upon at least a portion of contents of said request.

18. The system of claim 13, wherein said multiple correlation is based upon at least one of:

an address of said requester; and
a type of service requested by said request; and
a quality of service requested by said request.

19. The system of claim 1, wherein said multiple correlation is based upon information not explicitly contained within said request.

20. The system of claim 19, wherein said multiple correlation is based upon at least one of:

a geographical region of said receiver;
load information relating to said receiver;
time information;
date information; and
a random factor generated by said name resolver.

21. A system for name resolution of at least one request directed to a destination name of a receiver and issued from a requester system, the request information relating to caller context, the system including:

a name resolver connected to the requester service and including

predetermined information correlating a plurality of service names with said caller context;
a service selection subsystem configured to provide a selection of at least one said service name based upon said caller context; and
a host name selection subsystem configured to return a host name based corresponding to said selected service name.

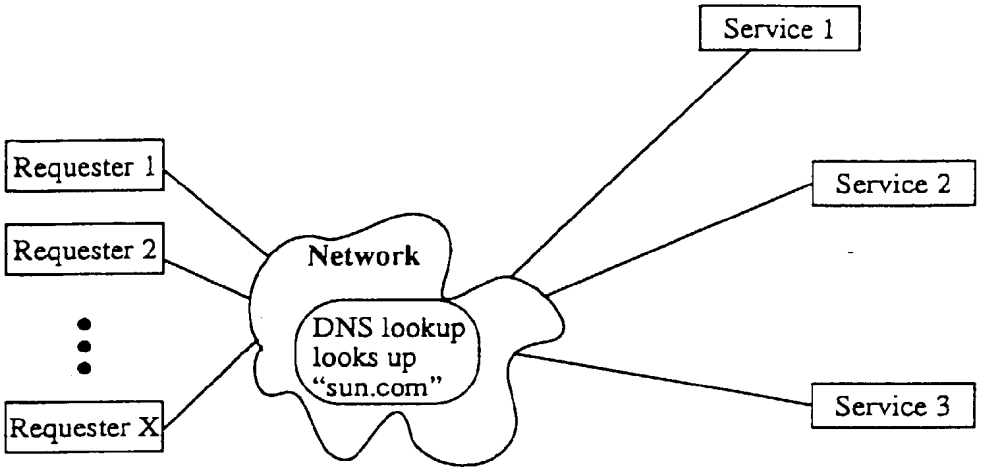
22. The system of claim 1, wherein said at least one predetermined criterion includes:

a first criterion based upon information explicitly contained within said request; and
a second criterion based upon information not explicitly contained within said request.

23. The system of claim 22, wherein said second criterion corresponds to a predetermined policy used by said name resolver.

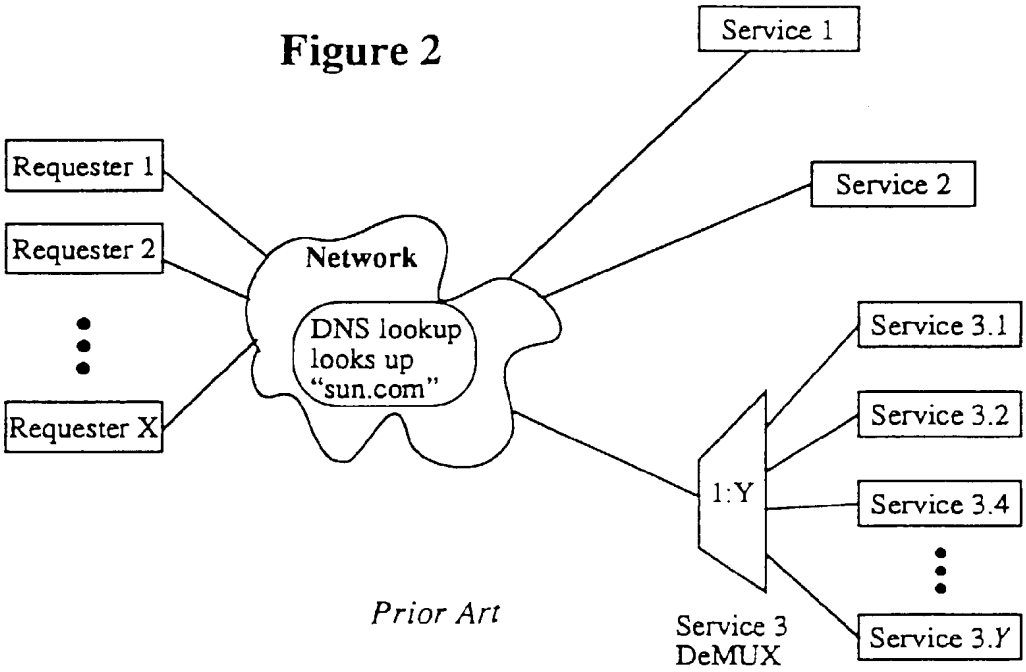
24. The system of claim 23, wherein said first criterion corresponds to information relating specifically to said requester system.

Figure 1



Prior Art

Figure 2



Prior Art

Figure 2A

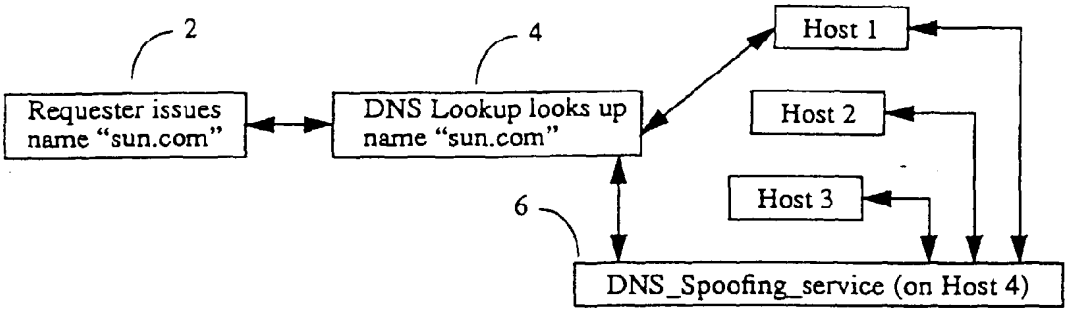


Figure 3 Service Resolution

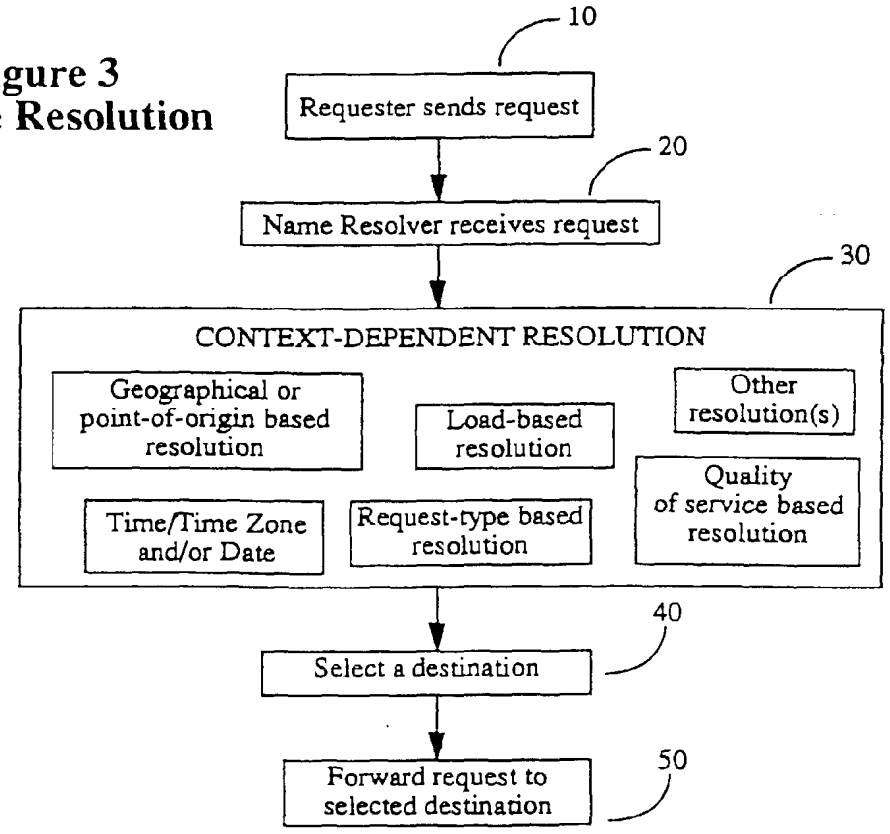


Figure 4

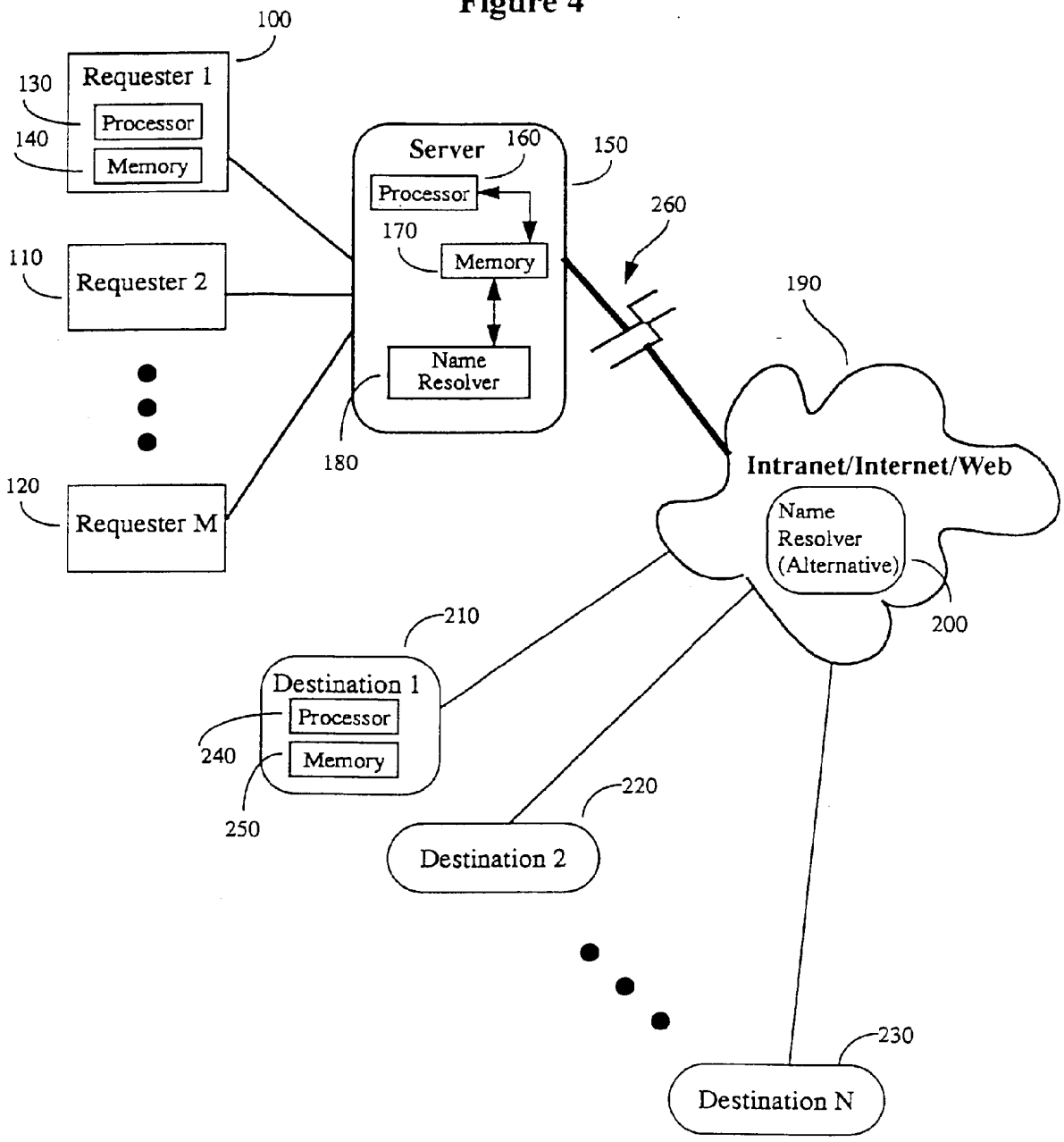

100
Requester 1
130
Processor
140
Memory
110
Requester 2
120
Requester M
Server
160
150
Processor
170
Memory
Name Resolver
180
260
190
Intranet/Internet/Web
Name Resolver (Alternative)
200
210
Destination 1
Processor
240
Memory
250
220
Destination 2
230
Destination N

Figure 5

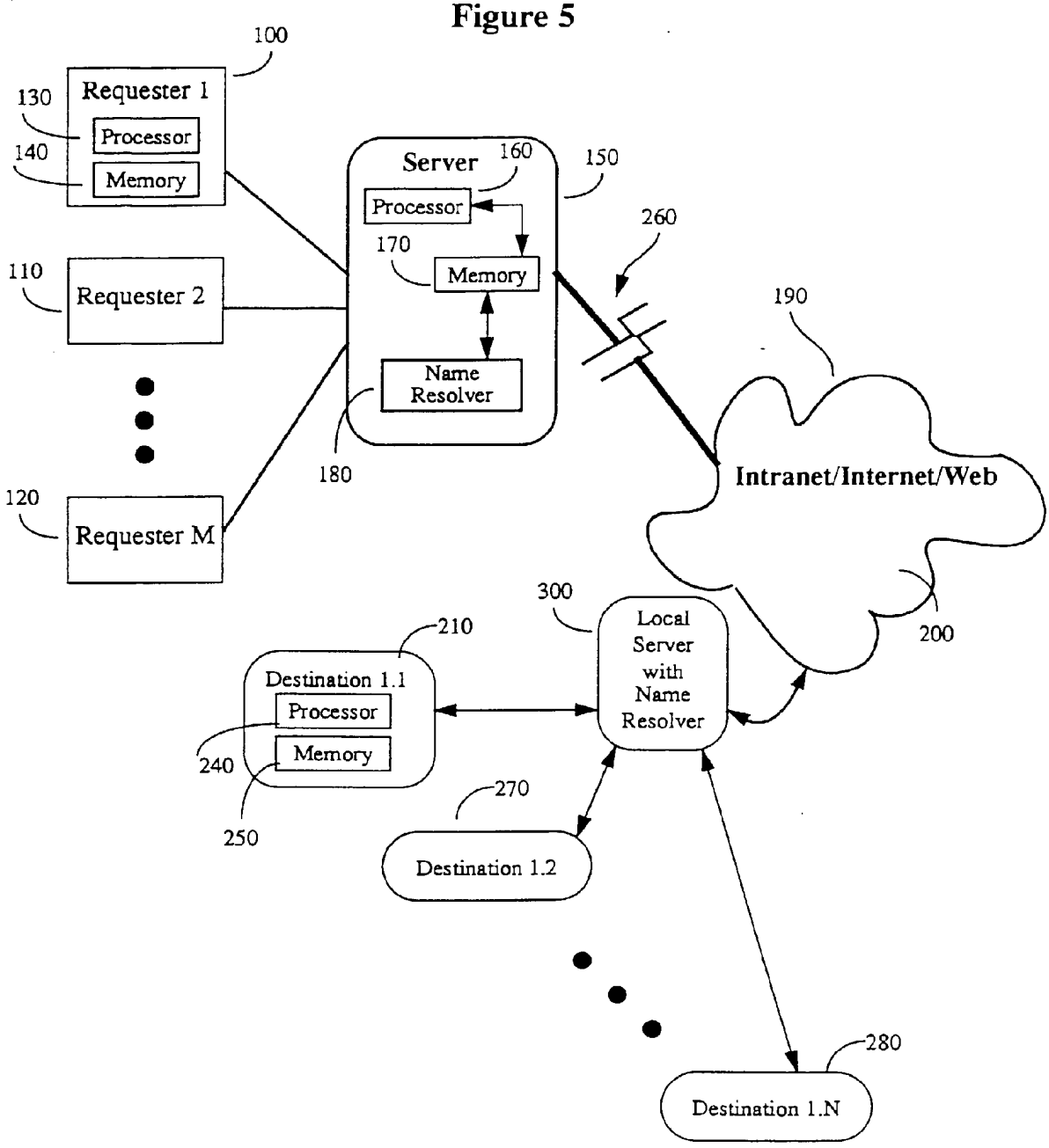

100
Requester 1
130
Processor
140
Memory
110
Requester 2
120
Requester M
Server
160
150
Processor
170
Memory
Name Resolver
180
260
190
Intranet/Internet/Web
200
300
Local Server with Name Resolver
210
Destination 1.1
Processor
Memory
240
250
270
Destination 1.2
280
Destination 1.N

Figure 6

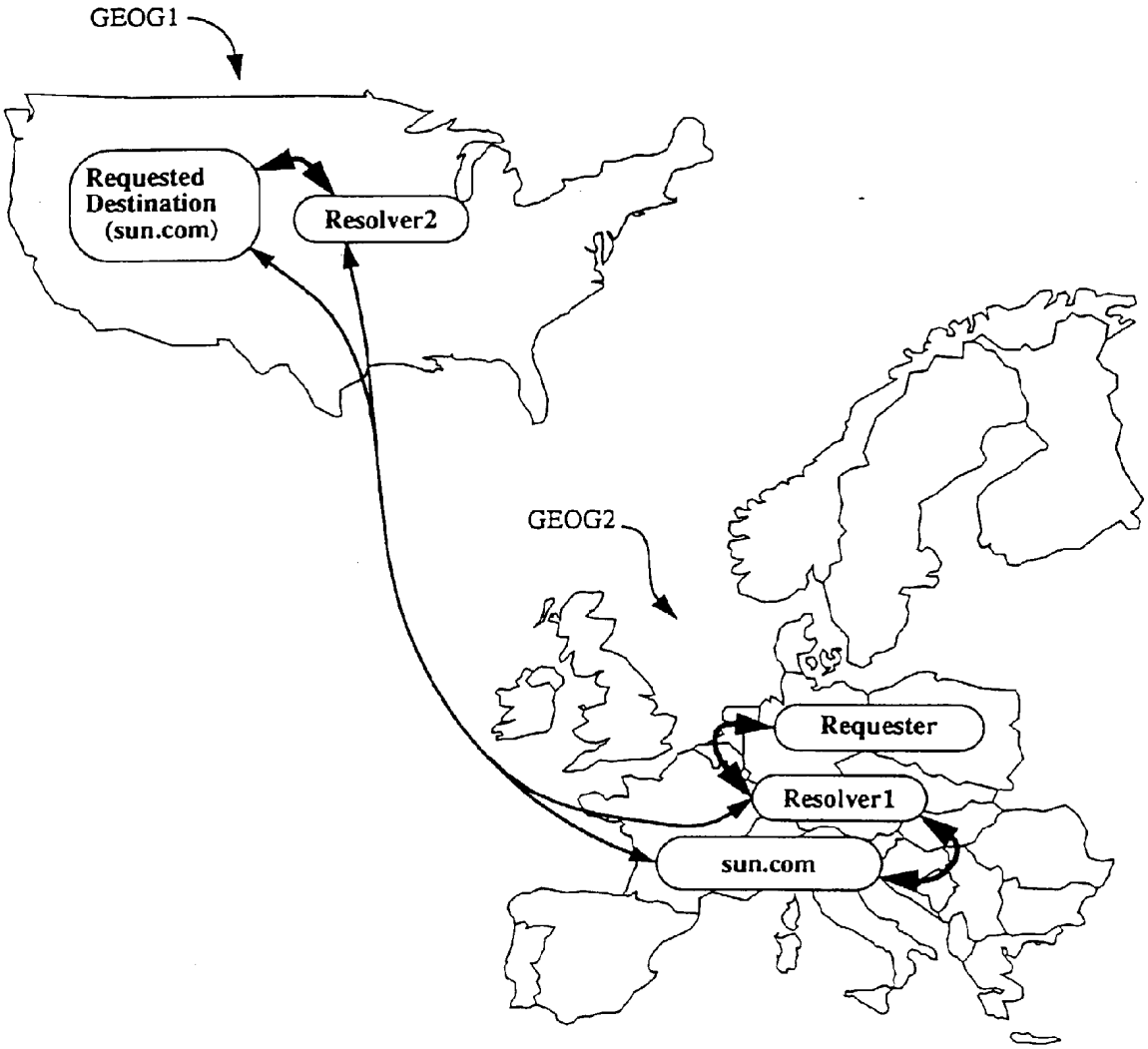

GEOG1
Requested Destination (sun.com)
Resolver2
GEOG2
Requester
Resolver1
sun.com

Figure 7

Zone 1 SENDER	Zone 2 RESOLVER SYSTEM	Zone 3 RECEIVER
Service Location Resolver1	Service Location Resolver2	Service Location Resolver3
Destination Lookup1	Destination Lookup2	

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(57) Abstract

A domain name server (DNS) system for processing domain name requests includes a query mechanism constructed and adapted to obtain a user request for response information corresponding to a particular domain name; and provide complete response information in a single response to the user request. The user request may be a domain name resolution request and the query mechanism provides an Internet Protocol (IP) address corresponding to the domain name. A different response may be provided, depending on context information. The system may include an Internet protocol processor and an underlying database repository. The system incorporates a database layout and associated database query strategy that may comprise multiple components which significantly reduces the transaction processing time and overhead as compared to conventional implementations.

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SCALABLE AND EFFICIENT DOMAIN NAME RESOLUTION

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BACKGROUND

1. FIELD OF THE INVENTION

This invention relates generally to enhanced domain name servers, and more particularly, to efficiently processing domain name queries in a network such as the Internet.

2. BACKGROUND

The Internet has brought about an information revolution through the development of computerized information resources, on-line services and the World Wide Web (WWW). The Internet is growing rapidly, with an ever increasing number of computers and users being connected to the Internet daily.

In order for devices (computers, printers, and the like) on a network such as the Internet to be able to communicate with each other, the devices need to know (or be able to determine) each others' addresses. Many distributive systems (e.g., the Internet) assign device names in the distributive system by a hierarchical naming scheme known as domain names. An Internet domain name is generally a sequence of domain labels separated by periods. For example, "a.ultradns.com" is a domain name where "com" is a top level domain name of a top level domain, "ultradns" is a

second level domain name of a second level domain and "a" is a third level domain name of a third level domain. A device in a domain is labeled by the name of the device followed by the domain name. Thus, a device labeled "server" in the "a.ultradns.com" domain has the name, "server.a.ultradns.com". A device name is also referred to as a domain name. The Domain Name System (DNS) is a distributed hierarchical database comprised of client/server transaction servers that provide a mapping from domain names to associated information, e.g., to IP addresses.

While domain names partition a distributive system in a logical and hierarchical manner, messages are transferred between devices of the DNS by identifying devices using specific IP addresses. In the present Internet protocol, IP addresses are thirty-two-bit numbers that are expressed as four eight-bit values (i.e., four numbers in the range 0 to 255) separated by periods, e.g., "121.121.122.2". IP addresses contain information such as a network identifier ("ID") of a device network connection and a device ID. IP address are assigned by an address authority. The addresses are assigned in blocks to authoritative address servers.

A comprehensive description of the operation of domain name servers and IP addresses is given in *DNS and BIND In A Nutshell,* Paul Albitz and Cricket Liu, O'Reilly & Associates, 1994, ISBN: 1-56582-010-4, which is incorporated herein by reference.

IP addresses also relate to each other in a hierarchical manner. Thus, the DNS also provides a "reverse mapping" of IP addresses to domain names, by using a representation of the IP address that follows the DNS indexing model. However, the domain name hierarchy and the IP address hierarchy are not directly related to each other. While some name servers are also address servers, name and address servers do not have to be the same device. Thus, it is possible for a server to have authority to

resolve a domain name into a corresponding IP address of a device, the same name server may not be able to resolve the IP address to the corresponding domain name of the same device. Thus, resolution of IP addresses to domain names follows a similar process as resolving domain names to IP addresses except different servers may be involved.

Because IP addresses are numerical and, unlike domain names, are assigned without regard to the logical and hierarchical organization of the DNS, domain names are generally used in instructions for functions such as data transfers. Thus, a data transfer instruction identifies the receiving device by its domain name. However, the domain name must be translated into a corresponding IP address before the data transfer can occur.

Domain names are managed by authoritative devices called name servers. That is, domain name servers perform the task of converting names to IP addresses. Name servers translate domain names into corresponding IP addresses and vice versa. When a first device desires to transfer a message to a second device known only by its domain name, the first device must query a name server to acquire the corresponding IP address to the known domain name of the second device.

It is estimated that by the year 2003, the number of domains on the Internet will increase ten-fold, exceeding 150 million domains. Associated with this increase in the number of domains will be an increase in user dissonance. Current implementations of the Domain Name System are entirely inadequate and unable to handle resultant DNS files' size or the magnitude and frequency of changes to these DNS files. Even today, real problems exist with content access and/or content distribution over the Internet. It is estimated that ten to thirty percent of Internet connection events are unsuccessful or unsatisfactory.

SUMMARY

The present invention provides a scalable and flexible platform for providing global directory services. In some embodiments, the invention uses redundant information servers to provide ubiquitous and high-performance access to directory services. This system of servers leverages the scalability and replication mechanisms provided by commercial database software. The DNS according to the present invention has an underlying modular design which allows additional wire-protocol services to be easily incorporated into the system, and allows additional modules to provide intelligent/dynamic responses by affecting changes in the data repository.

In various aspects, the present invention:

- Supports large-scale service model better than alternative DNS servers.
- Integrates other Internet services, e.g. "whois", in a single data repository.
- Multi-threaded server provides scalability to exploit commercial-level hardware.
- Modular database implementation facilitates the addition of new features.
- Database replication provides for ease of management of distributed servers, and database backup features provide information integrity.

Globally distributed server replicas provide the reliability, throughput and low delay required to scale a large commercial service. The servers are tied together using advanced Internet routing mechanisms that are reactive to the state of individual server replicas.

Multiple servers provide increased system throughput, reliability in the event of server failure, reliability in the event of provider network failure and nearest server mechanics serve as basis for advanced redirection service.

Embodiments of the present invention provide a DNS system based on an information-centric design, where multiple system components interact with system state that is maintained in the database. The database provides both the principle Internet information, and the required associations and configuration to specify the operation of the active components. The system allows for reduced operational staff requirements by supporting custom user-interface for direct management of user data, with integrated security and data validation to maintain data integrity.

The present invention also provides:

- Information update via multiple user-specific custom interfaces, program APIs, or Internet services such as dynamic DNS updates.
- Fine-granularity security based on association between login and information objects.
- Modular active components for reporting, billing and data integrity checking.

In one aspect, this invention provides a system for processing domain name requests. The system includes a query mechanism constructed and adapted to (a) obtain a user request for response information corresponding to a particular domain name; and (b) provide complete response information in a single response to the user request. The user request may be a domain name resolution request, in which case the query mechanism provides an Internet Protocol (IP) address corresponding to the domain name. The system accommodates user requests for other typed DNS data.

In some embodiments the a query mechanism is further constructed and adapted to provide the response depending on context information. The context information may include at least one of (a) context information from the request; (b) context information from the system; and (c) global context information.

The context information may include address information indicating an address of the user; the local time; and/or the location of the system.

In some embodiments, the system has a data cache and the query mechanism is further constructed and adapted to, upon receipt of a user request, first attempt to find an answer to the user request in the data cache.

In some embodiments, the query mechanism is further constructed and adapted to (a) if the answer exists in the data cache and the answer is fresh, send the answer directly from the cached data; and (b) if the answer exists in the data cache and the answer is stale, or if the answer does not exist in the data cache, then acquire the answer from a database; send the answer; and update the data cache to reflect the acquired answer.

Sometimes items in the data cache have a maximum lifetime which ranges from the time to live of the lowest resource record in a complete answer to the maximum cache time value configured for the system as a whole.

In some embodiments, the query mechanism is further constructed and adapted to implement negative caching such that if a request is made for a host that does not exist in an active domain, the negative response will be saved in the cache.

In another aspect, this invention is a method of providing an Internet Protocol (IP) address of one of a plurality of devices on the Internet. The method includes obtaining a user request for an IP address corresponding to a particular domain name; and providing the IP address in a single response to the user request. The method may include providing the IP address depending on context information. The context information may include at least one of (a) context information from the user request; (b) local context information; and (c) global context information.

In yet another aspect, this invention is a system comprising a network of distributed Domain Name Servers (DNSs), each DNS comprising a database; and a query mechanism constructed and adapted to obtain from the database a user request for response information corresponding to a particular domain name; and to provide complete response information in a single response to the user request. The databases in the network are replicated.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which the reference characters refer to like parts throughout and in which:

FIGURE 1 provides an overview of embodiments of the present invention operating within the Internet; and

FIGURE 2 depicts the logical structure of the database schema according to embodiments of the present invention.

DETAILED DESCRIPTION

With reference to **FIGURE 1**, a Domain Name System (DNS) server **100** (DNS_1) according to the present invention comprises a database **102** having a unique database schema and a complementary unique SQL interface **104**. A query mechanism **106** uses the SQL interface **104** to query the database **102** and to return results to requesting users, e.g., user **108**.

The present invention can be considered at two levels, namely at a server level (e.g., *DNS*$_1$ **100**) and at a system level (e.g., *DNS*$_1$, *DNS*$_2$, ..., *DNS*$_n$).

1. **Server-level**: At the server level, this invention provides mechanisms that enable a DNS server (e.g., *DNS*$_1$ **100**) according to the present invention to

achieve sufficient performance (circa thousands of queries/second) even though the underlying data repository supports basic data retrieval at a rate of hundreds of queries/second.

Features of this server level, discussed below in detail, include:

- Aggregate database queries
- Common case optimizations
- Data caching (and consequently-required cache invalidation mechanisms)

2. **System-level**: At the system level, this invention provides mechanisms that enable a system of DNS servers (e.g., DNS_1, DNS_2, ..., DNS_n in **FIGURE 1**) to provide enhanced/integrated management of information, and provides various levels of performance enhancement for incoming queries and internal transactions.

Features of this system level, discussed below in detail, include:

- Modular data-centric design
- Database-layer synchronization
- Single IP address announcement of replicated servers

The server-level mechanisms according to the present invention enable the DNS server to achieve a greater transaction throughput rate. The system-level mechanisms work synergistically, and allow the DNS System according to the present invention to provide a diverse set of features and benefits.

The server-level mechanisms according to the present invention enable the modular data-centric design and database-layer synchronization.

SERVER-LEVEL MECHANISMS

A name server response to a DNS query requires a complex set of calculations that allow:

(a) different responses to be returned depending on the servers authority,

(b) different answers depending on the existing domain name data, and

(c) the server to return an answer comprised of multiple inter-dependent sections.

Specifically, a DNS's response algorithm must consider at least the following:

- Three response sections: *Answers*, *Authority*, and *Additional*
- CNAME (domain name alias) dereferencing
- Wild card matching (matching of leading superstrings)
- Iterative domain name search (matching the longest recognized domain name)

Conventional (prior art) DNS servers make many distinct queries to the data repository in order to determine the correct records to include in a response. Consequently, the transaction rate of the DNS server will be reduced by a similar factor (e.g., if eight database queries are required, transaction rate will be reduced by approximately a factor of eight). The DNS server according to the present invention significantly reduce the average number of queries required to construct a DNS response, as compared with conventional so-called "straight forward" algorithms that depend on many distinct queries to the data repository.

Aggregate Database Queries

The DNS server according to the present invention uses compound database queries so that a single query can return multiple component records required to construct a DNS response. Moreover, database queries are correlated so that in instances where multiple queries are required, subsequent queries can be optimized

based on records retrieved by earlier database queries. The DNS query strategy according to the present invention:

(a) retrieves combinations of *Answer*, *Authority*, and *Additional* records in a single query,

(b) retrieves available CNAME records along with *Answer/Authority/Additional* records, and

(c) reduces iterative domain name search overhead by correlating records from different iterations.

With this invention, the number of database queries required to construct a complete DNS response can be as low as one. This is a considerably improvement when compared to a similar strategy based on simple database queries that would require a separate query for each of *Answers* and *Authority*, and multiple queries for *Additional* records.

Common Case Optimizations

In general, common case optimizations are effective in systems where there are a number of distinct potential outcomes (a) with different probabilities of occurrence, (b) requiring varying levels of incremental overhead, and (c) where a determination can be made that a specific outcome has been reached, without an exhaustive outcome analysis.

The present invention recognizes that common case optimization is applicable to the DNS server database query strategy, and has identified two specific optimizations based on knowledge of DNS protocols and the expected incoming query stream. The DNS system according to the present invention implements these optimizations by making the test for (and handling of) each case a separate code segment, and promotes this code to handle the task prior to the execution of any general query code.

Case #1:

The DNS server according to the present invention contains authoritative answer for a domain name query that is one label longer than the zone's domain name (e.g., with a zone name of "*foo.com*", then an optimization is effective for "*www.foo.com*" but not for "*www.mkt.foo.com*").

Case #2:

The DNS server according to the present invention has delegated the next-level subdomain name (e.g., the incoming query is for the domain name "*www.mkt.foo.com*", which is in the zone "*foo.com*", then the optimization is effective if the "*mkt.foo.com*" zone has been subdelegated).

The use of these specific optimizations does not preclude the development of additional optimizations. The fundamental realization and requirements remain unchanged, allowing common case optimizations to be applied to outcomes based on revised outcome probabilities.

Specifically, further common case optimizations specified rely on restrictions on the records in the database to guarantee the validity of the query response. For example, a generalization of *Case #1* (above) that optimizes for arbitrary length domain name queries (e.g., the incoming query is for the domain name "*www.unit.mkt.foo.com*" within the zone for "*foo.com*"). This case can be optimized if no conflicting records are present, i.e., any record that could alter the precedence made for the optimization case (e.g., an intervening NS record or wildcard record associated with the domain name "*mkt.foo.com*" would have an impact on the above example of "*www.unit.mkt.foo.com*" in zone "*foo.com*").

Additionally, the DNS query strategy according to the present invention allows for flexible/dynamic optimization code to be constructed, where, e.g., a

specific ordering of individual common case optimizations is associated with each zone, based on prior knowledge or statistics maintained about each zone. This technique can be applied so that the best strategy is selected at the granularity of each zone, each server, or any identifiable class of query stream.

Data Caching and Cache Invalidation

Dynamic data caching is a mechanism that has been applied to achieve performance in many types of systems, but has never before been use to provide a fast-access data repository of authoritative data within an Domain Name Server.

The Domain Name System was designed with an integrated "time to live" (TTL) caching mechanism, and we note three example applications of caching elsewhere within the Internet and Domain Name System.

- Applications such as web browsers frequently maintain copies of DNS records obtained while processing HTTP requests, and use applicable DNS records for subsequent requests. This use of caching does not maintain authoritative data, nor does it directly effect the operation of a DNS server.
- Caching DNS servers (also known as recursive servers or "helper" servers) provide a separate function from "hosting" DNS servers. Recursive servers act on the behalf of an application (e.g., a user's web browser) and query a hierarchical series of hosting DNS servers to obtain the required DNS response. Information obtained in the course of a DNS query resolution may be maintained and used to expedite subsequent DNS queries, until each record's specified time-to-live has expired. This is a fundamental use within the DNS, but only addresses the behavior of non-authoritative servers when handling authoritative data.

- Conventional primary DNS servers (e.g., as embodied by the "bind" server distribution) read all authoritative domain information into a computer memory directly from files, and answer queries based on a complete memory-resident copy of all domain information. Unlike the above caching examples, this is not an application of dynamic caching, but is a static copy of DNS information that does not change or replace based on well-known caching criteria such as frequency of use, nor does it embody any dynamic mechanisms for maintaining cache consistency. There is no dynamic mechanism for a "cache miss" that involves the standard alternative method of making a backup query to the primary (i.e., non-cache) repository.

According to embodiments of the present invention, the DNS server maintains an internal dynamic cache of recently-used authoritative DNS records taken from the database repository. Two embodiments are specified: (1) where individual resource records are cached separately and subsequent DNS response are comprised of the individual records, and (2) where the entire response to a DNS query is cached as an aggregate and are immediately available for a subsequent response, eliminating overhead required to construct a complete response. The strategy for handling incoming DNS queries includes an examination of the internal cache for efficient access to data, and if not available, a subsequent query to the primary data repository (database) is made. These mechanisms are used for both "positive caching," i.e., when the data exists, and "negative caching," i.e., when the server can authoritatively respond that the information does not exist.

The DNS server according to the present invention also embodies cache replacement mechanisms to control the amount of "stale" (infrequently used) data in the cache, and to allow for effective utilization of cache and system resources.

Multiple embodiments exist to remove DNS data from the cache based on frequency or timeliness of use.

Cache Invalidation

A dynamic caching system must employ cache invalidation mechanisms to guarantee that information in the cache corresponds to the state of the primary data repository. This requires that data items are removed from (or replaced within) the cache when the corresponding information is changed within the primary data repository. This allows a DNS server according to the present invention to accurately reflect the correct information within the system.

The DNS server according to the present invention are embodied by a number of related cache invalidation mechanisms that address the complete range of transaction types that can be performed on the primary data repository, and the type of cache data that can be maintained in the system. The design space that defines the cache transactions of interest is represented by the Table below which specifies twenty four different cache invalidation transactions that can be addressed by the invention's cache invalidation strategy. Note that not every space need be addressed by a particular embodiment of the invention, and that some cache invalidation mechanisms will address multiple invalidation requirements.

	Record Cache	**Query Cache (*Answers*)**	**Query Cache (*Authority*)**	**Query Cache (*Additional*)**
Delete from Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative
Addition to Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative
Modify within Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative

Multiple embodiments exist to remove DNS data from the cache based on frequency or timeliness of use.

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	Record Cache	**Query Cache (*Answers*)**	**Query Cache (*Authority*)**	**Query Cache (*Additional*)**
Delete from Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative
Addition to Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative
Modify within Primary Dbase	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative	Positive -vs.- Negative

Multiple invalidation mechanisms can be applied together, so that each addresses a subset of the potential cache interactions and requirements. Further, these mechanisms can embody varying criteria for timeliness of data invalidation, according to the importance assigned to each subset. For example, when caching entire DNS responses the data within an Answer section may be considered more critical than the data within an *Authority* section. In this case, mechanisms can be employed that immediately respond to updates to information in the Answer section, while other less timely mechanisms will eventually invalidate the records within the *Authority* section.

SYSTEM-LEVEL MECHANISMS

The system-level mechanisms according to the present invention work synergistically, enabling the DNS System according to the present invention to provide enhanced/integrated management of information, and to provide a range of performance enhancement for incoming queries and internal transactions.

- Modular data-centric design
- Database-layer synchronization
- Single IP address announcement of replicated servers

Modular Data-Centric Design

The DNS domain name server according to the present invention (e.g., DNS_1 **100** of **FIGURE 1**) separates the functionality of the standard monolithic Internet server into two distinct components: a commercial database system as the data repository, and a DNS wire-protocol server designed to answer queries based on authoritative DNS data from the database component. This architectural choice

provides for a clean modular design, which in turn provides a flexible and scalable platform that is leveraged to provide a diverse set of features and inventions.

- Data-Centric Modeling and Functional Server Module Extensions—The two-component design allows for modular extensions to both the data model, and the functions (e.g., servers) that operate on the system. Embodiments of this invention include, but are not limited to, one or more user interfaces for data management, transaction processors to provide an extensible API for data management, Internet system monitors that can query external system status (e.g., webserver availability) and affect changes to the data repository, and servers for other Internet directory servers (e.g., *whois, radius*, etc).
- Integrated Access Control Mechanisms—Using a database repository for DNS information allows several principle objects (e.g., users and other network data schemas) to be modeled and managed. A significant feature of the DNS Domain Management System according to the present invention is the ability to control and delegate the many-to-many access patterns of users accessing domain name data.
- Query and Context Specific Responses—Conventional (prior art) DNS servers take as input a <*domain name, query type, query class*> tuple, and return the appropriate resource records. The DNS system according to the present invention has revised the basic query/response transaction by incorporating additional fields within the data model such that the response to a query can be based on additional criteria. These criteria can be comprised of information obtained from the incoming query (e.g., source IP address), information available to the local server (e.g., time of day or server identity), and similar context or query specific information.

- Dynamically Configurable DNS Record Types—The DNS server according to the present invention allows new resource record types to be defined, and immediately incorporated into the system. Based on resource record templates included in the data model, the DNS server according to the present invention system can incorporate new record types in minutes without additional low-level code development. This is in contrast to the conventional (prior art), where deployment of a new resource record type requires considerable low-level program design and coding, and requires a new server binary be deployed on all applicable machines. Moreover, combined with context specific responses (above), domain administrators may define their own "local" types that are specific to the answers returned for their DNS domain.
- Ability to deploy and maintain a state-of-the-art data management service based on commodity implementations of core database technologies. The conventional (prior art) systems for Domain Name System management deploy integrated ad-hoc implementations of database technology, which lag advanced database features and make it difficult to deploy new features based on database technology advances.

Database-Layer Synchronization

The DNS system according to the present invention maintains data consistency between multiple redundant servers (e.g., DNS_1, DNS_2, ..., DNS_n in FIGURE 1) by propagating changes to the managed data using database-level transaction processing. This has advantages over conventional (prior art) consistency mechanisms, which are based on application-level transactions. These advantages include:

- Virtually immediate propagation of changes to Domain Name System information. This is particularly important when inaccurate information must be corrected, or when critical domain information changes frequently and changes must be visible quickly. For example, one of the most frequently changed zones, ".COM", also has the greatest number of records. Using conventional (prior art) systems, ".COM" has historically been restricted to a twelve-hour periodic updates. Using the DNS system of the present invention, changes to ".COM" are routinely propagated within 5-15 minutes.
- Ability to accept and propagate changes to Domain Name System information from multiple servers, and consequently, the ability to make data management more reliable with better system availability and performance. This is in contrast to conventional (prior art) DNS systems, which do not have the conflict resolution mechanisms required to support multiple sources of update transactions.

Single IP Address Deployment for Replicated Servers

Globally distributed server replicas (e.g., DNS_1, DNS_2, ..., DNS_n) provide the reliability, throughput and low delay required to scale a large commercial service. The servers are tied together using advanced Internet routing mechanisms that are reactive to the state of individual server replicas. In preferred embodiments, each DNS system according to the present invention shares a common IP address and supports a name server replica. The shared IP addresses are injected into the Internet routing mesh by each server so that Internet routers will direct IP packets to the nearest topological server. Each server replica is monitored for correct behavior, and the IP route is withdrawn if the server no longer responds to DNS queries. This mechanism provides the following benefits:

- User DNS queries are directed to the nearest DNS replica minimizes the delay experienced for DNS resolution.
- Transitory server and network failures are transparent to a user's DNS query and application transaction. Servers that are not reachable or functional are invisible, and DNS queries arrive at the nearest functional server without experiencing the delay for standard DNS timeout and retransmission.
- The DNS system acquires user proximity information based on the server replica that receives the user DNS query. This information can be used to provide proximity based responses to direct users to nearby application servers.

IMPLEMENTATION

THE DATABASE

This section describes the unique database schema of the database **102**.

OVERVIEW

The database **102** according to preferred embodiments of this invention is organized and structured according to the following unique database schema. The database schema involves fourteen (14) tables. Only three (3) of these tables contain actual data (i.e., DNS & Contact), the other eleven (11) tables are needed to manage the data. The schema allows management of who has access to which data, how can they access it, who can create new data, and how they should be billed for use of the system.

The data managed by the DNS Server **100** is (a) contact information, (b) zone information, and (c) resource record information. Although zones and resource records are related, the system must have the ability to manage them distinctly. The

reason for this is to enable targeting different users, some of which want to use the Server **100** to manage an entire zone for them, and some of which will just enter individual resource records (in a particular zone).

For any data that can put in the system, there are two access control mechanisms involved: (1) a mechanism that specifies whether the item can be put in (created) in the system, and (2) a mechanism that specifies how items can be accessed.

TABLE LIST & SUMMARY

Table Name	Description
LOGIN	User information (to establish identity on the system)
SYS_MGMT	Describes how the DNS system is managed (e.g., who can create new zones, billing policy, etc)
RRJUMBO	combined Resource Record (RR) index and data.
CONTACT	people/role/organization (like whois)
CONTACT_ASSOC	indicates association between contact information, and other data/items (e.g., zones or RRs)
ZONE	basic mgmt information for a related set of DNS RRs
ZONE_INTERFACE	list of "outside" servers the system must talk to primaries/masters OR secondaries we update)
ZONE_CNTL	much like information in SOA record
ZONE_MGMT	zone owner describes how zone may be used (e.g., who can create new RRs, billing policy, etc)
ZONE_SERVERS	maintains list of which zones in system, and which IP addresses can do zone transfer
RR_MGMT	indicates logins that can modify specific RRs (Resource Records)
BillingPolicy	rules/policy owners set for billing others for use
BillingInfo	actual billing information for a particular object (derived from owners BillingPolicy)
USAGE_HISTORY	contains past usage data (to answer billing concerns)

Table Name	Description
IPV4RANGE	restricts (or allows) access per source IP address

TABLE SCHEMA

This section describes what information is in the tables and, in some cases, gives the formats and sizes of the data used in some embodiments of the present invention.

The LOGIN table describes identity within DNS system of the present invention. The table includes information on how to authenticate a user to system. The LOGIN Table is established via login/password, X.509, PGP, DNSSec, etc.

The following table summarizes the fields of the LOGIN table.

LOGIN		
Field	**Description**	**Relationship to other Tables**
Id	internal dbase index/pointer	appears in other tables indicating this users has some claim/access to the object
Email	contact information	
Ipaddr	restrict logins to specific IP range	index to IPV4RANGE table
x509id	ID for primary authentication method	
Username	backup login name	
Password	backup password	
Passques	user-supplied question for lost information	
Passansw	user-supplies answer for lost information	

The SYS_MGMT table (described below) provides a template about use, access, etc. It provides information about how the system is managed; who can access, modify, create new "objects", and information on how users are charged for

access. The SYS_MGMT table allows the DNS according to the present invention to be deployed in different ways (e.g., closed access at large companies versus open ISP access). Some preferred embodiments allow deployment of two object types to be created, namely contacts and zones. Both can be created by anyone. Contacts can be created at no charge; zones may or may not incur charges (perhaps per-user).

SYS_MGMT		
Field	**Description**	**Relationship to other Tables**
Objtype	what type of objects can be created	
Access	type (create or read)	
Login	(loginid OR "ANY")	ID in LOGIN table about who can create
Ipaddr	restrict/grant access by IPsrc Addr	
Billing	specifies how to charge for access	index into BILLING table

The RRJUMBO table represents DNS resource record (RR) information. This table is for the "index" or "lookup" of the incoming query, and contains columns for different parts of RR data section. Resource records are defined in RFC 1035 [Network Working Group Request for Comments: 1035, P. Mockapetris, ISI, November 1987] which is incorporated herein by reference.

RRJUMBO		
Field	**Description**	**Relationship to other Tables**
Id	internal dbase ID	referenced by other tables
Active	indicates RR is "active" (e.g., paid for)	
Dead	indicates "machine" inactive	
Zone	zone membership identifier	indicates RR associated with ZONE table
Dname	domain name (e.g., "www.ultradns.com")	
Lname	Lower case Dname to optimize lookups	
Type	RR type	
Class	RR Class	

RRJUMBO		
Field	**Description**	**Relationship to other Tables**
Servers	indicates which server return particular RR	
Time	Indicates time frame RR is returned	
ipv4addr	index into IPV4RANGE Table	index into IPV4RANGE table (to specify per IPaddress RRs)
ip_low	simple (hi-performance) IP source address specification	
ip_high	simple (hi-performance) IP source address specification	
ip_bits	simple (hi-performance) IP source address specification	
Create_who	login ID of record creator	indicates record created by LOGIN table
Create_ip	IP address of creator (if anonymous)	
Create_date	when created	
Update_who	login ID last modify	login id of last update
Update_when	last modified time	
Billing	index to BillingInfo	billing information associated with RR
Readcnt	recent RR reads	
Readsince	start time of read count	
Writecnt	recent RR changes	
Writesince	start time of write count	
Ttl	Resource record TTL (time to live) (seconds)	
f1	RRdata field #1	
F2	RRdata field #2	
F3	RRdata field #3	
F4	RRdata field #4	
F5	RRdata field #5	
F6	RRdata field #6	
F7	RRdata field #7	
F8	RRdata field #8	
refl	dname reference for "additional" RRs	

A "DNS lookup" in the RRJUMBO table uses (matches against) the following six values to find the requested DNS resource record:

1. domain name (from dns query packet)
2. dns type (from dns query packet)

3. dns class (from dns query packet)
4. server id (name/id of server answering query)
5. time (current time of day at server)
6. source IP address (from the IP packet)

Note that the use of the RRdata fields, f1 ... f8, depends on the type of RR (e.g., MX records will use f1 and f2, A records will only use f1, and SOA records will use f1 - f7).

The RRJUMBO table is used to store data for multiple purposes: in addition to storing "live" domain records, "template" records are stored which embody the mechanism to provide configurable DNS records. Each DNS Resource Record type is represented by one or more template records in the RRJUMBO table which specify the format and structure of each record type.

The CONTACT Table contains information about a person, role, or organization (i.e., this is basically "whois" information). Note that the information in the CONTACT Table has nothing to do system login.

CONTACT		
Field	**Description**	**Relationship to other Tables**
Id	Internal dbase index	referenced by other tables
Order	Sequence information for related records	
Type	name, phone, fax, email, etc. (see list below)	
Information	Associated information (e.g., name: Steve Hotz)	
Anonacl	read permission for field (e.g., do not give out phone number)	
ipaddr	IP address based read restrictions/permissions	index into IPV4RANGE Table

The TYPE values for above "type" field (similar to RIPE-181) include:

- name

- email
- email-alt
- phone
- phone-alt
- fax-no
- nic-hdl
- nic-hdl-alt
- address (multiple-line text string)
- source (in case information came from another place)
- date-create
- date-update

The CONTACT_ASSOC Table indicates association between contact information, and other data/items (e.g., zones or RRs)

CONTACT_ASSOC		
Field	**Description**	**Relationship to other Tables**
Id	name/id of object (e.g., "ultradns.com".)	internal identifier of DNS data item (e.g., contact, zone, or RR)
Objtype	{system, zone, record}	
contact	id of CONTACT information	
Type	{admin, tech, billing, registration}	
Public	{yes, no} read access for general public	

The ZONE table basic information about a group of related RRs.

ZONE		
Field	**Description**	**Relationship to other Tables**
Zone	Name of the zone (e.g., "ultradns.com")	Every column in this table relates to other tables.
Owner	LOGIN id of zone owner	
Billing	How this zone is billed (BillingInfo)	
zonecntl	ZONE_CTRL id for internal consistency	

The ZONE_INTERFACE Table specifies external servers (i.e., servers that are not embodiments of the present invention) that must either be used as primary/master, or updated as secondary/slave.

ZONE_INTERFACE		
Field	**Description**	**Relationship to other Tables**
Zone	zone being updated/transferred	refers to zone name in numerous tables
inout	{in, out}	
srvname	name of server	
Srvip	IP address of server	
ctrl	ZONE_CTRL id for record controlling frequency	reference into ZONE_CTRL table
view_ip	if multi-dimension records, snapshot this IP	
view_time	if multi-dimension, snapshot at this time	
view_srv	if multi-dimension, snapshot for server	

The ZONE_CNTL Table contains zone control information, similar to SOA parameters. This Table is used for database consistency (may not be needed with internal Oracle, however, can specify interface with external servers).

ZONE_CNTL		
Field	**Description**	**Relationship to other Tables**
Id	Internal Identifier	Referenced by other tables
Serial		
Refresh		
Retry		
Expire		
Mincache		
Flags	Notify turned on	

5

The ZONE_MGMT table includes information about how a particular zone is managed; who can access, modify, create new "objects", and information on how the user is charged for access.

ZONE_MGMT		
Field	**Description**	**Relationship to other Tables**
Zone	zone being managed	relates several tables holding zone information
login	login ID with access (or "ANY")	LOGIN table for who has access

ZONE_MGMT		
Field	**Description**	**Relationship to other Tables**
ipaddr	source IP access restrictions	IPv4Range table for src address access
Billing	billing policy associated with access	index into BillingPolicy table
rrlist	bit map of RR types that can be created	
Mods	allow zone modifications: • can modify via dynamic update • modify all RRs • modify all contact information • modify zone information • modify zone_mgmt information	
Features	• Bit map of allowed features • define new types • create multi-dimensional • can create RRs that allow dynamic updates • can create new RRs using dynamic update • dead machine monitoring • other	
Flags	indicate other actions associated with update/access • indicating required per-record information (i.e., contact) • owner requires change notification (via email)	

The ZONE_SERVERS table is an auxiliary table listing zones for which the system is responsible. This table is used by servers to find zones for which they are authoritative.

ZONE_SERVERS		
Field	**Description**	**Relationship to other Tables**
Zone	Zone name	Zone name relates to multiple tables
Server	Server holding zone	
xferip	IPV4RANGE allowed zone transfers	IPv4Range index

5

The RR_MGMT Table provides an access list for specific RRs.

RR_MGMT		
Field	**Description**	**Relationship to other Tables**
Rrod	Rrindex id	Every column (except flags) relates columns in other tables.
Login	Login allowed to change (or "ANY")	
ipaddr	src IP based access restrictions	
Flags	access allowed (initially, all or nothing)	

The BillingPolicy table (set by owner(s) of system or zone) contains information about how to bill for system use. The owner of system sets this up ahead of time, and the system enforces the various billing policies.

BillingPolicy		
Field	**Description**	**Relationship to other Tables**
billp_id	internal dbase index	referenced by other table columns
what	zone, contact, dname, RRtype(s), feature	
type	one-time, read, write, time, <feature_name>	
Unit	<count> for read/write day|week|month|year for time or feature	
Amt	Amount (in dollars)	
cnd_type	reads OR writes [must be greater than]	
cnd_unit	count [per]	
cnd_time	time unit (day|week|month|year)	
intro_time	days before billing starts	
period	yearly/monthly/choice	
year_discount	can offer (percentage) discount for yearly rate	

Each zone may specify more than one policy. For example,:

<what>	<type>	<unit>	<amt>	<cond>			
				Type	**>**	**Unit**	**Time**
Zone	1-time		29.99				
Zone	Time	Year	9.99				
Zone	Write	1	1.00	Write	>	10	Month

<what>	<type>	<unit>	<amt>	<cond>			
				Type	>	Unit	Time
Feature	Dyn_Upd	Month	1.99				

The BILLINGINFO Table contains information about who and when to bill for use.

BILLINGINFO		
Field	**Description**	**Relationship to other Tables**
billi_id	internal dbase index	referenced by other table columns
who_id	billing contact index	reference to CONTACT table
Method	Credit card, usmail, email	
billp_id	Reference to BillingPolicy table	
Credcard	credit card account	
expire	credit card expire date	
card_id	billing address for credit card (if different from who_id)	reference to CONTACT table
billp_id	index to Billing Policy record	
Create_date	when billing record was created	
next_date	next statement date	

The USAGE_HIST Table contains historical system/information usage information. Can attach to various objects: RRdata, Zone, Contact, etc. (Some preferred embodiments attach to RRs)

USAGE_HIST		
Field	**Description**	**Relationship to other Tables**
Id	internal dbase ID of object tracked	relates to id field of other tables
Objtype	RR/zone/contact/other	determines which "other table"
Access	read/write/other	
start	start of period (seconds since epoch)	
End	duration of period (e.g., in seconds)	
cnt	number of accesses	

Preferably use logging is (a) only turned on for some records, and (b) could be a "premium service". Must keep "current" usage for billing, but this feature is "turned on".

The IPv4Range Table contains CIDRized subnet masks, primarily used for address based (i.e., weak) authentication. This table is used for (a) handing out RRs based on srcipaddress, and (b) simple access control for updates to data (e.g., using dynamic updates as implemented).

IPv4Range		
Field	**Description**	**Relationship to other Tables**
Ipid	index of IP range spec	this table id serves as index, and appears in other tables (indicating whether access is allowed from specific source IP addresses
Flag	flag indicating allowed/prohibited	
bits	number of bits in mask	
Low	lowest address value	
High	highest address value	

Example

listid	**Flag**	**bits**	**iprangelow**	**Iprangehi**
#1	Prohibit	0	0x00000000	0xffffffff
#1	Allow	16	0x80090000	0x8009ffff
#2	Allow	0	0x00000000	0xffffffff
#2	Prohibit	16	0xa0070000	0xa007ffff
#2	Prohibit	16	0xa0090000	0xa009ffff
#3	Prohibit	0	0x00000000	0xffffffff
#3	allow	16	0xc9140000	0xc914ffff
#3	prohibit	24	0xc9142800	0xc91428ff
#3	prohibit	24	0xc9142a00	0xc9142aff

#1 allows small number of addresses;

#2 prohibits small number of addresses;

#3 allows all in range, with exceptions;

The following section provides the database field formats and sizes for a preferred embodiment of the present invention. Some of the fields have common sizes:

256 char == dnames
10 num == 32bit integers (e.g., IPv4addr and time in seconds)
14 num == internal identifier

LOGIN		
Id	num 14	
Email	vch 256	
Ipaddr	num 14	null-ok
x509id	vch 256	
Username	vch 64	
Password	vch 32	
Passques	vch 80	
Passansw	vch 80	

SYS_MGMT		
objtype	Vch 16	
access	Vch 16	
login	Num 14	
ipaddr	Num 14	null-ok
billing	Num 14	null-ok

RRJUMBO		
id	num 14	
active	num 1	
dead	num 2	
zone	vch 256	
dname	vch 256	
type	vch 16	
class	vch 16	
servers	vch 32	null-ok
time	vch 168	null-ok
ipv4addr	num 14	null-ok
ip_low	num 10	null-ok
ip_high	num 10	null-ok
ip_bits	num 3	null-ok
create_who	num 14	
create_ip	num 10	
create_date	num 10	
update_who	num 14	
update_when	num 10	
billing	num 14	null-ok
readcnt	num 8	null-ok

RRJUMBO		
readsince	num 10	null-ok
writecnt	num 8	null-ok
writesince	num 10	null-ok
TTL	num 10	
f1	vch 1024	
f2	vch 1024	null-ok
f3	vch 256	null-ok
f4	vch 256	null-ok
f5	vch 256	null-ok
f6	vch 256	null-ok
f7	vch 256	null-ok
f8	vch 256	null-ok
ref1	vch 256	null-ok

CONTACT		
id	num 14	
order	num 2	
type	vch 16	
info	vch 168	
anonacl	vch 8	null-ok
ipaddr	num 14	null-ok

CONTACT_ASSOC		
id	num 14	
objtype	vch 16	
contact	num 14	
type	vch 20	null-ok
public	vch 8	

ZONE		
zone	vch 256	
owner	num 14	
billing	num 14	null-ok
zonecntl	num 14	

5

ZONE_INTERFACE		
zone	vch 256	
inout	vch 8	
srvname	vch 256	null-ok
srvip	num 10	null-ok
ctrl	num 14	
view_ip	num 10	null-ok
view_time	num 3	null-ok
view_srv	num 3	null-ok

ZONE_CNTL		
id	num 14	
serial	num 10	
refresh	num 10	
retry	num 10	
expire	num 10	
mincache	num 10	
flags	vch 8	null-ok

ZONE_MGMT		
zone	vch 256	
login	num 14	null-ok
ipaddr	num 14	null-ok
billing	num 14	null-ok
rrlist	vch 256	
mods	vch 16	
features vch 16	null-ok	
flags	vch 8	

ZONE_SERVERS		
zone	vch 256	
server	vch 256	
xferip	num 14	null-ok

RR_MGMT		
rrid	num 14	
login	num 14	null-ok
ipaddr	num 14	null-ok
flags	vch 8	null-ok

5

BILLINGPOLICY		
billp_id	num 14	
what	vch 32	
type	vch 32	
unit	vch 16	
amt	num 8	
cnd_type	vch 8	null-ok
cnd_unit	num 8	null-ok
cnd_time	vch 8	null-ok
intro_time	num 6	
period	vch 8	
year_discount	num 4	

BILLINGINFO		
billi_id	num 14	
who_id	num 14	

BILLINGINFO		
method	vch 12	
credcard	num 16	null-ok
expire	vch 7	null-ok
card_id	num 14	null-ok
billp_id	num 14	
create_date	num 10	
next_date	num 10	

USAGE_HIST	
id	num 14
objtype	vch 16
access	vch 16
start	num 10
end	num 10
cnt	num 12

IPV4RANGE	
ipid	num 14
flag	num 2
bits	num 2
low	num 10
high	num 10

5 **DESIGN CHOICES**

Probably the least obvious design choice is the way that CONTACT is laid out. What would be more obvious/natural is to have one table row represent each particular contact record . However, this design breaks contact information into multiple fields, and represents each field as a row in the database. This method is 10 more flexible (given the flexible nature of the data), and supports the association and efficient lookup of "ACCESS POLICY" to individual fields (e.g., to allow random people looking at a CONTACT record to see an email address but not see a phone number associated with that record).

THE SQL INTERFACE

15 The SQL Interface **104** takes queries/requests for domain name/address resolution and returns the appropriate address and other information. The SQL

implementing the interface **104** in a preferred embodiment is listed below (in the Table titled **SQL Query**).

EXAMPLE

Here is a sample query made by a user **108** of the DNS **100** according to the present invention. The request is processed by the query mechanism **106** which uses the SQL interface **104** to access the database **102**.

Query: a.b.c.d.wonk.com. <type>

where the system knows that it has "wonk.com. ZONE"

Then, in the worst case, the system has to make the following queries into the database **102**:

a.b.c.d.wonk.com. <type> ## commonly returns ANSWER

b.c.d.wonk.com. NS ## commonly returns AUTH data

a.b.c.d.wonk.com. NS ## common to indicate sub-delegation

*.b.c.d.wonk.com. <type>

b.c.d.wonk.com. NS

*.c.d.wonk.com. <type>

c.d.wonk.com. NS

*.d.wonk.com. <type>

d.wonk.com. NS

*.wonk.com. <type>

This invention embodies a query strategy that significantly reduces the average number of database queries required to complete a DNS query.

There are essentially two common cases:

(1) no sub-delegation—Query gets simple answer for foo.wonk.com

(2) the system will end-up telling about sub-delegation—Query made for a.b.c.d.wonk.com gets NS for d.wonk.com

In both of the common cases noted above, the answer "dname" is likely to be one component longer than the zone name. So, the system tests this before making the query (i.e., the system does not want to query for "a.b.c.d.wonk.com", "b.c.d.wonk.com", and "c.d.wonk.com" just to finally say that the delegation is made at "d.wonk.com").

Consequently, the following query optimization (in the query mechanism **106**) can be used:

If the requested name is one component longer than zone name, then look for a quick answer.

This can be written as:

```
if (shorten(req.dname) == ZONE) {
      SQL(<req.dname>, <type>          ##
SQL(d.wonk.com, <type>,
      shorten(<req.dname>), NS)        ##
wonk.com,     NS)
if (<type> found)
      return_answer;
      save_NS_for_later();
SQL(req.dname, NS,
      "*" + shorten(req.dname), <type>);
      if ("*" found, return answer and my NS
records);
      if (NS found, return authority);
      return(NXDOMAIN);
}
```

If long request name, check for shortest delegation first. For example, if the request name is "a.b.c.d.wonk.com", check if "d.wonk.com" has NS.

```
SQL(shorten.to_one_piece(<req.dname>), NS); if (NS
found) return;
```

If neither optimization worked then start with original question.

```
SQL(<req.name>, <type>,
```

```
        zone.name,     NS);
    if (answer found) {
        return(answer + NS);
    } else {
        save_NS_for_later();
    }
```

If no answer is found then loop through and look for NS delegations.

```
    for (working_name = req.dname,
        next_name = shorten(working_name);
        next != zone;
        working_name = next_name, next_name =
    shorten(working_name)
    ) {
        SQL(working_name, NS);
        if (NS found) return;
    }
```

No delegation made.

Now loop looking for "*" records.

```
    for (working_name = shorten(req.dname),
        next_name = shorten(working_name);
        next != zone;
        working_name = next_name, next_name =
    shorten(working_name)
    ) {
        SQL("*" + working_name, <type>;
        if (<type> found) {
        return (answer + save_NS_records);
    }
    }

        return(NXDOMAIN);
```

EXAMPLE

Give the example query "foo.bar.wonk.com. MX", call following SQL (Table XX) with following variables:

```
req.name1 = "foo.bar.wonk.com."

req.name2 =   "*.bar.wonk.com."

req.name3 =     "bar.wonk.com."

req.type  = 15  (this is the MX type)
```

```
req.class = 1    (this is the IN class)

req.time  = <current_time>

req.server = <server ID#>

req.ipaddr = <incoming pkt IP source>
```

5

SQL QUERY

```
SELECT * FROM rrjumbo, RR
```

The main "start with" clause gets the ANSWERS and AUTHORATATIVE, plus it gets any "" records that exist.*

```
START WITH
(
      (RR.dname = 'req.name1' AND ((RR.type =
      'req.type')
       OR (RR.type = = 2)))
            OR
      (RR.dname = 'req.name2' AND (RR.type =
      'req.type'))
            OR
      (RR.dname = 'req.name3' AND (RR.type = 2))
)
      AND
      RR.class = 'req.class'                          AND
      substr(RR.time, 'req.time', 1) = 1              AND
      substr(RR.servers, 'req.server', 1) = 1         AND
      RR.active = 1                                   AND
      RR.dead   = 0                                   AND
```

This is part of main query, that handles the IPv4range

```
EXISTS (select * FROM ipv4range, IP WHERE
      RR.ipv4addr = IP.ipid      AND
      IP.low  <= req.ipaddr      AND
      IP.high >= req.ipaddr      AND
      IP.flag = 2                AND)
```

This part of query grabs ADDITIONAL records

```
CONNECT BY
      PRIOR ref1 = dname           AND
            type = 1               AND
            class = 'req.class'    AND
            substr(time, 'req.time', 1) = 1          AND
            substr(servers, 'req.server', 1) = 1     AND
            active = 1                               AND
            dead   = 0                               AND
```

Make certain ADDITIONAL RECORDS also have IPv4 permission

SQL QUERY

```
      EXISTS (select * FROM ipv4range, IP WHERE
           RR.ipv4addr = IP.ipid      AND
           IP.low  <= req.ipaddr      AND
           IP.high >= req.ipaddr      AND
           IP.flag = 2                AND)

SELECT * FROM rrjumbo, RR
START WITH
(
      (RR.dname = 'req.name1' AND ((RR.type =
      'req.type')
       OR (RR.type = = 2)))
           OR
      (RR.dname = 'req.name2' AND (RR.type =
      'req.type'))
           OR
      (RR.dname = 'req.name3' AND (RR.type = 2))
)
      AND
      RR.class = 'req.class'                          AND
      substr(RR.time, 'req.time', 1) = 1              AND
      substr(RR.servers, 'req.server', 1) = 1         AND
      RR.active = 1                                   AND
      RR.dead   = 0                                   AND

EXISTS (select * FROM ipv4range, IP WHERE
      RR.ipv4addr = IP.ipid      AND
      IP.low  <= req.ipaddr      AND
      IP.high >= req.ipaddr      AND
      IP.flag = 2                AND)

CONNECT BY
      PRIOR ref1 = dname           AND
           type = 1                AND
           class = 'req.class'     AND
           substr(time, 'req.time', 1) = 1          AND
           substr(servers, 'req.server', 1) = 1     AND
           active = 1                               AND
           dead   = 0                               AND

      EXISTS (select * FROM ipv4range, IP WHERE
           RR.ipv4addr = IP.ipid      AND
           IP.low  <= req.ipaddr      AND
           IP.high >= req.ipaddr      AND
           IP.flag = 2                AND)
```

OTHER FEATURES

Building a modular system has allowed additional mechanisms to be incorporated easily into the system which can serve as the base for new features/uses.

CONFIGURABLE RESOURCE RECORD TYPES

The DNS according to some embodiments of the present invention has over thirty (30) defined resource record types, which provide data formats/fields for use by different applications; current implementations hard-code the type definitions. Thus, the present invention offers users the ability to dynamically configure RR types, to allow directory-enabled applications to be deployed and tested within short time frames.

CONTEXT SENSITIVE (QUERY-SPECIFIC) ANSWERS

In the abstract, a directory service maps a query's incoming request (key) to an outgoing response (data indexed by the key). Using a relational database model gives the present invention an effective mechanism to add other components to the lookup key. In the DNS example, a different answer can be given depending on various context information: from the packet (IP address), from the machine (local time), and from global system (which server location). Thus, for example, the system may provide different answers at different times of day or to different geographic regions.

DYNAMIC DATA CACHE

In some embodiments, the DNS server **100** incorporates a dynamic load-on-demand cache algorithm which significantly enhances performance by reducing the amount of data that must be retrieved from the database **102**.

When an inbound query is received, the server **100** will first attempt to find the answer in the data cache **110**. If the answer exists and is fresh, the response will

be sent directly from the cached data stored in data cache **110**. If the answer exists in the cache **110** but is stale, or if the answer does not yet exist in the cache, the data will be acquired from the database **102**, transmitted in the response, and then added to or updated within the cache **110**. In some embodiments, the cache is maintained in a Most Recently Used order to optimize lookup times and facilitate cache management.

Items in the cache **110** have a maximum lifetime which ranges from the time to live (TTL) of the lowest resource record (RR) in the complete answer to the maximum cache time value configured for the server as a whole. For records that change frequently, the TTL value can be set to zero to ensure the data is never added to cache and always retrieved from the database.

By setting a relatively short lifetime on data in the cache **110**, the server **100** can provide maximum throughput while still offering near real-time propagation of zone changes. Because the cache is load-on-demand, the DNS daemon can be up and ready to respond to queries within moments of execution.

In addition to normal caching of DNS response data, the cache algorithm is designed so that negative caching is also achieved. For example, if a request is made for a host that does not exist in an active domain, the negative response will be saved just like a valid response. If the server is for some reason hit with a barrage of requests for this same invalid host, they can be filled using the negative response in cache, once again eliminating unnecessary calls to the database.

Further, in some embodiments, a management thread is incorporated into the cache design. This thread comes to life at a configurable interval and walks through the RR data cache, deleting any stale entries that it encounters. This feature ensures that the most active data is always the most readily available.

In some embodiments, a cache invalidation mechanism is incorporated that is responsible for removing (or modifying) data within the dynamic cache so that the cache accurately and acceptably reflects changes made to the primary data repository.

IMPLEMENTATION DETAILS

An embodiment of this invention has been implemented. The DNS server **100** was designed on top of and tightly integrated with the database **102**. The database **102** was implemented using Oracle, however, care was taken to modularize the database interface so that the system could easily be integrated with a database from a different vendor, such as Sybase or Informix. The server was developed using Gnu C++ on a Linux platform. The server build process was later expanded to support both Linux and Solaris.

Implementations of the present invention can be written in any suitable high-level computer language. Further, while aspects of the present invention have been implemented in software running on a computer system as described above, all aspects of the present invention can also be implemented in hardware or in a combination of software and hardware. That is, although described with reference to a particular system, the present invention operates on any computer system and can be implemented in software, hardware or any combination thereof. When implemented fully or partially in software, the invention can reside, permanently or temporarily, on any memory or storage medium, including but not limited to a RAM, a ROM, a disk, an ASIC, a PROM and the like.

While the above embodiments relate to domain name processing, one skilled in the art will realize that domain names are merely one example of directory services, and that the present invention is applicable to other directory services.

Thus are provided methods, systems and devices for scalable domain name resolution. One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not limitation, and the present invention is limited only by the claims that follow.

We claim:

1. A system for processing domain name requests, the system comprising:

a query mechanism constructed and adapted to:

(a) obtain a user request for response information corresponding to a particular domain name; and

(b) provide complete response information in a single response to the user request.

2. A system as in claim 1 wherein the user request is a domain name resolution request and wherein the query mechanism provides an Internet Protocol (IP) address corresponding to the domain name.

3. A system as in claim 1 wherein the a query mechanism is further constructed and adapted to:

provide the response depending on context information.

4. A system as in claim 3 wherein the context information includes at least one of (a) context information from the request; (b) context information from the system; and (c) global context information.

5. A system as in claim 4 wherein the context information includes address information indicating an address of the user.

6. A system as in claim 4 wherein the context information includes the local time.

7. A system as in claim 4 wherein the context information includes the location of the system.

8. A system as in claim 1 further comprising:

a data cache;

wherein the query mechanism is further constructed and adapted to:

upon receipt of a user request, first attempt to find an answer to the user request in the data cache.

9. A system as in claim 8 wherein the query mechanism is further constructed and adapted to:

(a) if the answer exists in the data cache and the answer is fresh, send the answer directly from the cached data; and

(b) if the answer exists in the data cache and the answer is stale, or if the answer does not exist in the data cache, then

(b1) acquire the answer from a database;

(b2) send the answer; and

(b3) update the data cache to reflect the acquired answer.

10. A system as in claim 8 wherein items in the data cache have a maximum lifetime which ranges from the time to live of the lowest resource record in

a complete answer to the maximum cache time value configured for the system as a whole.

11. A system as in claim 8 wherein the query mechanism is further constructed and adapted to:

implement negative caching such that if a request is made for a host that does not exist in an active domain, the negative response will be saved in the cache.

12. A method of providing an Internet Protocol (IP) address of one of a plurality of devices on the Internet, the method comprising:

obtaining a user request for an IP address corresponding to a particular domain name; and

providing the IP address in a single response to the user request.

13. A method as in claim 12 further comprising:

providing the IP address depending on context information.

14. A method as in claim 13 wherein the context information includes at least one of (a) context information from the user request; (b) local context information; and (c) global context information.

15. A method as in claim 14 wherein the context information includes address information indicating an address of the user.

16. A method as in claim 14 wherein the context information includes the local time.

17. A method as in claim 14 wherein the context information includes a geographic location.

18. A method as in claim 12 further comprising:

attempting to find an answer to the user request in a data cache.

19. A method as in claim 18 further comprising:

(a) if the answer exists in the data cache and the answer is fresh, sending the answer directly from the cached data; and

(b) if the answer exists in the data cache and the answer is stale, or if the answer does not exist in the data cache, then

(b1) acquiring the answer from a database;

(b2) sending the answer; and

(b3) updating the data cache to reflect the acquired answer.

20. A method as in claim 18 wherein items in the data cache have a maximum lifetime which ranges from the time to live of the lowest resource record in a complete answer to a maximum cache time value.

21. A method as in claim 18 further comprising:

if a request is made for a host that does not exist in an active domain, saving the negative response in the data cache.

22. A system comprising:

a network of distributed replicated Domain Name Servers (DNSs), each DNS comprising:

a database; and

a query mechanism constructed and adapted to:

(a) obtain from the database a user request for response information corresponding to a particular domain name; and

(b) provide complete response information in a single response to the user request,

wherein the databases in the network are replicated and wherein the DNSs share the same network address.

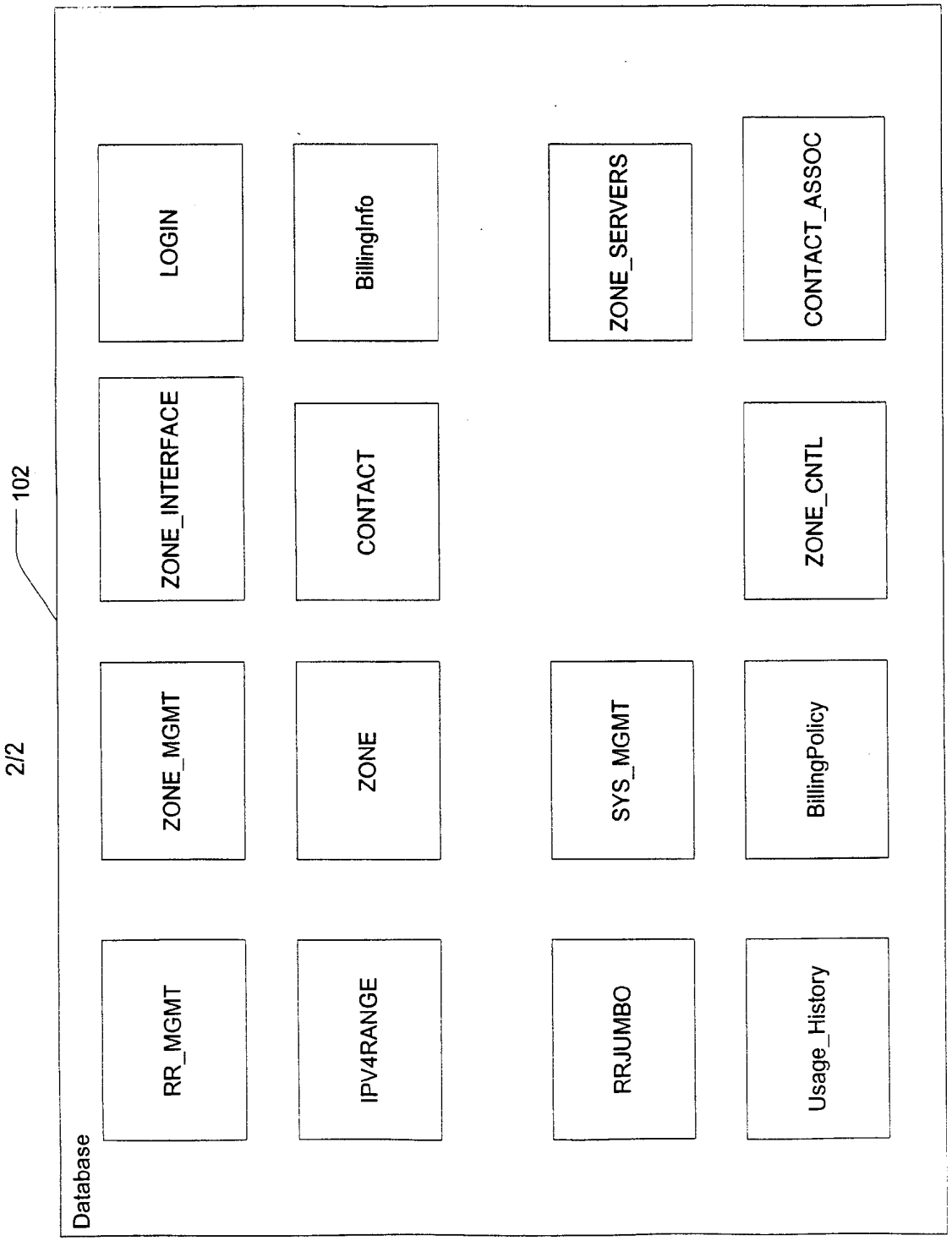

2/2
102
Database
RR_MGMT
ZONE_MGMT
ZONE_INTERFACE
LOGIN
IPV4RANGE
ZONE
CONTACT
BillingInfo
RRJUMBO
SYS_MGMT
ZONE_SERVERS
Usage_History
BillingPolicy
ZONE_CNTL
CONTACT_ASSOC

Fig. 2

1/2

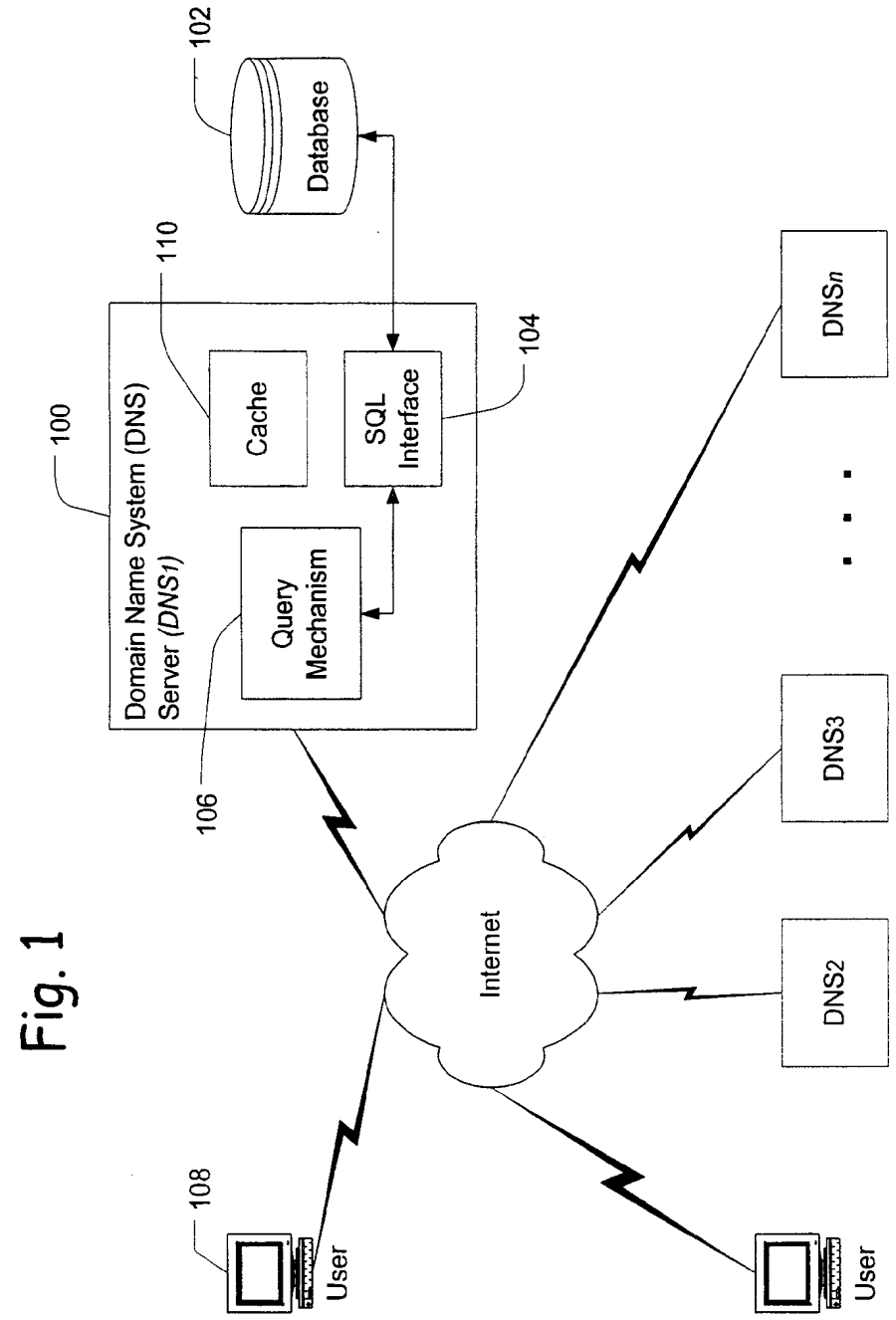

102
Database
110
Cache
SQL Interface
104
100
Domain Name System (DNS) Server (DNS1)
Query Mechanism
106
Internet
DNSn
DNS3
DNS2
108
User
User

Fig. 1

Electronic Acknowledgement Receipt

EFS ID:	11663147
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	20-DEC-2011
Filing Date:	21-MAR-2009
Time Stamp:	13:30:13
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	Transmittal Letter	137_US_U1_Supp_IDS.pdf	36230 fb77bca82da0c8b3fac5c23de0de4ed2b8471043	no	5

Warnings:	
Information:	

2	Information Disclosure Statement (IDS) Form (SB08)	137_US_U1_SB08.pdf	28122 2bb9148d9d5aefd619d9774aa07e252dc44d2ea1	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	EP0817444A2.pdf	615681 e1e3ca08aa58b7d12010c3031ad3773e4cae3bce	no	13
Warnings:					
Information:					
4	Foreign Reference	WO0052594A2.pdf	1890801 70b9d4dd50714aee3eab404befd4b8ffb9454438	no	54
Warnings:					
Information:					
5	Non Patent Literature	EPO_2011_12_06_Extended_SR_0093_EP_01.pdf	207787 dd6fb42242fab24a1dcd0fc911fda841a3f86bd3	no	7
Warnings:					
Information:					
		Total Files Size (in bytes):	2778621		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Neeraj K.Utreja
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☒ No fee is due.

☐ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☐ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☐ No statement is necessary.

☒ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☒ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VI
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: December 20, 2011

/JCS/

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UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

83579 7590 11/30/2011

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EXAMINER	
UTREJA, NEERAJ K	

ART UNIT	PAPER NUMBER
2452	

NOTIFICATION DATE	DELIVERY MODE
11/30/2011	ELECTRONIC

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

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

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

docketing@cpaglobal.com

Office Action Summary	Application No.	Applicant(s)	
	12/408,681	FULLAGAR ET AL.	
	Examiner	Art Unit	
	NEERAJ UTREJA	2452	

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *04 August 2011*.

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) *1-24* 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) *1-24* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/17/2011*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The Office Action has been issued in response to amendment filed 8/4/2011. Claims 1-26 are pending. Objections to claims 6 and 7 have been withdrawn. The rejection of claim 8 under 35 U.S.C. 101 has also been withdrawn because Applicant specifically indicated that at least a portion of the system is implemented via hardware. Applicant's arguments have been carefully and respectfully considered in light of the instant amendment but are rendered moot in view of the new ground(s) of rejection. Because the change in grounds was not necessitated by amendment, this Action has been made Non-Final.

Double Patenting

> The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).
>
> A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.
>
> Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

1. Claims 1, 5, 8, and 9 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over

claims 1, 12, and 17 of copending Application No. 12105079. This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the only significant difference is that the copending application includes additional features. For example, with respect to claim 1, the copending application includes the additional feature of "wherein the second server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library"; however, claim 1 of the copending application still anticipates claim 1 of the instant application.

Current Application: 12408681	Copending Application: 12880324
1. A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising: at a first server in said first tier of servers, obtaining a request from a client for a resource; if said resource is available at said first server or at a peer of said first server, serving the resource to the client; otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular, and if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise, if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and	1. A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising: at a first server in the first tier of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library; if the resource is not available at the first server or at a peer of the first server, determining if the resource is popular; if the resource is determined to be popular, then the first server obtaining the resource and the first server serving the resource to the client, otherwise, if the resource is determined not to be popular, directing the client to a second server in a second tier of servers distinct from the first tier of servers, **wherein the second server comprises a first portion of the**

said second server serving the resource to the client.	**content provider's library, the first portion comprising at least the resource, and wherein at least one other server in the second tier comprises a second portion of the content provider's library**, and the second server serving the resource to the client.
5. A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising: (A) at a first server in said first tier of servers, obtaining a request from a client for a resource; (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource.	17. A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising: at a first server in one tier of the tiers of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library; if the resource is not available at the first server or at a peer of the first server, then selectively redirecting the request from the client to a second tier server, the second tier server being in a tier distinct from the tier containing the first server, the redirecting being based, at least in part, on a current popularity value for the resource; wherein the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and **wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion.**
8. A content delivery framework comprising: a plurality of edge servers forming a first tier of servers; and a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which	12. A content delivery framework comprising: a plurality of edge servers forming a first tier of servers; a plurality of parent servers forming a second tier of servers, the parent servers being distinct from the edge servers; and at least one popularity service constructed and adapted to obtain a first set of information from at least some of the edge servers about requests for content, and to provide the edge servers with a second set of

tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content.	information about which tier of servers should handle those requests for content, the popularity service making its determinations based, at least in part, on a measure of popularity of requested content; and wherein the requested content is available as part of a content provider's library, **and wherein distinct portions of the content provider's library are logically partitioned across parent servers in the second tier.**
9. A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising: (A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource; (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on a current popularity value for said resource.	17. A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising: at a first server in one tier of the tiers of servers, obtaining a request from a client for a resource, wherein the resource is available as part of a content provider's library; if the resource is not available at the first server or at a peer of the first server, then selectively redirecting the request from the client to a second tier server, the second tier server being in a tier distinct from the tier containing the first server, the redirecting being based, at least in part, on a current popularity value for the resource; wherein the second tier server comprises a first portion of the content provider's library, the first portion comprising at least the resource, and wherein at least one other second tier server comprises a second portion of the content provider's library distinct from the first portion.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 13, 23, and 24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Support for the newly added feature "dynamic measure of popularity of the resource" could not be found in the specification.

Claim Rejections - 35 USC § 103

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

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

3. Claims 1-19, 21, and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seed et al. (US 2006/0015574 A1).

Claims 1, 5, 8, 9

Seed discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (Fig. 1), the method comprising:

at a first server in said first tier of servers (Edge Server or Parent Server of Fig. 1), obtaining a request from a client for a resource (Fig. 3a, 300 – Direct client to best or optimal edge server for requested object);

if said resource is available at said first server or at a peer of said first server (Fig. 3a, 305 – Does the selected best or optimal edge server have requested object?), serving the resource to the client (Fig. 3a, 310 – Serve requested object to client);

otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular (Fig. 3a, 315 – Check for edge server whether requested object is popular), and

if the resource is determined to be popular, then said first server obtaining said resource (Fig. 3b, 360 – Pull requested object to edge and/or parent servers), otherwise,

if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers (Fig. 3a, 320 – Re-direct client to a parent (or origin) server), and

said second server serving the resource to the client (Fig. 3a, 345 – Serve requested object to client from parent (or origin) server).

There is a subtle difference between the instant invention and the prior art. It appears as if Seed focuses on the embodiment wherein popular content is replicated to the edge servers after a client requests it and the edge server determines it is popular so that the edge servers carry the popular content in the event of future requests. Seed

does not explicitly teach that the edge servers will pull the popular content from the parent or origin server and then serve it to the same client that initially made the request.

However, in Paragraph 27, Seed teaches that the checking of whether the requested object is popular and replicating the popular object to the edge server may be performed in parallel or before the performance of other functions related to the prior art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Seed to serve the client once the replication of the popular content has taken place in order to give the system more flexibility and offer an administrative design choice. Seed teaches in Paragraph 10 that it is "desirable to serve objects from edge servers because the edge servers are typically closer to end-users". By modifying the system as suggested, user performance could be bolstered in the event that serving the requested popular content to the user is faster than serving the content from a higher-level server such as a parent/origin server such that the increased speed gains offset the time required to replicate the content from one of those servers.

With regard to claim 8, Seed further discloses:

a plurality of edge servers forming a first tier of servers (Fig. 1, Edge Server);

a plurality of parent servers forming a second tier of servers (Fig. 1, Parent Server); and

at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said

edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content (Paragraph 44 teaches that an object is replicated when the popularity P of the object is greater than a threshold.).

Claim 2

Seed further discloses the method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers (Fig. 1 – the parent servers or origin servers can read on second tier of servers).

Claim 3

Seed further discloses the method of claim 1 wherein the second server is a content provider's origin server (Fig. 1, Origin Server 110).

Claim 4

Seed further discloses the method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold (Paragraph 44 teaches that an object is replicated when the popularity P of the object is greater than a threshold.).

Claim 6

Seed further discloses the method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers (Fig. 1, Parent Server or Origin Server reads on second tier).

Claim 7

Seed further discloses the method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server (Fig. 1, Origin Server).

Claim 10

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier (Fig. 1).

Claim 11

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a

plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier (Fig. 1).

Claim 12

Seed further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier (Fig. 1).

Claims 13, 23, 24

Seed further discloses the methods of claims 1 and 5 and 9 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource (Paragraph 44).

Claims 14, 15, 25, 26

Seed further discloses the method of claims 1 and 9 wherein the resource is part of an object (The resource itself is an object.), but does not explicitly disclose wherein determining whether said resource is popular is based at least in part on whether the resource is an initial part of the object.

However, the use of metadata of header information in a CDN is well-known in the art. In fact, although not specifically addressed by Seed, since Seed teaches of a

CDN, it is more than likely that such information is used in the implementation of the system (The customer/client must have some way of identifying content.). Such metadata reads on "initial part of an object" and it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Seed so that the popularity is determined once the content metadata is requested so that Seed can go ahead and replicate said content if it is determined to be popular. The advantage conferred is that Seed's system will be more readily and quickly prepared to serve both the initial and/or future customers.

With regard to claims 15 and 26, the rest of the content aside from the header information or metadata reads on "another part of the object". And because header information is downloaded before the actual content, this reads on "the initial part of the object having already been served to the client".

Claim 16

Seed further discloses the method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers (Fig. 3a, 315 – edge server checks popularity and reads on popularity server).

Claim 17

Seed further discloses the method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service (Fig. 3a, 315 – edge server checks popularity and reads on popularity server.

The code or means on the edge server that allows for this reads on popularity service. Also see e.g., Paragraph 44.).

Claim 18

Seed further discloses the method of claim 17 wherein the popularity service runs on a popularity server (Fig. 3a, 315 – edge server checks popularity and reads on popularity server. The code or means on the edge server that allows for this reads on popularity service. Also see e.g., Paragraph 44.).

Claim 19

Seed further discloses the method of claim 18 wherein the popularity server maintains information on relative popularity of content being served (Paragraph 41 - "more popular than the least popular object currently in storage").

Claim 21

Seed further discloses the method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity of said resource (Paragraph 41 - "more popular than the least popular object currently in storage").

4. Claims 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seed et al. (US 2006/0015574 A1) in view of Kolhi et al. (US 2010/0312861 A1).

Claims 20, 22

Seed discloses the method of claims 19 and 21 wherein the popularity server maintains information on relative popularity of content but does not explicitly state that the information is specific to the relative priority of content served in a region comprising the first server.

This deficiency is cured by Kohli. Kohli is similarly directed toward caching popular content on servers as close to possible to users that have the highest probability of requesting the content (Abstract). In Paragraph 39, Kohli teaches that content may have different popularity levels in different geographical locations, so the invention of the prior art adapts to different viewing patterns in different areas and caches content accordingly.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement Kolhi's features of differentiating popularity among different regions in Seed's system in order to augment the functionality by allowing for content to be more efficiently routed to regions where it is most popular. Based on the combination, an edge server must maintain information on the relative priority of content served in various regions, including the region comprising said edge server. For example, Seed discloses that the edge server determines whether a give object is popular (Seed, Fig. 3a, 315), and Kolhi discloses that popularity information can be differentiated by region (Kolhi, Paragraph 39).

Response to Arguments

5. Applicant's arguments with respect to claims 1-26 have been considered but are moot in view of the new ground(s) of rejection.

Without conceding to Applicant's arguments, Examiner has withdrawn the Dilley reference and replaced it with another pertinent reference (Seed et al.). Because the new ground(s) of rejection were issued but not necessitated by amendment, this action has been made Non-Final. Examiner reserves the right to use the Dilley reference during the remainder of prosecution, if needed. Applicant is directed to claim rejections above for more information.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NEERAJ UTREJA whose telephone number is (571)270-7902. The examiner can normally be reached on Monday to Thursday, 8:30AM - 6PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thu Nguyen can be reached on 571-272-6967. 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.

/N. U./
Examiner, Art Unit 2452

/THU NGUYEN/
Supervisory Patent Examiner, Art Unit 2452

Notice of References Cited	Application/Control No. 12/408,681	Applicant(s)/Patent Under Reexamination FULLAGAR ET AL.	
	Examiner NEERAJ UTREJA	Art Unit 2452	Page 1 of 1

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	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					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	41	(fullagar-david or newton-christopher or lipstone-laurence-$).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:33
L2	8536	cdn or (content near delivery near network)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:33
L3	6	L1 and L2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:33
L4	475	L2 and (tier or level or echelon or class) same (popular or desir$3 or ((frequent$2 or often or most or highly or continuous$2) near2 (requested)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:33

L5	84	("long tail" or "long-tail") near2 (content or media or video or data or pictures or pics)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:34
L6	27	("long tail" or "long-tail") near2 (content or media or video or data or pictures or pics) same popular $3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:34
L7	2	"20070055764".did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/11/10 04:35
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S1	13228	((709/224.ccls.)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:25
S2	5710	((709/226.ccls.)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:25
S3	0	("CDNor(contentneardeliverynearnetwork)").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:26
S4	0	("CDNor(contentneardeliverynearnetwork)").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:31
S5	5710	709/226.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:28

S6	38	(fullagar-david or newton-christopher or lipstone-laurence-$).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:30
S7	7876	cdn or (content near delivery near network)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:31
S8	5	S6 and S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:31
S9	264	S7 and tier and popular	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:38
S10	1736	S7 and (tier or level or echelon or class) and (popular or desir$3 or ((frequent$2 or often or most or highly or continuous$2) near2 (requested)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:41

S11	431	S7 and (tier or level or echelon or class) same (popular or desir$3 or ((frequent$2 or often or most or highly or continuous$2) near2 (requested)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:41
S12	2	"20070055764".did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:44

EAST Search History (Interference)

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David FULLAGAR
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	2	Attorney Docket No: 0137-US-U1

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EXAMINER /Neeraj Utreja/ **DATE CONSIDERED** 11/10/2011

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* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

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Examiner Name	Neeraj K. Utreja

Sheet	2	of	2	Attorney Docket No: 0137-US-U1

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Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
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		7254645	Aug 7, 2007	Nishi, Koji	
		7274658	Sep 25, 2007	Bornstein, Claudson F., et al.	
		7359955	Apr 15, 2008	Menon, Satish N., et al.	
		7373644B2	May 13, 2008	Aborn, J.	
		7562153	Jul 14, 2009	Biliris, Alexandros et al.	
		7577754B2	Aug 18, 2009	Garcia, L. A., et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T[2]

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

EXAMINER	/Neeraj Utreja/	DATE CONSIDERED	11/10/2011

Substitute Disclosure Statement Form (PTO-1449)

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1] Applicant's unique citation designation number (optional) [2] Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.U

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

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

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

CLAIM		DATE								
Final	Original	03/25/2011	11/10/2011							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13		✓							
	14		✓							
	15		✓							
	16		✓							
	17		✓							
	18		✓							
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	20		✓							
	21		✓							
	22		✓							
	23		✓							
	24		✓							
	25		✓							
	26		✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

SEARCHED			
Class	Subclass	Date	Examiner
709	226	3/23/2011	NU

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	3/23/2011	NU
Google Patents search	3/23/2011	NU
double patenting / inventor search	3/23/2011	NU
EAST text search updated	11/10/2011	NU
double patenting / inventor search	11/10/2011	NU
Google Patents search: "long tail popular cdn"	11/10/2011	NU

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/NEERAJ UTREJA/ Examiner.Art Unit 2452	

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Complete if Known	
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David FULLAGAR
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	1	of	2	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		20010027491A1	Oct 4, 2001	Terretta, M	
		20020016831	Feb 7, 2002	Peled, Ariel et al.	
		20020016835A1	Feb 7, 2002	Gamerman, G	
		20020040404A1	Apr 4, 2002	Lahr, Nils B.	
		20020087797A1	Jul 4, 2002	Adrangi, F	
		20020116444	Aug 22, 2002	Chaudhri, Imran et al.	
		20020133537A1	Sep 19, 2002	Lau, F	
		20020198953A1	Dec 26, 2002	O'Rourke, B. P., et al.	
		20030031176A1	Feb 13, 2003	Sim, S. Y.	
		20030112792A1	Jun 19, 2003	Cranor, C. D., et al.	
		20030149581	Aug 7, 2003	Chaudhri, Imran et al.	
		20050021863A1	Jan 27, 2005	Jungck, P. J.	
		20060015574	Jan 19, 2006	Seed, Steven L., et al.	
		20080065724	Mar 13, 2008	Seed, Steven L., et al.	
		20080071859	Mar 20, 2008	Seed, Steven L., et al.	
		20080147866	Jun 19, 2008	Stolorz, Paul E., et al.	
		20110145386	Jun 16, 2011	Stolorz, Paul E., et al.	
		5777988	Jul 7, 1998	Cisneros, Arturo	
		5815662	Sep 29, 1998	Ong, L	
		6085193	Jul 4, 2000	Malkin, P. K., et al.	
		6094680	Jul 25, 2009	Hokanson, T. E.	
		6463454	Oct 8, 2002	Lumelsky, Leon et al.	
		6591288	Jul 8, 2003	Edwards, Keith R., et al.	
		6594260B1	Jul 15, 2003	Aviani Jr, J. A., et al.	
		6598121B2	Jul 22, 2003	Challenger, J. R., et al.	
		6732237B1	May 4, 2004	Jacobs, L. et al.	
		6741990	May 25, 2004	Nair, Sandeep R., et al.	
		6785704	Aug 31, 2004	McCanne, Steve	
		6839758	Apr 1, 2005	Sorensen, Lauge S.	
		6859840B2	Feb 22, 2005	Singal, S. S., et al.	
		6976090	Dec 13, 2005	Ben-Shaul, Israel et al.	
		6999988	Feb 14, 2006	Buddhikot, Milind M., et al.	
		7024466B2	Apr 4, 2006	Outten, Todd A., et al.	
		7103645B2	Sep 5, 2006	Leighton, F. T., et al.	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

	Complete if Known
Application Number	12/408,681
Filing Date	Mar 21, 2009
First Named Inventor	David FULLAGAR
Art Unit	2452
Examiner Name	Neeraj K. Utreja

Sheet	2	of	2	Attorney Docket No: 0137-US-U1

US PATENT DOCUMENTS

Examiner Initial *	Cite No	Document Number	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear
		7185052B2	Feb 27, 2007	Day, R	
		7254645	Aug 7, 2007	Nishi, Koji	
		7274658	Sep 25, 2007	Bornstein, Claudson F., et al.	
		7359955	Apr 15, 2008	Menon, Satish N., et al.	
		7373644B2	May 13, 2008	Aborn, J.	
		7562153	Jul 14, 2009	Biliris, Alexandros et al.	
		7577754B2	Aug 18, 2009	Garcia, L. A., et al.	

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Examiner Initials*	Cite No	Foreign Patent Document	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or RelevantFigures Appear	T^2

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No [1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T^2

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)
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Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Kathleen McInnish
Attorney Docket Number:	0137-US-U1

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

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

Electronic Acknowledgement Receipt

EFS ID:	10759075
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Kathleen McInnish
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	17-AUG-2011
Filing Date:	21-MAR-2009
Time Stamp:	16:59:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	3636
Deposit Account	505063
Authorized User	SIEKMANN,JONATHAN
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 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	137_US_U1_Supp_IDS.pdf	39161 4d7ab14fb194edc051a1410bccbdbe960d51742b	no	6
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	137_US_U1_SB08.pdf	38028 a935702516677b7a37bbc47f0031b0a06ab65e4b	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Fee Worksheet (SB06)	fee-info.pdf	30595 c88335228eaae9c7983cced4857aaafe6c95d2e0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	107784		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	12/408,681	Confirmation No.	:	9965
First Applicant	:	FULLAGAR et al.	Art Unit	:	2452
Filed	:	March 21, 2009	Examiner	:	Neeraj K.Utreja
Title	:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)			
Docket No.	:	0137-US-U1			

Submitted Via EFS-Web

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT PURSUANT TO 37 C.F.R. §§ 1.56, 1.97, AND 1.98

Sir:

The Examiner is respectfully requested to consider the patents, patent applications, publications, or other information cataloged on the enclosed Form (e.g., PTO-1449, PTO-892, PTO/SB/08, etc.) during examination of the above-identified patent application. The order of presentation of the references should not be construed as an indication of importance. These references are submitted for the Examiner's consideration and are submitted pursuant to an Applicant's duty of disclosure under 37 C.F.R. § 1.56.

Copies of all of the cited documents:

☐ are enclosed unless otherwise indicated on the enclosed Form PTO/SB/08a.

☐ have been previously furnished to the Office in prior application No. _____, filed _____, which the present application relies upon for an earlier effective filing date under 35 U.S.C. § 120. Therefore, no copies of the cited documents are included herewith pursuant to 37 C.F.R. § 1.98(d); MPEP § 609(III)(A)(2).

☒ are enclosed unless they are U.S. patents or U.S. patent application publications pursuant to 37 C.F.R. § 1.98(a).

I
BASIS

This information disclosure statement is filed pursuant to

☐ 37 C.F.R. § 1.97(b).
This information disclosure statement is filed either (1) within three months of the filing date of a national application other than a continued prosecution application under 37 C.F.R. § 1.53(d); (2) within three months of the date of entry of the national stage as set forth in 37 C.F.R. § 1.491 in an international application; (3) before the mailing date of a first Office action on the merits; (4) concurrently with the filing of a request for continued examination under 37 C.F.R. § 1.114; or (5) before the mailing of a first Office action after the filing of a request for continued examination under 37 C.F.R. § 1.114, whichever event occurs last.

Accordingly, this information disclosure statement requires no fee and no certification.

☒ 37 C.F.R. § 1.97(c).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(b), but before the mailing date of any of (1) a final action under 37 C.F.R. § 1.113; (2) a notice of allowance under 37 C.F.R. § 1.311; or (3) an action that otherwise closes prosecution in the application.

Accordingly, this information disclosure statement requires either the fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c), or a statement under 37 C.F.R. § 1.97(e).

☐ 37 C.F.R. § 1.97(d).
This information disclosure statement is filed after the period specified in 37 C.F.R. § 1.97(c) since a:

☐ final action under 37 C.F.R. § 1.113

☐ notice of allowance under 37 C.F.R. § 1.311

was mailed to the Applicant on _____.

Accordingly, this information disclosure statement requires the fee set forth in 37 C.F.R. § 1.17(p) to consider an information disclosure statement under 37 C.F.R. § 1.97(d), and a statement under 37 C.F.R. § 1.97(e).

If this statement crosses in the mail with an Office action, or is otherwise not in the indicated category of 37 C.F.R. § 1.97, it is respectfully requested that this statement be treated in the next appropriate category and made of record. To the extent required, please treat this paper as a conditional petition for acceptance of the information disclosure statement.

II
FEES

Any required fee is being paid as indicated below:

☐ No fee is due.

☒ The $180 fee specified in 37 C.F.R. § 1.17(p) for submission of an information disclosure statement under 37 C.F.R. § 1.97(c) or (d) is due.

☒ This fee is paid by credit card.

☐ Please charge the required fee to Deposit Account No. 505063.

☒ The Commissioner is hereby authorized to charge any additional required fees or credit any overpayments associated with this information disclosure statement to the account.

III

CERTIFICATION

Pursuant to 37 C.F.R. § 1.97(e), I state as follows:

☒ No statement is necessary.

☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(1).

☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to my knowledge after making reasonable inquiry, no item of information contained in this information disclosure statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this information disclosure statement. 37 C.F.R. § 1.97(e)(2).

Pursuant to 37 C.F.R. § 1.704(d), I state as follows:

☐ Each item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart application, and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this information disclosure statement.

IV
FOREIGN LANGUAGE REFERENCES

Pursuant to 37 C.F.R. § 1.98(a)(3)(i), any information disclosure statement filed under 37 C.F.R. § 1.97 shall include a concise explanation of the relevance, as it is presently understood by the individual designated in § 1.56(c) most knowledgeable about the content of the information, of each patent, publication, or other information listed that is not in the English language. The concise explanation may be either separate from the specification or incorporated therein. In compliance with the rules, the Applicant states as follows:

☐ No concise explanation is required since all cited references are in English.

☐ A concise explanation of the relevance of one or more foreign language references is attached.

☐ According to the procedural policy adopted by the PTO with regard to disclosure requirements, the Applicant is satisfying the disclosure requirement pursuant to MPEP § 609.04(a)(III) by submitting herewith the following:

- ☐ English language versions of any non-English language documents.
- ☐ English language versions of one or more search reports or other actions by one or more foreign patent offices in one or more counterpart foreign applications, which indicate the degree of relevance found by the foreign office(s).
- ☐ Pursuant to 37 C.F.R. § 1.98(a)(3)(ii), a copy of a translation is not submitted herewith because a written English-language translation of a non-English-language document, or portion thereof, is not within the possession, custody, or control of, or is readily available to any individual designated in § 1.56(c).

The Applicant has not analyzed these documents and, therefore, declines to comment on their relevance at this time.

☐ One or more English language abstracts for the non-English language references are also enclosed.

V
STATEMENT OF RELATEDNESS (Under M.P.E.P. § 2001.06(b))

In satisfaction of the duty of disclosure under 37 C.F.R. § 1.56, and in accordance with M.P.E.P. § 2001.06(b), the Examiner is respectfully requested to consider the pending applications (2011/0145386, filed December 24, 2010; 2008/0147866, filed October 31, 2007; 2006/0015574, filed February 14, 2002; 2008/0071859, filed October 31, 2007; 2008/0065724, filed October 30, 2007, and listed in the attached IDS document) which are owned by the

Applicant of the present application. The pending applications may include subject matter similar to that of the present application.

VI
REMARKS

It is respectfully requested that:

(1) The Examiner sign the enclosed Form to evidence that the cited information has been fully considered by the Patent and Trademark Office during the examination of this application; and

(2) The citations for the cited information be printed on any patent that issues from this application.

The submission of this information disclosure statement by the Applicant shall not be construed as a representation that a search has been performed or that no other material information under 37 C.F.R. § 1.56 exists. See 37 C.F.R. § 1.97(g).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, material to the patentability of one or more of the pending claims in this application pursuant to 37 C.F.R. § 1.56(b), unless specifically designated by the Applicant as such. See 37 C.F.R. § 1.97(h).

The submission of this information disclosure statement by the Applicant shall not be construed as an admission that any information cited or referred to herein is, or is considered to be, or even qualifies as "prior art" under 35 U.S.C. § 102 with respect to this invention, unless specifically designated by the Applicant as such.

Notwithstanding any statements by the Applicant, the Examiner is urged to form his or her own conclusion regarding the relevance of the cited information.

VII
CONCLUSION

The Examiner is encouraged to contact the undersigned attorney to discuss any questions concerning this information disclosure statement or any of the information cited or referred to herein.

Respectfully submitted,

Date: August 17, 2011

/JCS/

Jonathan C. Siekmann
Registration No. 58,259
USPTO Customer No. 83579
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1025 Eldorado Blvd.
Broomfield, Colorado 80021
Tel: 720-888-2140
Fax: 720-888-5619

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF:	Attorney Docket: 0137-US-U1
Fullagar et al.	Group Art Unit: 2452
Application Serial No.: 12/408,681	Examiner: UTREJA, Neeraj K
Application Filing Date: 03/21/2009	Confirmation No.: 9965
Title: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)	Date: August 4, 2011

AMENDMENT/RESPONSE

via EFS-Web

Sir:

In response to the non-final Office Action mailed April 4, 2011, please amend this application as follows.

Petition for an Extension of Time begins on page 2 hereof.

Amendments to the Specification begin on page 3 hereof.

Amendments to the claims begin on page 5 hereof.

Remarks begin on page 12 hereof.

Petition for an Extension of Time

Applicant hereby petitions for a **one**-month extension of time and is electronically submitting the required fee with this Amendment. Other than this extension fee and the fees for additional claims, Applicant believes no other Petitions or fees are necessary, but if this is incorrect, please consider this a Petition and authorization of payment therefor. The Commissioner is authorized to deduct any additional fees from or credit any over-payment to the undersigned's Deposit Account No. 50-5063.

IN THE SPECIFICATION

Please amend the specification as follows:

Please replace **paragraph 0002** in its entirety with the following:

[0002] This application is also related to the following co-owned and co-pending patent applications, the contents of each of which are fully incorporated herein by reference for all purposes:

Application No.	**Filing Date**	**Issued / Published as**	**Issue/publication date**
10/073,938	02-14-2002	2006-0015574	Jan. 19, 2006
11/715,316	03-08-2007	2007-0174463	July 26, 2007
11/978,656	10-30-2007	2008-0065724	Mar. 13, 2008
11/980,672	10-31-2007	2008-0071859	Mar. 20, 2008
10/259,497	09-30-2002	7,822,871	Oct. 26, 2010
11/932,162	10-31-2007	2008-0147866	June 19, 2008
11/976,648	10-26-2007	7,860,964	Dec. 28, 2010

Please replace paragraph 0032 with the following:

[0032] In a presently preferred embodiment the server selector **106** is an intelligent traffic manager (ITM) / adaptive traffic controller (ATC) such as described in co-pending U.S. patent application no. 10/259,497, filed 09-30-2002, and titled "Configurable Adaptive Global Traffic Control And Management," (published as US 2003-0065762 A1 on April 3, 2003, issued as U.S. Patent No. 7,822,871 on October 26, 2010); and in U.S. patent application no. 11/976,648, filed 10-26-2007, titled "Policy-based content delivery network selection," published as US 2008-0215718 A1 on September 4, 2008, and issued as U.S. Patent No. 7,860,964 on December 28, 2010 (collectively the "ITM applications"), the entire contents of each of which have been incorporated herein by reference for all purposes. In some embodiments the server selector **106** may include a "best" or "optimal" server selector such as disclosed in U.S. Patent No. 6,185,598 titled, "Optimized Network Resource Location," the entire contents of which are incorporated herein by reference for all purposes. ~~The '598 patent~~ U.S. Patent No. 6,185,598 refers to CDN servers as so-called repeater servers, and describes a so-called "Best Repeater Selector (BRS) mechanism".

IN THE CLAIMS

Please amend the claims as follows. This listing of the claims replaces all prior claim listings.

1. (Original) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

at a first server in said first tier of servers, obtaining a request from a client for a resource;

if said resource is available at said first server or at a peer of said first server, serving the resource to the client;

otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular, and

if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise,

if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and

said second server serving the resource to the client.

2. (Original) The method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers.

3. (Original) The method of claim 1 wherein the second server is a content provider's origin server.

4. (Original) The method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

5. (Original) A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource.

6. (Original) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers.

7. (Currently amended) The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is an origin server.

8. (Currently amended) A content delivery framework comprising:

a plurality of edge servers forming a first tier of servers; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and

at least one popularity service, implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content.

9. (Original) A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a

second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on a current popularity value for said resource.

10. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier.

11. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier.

12. (Original) A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier.

13. (New) The method of claim 1 wherein determining whether said resource is popular is based at least in part on a dynamic measure of popularity of the resource.

14. (New) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is an initial part of the object.

15. (New) The method of claim 1 wherein the resource is part of an object, and wherein determining whether said resource is popular is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

16. (New) The method of claim 1 wherein the determining whether said resource is popular is determined, at least in part, using one or more popularity servers.

17. (New) The method of claim 1 wherein the first server determines whether said resource is popular based on information obtained from a popularity service.

18. (New) The method of claim 17 wherein the popularity service runs on a popularity server.

19. (New) The method of claim 18 wherein the popularity server maintains information on relative popularity of content being served.

20. (New) The method of claim 19 wherein the popularity server maintains information on relative popularity of content being served in a region comprising the first server.

21. (New) The method of claim 1 wherein determining whether said resource is popular comprises:

determining a relative popularity of said resource.

22. (New) The method of claim 21 wherein determining whether said resource is popular comprises:

determining a relative popularity of said resource in a region comprising the first server.

23. (New) The method of claim 5 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

24. (New) The method of claim 9 wherein the current popularity value for the resource is based at least in part on a dynamic measure of popularity of the resource.

25. (New) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is an initial part of the object.

26. (New) The method of claim 9 wherein the resource is part of an object, and wherein the current popularity value for the resource is based at least in part on whether the resource is for another part of the object, the initial part of the object having already been served to the client.

REMARKS

Favorable reconsideration and allowance of this application are respectfully requested.

By this Amendment, the specification has been amended to include the publication number or patent number of patent applications and issued patents referenced and incorporated by reference. Claims 7 and 8 have been amended and new claims 13-26 have been added.

Support for the new claims can be found throughout the application, including, *e.g.*, ¶0044.

No new matter has been added by these amendments.

It should be appreciated that the Applicant has not invoked 35 U.S.C. §112, paragraph 6, with respect to any term in any claim of the present application. It should further be appreciated that the words "first" and "second" in the claims are used to distinguish or identify within a claim, and not to show a serial or numerical limitation or ordering. Similarly, words such as "particular," "specific," "certain," and "given" are used to distinguish or identify within a claim and are not intended to be otherwise limiting. Furthermore, letter labels (*e.g.*, "(A)", "(B)", "(C)", and so on) and/or numbers (*e.g.*, "(i)", "(ii)", and so on) if in the claims, are used to assist in readability, and are not intended to be otherwise limiting or to impose any serial or numerical limitations or orderings.

Claims 1-26 are pending in this application.

Claim objections

The Examiner objected to claims 6 and 7 for an informality. According to the Examiner, "the claims recite a 'serves'." The Examiner believes this to be a typographical error of the intended term "servers," and requires correction.

Claim 7 is amended to correct the typographic error noted by the Examiner. However, applicant does not find the same "typo" in claim 6, and so has not amended that claim.

In view of the above amendments, withdrawal of this objection is respectfully requested.

Claim Rejections - 35 USC § 101

The Examiner rejected claim 8 under 35 U.S.C. § 101 "because the claimed invention is not supported by either a process, machines, manufactures and composition of matter asserted utility or a well established utility."

Claim 8 has been amended to clarify that at least one of the elements is implemented by hardware, in combination with software.

In view of the above, withdrawal of this rejection is respectfully requested.

THE PRIOR ART REJECTIONS

Claim Rejections - 35 USC § 102

The Examiner rejected claims 1-3 and 5-12 under 35 U.S.C. §102(b) as being anticipated by Dilley et al. (US 2007/0055764 Al – hereinafter "Dilley")[1]. The grounds for this rejection are respectfully traversed.

The presently claimed invention relates to content delivery, to content delivery networks (CDNs), and to frameworks and systems using CDNs. *Specification*, ¶0003. CDNs typically operate to deliver content to end users - preferably on behalf of content providers - from servers that are, by some measure, close to the end users. Using a CDN, some (or all) of a content provider's content can be served to clients from the CDN (i.e., from one or more servers in the CDN) instead of from the content provider's server(s). *Id.* ¶0013.

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[1] Dilley issued as U.S. Patent No. 7,376,716 on May 20, 2008.

A typical caching CDN generally operates as follows:

1. A content provider decides to serve some of its content using the CDN instead of via its own server(s) (the content provider's server(s) is/are referred to as origin server(s)).

2. When a user requests content that is to be served by the CDN, that user is somehow directed to the CDN (or to a server in the CDN), and the content is served to the user from a CDN server.

One issue in operation of a CDN is how and where the CDN server gets a copy of requested content that it does not already have. In a typical CDN, if the CDN server that is to serve the user's request does not already have a copy of a particular request resource, then it tries to get a copy of that resource (e.g., either from a peer server or some other server in the CDN, or from the content provider's origin server). In a caching CDN, content that is served may also be cached on some or all of the CDN servers, either before being served or in response to specific requests for that content. Thus, when a typical CDN server serves some content to a user it may also cache that content.

The inventors realized that having a CDN server always cache content that it serves may not be advantageous. To the contrary, as they realized, automatic and indiscriminate caching of all requested content may lead to inefficiencies. For example, as described in the present application (at *Id.* ¶0015):

> Certain publishers have large content libraries in which only a small proportion of the content (the so-called "short head") is popular enough to benefit from serving through a caching CDN, while the majority of the content (the so-called "long tail") is accessed only occasionally and not generally worth caching (or even serving from an edge server). This situation would be typical for a content publisher with a very large music or video library. Some music content – the popular content – may be regularly requested, whereas other music – the

not popular (also referred to as unpopular) content
– may be seldom if ever requested.

Consider the following **example**: A content provider with a library of movies wishes to serve content using a CDN. The CDN will help the content provider to deliver its movies efficiently and quickly to users all over various geographic regions. Some of the movies in the library may be very popular and may be requested by lots of users. Other movies in the library may be seldom if ever viewed. Suppose, for the sake of this example, that a first movie (M1) is very popular. Movie M1 is requested often and by lots of different users over the various regions served by the CDN. Suppose too, for the sake of this example, that a second movie (M2) is in the content provider's library but it has never been requested by any user.

Because of movie M1's popularity, copies of M1 will start to propagate to the CDN's edge servers. As users request M1, those users will be directed to edge servers in the CDN, and those edge servers will either have a copy of M1 or they will fetch a copy of M1 and serve it.

Now suppose that a user requests movie M2 (an obscure and unpopular movie). That user will be directed to a particular edge server (ES1) in the CDN which is supposed to serve that movie to the user. Suppose that this particular edge server (ES1) already has local copies of lots of content, including the popular movie M1. Since the movie M2 has never been requested before, the edge server (ES1) will have to obtain a copy from somewhere (in the conventional manner). If the edge server (ES1) has no more storage, it will have to remove something that it already has stored (*e.g.*, the popular movie M1).

So, in this example, a non-popular movie (M2) has displaced a popular movie (M1) from the local storage of an edge server. As a consequence, the next

request for movie M1 at that server will require the server to obtain the content in order to serve it. While the server tries to get this content the user has to wait.

The inventors realized that such indiscriminate local caching (with all of its associated costs and overhead) could be avoided. The inventors realized that if certain content was not currently popular (i.e., by some measure of popularity), then a CDN may operate more efficiently if that content was not indiscriminately and unconditionally copied to and served from the CDN's edge servers.

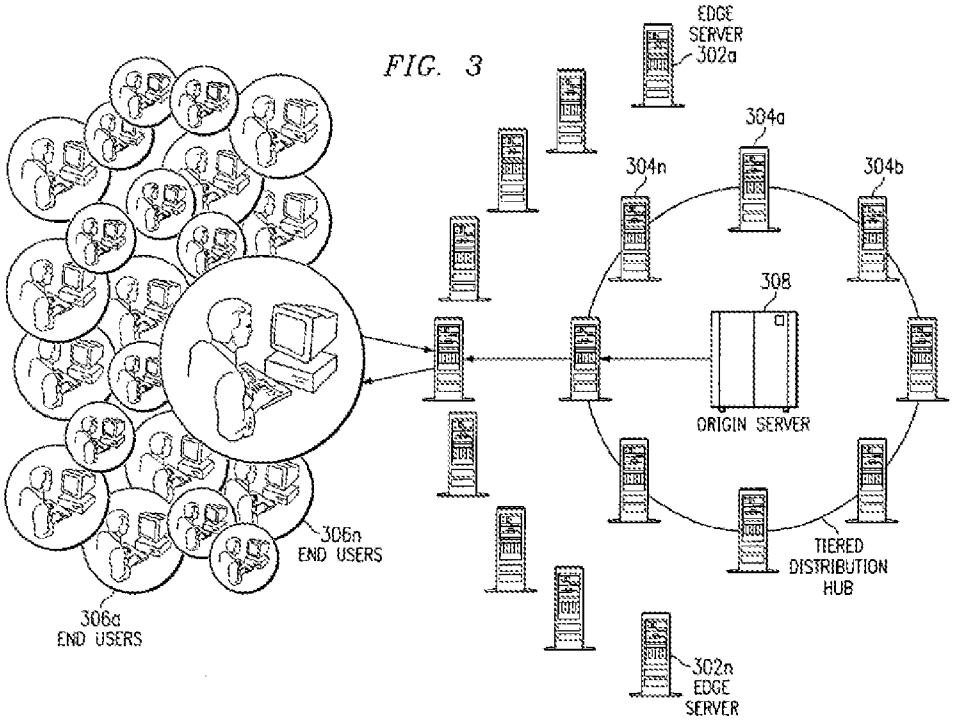
Claim 1

Thus, as recited in independent claim 1, this invention is a method of content delivery in a content delivery network comprising at least a first tier of servers. The method of claim 1 includes, at a first server in the first tier of servers, obtaining a request from a client for a resource. If the resource is available at the first server or at a peer of the first server, the resource is served to the client. Otherwise, if the resource is not available at the first server or at a peer of the first server, the method of claim 1 includes determining whether the resource is popular. If the resource is determined to be popular, then the first server obtains the resource and serves the resource to the client. Otherwise, if the resource is determined not to be popular, the client is directed to a second server, the second server not in the first tier of servers, and the second server serves the resource to the client.

Dilley describes a method and system for tiered *distribution* in a content delivery network. *Dilley*, Abstract, ¶0008. In Dilley, as in a conventional CDN, content is served to users from edge servers in the CDN. (See, *e.g.*, Dilley Figs. 1 and 3 and their related description). According to Dilley, in prior CDN systems, when an edge server didn't have a requested object, that edge server would have to go back to the content provider's origin sever to get the content. ¶¶0005-06. This

meant that even though the content provider was using a CDN to offload its own origin servers, those servers would still be used by edge servers to fetch content. *Id.* Dilley provides an intermediate layer (or tier) between the edge servers and the origin server to deal with this distribution issue. ("It is a primary object of the present invention to provide a technique for delivering Internet traffic using tiered distribution, namely, a cache hierarchy, in which requests for content that cannot be serviced in edge servers are funneled through intermediate nodes." *Dilley*, ¶0008.)

Figure 3 of Dilley (reproduced below) shows end-user requests being served from an edge server, *through* a server in the tiered distribution hub.



The servers 304 in Dilley's distribution hub obtain the requested content from the origin server 308 and pass it on to the edge servers which serve that content to the end users ("preferably the CDN … employs a tiered infrastructure using two or more tiers: a set of edge servers and a hierarchical set of "parent" or

hub regions ***that service the edge servers***." *Dilley* ¶0027, emphasis provided. See also, "The tiered distribution hubs ensure that the edge servers have the information requested by the end users. If the edge servers do not have the appropriate file when it is requested, the servers in the tiered distribution hubs will provide the edge servers with the requested content." *Id.*)

Note that Dilley does not always use the distribution hub to get content to edge servers. Dilley describes tagging content for processing by the distribution hub. *Dilley*, ¶¶0030-0040. By default, Dilley's content is served *through* the distribution hub ("The default setting is for cache hierarchy." *Id.* ¶0032). However, in some cases Dilley's edge server will go directly to the origin server to get the requested content. (When Dilley's edge server goes directly to the origin server, this "is essentially the equivalent of turning the cache hierarchy off." *Id.* ¶0033).

Dilley's distribution hubs act to protect the origin servers ("... do not flood the origin site with requests if the site is experiencing high traffic load or if the content is stale, large, or infrequently accessed." *Id.* ¶0027; and "the cache hierarchy protects the content providers from requests for large, popular objects causing the CDN to make more requests than the content provider can handle." *Id.* ¶0029).

Dilley's Figure 6 (reproduced here) describes the operation of Dilley's system "when a given edge server receives a client request for an object." *Id.* ¶0044 *et seq.*

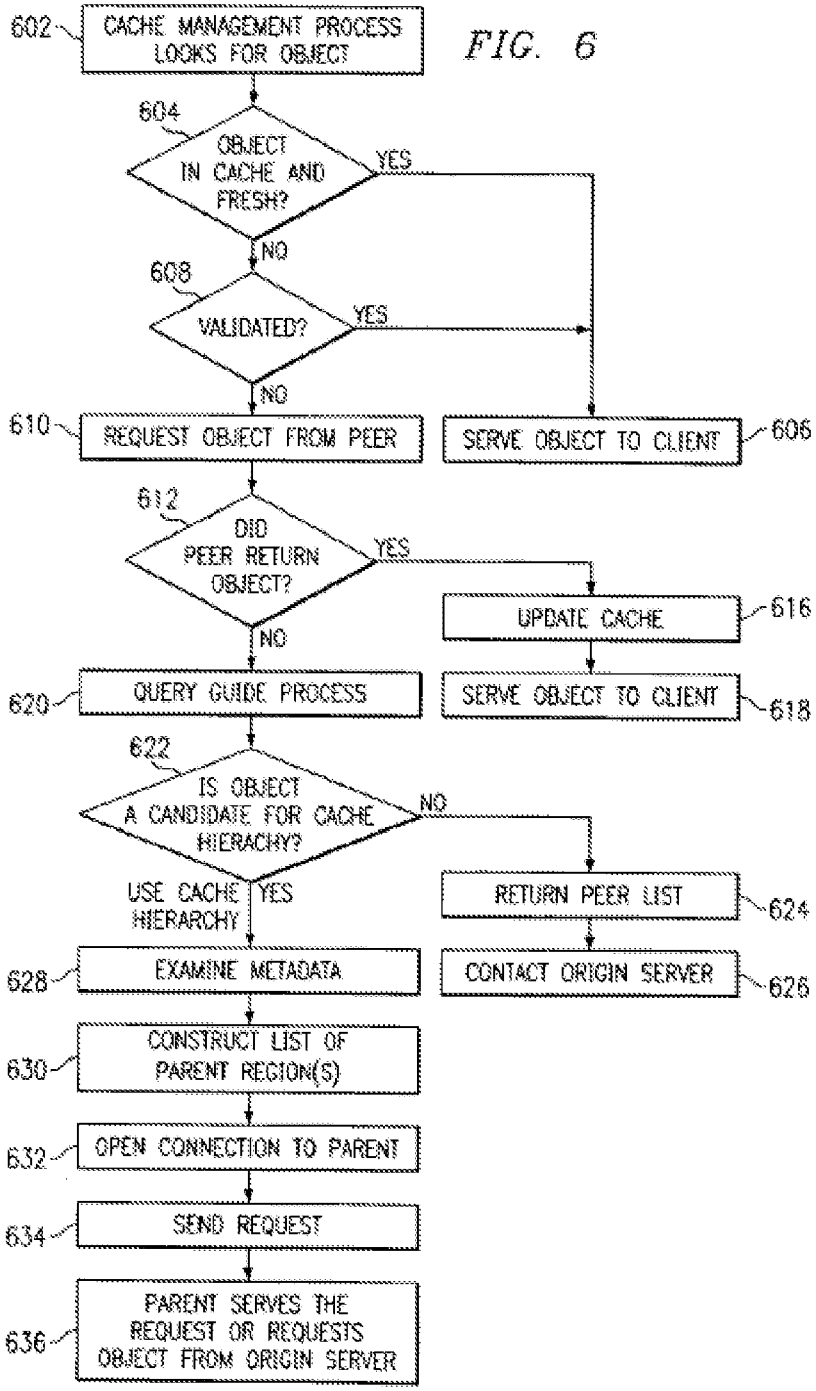


FIG. 6

As described in Dilley, when the edge server has the requested content (and it is valid and fresh) the content is served to the user (steps 604-606). If the edge

server does not have the object in cache (or its not valid or fresh), it then tries to get the object from a peer edge server (steps 610-618). If it gets the object from a peer then it caches the object (616) and serves it to the requesting client (618).

If the edge server was unable to get a copy of the object from a peer (step 612 "NO" path), then it checks (at 620) where to go for the object – i.e., either to the origin server or to a server in the cache hierarchy (recall that Dilley tags content for processing by the distribution hub. *Dilley*, ¶¶0030-0040).

If the object is not a candidate for the cache hierarchy (at 622) (per the setting of the metadata tag for the object), then the edge server will "talk to the origin server to obtain the object as usual" (step 626). *Id.* ¶0045.

On the other hand, if the object is supposed to be obtained via the cache hierarchy, then the edge server opens a connection to a parent server in the cache hierarchy (at 632), and sends it a request for the object (at 634). The parent server then serves the object to the edge server (at 636). The parent server may first need to get the object from the origin server (at 636). *Id.* ¶0047.

Two points should be noted here:

1. When Dilley's edge server gets a request for content from an end user, that edge server serves the content to the end user – regardless of whether the edge server gets the content from a peer or the distribution hub (the cache hierarchy) or directly from the origin server.

2. When Dilley's edge server serves content that it did not previously have, that edge server caches that content (regardless of anything to do with the popularity of that content).

Dilley lacks any teaching or suggestion of various elements of claim 1.

Dilley does not teach or in any way suggest "determining whether said resource is popular," as recited in claim 1.

According to the Examiner, Dilley teaches:

> ... otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular ("CDN software 206 creates and manages a "hot" object cache 212 for popular objects being served by the CDN", Paragraph 26. Also see e.g., Paragraphs 27, 45, and 47)

Office Action, pg. 4.

The Examiner appears to consider Dilley's statement (in ¶0026) that "CDN software 206 creates and manages a "hot" object cache 212 for popular objects being served by the CDN" to mean that Dilley has a step of "determining whether said resource is popular," as recited in claim 1. However, what Dilley states in ¶0026 is that popular objects will populate the edge server caches. There is, however, nothing in Dilley to teach or in any way suggest any determining (actual or implied) whether a requested resource is popular.

The Examiner next states that Dilley teaches:

> if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client ("*determines whether the requested object is present in the hot object cache or the disk storage,* serves the requested content via HTTP (if it is present) or establishes a connection to another content server or an origin server to attempt to retrieve the requested object upon a cache miss", Paragraph 26. Also see e.g., Paragraphs 27, 45, and 47) ...

Office Action, pg. 4, emphasis provided.

It appears that the Examiner considers Dilley's statement "determines whether the requested object is present in the hot object cache or the disk storage" to be Dilley's test for popularity. However, testing for the presence (or absence) of an object in Dilley's hot object cache cannot be used as a test for popularity for at least the following reason. Suppose that the test for whether an object is popular is based on whether or not that object is in the hot object cache. In that case there would be no way for any object to ever become "popular." Either every

object is put in the hot object cache or no object is put there. If objects cannot be put in the hot object cache until they are popular then there must be some other test to determine popularity – but no such test is taught or suggested by Dilley.

Dilley would not work to produce the presently claimed invention using the Examiner's proposed popularity "test" ("*determines whether the requested object is present in the hot object cache or the disk storage*"). There are two options – either an object is in the hot object cache or it is not. If the object is in the hot object cache, then Dilley's edge server will always serve that object (subject to freshness), per steps 604-606 in Fig. 6. If the object is not in the hot object cache, then Dilley will request it from a peer (step 610) and serve it (step 618), or get it from the origin server (step 626) or from a parent server in the cache hierarchy (622). The parent server will then serve the object to the edge server (the parent may have to get the object from the origin server) at step 636. Regardless of how the object gets to the edge server, it is the edge server that serves it to the client. Furthermore, once the object is on the edge server, that object will be in the edge server's cache (until it is replaced by another object). By the Examiner's definition, that object is now deemed popular (by virtue of being in the edge server's cache).

Dilley does not teach or suggest how content gets put into the hot object cache. In any case, even if, arguendo, Dilley's hot object cache contains popular content (by some measure of popularity), Dilley lacks any teaching or suggestion of what do if a requested resource is <u>not popular</u>. Thus Dilley lacks any teaching or suggestion of the claimed "<u>if the resource is determined not to be popular</u>, directing said client to a second server, said second server not in said first tier of servers, and said second server serving the resource to the client." Recall that (as shown above) in Dilley the edge server that gets the request from the client always serves the object to the client, regardless of how that edge server obtained the

object. Dilley teaches different places that the edge server may go to get the object to be served, but in the end the edge server invariably serves the object to the client.

When Dilley states "the original request is only forwarded on to the origin server if it cannot be serviced by the intermediate node in the hierarchy," what is being described is the situation where the edge server goes to the distribution hierarchy for an object (the edge server goes to an intermediate node in the hierarchy) and that intermediate node does not have the object. In that case, the intermediate node goes to the origin server, gets the object, and serves the object to the edge server. The edge server then serves the object to the requesting user. But in Dilley the requesting user (client) is not directed to another server to get the content (i.e., a server in a different tier).

Using Dilley's system on the example described above, the popular movie M1 could be replaced in the edge server's cache by the non-popular move M2. Using the presently claimed invention, on the other hand, the non-popular movie M2 would likely be served from a "second server not in said first tier of servers" (i.e., the movie M2 would be served to the user but not from an edge server); and, thus, the non-popular movie M2 would not take up space on the edge servers (or replace more popular content).

It should be noted, as the application points out, popularity of a resource is dynamic and can change over time. By determining popularity when a request is made, the server can get a then-current assessment of popularity.

For at least these reasons, claim 1 and its dependents are patentable over Dilley.

Claims 5, 8, and 9 (and their dependents) are patentable over Dilley for similar reasons.

Claim 5 recites a method of content delivery in a content delivery network comprising at least a first tier of servers. The method of claim 5 includes (A) at a first server in the first tier of servers, obtaining a request from a client for a resource. The method further includes: "(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource."

Again, Dilley lacks any teaching or suggestion of redirecting a client request to a server in a different tier, let alone redirecting any request "based, at least in part, on a current popularity value for said resource."

For at least these reasons, claim 5 and its dependents are patentable over Dilley.

Independent claim 8 recites a content delivery framework including a plurality of edge servers forming a first tier of servers; and a plurality of parent servers forming a second tier of servers, the parent servers being distinct from the edge servers. Claim 8 further recites "at least one popularity service, implemented at least in part by hardware in combination with software, and constructed and adapted to obtain information from at least some of the edge servers about requests for content, and to provide the edge servers with information about which tier of servers should handle those requests for content, the popularity service making its determinations based, at least in part, on a measure of popularity of requested content."

As to claim 8, according to the Examiner (Office Action, pg. 5), Dilley discloses:

> at least one popularity service ... ("hubs act as buffers for the origin site's internal infrastructure, guaranteeing that the site is not overwhelmed with requests for popular

content", Paragraph 27; "CDN software 206", Paragraph 26).

The portion of Dilley cited and relied upon by the Examiner (¶¶0026-27) lacks any teaching or suggestion of any popularity service, let alone a popularity service as claimed:

> "to obtain information from at least some of the edge servers about requests for content, and
>
> to provide the edge servers with information about which tier of servers should handle those requests for content,
>
> the popularity service making its determinations based, at least in part, on a measure of popularity of requested content."

For at least these reasons, claim 8 is patentable over Dilley.

Claim 2 depends from claim 1 and is therefore patentable over Dilley for at least the reasons given above. Claim 2 recites a method as in claim 1 "wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and **wherein said second server is in said second tier of servers**." The Examiner is reminded that the "second server" in this claim is the server from which the requested resource is served to the client "if the resource is determined not to be popular." While Dilley does show a second tier of servers (Dilley's distribution tier), there is nothing in Dilley to teach or in any way suggest serving resources to clients from that second tier of servers if the resources are determined not to be popular. As noted above, Dilley's second tier is a distribution hub from which the edge servers can obtain content and which those edge servers then serve the content to the requesting users.

It should be noted that Dilley's distribution servers may also be edge servers. *Id.* ¶0051. But even if one of Dilley's distribution servers also acts as an

edge server, it would not qualify as the claimed "second server is in said second tier of servers."

For at least these additional reasons, claim 2 is further patentable over Dilley. Similar arguments apply to claim 6.

Claim 3 depends from claim 1 and is therefore patentable over Dilley for at least the reasons given above. Claim 3 recites a method as in claim 1 "wherein the second server is a content provider's origin server." The Examiner is again reminded that the "second server" in this claim is the server from which the requested resource is served to the client "if the resource is determined not to be popular."

In Dilley an edge server that does not have a copy of requested content may get the content either from a server in the distribution hub or from the origin server; and the distribution hub may itself get the content from the origin server. However, as noted above, it is ultimately the edge server that serves the content to the user, not the origin server. Thus the origin server cannot be the claimed "second server" from which the requested resource is served to the client "if the resource is determined not to be popular."

For at least these additional reasons, claim 3 is patentable over Dilley.

Similar arguments apply to claim 7.

In view of the above, withdrawal of this rejection under §102 is respectfully requested.

Claim Rejections - 35 USC § 103

The Examiner rejected claim 4 under 35 U.S.C. §103(a) as being unpatentable over Dilley in view of "what is well-known in the art." The grounds for this rejection are respectfully traversed.

Claim 4 depends from claim 1 and is therefore patentable over Dilley for at least the reasons given above.

Claim 1 (and thus claim 4) recite the act of "if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular." Claim 4 further recites that "the step of determining whether said resource is popular comprises: determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold."

The Examiner's rejection of claim 4 fails to reach the level of a prima facie rejection of the claim.

The Examiner makes a rejection of the claim based on "what is well-known in the art," without any substantiation of that assertion. The Examiner merely states (at pg. 7, item 4):

> However using a predetermined threshold is known in the art and it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a popularity threshold to determine the popularity of a resource in order to technically define what makes a resource popular so that the system can respond accordingly

Even accepting, arguendo, that "using a predetermined threshold is known in the art," the Examiner has not shown how such knowledge could be combined with Dilley to produce the presently claimed invention.

As noted above, the Examiner considers Dilley's statement "determines whether the requested object is present in the hot object cache or the disk storage" to be Dilley's test for popularity. The Examiner has not shown how such a "test" would use a threshold or what would be done with such a threshold.

In view of the above, withdrawal of this rejection under §103 is respectfully requested.

CONCLUSION

Applicant respectfully submits that this application is in condition for allowance. An early action to that effect is earnestly solicited.

The Examiner is kindly requested to contact the undersigned at the number provided to schedule a personal interview to resolve any outstanding issues in this case.

Respectfully submitted,

Date: August 4, 2011

/JCS/

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Electronic Patent Application Fee Transmittal

Application Number:	12408681
Filing Date:	21-Mar-2009
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	David Dewey Wier/Jonathan Siekmann
Attorney Docket Number:	0137-US-U1

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:				
Claims in excess of 20	1202	6	52	312
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	130	130
Miscellaneous:				
			Total in USD ($)	**442**

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

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

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		20110804ResponseNFOA.pdf	295103 8663495627689742e14309f2042a75bcdcd26d48	yes	28

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Extension of Time	2	2
Specification	3	4
Claims	5	11
Applicant Arguments/Remarks Made in an Amendment	12	28

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	32595 4cac647ef07f38398e1304f49964a1eb5c376dee	no	2

Warnings:

Information:

Total Files Size (in bytes):	327698

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
12/408,681	03/21/2009	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY ☐ FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 08/04/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 26	Minus	** 20	= 6	X $ =		OR	X $52=	312
Independent (37 CFR 1.16(h))	* 4	Minus	***4	= 0	X $ =		OR	X $220=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	312

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

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

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

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

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

Legal Instrument Examiner:
/TRACIE ROBERTSON/

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.
12/408,681	03/21/2009	David Fullagar	0137-US-U1	9965

83579 7590 04/04/2011

LEVEL 3 COMMUNICATIONS, LLC
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402

EXAMINER	
UTREJA, NEERAJ K	

ART UNIT	PAPER NUMBER
2452	

NOTIFICATION DATE	DELIVERY MODE
04/04/2011	ELECTRONIC

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

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

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

docketing@cpaglobal.com

Office Action Summary	Application No.	Applicant(s)	
	12/408,681	FULLAGAR ET AL.	
	Examiner	Art Unit	
	NEERAJ UTREJA	2452	

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

Period for Reply

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

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

Status

1)☒ Responsive to communication(s) filed on *21 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

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

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 March 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

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

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/5/09; 1/7/2011*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 6 and 7 are objected to because of the following informalities: the claims recite a “serves”. Examiner believes this to be a typo of the intended term "servers". Appropriate correction is required.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 8 is rejected under 35 U.S.C. 101 because the claimed invention is not supported by either a process, machines, manufactures and composition of matter asserted utility or a well established utility.

If a system can be interpreted as software *per se*, then the claims are not statutory because software *per se* is not a process, machine, manufacture, or composition of matter.

Claim 8 recites a “content delivery framework” comprising “edge servers”, "parent servers”, and a “popularity service”. Because no specific implementation details for “content delivery framework” are offered in the Specification, it must be given its broadest reasonable interpretation which includes software, i.e., a "framework can be a software implementation". The same rational applies to the term "server". The Specification does not explicitly recite that a server is implemented in hardware. Accordingly, a software-only embodiment can be construed, e.g., "virtual machines",

which is not statutory. The same rationale also applies to the term "popularity service". The broadest reasonable interpretation of the term allows for a software-only embodiment. Based on the Specification, it seems fair to interpret the system as software *per se* which is not statutory.

Claim Rejections - 35 USC § 102

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

> A person shall be entitled to a patent unless –
>
> (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.

3. Claims 1-3, and 5-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Dilley et al. (US 2007/0055764 A1).

Claims 1, 5, 8, 9

Dilley discloses a method of content delivery in a content delivery network comprising at least a first tier of servers ("delivering Internet traffic using tiered distribution", Paragraph 8), the method comprising:

at a first server in said first tier of servers, obtaining a request from a client for a resource ("edge server receives a client request for an object", Paragraph 44);

if said resource is available at said first server or at a peer of said first server, serving the resource to the client ("If the requested object is in cache and is fresh as

indicated by a positive outcome of the test at step 604, the object is served back to the requesting client", Paragraph 44);

otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular ("CDN software 206 creates and manages a "hot" object cache 212 for popular objects being served by the CDN", Paragraph 26. Also see e.g., Paragraphs 27, 45, and 47), and

if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client ("determines whether the requested object is present in the hot object cache or the disk storage, serves the requested content via HTTP (if it is present) or establishes a connection to another content server or an origin server to attempt to retrieve the requested object upon a cache miss", Paragraph 26. Also see e.g., Paragraphs 27, 45, and 47), otherwise,

if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers ("the original request is only forwarded on to the origin server if it cannot be serviced by the intermediate node in the hierarchy", Paragraph 14. If the resource is not popular, i.e., it is not in hot object cache and if an intermediate node cannot service the request, then client will be directed to origin server. Also see e.g., Paragraphs 27, 45, and 47), and

said second server serving the resource to the client ("the original request is only forwarded on to the origin server if it cannot be serviced by the intermediate node in the hierarchy", Paragraph 14).

With regard to claim 8, Dilley further discloses:

a plurality of edge servers forming a first tier of servers (“Edge Region”, Fig. 4);

a plurality of parent servers forming a second tier of servers ("Parent Region”, Fig. 4); and

at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content (“hubs act as buffers for the origin site’s internal infrastructure, guaranteeing that the site is not overwhelmed with requests for popular content”, Paragraph 27; “CDN software 206”, Paragraph 26).

Claims 2 and 6

Dilley further discloses the method of claims 1 and 5 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers (Paragraph 27 teaches the different tiers. Also see e.g., Paragraphs 44, 45, and 47.).

Claims 3 and 7

Dilley further discloses the method of claims 1 and 5 wherein the second server is a content provider's origin server (“origin server”, Paragraphs 14, 27, 45, and 47).

Claim 10

Dilley further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier (Paragraphs 13 and 22).

Claim 11

Dilley further disclose a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier (Paragraphs 44 and 45).

Claim 12

Dilley further discloses a method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier (Paragraph 47. Also see e.g., Figs. 3 and 4.).

Claim Rejections - 35 USC § 103

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

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

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dilley et al. (US 2007/0055764 A1) in view of what is well-known in the art.

Claim 4

Dilley further discloses the method of claim 1 but does not explicitly disclose wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

However using a predetermined threshold is known in the art and it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a popularity threshold to determine the popularity of a resource in order to technically define what makes a resource popular so that the system can respond accordingly.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NEERAJ UTREJA whose telephone number is (571)270-7902. The examiner can normally be reached on Monday to Thursday, 8:30AM - 6PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thu Nguyen can be reached on 571-272-6967. 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.

/N. U./
Examiner, Art Unit 2452

/THU NGUYEN/
Supervisory Patent Examiner, Art Unit 2452

Notice of References Cited	Application/Control No. 12/408,681	Applicant(s)/Patent Under Reexamination FULLAGAR ET AL.	
	Examiner NEERAJ UTREJA	Art Unit 2452	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2007/0055764 a1	03-2007	Dilley et al.	709/223
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT FORM PTO-1449 (modified) Sheet 1 of 1		
	Application No.	12/408,681
	Filing Date	03/21/2009
	First Named Inventor	David Fullagar
	Group Art Unit	2452
	Examiner Name	Utreja, Neeraj K.
	Attorney Docket No.	0137-US-01
	Confirmation No.	9965

NON-PATENT REFERENCES

Examiner Initials*	Cite No.	Non-patent Reference bibliographic information, where available	Notes
		International Preliminary Report on Patentability, WIPO, PCT/US2009/037904, October 14, 2010	

Examiner Signature	/Neeraj Utreja/	Date Considered	03/25/2011

*Examiner: Initial if reference was considered, whether or not citation is in conformance with MPEP 609. Draw a line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant. Notes: If identified, the following is provided: EA = English Abstract, T = Translation, PT = Partial Translation, SOR = Statement of Relevancy, PF = Patent Family.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.U

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BIB DATA SHEET

CONFIRMATION NO. 9965

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/408,681	03/21/2009	709	2452	0137-US-U1

APPLICANTS

David Fullagar, Boulder, CO;
Christopher Newton, Thousand Oaks, CA;
Laurence R. Lipstone, Calabasas, CA;

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

This appln claims benefit of 61/042,412 04/04/2008 YES /N.U./

**** FOREIGN APPLICATIONS *************************** NONE /N.U./

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

04/01/2009

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /NEERAJ K UTREJA/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CO	6	12	4

ADDRESS

LEVEL 3 COMMUNICATIONS, LLC
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402
UNITED STATES

TITLE

HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

FILING FEE RECEIVED		
1440	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

BIB (Rev. 05/07).

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

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

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

CLAIM		DATE								
Final	Original	03/25/2011								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	12408681	FULLAGAR ET AL.
	Examiner	Art Unit
	NEERAJ UTREJA	2452

SEARCHED			
Class	Subclass	Date	Examiner
709	226	3/23/2011	NU

SEARCH NOTES		
Search Notes	Date	Examiner
EAST text search	3/23/2011	NU
Google Patents search	3/23/2011	NU
double patenting / inventor search	3/23/2011	NU

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/NEERAJ UTREJA/ Examiner.Art Unit 2452	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	13228	((709/224.ccls.)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:25
S2	5710	((709/226.ccls.)).CCLS.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:25
S3	0	("CDNor(contentneardeliverynearnetwork)").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:26
S4	0	("CDNor(contentneardeliverynearnetwork)").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/03/25 14:31

S5	5710	709/226.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:28
S6	38	(fullagar-david or newton-christopher or lipstone-laurence-$).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:30
S7	7876	cdn or (content near delivery near network)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:31
S8	5	S6 and S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:31
S9	264	S7 and tier and popular	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:38

S10	1736	S7 and (tier or level or echelon or class) and (popular or desir$3 or ((frequent$2 or often or most or highly or continuous$2) near2 (requested)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:41
S11	431	S7 and (tier or level or echelon or class) same (popular or desir$3 or ((frequent$2 or often or most or highly or continuous$2) near2 (requested)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:41
S12	2	"20070055764".did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2011/03/25 15:44

EAST Search History (Interference)

<This search history is empty>

3/25/2011 9:10:49 PM
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OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
FORM PTO-1449 (modified)

Sheet 1 of 2

Application No.	12/408,681
Filing Date	03/21/2009
First Named Inventor	David Fullagar
Group Art Unit	~~2443~~ 2452
Examiner Name	~~Unassigned~~ Neeraj Utreja
Attorney Docket No.	2711-0161
Confirmation No.	9965

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document No.	Publication/ Issue Date	Name of Patentee or Applicant of Cited Document
	1-1	US-2004/0205162	2004/10/14	PARIKH
	1-2	US-2007/0055764	2007/03/08	DILLEY et al.
	1-3	US-2008/0071859	2008/03/20	SEED et al.
	1-4			
	1-5			
	1-6			
	1-7			
	1-8			
	1-9			
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	1-11			
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	1-22			
	1-23			
	1-24			
	1-25			
	1-26			

Examiner Signature	/Neeraj Utreja/	Date Considered	03/25/2011

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.U

INFORMATION DISCLOSURE STATEMENT BY APPLICANT FORM PTO-1449 (modified) Sheet 2 of 2		
	Application No.	12/408,681
	Filing Date	03/21/2009
	First Named Inventor	David Fullagar
	Group Art Unit	~~2443~~ 2452
	Examiner Name	~~Unassigned~~ Neeraj Utreja
	Attorney Docket No.	2711-0161
	Confirmation No.	9965

NON-PATENT REFERENCES

Examiner Initials*	Cite No.	Non-patent Reference bibliographic information, where available	Notes
	2-1	Search Report and Written Opinion mailed April 27, 2009 in PCT Appln. No. PCT/US2009/037904	
	2-2		
	2-3		
	2-4		
	2-5		
	2-6		
	2-7		

Examiner Signature	/Neeraj Utreja/	Date Considered	03/25/2011

*Examiner: Initial if reference was considered, whether or not citation is in conformance with MPEP 609. Draw a line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant. Notes: If identified, the following is provided: EA = English Abtract, T = Translation, PF = Patent Family.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.U

INFORMATION DISCLOSURE STATEMENT BY APPLICANT FORM PTO-1449 (modified) Sheet 1 of 1		
	Application No.	12/408,681
	Filing Date	03/21/2009
	First Named Inventor	David Fullagar
	Group Art Unit	2452
	Examiner Name	Utreja, Neeraj K.
	Attorney Docket No.	0137-US-01
	Confirmation No.	9965

NON-PATENT REFERENCES

Examiner Initials*	Cite No.	Non-patent Reference bibliographic information, where available	Notes
		International Preliminary Report on Patentability, WIPO, PCT/US2009/037904, October 14, 2010	

Examiner Signature		Date Considered	

*Examiner: Initial if reference was considered, whether or not citation is in conformance with MPEP 609. Draw a line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant. Notes: If identified, the following is provided: EA = English Abstract, T = Translation, PT = Partial Translation, SOR = Statement of Relevancy, PF = Patent Family.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF:	Attorney Docket: 0137-US-U1
Fullagar et al.	Group Art Unit: 2452
Application Serial No.: 12/408,681	Examiner: UTREJA, Neeraj K
Application Filing Date: 03/21/2009	Confirmation No.: 9965
Title: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)	Date: January 7, 2011

INFORMATION DISCLOSURE STATEMENT

via EFS-Web
Hon. Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 C.F.R. § 1.56, the attention of the Patent and Trademark Office is hereby directed to the reference(s) listed on the attached PTO-1449. One copy of each non-U.S. Patent reference is attached. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the reference(s) be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

The submission of any document herewith, which is not a statutory bar, is not intended that any such document constitutes prior art against any of the claims of the present application or is considered to be material to patentability as defined in 37 C.F.R. § 1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference against the claims of the present application.

This Information Disclosure Statement is being filed within three (3) months of the U.S. filing date OR before the mailing date of a first Office Action on the merits. No certification or fee is required.

Related Applications: The Examiner's attention is directed to co-pending U.S. Patent Application No. 12/880,324, filed 09/13/2010, which is directed to related technical subject matter. The identification of this U.S. Patent Application is not to be construed as a waiver of secrecy as to that application now or upon issuance of the present application as a patent. The Examiner is respectfully requested to consider the cited application and the art cited therein during examination. As the related U.S. patent applications are stored electronically at the PTO, no copies are being provided herewith.

This application is also related to the following applications (this application is marked with a "*" on the list):

Country	Application No.
US	61/042,412
US (*)	12/408,681
US	12/880,324
WIPO	PCT/US09/37904
EP	EP 9727342.9
CA	*TBD*
CN	200980120043

Related International application No. PCT/US09/37904 filed on 03-21-2009 was published as WO 2009/123868 on October 8, 2009. This IDS cites an International Preliminary Report on Patentability from PCT/US09/37904.

If the Examiner requires copies of any of these applications or any additional information regarding any of the documents cited herein, the Examiner is respectfully requested to contact the undersigned at the number provided.

This IDS is intended to be in full compliance with the rules, but should the Examiner find any part of its requirement content to have been omitted, prompt

notice to that effect is earnestly solicited, along with additional time under Rule 97(f), to enable Applicant to comply fully.

Contingent IDS Request Under Rule 97(c): Should a first Office Action on the merits issue with a mailing date which precedes or is the same as the filing date of this IDS, please consider this a Request under Rule 97(c), charge the IDS fee (Rule 17(p)) to our Deposit Account No. 501860 under Order No. 2711-0161, and proceed to consider this IDS under Rule 97(c).

CHARGE STATEMENT: Deposit Account No. 501860, order no. **2711-0161**.

The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 (missing or insufficiencies only) now or hereafter relative to this application and the resulting Official Document under Rule 20, or credit any overpayment, to our Accounting/Order Nos. shown above.

This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal sheet is filed.

CUSTOMER NUMBER

75948

Davidson Berquist Jackson & Gowdey LLP
4300 Wilson Blvd., 7th Floor,
Arlington Virginia 22203
(703) 894-6400 • FAX: (703) 894-6430

Respectfully submitted,

/Brian Siritzky/Reg. No. 37,497

By:_____

Brian Siritzky, Ph.D.
Registration No.: 37,497

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 2711-0162	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2009/037904	International filing date *(day/month/year)* 21 March 2009 (21.03.2009)	Priority date *(day/month/year)* 04 April 2008 (04.04.2008)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant LEVEL 3 COMMUNICATIONS, LLC		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	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 Article 35(2) 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

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 05 October 2010 (05.10.2010)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Dorothée Mülhausen e-mail: pt01.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
Brian Siritzky, Ph.D.
DAVIDSON BERQUIST JACKSON & GOWDEY LLP
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	27 APR 2009

Applicant's or agent's file reference	FOR FURTHER ACTION
2711-0162	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 09/37904	21 March 2009 (21.03.2009)	04 April 2008 (04.04.2008)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G06F 15/173 (2009.01)
USPC - 709/226

Applicant Level 3 Communications, LLC

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

- [X] 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
- [X] Box No. V Reasoned statement under Rule 43*bis*.1(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 66.1*bis*(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.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	17 April 2009 (17.04.2009)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/37904

Box No. I 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. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ on paper

      ☐ in electronic form

   c. time of filing/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 and/or table(s) relating thereto 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:

Form PCT/ISA/237 (Box No. I) (April 2007)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/37904

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

1. Statement

Novelty (N)	Claims	None	YES
	Claims	1-12	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-12	NO
Industrial applicability (IA)	Claims	1-12	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-12 lack novelty under PCT Article 33(2) as being anticipated by US 2007/0055764 A1 to Dilley et al. (hereinafter 'Dilley').

As per claim 1, Dilley discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (para [0008]), the method comprising: at a first server in said first tier of servers, obtaining a request from a client for a resource (para [0044]); if said resource is available at said first server or at a peer of said first server, serving the resource to the client (para [0044]); otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular, and if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise, if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and said second server serving the resource to the client (para [0027], [0045], [0047]).

As per claim 2, Dilley further discloses wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers (para [0044]-[0045], [0047]).

As per claim 3, Dilley further discloses wherein the second server is a content provider's origin server (para [0045]).

As per claim 4, Dilley further discloses wherein the step of determining whether said resource is popular comprises: determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold (para [0015], [0027]).

As per claim 5, Dilley discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (para [0008]), the method comprising: (A) at a first server in said first tier of servers, obtaining a request from a client for a resource (para [0044]); (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource (para [0027], [0044]-[0045], [0047]).

As per claim 6, Dilley further discloses wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers (para [0044]-[0045], [0047]).

As per claim 7, Dilley further discloses wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said serves in said first tier, and wherein said second server is an origin server (para [0044]-[0045], [0047]).

As per claim 8, Dilley discloses a content delivery framework (para [0008]-[0009]) comprising: a plurality of edge servers forming a first tier of servers (para [0044]); and a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers (para [0045], [0047]-[0048]); and at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content (para [0027], [0045]).

As per claim 9, Dilley discloses a method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers (para [0008], [0044]-[0045]), the method comprising: (A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource (para [0044]); (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on a current popularity value for said resource (para [0027], [0044]-[0045], [0047]).

As per claim 10, Dilley further discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier (para [0013], [0042]).

(See Supplemental Box)

Form PCT/ISA/237 (Box No. V) (April 2007)

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
Box NO. V --- Reasoned Statement
2. Citations and explanations:

As per claim 11, Dilley discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier (para [0044]-[0045]).

As per claim 12, Dilley further discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier (para [0047]).

Claims 1-12 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	9186370
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	0137-US-U1
Receipt Date:	07-JAN-2011
Filing Date:	21-MAR-2009
Time Stamp:	12:36:44
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) Filed (SB/08)	PA_1449_01_07_2011.pdf	254888 8b10716a7e2173702a35e0a9d9cf138d198646ca	no	1

Warnings:	
Information:	

This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	PA_IDS_01_07_2011.pdf	216179 b52baa5ce5c0a2037294fbf522cd19fac801b1bd	no	3
Warnings:					
Information:					
3	NPL Documents	NP0000.pdf	292289 49e841316bf5de3234bd4d7aa977320d6d75e89f	no	5
Warnings:					
Information:					
			Total Files Size (in bytes):	763356	

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
12/408,681	03/21/2009	David Fullagar	2711-0161 (0137-US-U1)

CONFIRMATION NO. 9965

83579
LEVEL 3 COMMUNICATIONS, LLC
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402

POA ACCEPTANCE LETTER

OC000000045100367

Date Mailed: 12/28/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/27/2009.

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

/hchristian/

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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
12/408,681	03/21/2009	David Fullagar	0137-US-U1

CONFIRMATION NO. 9965

POWER OF ATTORNEY NOTICE

83579
LEVEL 3 COMMUNICATIONS, LLC
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402

OC000000045100340

Date Mailed: 12/28/2010

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/27/2009.

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

/hchristian/

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

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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

Application Number	12/408,681
Filing Date	March 21, 2009
First Named Inventor	David Fullagar
Title	HANDLING LONG-TAIL CONTENT IN A CONTENT
Art Unit	2452
Examiner Name	Neeraj K Utreja
Attorney Docket Number	0137-US-U1

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

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 83579

OR

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

Practitioner(s) Name	Registration Number

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

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number: 83579

OR

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

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Assignee of Record

Signature		Date	12/14/2010
Name	David D. Wier	Telephone	720.888.3539
Title and Company	VP Patent Counsel, Level 3 Communications LLC		

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 2 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: David Fullagar

Application No./Patent No.: 12/408,681 Filed/Issue Date: March 21, 2009

Titled:

Level 3 Communications, LLC , a Limited Liability Company

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

states that it is:

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

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

3. [ ] the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made) the patent application/patent identified above, by virtue of either:

A. [X] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 022805, Frame 0741, or for which a copy therefore is attached.

OR

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

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

Signature	12/14/2010 Date
David D. Wier Printed or Typed Name	VP Patent Counsel Title

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

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

Electronic Acknowledgement Receipt

EFS ID:	9045161
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	David Dewey Wier/Jonathan Siekmann
Filer Authorized By:	David Dewey Wier
Attorney Docket Number:	0137-US-U1
Receipt Date:	15-DEC-2010
Filing Date:	21-MAR-2009
Time Stamp:	17:36:05
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	Power of Attorney	0137_US_U1_POA_signed.pdf	57155 794ca5447a32ea40fd6cc26a20dd12cc3edcde5e	no	1

Warnings:	
Information:	

2	Assignee showing of ownership per 37 CFR 3.73(b).	0137_US_U1_373b_signed.pdf	60493 817e571924a3547f8559f3bedacea4e6b81583a6	no	1

Warnings:	
Information:	
Total Files Size (in bytes):	117648

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

POWER OF ATTORNEY, CORRESPONDENCE ADDRESS AND REVOCATION OF PRIOR POWERS

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

Sir:

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

Power of Attorney: I hereby appoint the practitioners associated with customer number **83579**, individually and collectively, as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patents and patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Correspondence Address: Please recognize or change the correspondence address for the application/patent identified in the attached statement under 37 CFR 3.73(b) to the address associated with Customer Number **83579**.

Assignee Name and Address:

Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021

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

SIGNATURE of Assignee of Record The individual whose signature and title is supplied below is authorized to act on behalf of the assignee			
Signature		Date	10/27/09
Name	DAVID D. USER	Telephone	303-888-6166/720.888.3539
Title	SR. PATENT COUNSEL		

Electronic Acknowledgement Receipt

EFS ID:	6341106
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	83579
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	2711-0161 (0137-US-U1)
Receipt Date:	27-OCT-2009
Filing Date:	21-MAR-2009
Time Stamp:	17:01:14
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	Assignee showing of ownership per 37 CFR 3.73(b).	2711_0161_Stmt_under_37_CFR_3_73_b.pdf	161183 5ccf643728a5ea7d8b327aa857c1a89562ac6e2e	no	1

Warnings:	
Information:	

2	Power of Attorney	Power_of_Attorney_83579_signed.pdf	46268 550f062854b29bca5ad8e4269c8154f9eb3649c7	no	1

Warnings:	
Information:	
Total Files Size (in bytes):	207451

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.

STATEMENT UNDER 37 CFR 3.73(B)

Applicant / Patent Owner: Level 3 Communications, LLC — Docket No. 2711-0161 (0137-US-U1)

Application No. / Patent No. 12/408,681 — Filed / Issued Date: 03/21/2009

Entitled: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Assignee: Level 3 Communications, LLC (Name of assignee) — A corporation (Type of Assignee: corporation, partnership, university, government agency, etc.)

States that it is:

1. ☒ the assignee of the entire right, title, and interest; or

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

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

A. ☒ An assignment from the inventor(s) of the patent application / patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 022805, Frame 0741, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application / patent identified above, to the current assignee shown below:

1.	From: ___ To: The document was recorded in the United States Patent and Trademark Office at Reel ___ Frame __, or for which a copy thereof is attached.

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

☐ Copies of assignments or other documents in the chain of title are attached.

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

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

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

/Brian Siritzky/Reg. No. 37,497 — October 27, 2009

Signature — Date

Brian Siritzky, Ph.D. — (703) 894-6405

Printed or Typed Name — Telephone Number

Title: Attorney, Registration No. 37,497

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	PATENT NUMBER	GROUP ART UNIT	FILE WRAPPER LOCATION
12/408,681		2443	

OC000000038454544

Correspondence Address/Fee Address Change

The following fields have been set to Customer Number 83579 on 10/23/2009

- **Correspondence Address**
- **Power of Attorney Address**

The address of record for Customer Number 83579 is:

83579
LEVEL 3 COMMUNICATIONS, LLC
c/o CPA Global
P.O. Box 52050
Minneapolis, MN 55402

PART 1 - ATTORNEY/APPLICANT COPY
page 1 of 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	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/408,681	03/21/2009	David Fullagar	2711-0161 (0137-US-U1)

CONFIRMATION NO. 9965

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

PUBLICATION NOTICE

OC00000038189785

Title:HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Publication No.US-2009-0254661-A1
Publication Date:10/08/2009

NOTICE OF PUBLICATION OF APPLICATION

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

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

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

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

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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
12/408,681	03/21/2009	2443	1440	2711-0161	12	4

CONFIRMATION NO. 9965

UPDATED FILING RECEIPT

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

OC000000036509951

Date Mailed: 06/19/2009

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)

David Fullagar, Boulder, CO;
Christopher Newton, Thousand Oaks, CA;
Laurence R. Lipstone, Calabasas, CA;

Assignment For Published Patent Application

Level 3 Communications, LLC, Broomfield, CO

Power of Attorney: The patent practitioners associated with Customer Number 75948

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/042,412 04/04/2008

Foreign Applications

If Required, Foreign Filing License Granted: 04/01/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/408,681**

Projected Publication Date: 10/08/2009

Non-Publication Request: No

Early Publication Request: No

Title

HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Preliminary Class

709

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 AssetsControl, 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).

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
12/408,681	03/21/2009	David Fullagar	2711-0161

CONFIRMATION NO. 9965

POA ACCEPTANCE LETTER

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

OC000000036509965

Date Mailed: 06/19/2009

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/05/2009.

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

/hteffera/

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

OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE

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
12/408,681	03/21/2009	David Fullagar	2711-0161

CONFIRMATION NO. 9965

FORMALITIES LETTER

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

RECEIVED
APR 07 2009
DAVIDSON BERQUIST

Date Mailed: 04/06/2009

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 and pay any fees required 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 oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

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

- 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 with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$130** for a non-small entity
- **$130** Surcharge.

06/08/2009 SZEWDIE1 00000144 501860 12408681
01 FC:1051 130.00 DA

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/smunpanthavong/

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

OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE
IAP81

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FILING COMPLETION UNDER RULE 53(f)

For Design, Provisional, or Utility Applications
(NOT PCT Applications, Plant or Reissues)

In re PATENT APPLICATION of:

Attn: Application Division

Inventor(s):	FULLAGAR, David et al.		
Appln. No.:	12/408,681	Atty. Dkt. No.:	2711-0161
		Confirmation No.	9965
Filed:	03/21/2009	Group Art Unit:	2443
Title:	**HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)**	Date:	June 5, 2009

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

Sir:

The following **completes the filing** under Rule 53(f) of the above-identified patent application.

1. **Notice to File Missing Parts** ☒ copy attached ☐ not yet received

2. ☒ Signed Declaration attached. ☐ Original ☒ Facsimile/Copy

(Always "X" box 2 if filing signed Declaration and
"X" box 2A only if top box of the Declaration is X'd and file application copy, or
"X" box 2B if none of the top three boxes of the Declaration is X'd.)

2A. ☐ Attached: Original signed Declaration with attached specification (including claim(s)) which is a copy of specification and claim(s) originally filed to secure the above filing date.

2B. ☐ The original application as filed in the PTO on the above filing date is the application which each inventor executed by signing the attached Rule 63 Declaration.

3. ☐ Specification originally filed in non-English language; hence verified translation attached of:

a. ☐ Abstract
b. _____ pages of Specification (only spec. & claims)
c. ☐ Drawing(s) _____ Number of Sheets (Figure(s). 1-_____)

4. ☐ Letter filing formal drawing(s) attached.

5. ☒ Attached is an assignment and cover sheet. Please return the recorded assignment to the undersigned.

6. **DOMESTIC/INTERNATIONAL** priority is claimed under 35 U.S.C. 119(e)/120/365(c) based on the following provisional, non-provisional and/or PCT International application(s):

Application No.	Filing Date	Application No.	Filing Date
(1) 61/042,412	04/04/2008	**(2)**	

7. **FOREIGN** priority is claimed under 35 U.S.C. 119(a)-(d)/365(b) based on filing in _____

Application No.	Filing Date	Application No.	Filing Date
(1)		**(2)**	

8. _____ (No.) Certified copy/copies: ☐ attached
☐ previously filed on _____ in U.S. Application No. _____ filed on _____.

9. Small Entity Status: ☒ is **NOT** claimed ☐ is claimed

10. ☒ Attached: Statement Under 37 C.F.R. 3.73(b)

11. ☒ Attached: ☒ IDS ☒PTO–1449 ☒ 1 Cited Document

12. ☐ Preliminary Amendment Attached

THE FOLLOWING FILING FEE IS BASED ON CLAIMS AS FILED LESS ANY CANCELLED PREVIOUSLY/HEREWITH

Basis For Fee				Large /Small Entity	Amount
13a. Basic Filing Fee			Utility Application	$300/$150	$
			Design Application	$200/$100	
18b. Search Fee			Utility Application	$500/$250	$
			Design Application	$100/$50	
18c. Examination Fee			Utility Application	$200/$100	$
			Design Application	$130/$65	
			Extra Claims		
19. Total Claims		Minus 20 =		X $50 / $25	$
20. Ind. Claims		Minus 3 =		X $200 / $100	$
21. If any proper multiple dependent claim (ignore improper) is present, add:				$360 / $180	$
Application Size Fee (If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).)					
Total Sheets	**Minus 100 sheets**	**Extra Sheets**	**Number of each additional 50 or fraction thereof (round up to a whole number)**	x $250 / $150	
22.	**- 100 sheets**				$
23. **Total Filing Fee Enclosed:**					**$**
24. **Surcharge** for filing Declaration/filing fee late (1.16(e))				$130/$65	$130
25. **Original due date:**					
26. **Petition is herby made** to extend the original due date cover the date this response is filed for which the requisite fee is attached.			☐ (1 month) $120/$60 ☐ (2 months) $450/$225 ☐ (3 months) $1020/$510 ☐ (4 months) $1590/$795		$
27. If "non-English" box 2 is X'd, add Rule 17(k) processing fee				$130	$
28. If "assignment" box 7 is X'd, add recording fees ($40 / assignment)				$	$
29. ☐ Attached is a Petition/Fee under Rule No.				$	$

30. **Total Fee Enclosed:**	**$ 130**

31. ☒ Please charge the total fee on line 30 above to our following deposit account under the stated order number.

Our Deposit Account No.: 501860 Our Order No. 2711-0161

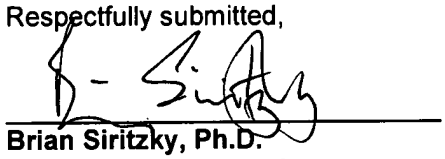
CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 (missing or insufficiencies only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown in the heading hereof for which purpose a duplicate copy of this sheet is attached.

This CHARGE STATEMENT does not authorize charge of the issue fee until/unless and issue fee transmittal form is filed.

32. **Correspondence Address: Use the address associated with customer number 75948.**

CUSTOMER NUMBER
75948

Respectfully submitted,

By: 

Brian Siritzky, Ph.D.
Registration No.: 37,497

Davidson Berquist Jackson & Gowdey LLP

PTO
JUN 05 2009
PATENT & TRADEMARK OFFICE

Attorney Docket No.: 2711-0161

RULE 63 (37 C.F.R. 1.63)
INVENTORS DECLARATION FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Handling Long-tail Content in a Content Delivery Network (CDN)

the specification of which (**check** applicable **box(es)**):

☐ is attached hereto
☒ was filed as U.S. Application Serial No. 12/408,681 (Atty. Dkt. No. 2711-0161) on March 21, 2009
☒ was filed as PCT International application No. PCT/US09/37904 on March 21, 2009.

And (if applicable to U.S. or PCT application) was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	Country	Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Day/Month/Year Filed
61/042,412	04/04/2008

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below.

Prior U.S./PCT Application(s) -- Application Serial No.	Day/Month/Year Filed	Status: Patented, Pending, Abandoned

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. And on behalf of the owner(s) hereof, I hereby ask that all communications in this matter be directed to: **DAVIDSON BERQUIST JACKSON & GOWDEY, LLP** at the address/phone numbers associated with customer number **75948**.

[Signatures on next page]

Inventor's Signature:	David Fullagar		Date: 6/3/2009
Inventor's Name:	David	**FULLAGAR**	
Citizenship:	Australian		
Residence:	City: Boulder	State/Country: CO/USA	
Mailing Address:	775 Cherryvale Rd., Boulder, Colorado		Zip Code: 80303

Inventor's Signature:			Date:
Inventor's Name:	Christopher	**NEWTON**	
Citizenship:	UK		
Residence:	City: Thousand Oaks	State/Country: CA/USA	
Mailing Address:	981 Via Colinas, Thousand Oaks, California		Zip Code: 91362

Inventor's Signature:			Date:
Inventor's Name:	Laurence R.	**LIPSTONE**	
Citizenship:	US		
Residence:	City: Calabasas	State/Country: CA/USA	
Mailing Address:	22724 Sparrow Dell Dr., Calabasas, California		Zip Code: 91302

JUN 05 2009
PATENT & TRADEMARK OFFICE

Attorney Docket No.: 2711-0161

RULE 63 (37 C.F.R. 1.63)
INVENTORS DECLARATION FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Handling Long-tail Content in a Content Delivery Network (CDN)

the specification of which (**check** applicable **box(es)**):

☐ is attached hereto
☒ was filed as U.S. Application Serial No. 12/408,681 (Atty. Dkt. No. 2711-0161) on March 21, 2009
☒ was filed as PCT International application No. PCT/US09/37904 on March 21, 2009.

And (if applicable to U.S. or PCT application) was amended on _____.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	Country	Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Day/Month/Year Filed
61/042,412	04/04/2008

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below.

Prior U.S./PCT Application(s) -- Application Serial No.	Day/Month/Year Filed	Status: Patented, Pending, Abandoned

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. And on behalf of the owner(s) hereof, I hereby ask that all communications in this matter be directed to: **DAVIDSON BERQUIST JACKSON & GOWDEY, LLP** at the address/phone numbers associated with customer number **75948**.

[Signatures on next page]

Inventor's Signature:			Date:
Inventor's Name:	David	**FULLAGAR**	
Citizenship:	Australian		
Residence:	City: Boulder	State/Country: CO/USA	
Mailing Address:	775 Cherryvale Rd., Boulder, Colorado		Zip Code: 80303

Inventor's Signature:	C. Newton		Date: 20 May 2009
Inventor's Name:	Christopher	**NEWTON**	
Citizenship:	UK		
Residence:	City: Thousand Oaks	State/Country: CA/USA	
Mailing Address:	981 Via Colinas, Thousand Oaks, California		Zip Code: 91362

Inventor's Signature:			Date: 5/20/09
Inventor's Name:	Laurence R.	**LIPSTONE**	
Citizenship:	US		
Residence:	City: Calabasas	State/Country: CA/USA	
Mailing Address:	22724 Sparrow Dell Dr., Calabasas, California		Zip Code: 91302

08SRU18

ACKNOWLEDGMENT

State of California
County of VENTURA)

On MAY 20, 2009 before me, MALA H PATEL, NOTARY PUBLIC
(insert name and title of the officer)

personally appeared CHRISTOPHER NEWTON AND LAURENCE LIPSTONE,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) ~~is~~/are subscribed to the within instrument and acknowledged to me that ~~he/she~~/they executed the same in ~~his/her~~/their authorized capacity(ies), and that by ~~his/her~~/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Mala H. Patel (Seal)

MALA H. PATEL
COMM. # 1701636
NOTARY PUBLIC-CALIFORNIA
VENTURA COUNTY
My Commission Expires
NOVEMBER 26, 2010

DOCUMENT: INVENTORS DECLARATION FOR PATENT APPLICATION IN THE US PATENT AND TRADEMARK OFFICE

MALA H. PATEL
COMM. # 1701636
NOTARY PUBLIC-CALIFORNIA
VENTURA COUNTY
My Commission Expires
NOVEMBER 26, 2010

OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

POWER OF ATTORNEY, CORRESPONDENCE ADDRESS AND REVOCATION OF PRIOR POWERS

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

Sir:

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

Power of Attorney: I hereby appoint the practitioners associated with customer number **75948**, individually and collectively, as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

I authorize Davidson Berquist Jackson & Gowdey, LLP to delete names/numbers of persons no longer with the Firm and to act and rely on instructions from and communicate directly with the entity who first sent this case to them and by whom I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Davidson Berquist Jackson & Gowdey, LLP in writing to the contrary.

Correspondence Address: Please recognize or change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to the address associated with Customer Number **75948**.

Assignee Name and Address:

Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021

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

SIGNATURE of Assignee of Record The individual whose signature and title is supplied below is authorized to act on behalf of the assignee			
Signature		Date	12/24/2008
Name	Robert M. Yates	Telephone	720-888-2283
Title	Senior Vice President, Assistant General Counsel		

JUN 05 2009
PATENT & TRADEMARK OFFICE

STATEMENT UNDER 37 CFR 3.73(B)

Applicant / Patent Owner: Level 3 Communications, LLC — Docket No. 2711-0161

Application No. / Patent No. 12/408,681 — Filed / Issued Date: 03/21/2009

Entitled: HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Assignee: Level 3 Communications, LLC (Name of assignee) — A corporation (Type of Assignee: corporation, partnership, university, government agency, etc.)

States that it is:

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

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

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

OR

B. ☐ A chain of title from the inventor(s), of the patent application / patent identified above, to the current assignee shown below:

1.	From: _____ To: _____ The document was recorded in the United States Patent and Trademark Office at Reel _____ Frame ____, or for which a copy thereof is attached.
2.	From: _____ To: _____ The document was recorded in the United States Patent and Trademark Office at Reel _____ Frame ____, or for which a copy thereof is attached.
3.	From: _____ To: _____ The document was recorded in the United States Patent and Trademark Office at Reel _____ Frame ____, or for which a copy thereof is attached.

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

☒ Copies of assignments or other documents in the chain of title are attached.

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

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

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

Signature — June 5, 2009 (Date)

Brian Siritzky, Ph.D. (Printed or Typed Name) — (703) 894-6405 (Telephone Number)

Title: Attorney, Registration No. 37,497

Attorney Docket No. **2711-0161**

ASSIGNMENT of U.S. and Foreign Patent Rights to Level 3 Communications, LLC

(Inventors) **David FULLAGAR** of 775 Cherryvale Rd., Boulder, Colorado 80303
Christopher NEWTON 981 Via Colinas, Thousand Oaks, California 91362
Laurence LIPSTONE of 22724 Sparrow Dell Dr., Calabasas, California 91302

In consideration of the sum of one dollar ($1.00) and other good valuable considerations paid to each of the undersigned, the undersigned agree(s) to assign, and hereby does assign, transfer and set over to **Level 3 Communications, LLC** ("Level 3"), a corporation of Delaware, having an office and place of business at 1025 Eldorado Blvd., Broomfield, Colorado, the undersigned's entire right, title and interest in the invention, all applications filed therefor for patent in the United States and in foreign countries (including divisional applications, continuation applications, continued prosecution applications, continuation-in-part applications, substitute applications, renewal applications, reissue applications, reexamination applications, extensions, and all other patent applications that have been or shall be filed on the invention), all Letters Patent (including original patents, reissued patents, reexamination certificates, and extensions) which may be granted therefor in the United States and in foreign countries, and all rights of priority resulting from the filing of any such application, for the invention known as:

Handling Long-tail Content in a Content Delivery Network (CDN)

for which the undersigned has have already filed U.S. application Serial No. 12/408,681 and international application no. PCT/US09/37904 on March 21, 2009.

The undersigned acknowledge(s) an obligation of assignment of this invention to Level 3 at the time the invention was made.

The undersigned agree(s) to execute all papers and documents necessary in connection with the application or any interference which may be declared and any provisional-completion, utility, design, continuing or divisional applications thereof and also to execute separate assignments in connection with such applications as Level 3 may deem necessary or expedient and further to perform any act which may be necessary in connection with claims or provisions of the International Convention for Protection of Industrial Property or similar agreements.

The undersigned agree(s) to perform all affirmative acts which may be necessary to obtain a grant of valid United States and corresponding foreign patents to Level 3.

The undersigned hereby authorize(s) and request(s) the Commissioner of Patents to issue any and all Letters Patent of the United States resulting from said application or any division or divisions or continuing applications thereof to Level 3, as assignee of the entire interest, and hereby covenants that he has (they have) full right to convey the entire interest herein assigned, and that he has (they have) not executed and will not execute, any agreement in conflict herewith.

The undersigned hereby grant(s) the firm of Davidson Berquist Jackson & Gowdey LLP the power to insert on this assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent Office for recordation of this document. It is understood and agreed that Level 3's attorneys Davidson Berquist Jackson & Gowdey LLP have represented only Level 3 and will continue to represent only Level 3 with respect to this invention.

In witness whereof, executed by the undersigned on the date(s) opposite the undersigned signature(s).

Date: 6/3/2009 Inventor: D. d T. May **David FULLAGAR** Witness: _____

Date: _____ Inventor: _____ **Christopher NEWTON** Witness: _____

Date: _____ Inventor: _____ **Laurence LIPSTONE** Witness: _____

Attorney Docket No. 2711-0161

ASSIGNMENT of U.S. and Foreign Patent Rights to Level 3 Communications, LLC

(Inventors) **David FULLAGAR** of 775 Cherryvale Rd., Boulder, Colorado 80303
Christopher NEWTON 981 Via Colinas, Thousand Oaks, California 91362
Laurence LIPSTONE of 22724 Sparrow Dell Dr., Calabasas, California 91302

In consideration of the sum of one dollar ($1.00) and other good valuable considerations paid to each of the undersigned, the undersigned agree(s) to assign, and hereby does assign, transfer and set over to **Level 3 Communications, LLC** ("Level 3"), a corporation of Delaware, having an office and place of business at 1025 Eldorado Blvd., Broomfield, Colorado, the undersigned's entire right, title and interest in the invention, all applications filed therefor for patent in the United States and in foreign countries (including divisional applications, continuation applications, continued prosecution applications, continuation-in-part applications, substitute applications, renewal applications, reissue applications, reexamination applications, extensions, and all other patent applications that have been or shall be filed on the invention), all Letters Patent (including original patents, reissued patents, reexamination certificates, and extensions) which may be granted therefor in the United States and in foreign countries, and all rights of priority resulting from the filing of any such application, for the invention known as:

Handling Long-tail Content in a Content Delivery Network (CDN)

for which the undersigned has have already filed U.S. application Serial No. 12/408,681 and international application no. PCT/US09/37904 on March 21, 2009.

The undersigned acknowledge(s) an obligation of assignment of this invention to Level 3 at the time the invention was made.

The undersigned agree(s) to execute all papers and documents necessary in connection with the application or any interference which may be declared and any provisional-completion, utility, design, continuing or divisional applications thereof and also to execute separate assignments in connection with such applications as Level 3 may deem necessary or expedient and further to perform any act which may be necessary in connection with claims or provisions of the International Convention for Protection of Industrial Property or similar agreements.

The undersigned agree(s) to perform all affirmative acts which may be necessary to obtain a grant of valid United States and corresponding foreign patents to Level 3.

The undersigned hereby authorize(s) and request(s) the Commissioner of Patents to issue any and all Letters Patent of the United States resulting from said application or any division or divisions or continuing applications thereof to Level 3, as assignee of the entire interest, and hereby covenants that he has (they have) full right to convey the entire interest herein assigned, and that he has (they have) not executed and will not execute, any agreement in conflict herewith.

The undersigned hereby grant(s) the firm of Davidson Berquist Jackson & Gowdey LLP the power to insert on this assignment any further identification which may be necessary or desirable in order to comply with the rules of the United States Patent Office for recordation of this document. It is understood and agreed that Level 3's attorneys Davidson Berquist Jackson & Gowdey LLP have represented only Level 3 and will continue to represent only Level 3 with respect to this invention.

In witness whereof, executed by the undersigned on the date(s) opposite the undersigned signature(s).

Date: _____ Inventor: _____ Witness: _____
David FULLAGAR

Date: 17 May 2009 Inventor: _____ Witness: _____
Christopher NEWTON

Date: 5/20/09 Inventor: _____ Witness: _____
Laurence LIPSTONE

ACKNOWLEDGMENT

State of California
County of VENTURA)

On MAY 20, 2009 before me, MALA H PATEL, NOTARY PUBLIC
(insert name and title of the officer)

personally appeared CHRISTOPHER NEWTON AND LAURENCE LIPSTONE,
who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) ~~is~~/are subscribed to the within instrument and acknowledged to me that ~~he/she~~/they executed the same in ~~his/her~~/their authorized capacity(ies), and that by ~~his/her~~/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

MALA H. PATEL
COMM. # 1701636
NOTARY PUBLIC-CALIFORNIA
VENTURA COUNTY
My Commission Expires
NOVEMBER 26, 2010

Signature Mala H Patel (Seal)

DOCUMENT: ASSIGNMENT OF US & FOREIGN PATENT RIGHTS TO LEVEL 3 COMMUNICATIONS, LLC.

MALA H. PATEL
COMM. # 1701636
NOTARY PUBLIC-CALIFORNIA
VENTURA COUNTY
My Commission Expires
NOVEMBER 26, 2010

OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF:	Attorney Docket: 2711-0161
FULLAGAR, David et al.	Group Art Unit: 2443
Application Serial No.: 12/408,681	Examiner: Unassigned
Application Filing Date: 03/21/2009	Date: June 5, 2009
Title: **HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)**	Confirmation No.: 9965

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Pursuant to 37 C.F.R. § 1.56, the attention of the Patent and Trademark Office is hereby directed to the reference(s) listed on the attached PTO-1449. One copy of each non-U.S. Patent reference is attached. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the reference(s) be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

The submission of any document herewith, which is not a statutory bar, is not intended that any such document constitutes prior art against any of the claims of the present application or is considered to be material to patentability as defined in 37 C.F.R. § 1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference against the claims of the present application.

☒ This Information Disclosure Statement is being filed within three (3) months of the U.S. filing date OR before the mailing date of a first Office Action on the merits. No certification or fee is required.

☐ This Information Disclosure Statement is being filed more than three (3) months after the U.S. filing date AND after the mailing date of the first Office Action on the merits, but before the mailing date of a Final Rejection or Notice of Allowance.

☐ I hereby certify that each item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.97(e)(1).

☐ I hereby certify that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three (3) months prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.97(e)(2).

☐ Attached is our check no. _____ in the amount required under 37 C.F.R. § 1.17(p). Please credit or debit Deposit Account No. 501860 as needed to ensure consideration of the disclosed information. A duplicate copy of this paper is attached.

☐ This Information Disclosure Statement is being filed more than three (3) months after the U.S. filing date and after the mailing date of a Final Rejection or Notice of Allowance, but before payment of the Issue Fee. Applicant(s) hereby requests that the Information Disclosure Statement be considered. Attached is our check in the amount required under 37 C.F.R. § 1.17(p). Please credit or debit

Deposit Account No. 501860 as needed to ensure consideration of the disclosed information. A duplicate copy of this paper is attached.

☐ I hereby certify that each item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application not more than three (3) months prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.97(e)(1).

☐ I hereby certify that no item of information in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three (3) months prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.97(e)(2).

☐ Relevance of the non-English language reference(s) is/are discussed in the present specification.

☐ The reference(s) was/were cited in a counterpart foreign application. An English language version of the foreign search report is attached for the Examiner's information.

☐ A concise explanation of the relevance of the non-English language reference(s) appear(s) in the Appendix hereto.

☐ The Examiner's attention is directed to co-pending U.S. Patent Application No. _____, filed _____, which is directed to related technical subject matter. The identification of this U.S. Patent Application is not to be construed as a waiver of secrecy as to that application now or upon issuance of the present application as a patent. The Examiner is respectfully requested to consider the cited application and the art cited therein during examination.

☐ Copies of the references were cited by or submitted to the Office in parent Application No. _____, filed _____, which is relied upon for an earlier filing date under 35 U.S.C. 120. Thus, Form PTO 1449 is attached without copies of these references. 37 C.F.R. § 1.98(d).

CHARGE STATEMENT: Deposit Account No. 501860, order no. **2711-0161**.

The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 (missing or insufficiencies only) now or hereafter relative to this application and the resulting Official Document under Rule 20, or credit any overpayment, to our Accounting/Order Nos. shown above, for which purpose a duplicate copy of this sheet is attached

This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal sheet is filed.

CUSTOMER NUMBER

75948

Davidson Berquist Jackson & Gowdey LLP
4300 Wilson Blvd., 7th Floor,
Arlington Virginia 22203
Main: (703) 894-6400 • FAX: (703) 894-6430

Respectfully submitted,

By: _____

Brian Siritzky, Ph.D.
Registration No.: 37,497

OIPE
JUN 05 2009
PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT FORM PTO-1449 (modified) Sheet 1 of 2	Application No.	12/408,681
	Filing Date	03/21/2009
	First Named Inventor	David Fullagar
	Group Art Unit	2443
	Examiner Name	Unassigned
	Attorney Docket No.	2711-0161
	Confirmation No.	9965

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.	Document No.	Publication/ Issue Date	Name of Patentee or Applicant of Cited Document
	1-1	US-2004/0205162	2004/10/14	PARIKH
	1-2	US-2007/0055764	2007/03/08	DILLEY et al.
	1-3	US-2008/0071859	2008/03/20	SEED et al.
	1-4			
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	1-25			
	1-26			

Examiner Signature		Date Considered	

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT FORM PTO-1449 (modified) Sheet 2 of 2		
	Application No.	12/408,681
	Filing Date	03/21/2009
	First Named Inventor	David Fullagar
	Group Art Unit	2443
	Examiner Name	Unassigned
	Attorney Docket No.	2711-0161
	Confirmation No.	9965

NON-PATENT REFERENCES

Examiner Initials*	Cite No.	Non-patent Reference bibliographic information, where available	Notes
	2-1	Search Report and Written Opinion mailed April 27, 2009 in PCT Appln. No. PCT/US2009/037904	
	2-2		
	2-3		
	2-4		
	2-5		
	2-6		
	2-7		

Examiner Signature		Date Considered	

*Examiner: Initial if reference was considered, whether or not citation is in conformance with MPEP 609. Draw a line through citation if not in conformance and not considered. Include a copy of this form with next communication to applicant. Notes: If identified, the following is provided: EA = English Abtract, T = Translation, PF = Patent Family.

PATENT COOPERATION TREATY

RECEIVED
APR 2 8 2009
DAVIDSON BERQUIST

From the INTERNATIONAL SEARCHING AUTHORITY

To:
Brian Siritzky, Ph.D.
DAVIDSON BERQUIST JACKSON & GOWDEY LLP
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

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)* 27 APR 2009
Applicant's or agent's file reference 2711-0162	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/US 09/37904	International filing date *(day/month/year)* 21 March 2009 (21.03.2009)
Applicant Level 3 Communications, LLC	

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 8270

   For more detailed instructions, see the notes on the accompanying sheet.

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 the 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 the applicant's 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**

   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 as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

   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. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

   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.

   See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/220 (January 2004) *(See notes on accompanying sheet)*

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 2711-0162	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 09/37904	International filing date *(day/month/year)* 21 March 2009 (21.03.2009)	(Earliest) Priority Date *(day/month/year)* 04 April 2008 (04.04.2008)
Applicant Level 3 Communications, LLC		

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 7 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 43.6*bis*(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(b), 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. 3

☒ 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 figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 09/37904

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 15/173 (2009.01)
USPC - 709/226
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)
USPC: 709/226

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 709/203, 223, 225, 226, 229; 718/100, 102, 104; 700/90, 91, 99 keyword limited - see search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWest (PGPB, USPT, USOC, EPAB, JPAB); Google Scholar; Google Patent
Search terms: CDN, content delivery network, edge, server, cache, popularity, origin, parent, tier, Internet, web, group, cluster, threshold

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0055764 A1 (DILLEY et al.) 08 March 2007 (08.03.2007), para [0008]-[0009], [0013], [0015], [0042], [0044]-[0045], [0047]	1-12
A	US 2008/0071859 A1 (SEED et al.) 20 March 2008 (20.03.2008), entire document	1-12
A	US 2004/0205162 A1 (PARIKH) 14 October 2004 (14.10.2004), entire document	1-12

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
17 April 2009 (17.04.2009)

Date of mailing of the international search report
27 APR 2009

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:
Lee W. Young
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
Brian Siritzky, Ph.D.
DAVIDSON BERQUIST JACKSON & GOWDEY LLP
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	27 APR 2009
Applicant's or agent's file reference 2711-0162	FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 09/37904	21 March 2009 (21.03.2009)	04 April 2008 (04.04.2008)

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G06F 15/173 (2009.01)
USPC - 709/226

Applicant Level 3 Communications, LLC

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 43*bis*.1(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 66.1*bis*(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.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	17 April 2009 (17.04.2009)	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/37904

Box No. I 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. type of material

      ☐ a sequence listing

      ☐ table(s) related to the sequence listing

   b. format of material

      ☐ on paper

      ☐ in electronic form

   c. time of filing/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 and/or table(s) relating thereto 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/US 09/37904

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

1 Statement

Novelty (N)	Claims	None	YES
	Claims	1-12	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-12	NO
Industrial applicability (IA)	Claims	1-12	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-12 lack novelty under PCT Article 33(2) as being anticipated by US 2007/0055764 A1 to Dilley et al. (hereinafter 'Dilley').

As per claim 1, Dilley discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (para [0008]), the method comprising: at a first server in said first tier of servers, obtaining a request from a client for a resource (para [0044]); if said resource is available at said first server or at a peer of said first server, serving the resource to the client (para [0044]); otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular, and if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise, if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and said second server serving the resource to the client (para [0027], [0045], [0047]).

As per claim 2, Dilley further discloses wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers (para [0044]-[0045], [0047]).

As per claim 3, Dilley further discloses wherein the second server is a content provider's origin server (para [0045]).

As per claim 4, Dilley further discloses wherein the step of determining whether said resource is popular comprises: determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold (para [0015], [0027]).

As per claim 5, Dilley discloses a method of content delivery in a content delivery network comprising at least a first tier of servers (para [0008]), the method comprising: (A) at a first server in said first tier of servers, obtaining a request from a client for a resource (para [0044]); (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource (para [0027], [0044]-[0045], [0047]).

As per claim 6, Dilley further discloses wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers (para [0044]-[0045], [0047]).

As per claim 7, Dilley further discloses wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said serves in said first tier, and wherein said second server is an origin server (para [0044]-[0045], [0047]).

As per claim 8, Dilley discloses a content delivery framework (para [0008]-[0009]) comprising: a plurality of edge servers forming a first tier of servers (para [0044]); and a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers (para [0045], [0047]-[0048]); and at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content (para [0027], [0045]).

As per claim 9, Dilley discloses a method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers (para [0008], [0044]-[0045]), the method comprising: (A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource (para [0044]); (B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on a current popularity value for said resource (para [0027], [0044]-[0045], [0047]).

As per claim 10, Dilley further discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier (para [0013], [0042]).

(See Supplemental Box)

Form PCT/ISA/237 (Box No. V) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 09/37904

Supplemental Box

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

Continuation of:
Box NO. V --- Reasoned Statement
2. Citations and explanations:

As per claim 11, Dilley discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier (para [0044]-[0045]).

As per claim 12, Dilley further discloses wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier (para [0047]).

Claims 1-12 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

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
12/408,681	03/21/2009	David Fullagar	2711-0161

CONFIRMATION NO. 9965

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

FORMALITIES LETTER

OC000000035293306

Date Mailed: 04/06/2009

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 and pay any fees required 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 oath or declaration is missing.
  A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
  Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

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

- 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 with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is $**130** for a non-small entity
- $**130** Surcharge.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/smunpanthavong/

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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
12/408,681	03/21/2009	2443	1310	2711-0161	12	4

CONFIRMATION NO. 9965

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
4300 WILSON BLVD., 7TH FLOOR
ARLINGTON, VA 22203

FILING RECEIPT



Date Mailed: 04/06/2009

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)

David Fullagar, Boulder, CO;
Laurence Lipstone, Calabasas, CA;
Christopher Newton, Thousand Oaks, CA;

Assignment For Published Patent Application

Level 3 Communications, LLC, Broomfield, CO

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/042,412 04/04/2008

Foreign Applications

If Required, Foreign Filing License Granted: 04/01/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/408,681**

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

Non-Publication Request: No

Early Publication Request: No

Title

HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

Preliminary Class

709

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.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/408,681	03/21/2009	David Fullagar	2711-0161 (IP 0137-US-U1)

CONFIRMATION NO. 9965

IMPROPER CPOA LETTER

75948
DAVIDSON BERQUIST JACKSON & GOWDEY, LLP
ATTN: BRIAN SIRITZKY, Ph.D.
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ARLINGTON, VA 22203

OC000000035288380

Date Mailed: 04/06/2009

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/21/2009. The Power of Attorney in this application is not accepted for the reason(s) listed below:

- The Power of Attorney is from an assignee and the Certificate required by 37 CFR 3.73(b) has not been received.

/rdepaz/

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

Electronic Acknowledgement Receipt

EFS ID:	5010213
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	75948
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	2711-0161 (IP 0137-US-U1)
Receipt Date:	21-MAR-2009
Filing Date:	
Time Stamp:	13:17:30
Application Type:	Utility under 35 USC 111(a)

04/01/2009 MTEKLEMI 00000018 501860 12408681
01 FC:1201 220.00 DA

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1090
RAM confirmation Number	5552
Deposit Account	501860
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
REQUEST FOR FILING PATENT APPLICATION UNDER RULE 53(a), (b) & (f)

RULE 53(f) NO DECLARATION

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

Atty. Dkt. No.: 2711-0161

Date: March 21, 2009

Sir:

1. This is a Request for filing a new Patent Application (☐ Design ☒ Utility) entitled:

2. Title:

Handling Long-tail Content in a Content Delivery Network (CDN)

without a Oath/Declaration but for which is enclosed the following:

3. ☒ Abstract 1 page

4. **27** Pages of Specification (only spec. and claims)

5. ☐ Specification in non-English Language

6. 12 Numbered claim(s); and

7. Drawings: 6 sheets (Figures 1-6)

8. **DOMESTIC/INTERNATIONAL** priority is claimed under 35 U.S.C. 119(e)/120/365(c) based on the following provisional, nonprovisional and/or PCT International application(s):

Application No.	Filing Date
61/042,412	**April 4, 2008**

9. **FOREIGN** priority is claimed under 35 U.S.C. 119(a)-(d)/365(b) based on filing in

Application No.	Filing Date

10. ___ (No.) Certified copy/copies: ☐ attached; ☐ previously filed on (date)

11. ☐ This is a reissue of Patent No.

12. ☒ See top first page re prior Provisional, National, International application(s) (X box if info there)

13. Extension to date: ☐ concurrently filed ☐ not needed ☐ previously filed

14. ☐ Small Entity Status is claimed (**pre**-filing confirmation **required**)

15. ☐ See **NONPUBLICATION REQUEST** under Rule 213(a) attached

16. ☒ Prior Application **61/042,412** is assigned to **LEVEL 3 COMMUNICATIONS, LLC** by an assignment recorded **12/17/2008** at Reel **021999** Frame **0962**.

17. ☒ **ATTACHED: (A) Application Data Sheet**
(B) Power of Attorney

THE FOLLOWING FILING FEE IS BASED ON CLAIMS AS FILED LESS ANY ABOVE CANCELLED

Basis For Fee				**Large Entity**	**Amount**
18a. Basic Filing Fee				$330	$330
18b. Search Fee				$540	$540
18c. Examination Fee				$220	$220
			Extra Claims		
19. Total Claims		Minus 20 =		X $50 / $25	$
20. Ind. Claims		Minus 3 =		X $210 / $105	$
21. If any proper multiple dependent claim is present, add: Leave this line blank if this is a reissue application)				$370 / $185	$
Application Size Fee (If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).)					
Total Sheets	**Minus 100 sheets**	**Extra Sheets**	**Number of each additional 50 or fraction thereof (round up to a whole number)**	x $260 / $130	
22.	**- 100 sheets**			X $	$
23. **Total Filing Fee Enclosed:**					**$ 1090**
24. If "non-English" box 2 is X'd, add Rule 17(k) processing fee				$130	$
25. If "assignment" box 7 is X'd, add recording fees ($40 / assignment)				$	$
26. ☐ Attached is a Petition/Fee under Rule No.				$	$
27. **Total Fee:**					**$ 1090**

28. ☐ Check No. in the amount of $ is attached.

29. ☐ Please charge the total fee to our deposit account below under the stated order no.:
Our Deposit Account No.: 501860.

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.

This Charge Statement does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed.

30. This application is made by the following named inventor(s):

	First name	M.I.	Family Name	
Inventor's Name:	**David**		**FULLAGAR**	
Citizenship:	Australian			
Residence:	City: Boulder		State/Country: CO/US	
Mailing Address:	775 Cherryvale Rd., Boulder, Colorado			Zip Code: 80303

	First name	M.I.	Family Name	
Inventor's Name:	**Laurence**		**LIPSTONE**	
Citizenship:	US			
Residence:	City: Calabasas		State/Country: CA/US	
Mailing Address:	22724 Sparrow Dell Dr., Calabasas, California			Zip Code: 91302

	First name	M.I.	Family Name	
Inventor's Name:	**Christopher**		**NEWTON**	
Citizenship:	UK			
Residence:	City: Thousand Oaks		State/Country: CA/US	
Mailing Address:	981 Via Colinas, Thousand Oaks, California			Zip Code: 91362

31. **Correspondence Address:** **Use the address associated with customer number 75948.**

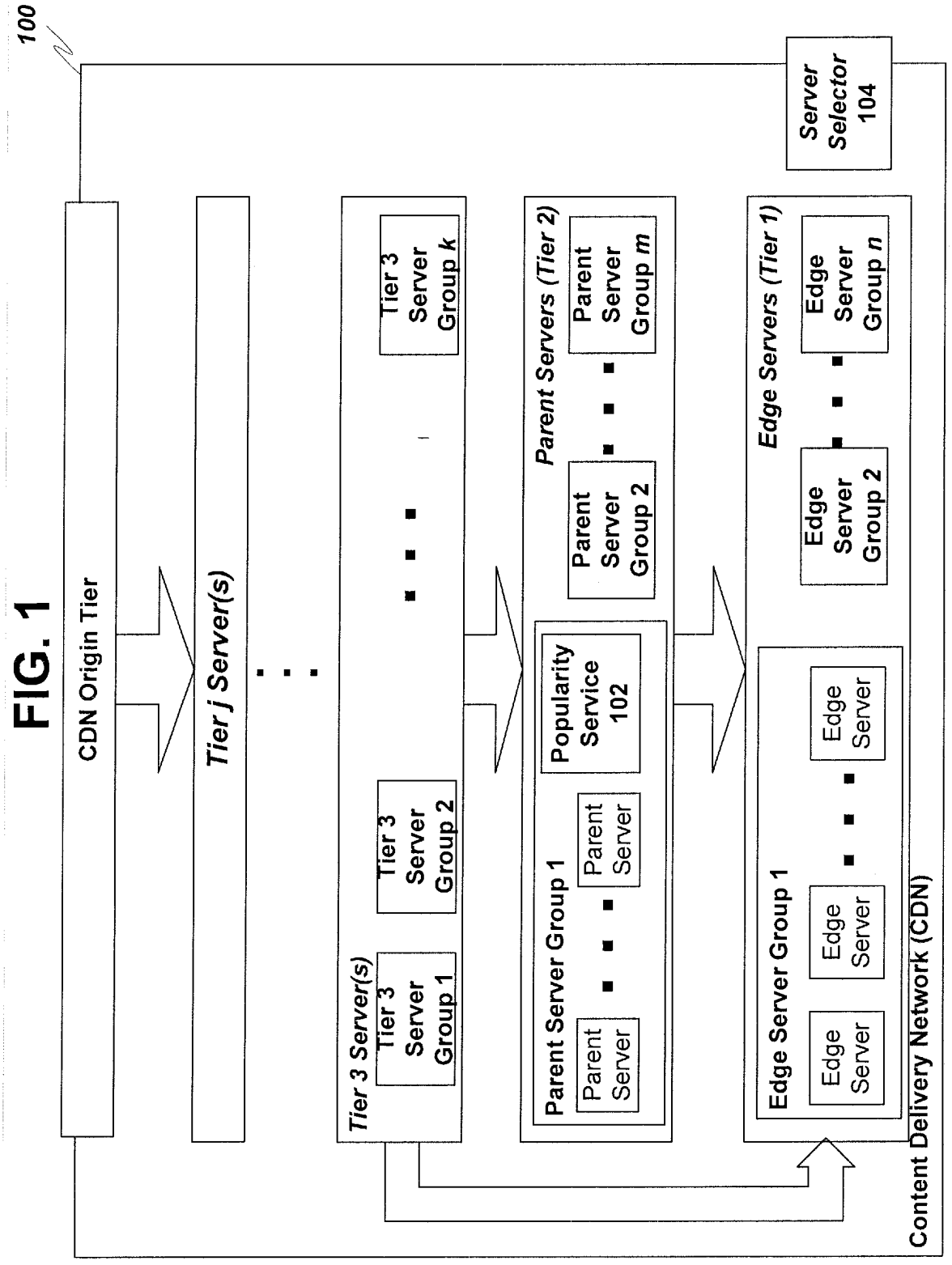
Respectfully submitted,

/Brian Siritzky/Reg. No. 37,497

Brian Siritzky
Registration No. 37497

Davidson Berquist Jackson & Gowdey LLP
4300 Wilson Boulevard, 7th Floor
Arlington, VA 22203
Main: (703) 894-6400
FAX: (703) 894-6430

FIG. 1


100
CDN Origin Tier
Tier j Server(s)
Tier 3 Server(s)
Tier 3 Server Group 1
Tier 3 Server Group 2
Tier 3 Server Group k
Parent Servers (Tier 2)
Parent Server Group 1
Parent Server
Parent Server
Popularity Service 102
Parent Server Group 2
Parent Server Group m
Edge Servers (Tier 1)
Edge Server Group 1
Edge Server
Edge Server
Edge Server
Edge Server Group 2
Edge Server Group n
Server Selector 104
Content Delivery Network (CDN)

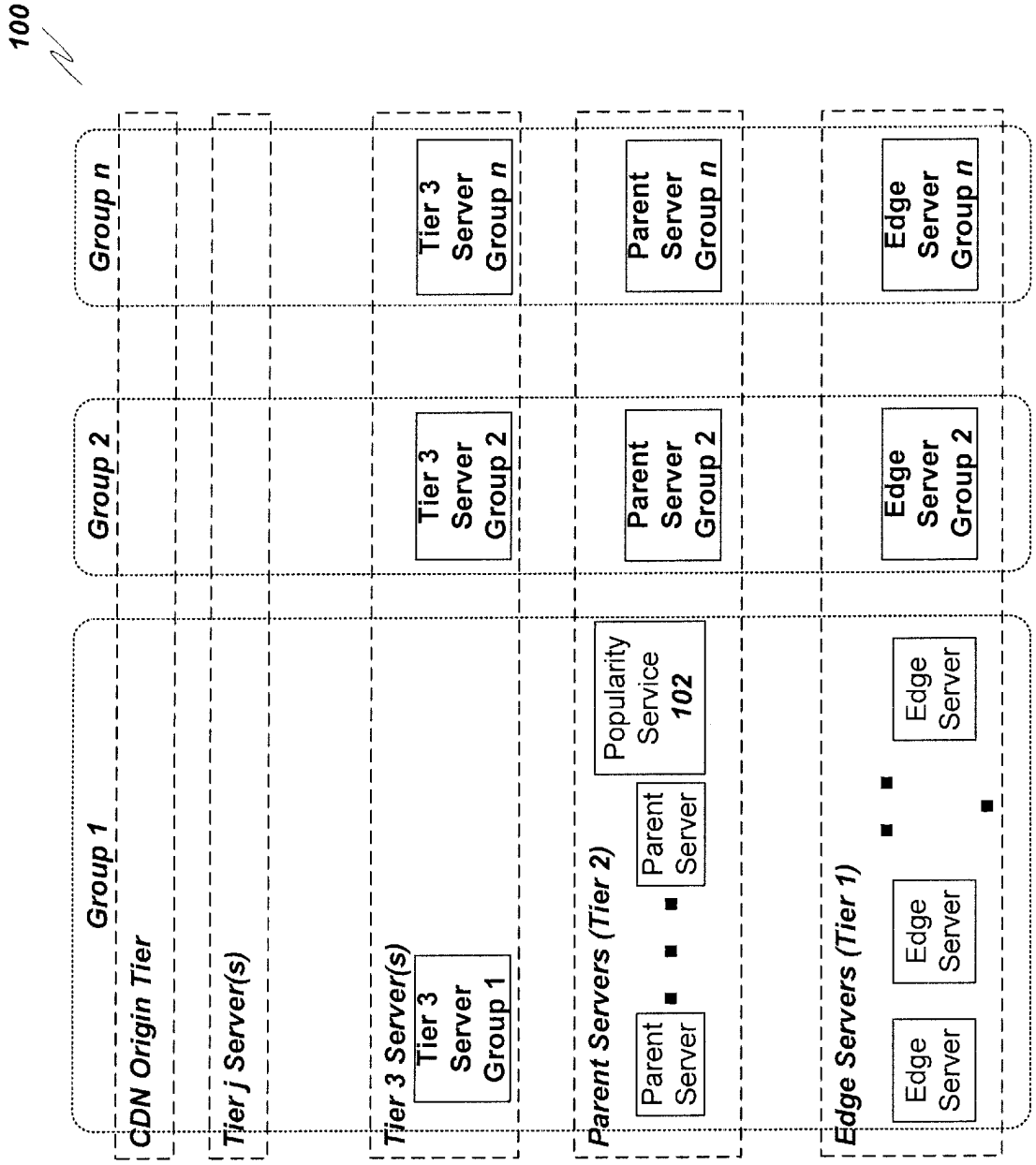

100
Group 1
Group 2
Group n
CDN Origin Tier
Tier j Server(s)
Tier 3 Server(s)
Tier 3 Server Group 1
Tier 3 Server Group 2
Tier 3 Server Group n
Parent Servers (Tier 2)
Parent Server
Parent Server
Popularity Service 102
Parent Server Group 2
Parent Server Group n
Edge Servers (Tier 1)
Edge Server
Edge Server
Edge Server
Edge Server Group 2
Edge Server Group n

FIG. 2

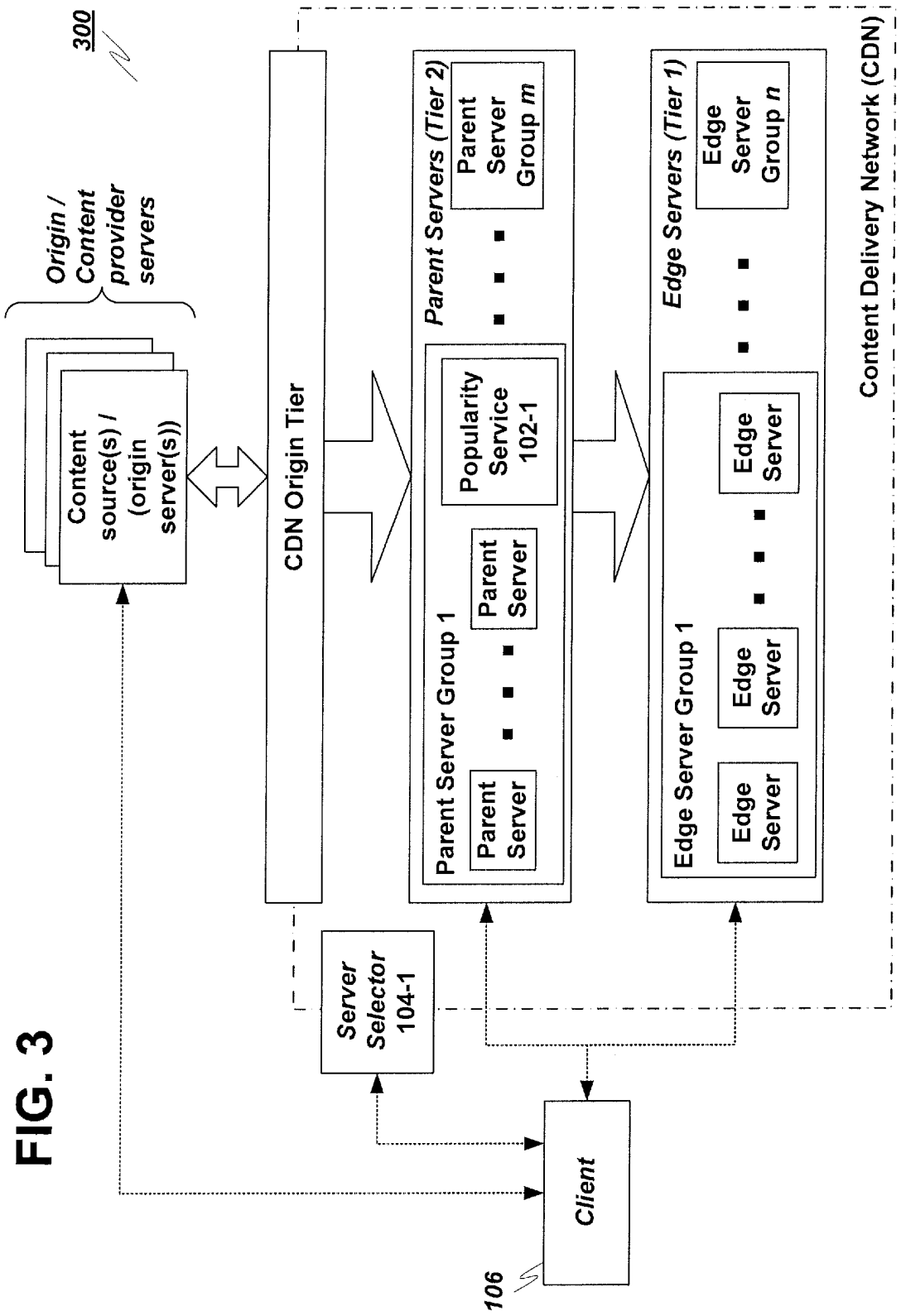

300
Origin / Content provider servers
Content source(s) / (origin server(s))
CDN Origin Tier
Parent Servers (Tier 2)
Parent Server Group m
Popularity Service 102-1
Parent Server Group 1
Parent Server
Parent Server
Edge Servers (Tier 1)
Edge Server Group n
Edge Server Group 1
Edge Server
Edge Server
Edge Server
Edge Server
Content Delivery Network (CDN)
Server Selector 104-1
Client
106

FIG. 3

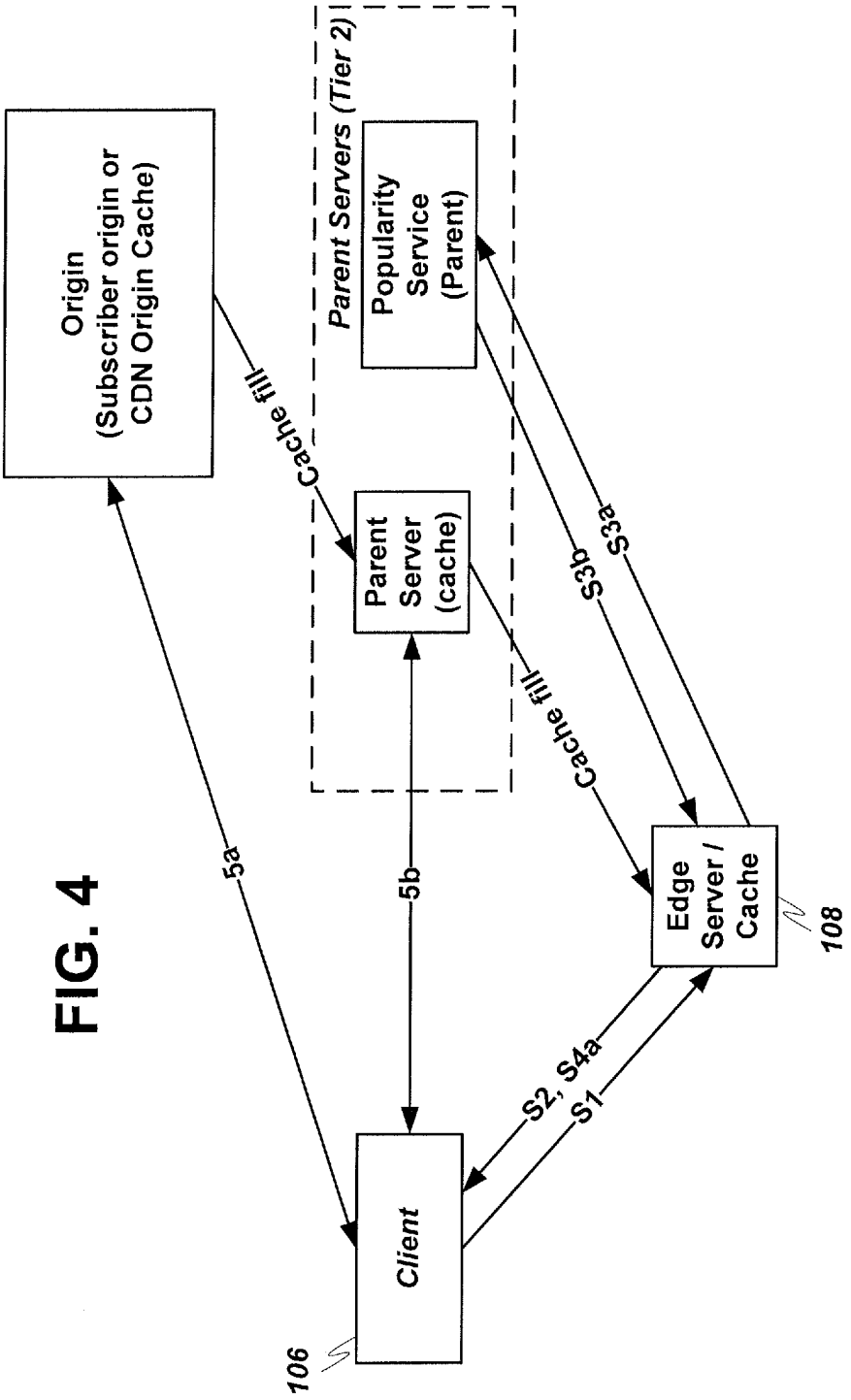

Origin
(Subscriber origin or
CDN Origin Cache)
Parent Servers (Tier 2)
Popularity
Service
(Parent)
Parent
Server
(cache)
Cache fill
Cache fill
S3a
S3b
5a
5b
Edge
Server /
Cache
108
S2, S4a
S1
Client
106

FIG. 4

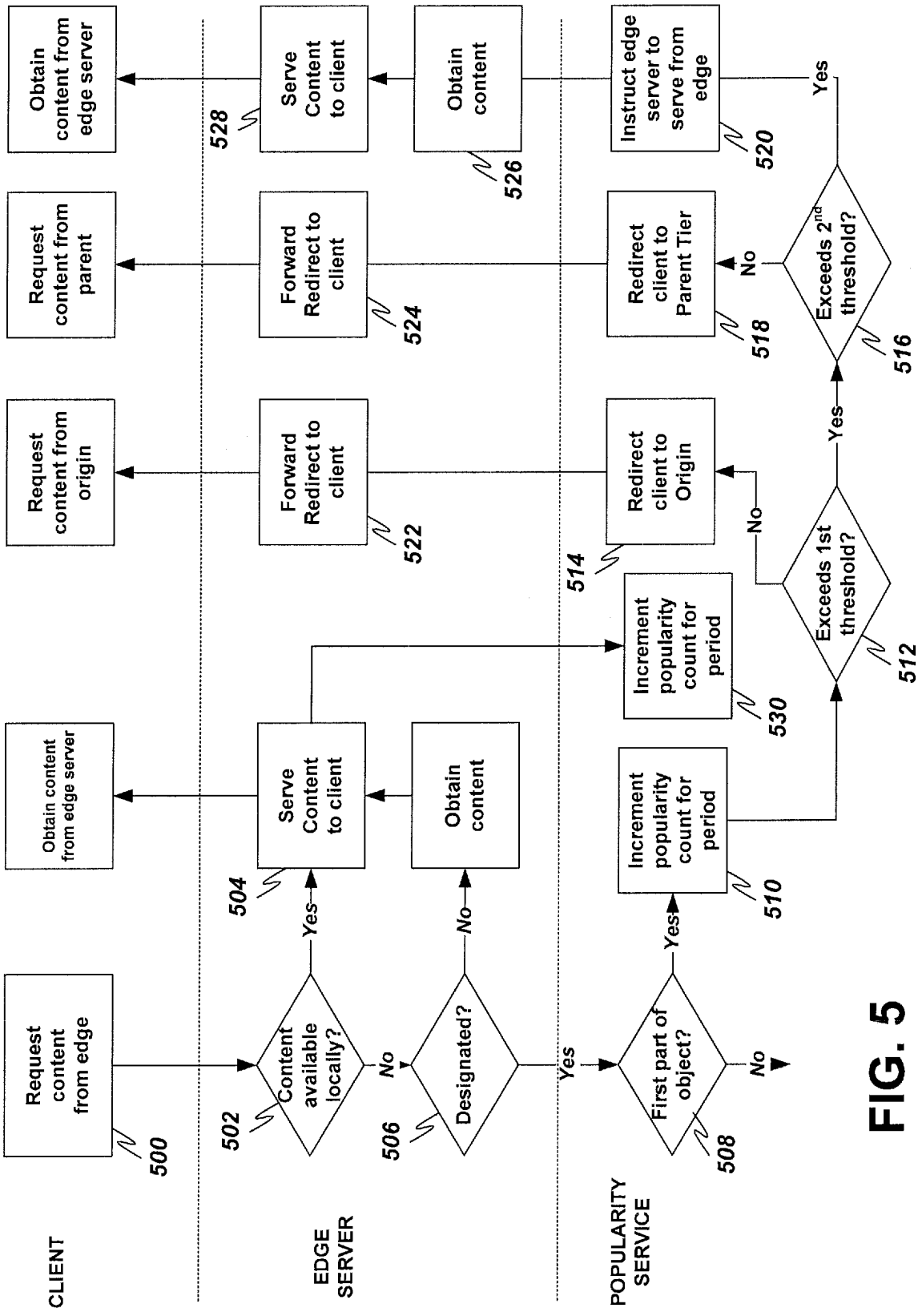
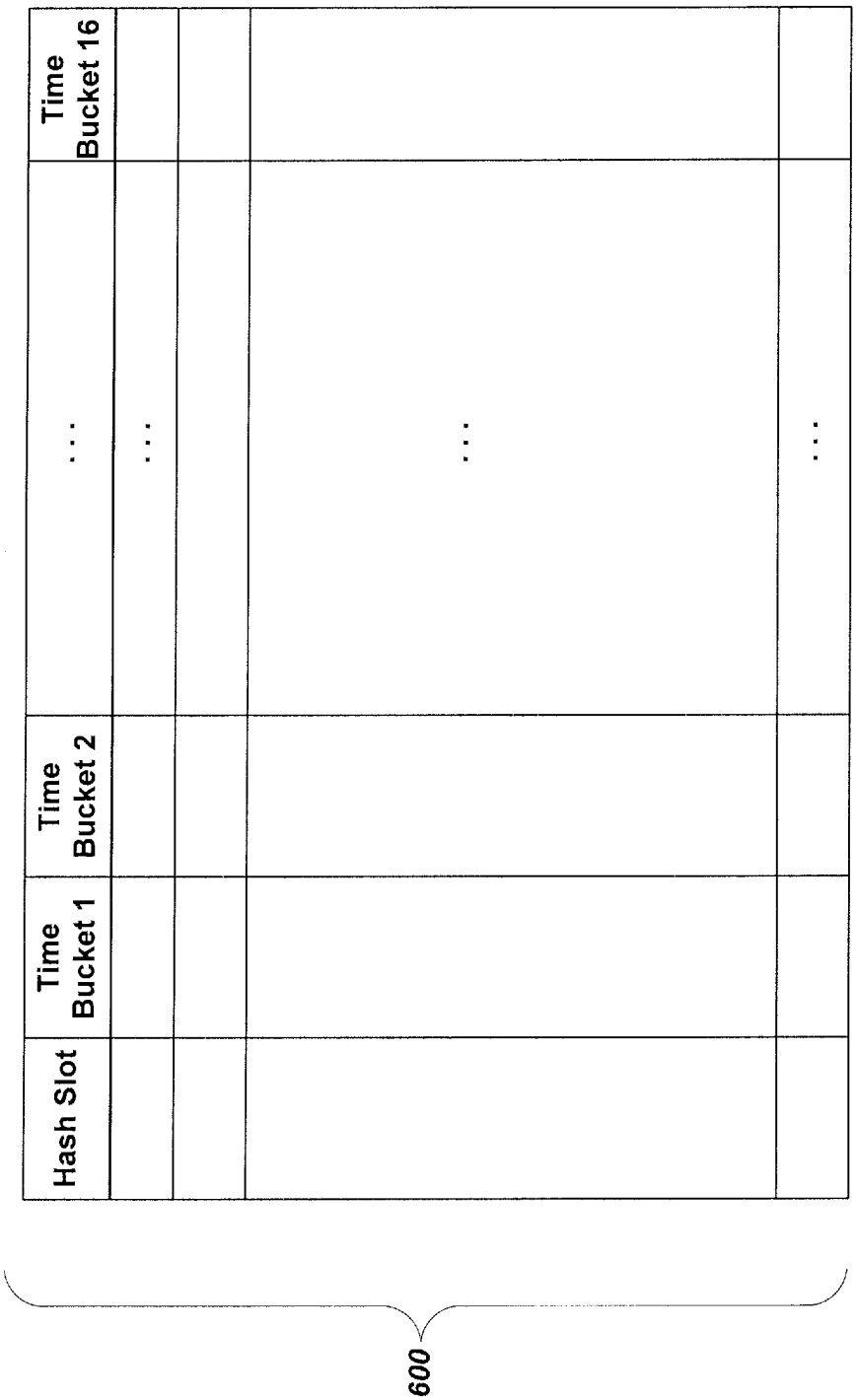

CLIENT
EDGE SERVER
POPULARITY SERVICE
Request content from edge
500
Content available locally?
502
Yes
No
Serve Content to client
504
Obtain content
Designated?
506
Yes
No
Obtain content from edge server
Request content from origin
Request content from parent
First part of object?
508
Yes
No
Increment popularity count for period
510
Exceeds 1st threshold?
512
No
Yes
Redirect client to Origin
514
Forward Redirect to client
522
Increment popularity count for period
530
Exceeds 2nd threshold?
516
Yes
No
Redirect client to Parent Tier
518
Forward Redirect to client
524
Instruct edge server to serve from edge
520
Obtain content
526
Serve Content to client
528
Obtain content from edge server

FIG. 5

FIG. 6



Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Filer:	Brian Siritzky
Attorney Docket Number:	2711-0161 (IP 0137-US-U1)

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	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1090**

Electronic Acknowledgement Receipt

EFS ID:	5010213
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	75948
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	2711-0161 (IP 0137-US-U1)
Receipt Date:	21-MAR-2009
Filing Date:	
Time Stamp:	13:17:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1090
RAM confirmation Number	5552
Deposit Account	501860
Authorized User	

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

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2711_0161_Application.pdf	457271 9a2f66deaee50a891fb261cb991dbb4b77b40289	yes	28

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Specification	1	23
Claims	24	27
Abstract	28	28

Warnings:

Information:

2	Application Data Sheet	2711_0161_ADS.pdf	67039 2edf3025b243724c00cd6b1558e9eb061f7352ad	no	3

Warnings:

Information:

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3	Power of Attorney	POA_75948.pdf	68984 2c8421e76483f62f512f896114eaac2702b829c3	no	1

Warnings:

Information:

4	Transmittal of New Application	2711_0146_AppFilingReq-Rule_53_f_No_Dec.pdf	324976 83a03afa411670ed30b2b4dbefdb8ffd54960133	no	3

Warnings:

Information:

5	Drawings-only black and white line drawings	2711_0161_Drawings.pdf	636913 8a3a3e2504c30bb0f88cd87ac25d6b7c96297e25	no	6

Warnings:

Information:

6	Fee Worksheet (PTO-06)	fee-info.pdf	33266 1299e6c9e2c83154ab660417dc57f79c2bad7d70	no	2

Warnings:

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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)

RELATED APPLICATIONS

[0001] This application is related to and claims priority under 35 U.S.C. § 119(e) from United States Patent Application No. 61/042,412, filed April 4, 2008, titled "Handling Long-tail Content in a Content Delivery Network (CDN)," the entire contents of which are incorporated herein by reference for all purposes.

[0002] This application is also related to the following co-owned and co-pending patent applications, the contents of each of which are fully incorporated herein by reference for all purposes:

Application No.	Filing Date
10/073,938	02-14-2002
11/715,316	03-08-2007
11/978,656	10-30-2007
11/980,672	10-31-2007
10/259,497	09-30-2002
11/932,162	10-31-2007
11/976,648	10-26-2007

FIELD OF THE INVENTION

[0003] This invention relates to content delivery, to content delivery networks (CDNs), and to frameworks and systems using CDNs.

DETAILED DESCRIPTION OF PRESENTLY PREFERRED EXEMPLARY EMBODIMENTS

GLOSSARY

[0004] As used herein, unless stated otherwise, the following terms or abbreviations have the following meanings:

1. IP means Internet Protocol.
2. "IP address" means an address used in the Internet Protocol to identify electronic devices such as servers and the like.
3. HTTP means Hypertext Transfer Protocol.
4. URL means Uniform Resource Locator.
5. DNS means Domain Name System.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The present invention can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Furthermore, like referenced numerals designate corresponding parts throughout the several views.

[0006] **Fig. 1** depicts a general hierarchical, multi-tiered content delivery network (CDN);

[0007] **Fig. 2** shows the logical organization of servers into groups or clusters in a CDN;

[0008] **Fig. 3** depicts a content delivery framework (CDF) using a content delivery network (CDN);

[0009] **Fig. 4** depicts the operation of a two-level content delivery network in a content delivery framework;

[0010] **Fig. 5** is a flowchart show operation of the popularity services of the CDN of **Fig. 4**; and

[0011] **Fig. 6** is an exemplary data structure for maintaining the popularity data for a particular popularity server.

BACKGROUND AND OVERVIEW

[0012] The Internet and the so-called World Wide Web (the "WWW") have become ubiquitous. Thousands or even tens of thousands of so-called content providers (publishers) now use the Internet (and, particularly, the WWW) to provide all sorts of content to tens or even hundreds of thousands of clients all over the world.

[0013] In order to offload the job of serving some or all of their content, many content providers now subscribe to so-called content delivery networks (CDNs). Using a CDN, some (or all) of a content provider's content can be served to clients from the CDN (i.e., from one or more servers in the CDN) instead of from the content provider's server(s). In a caching CDN, content that is served may also be cached on some or all of the CDN servers, either before being served or in response to specific requests for that content.

[0014] The term content as used herein means any kind of data, in any form, regardless of its representation and regardless of what it represents. Content may include, without limitation, static and/or dynamic images, text, audio content, including streamed audio, video content, including streamed video, web pages, computer programs, documents, files, and the like. Some content may be embedded in other content, e.g., using markup languages such

as HTML and XML. Content includes content which is created or formed or composed specifically in response to a particular request. The term "resource" is sometimes used herein to refer to content.

[0015] Certain publishers have large content libraries in which only a small proportion of the content (the so-called "short head") is popular enough to benefit from serving through a caching CDN, while the majority of the content (the so-called "long tail") is accessed only occasionally and not generally worth caching (or even serving from an edge server). This situation would be typical for a content publisher with a very large music or video library. Some music content – the popular content – may be regularly requested, whereas other music – the not popular (also referred to as unpopular) content – may be seldom if ever requested.

[0016] Content can become popular (by various measures of popularity) or fade into relative obscurity dynamically, so a content library cannot easily be explicitly partitioned. Instead, the CDN tracks popularity of certain content, and selectively migrates content toward the edge (i.e., toward the tier 1 servers) as that content becomes popular.

[0017] A CDN may have one or more tiers of servers, organized hierarchically. **Fig. 1** depicts a content delivery network **100** that includes multiple tiers of servers. Specifically, the CDN **100** of Fig. 1 shows *j* tiers of servers, denoted Tier 1, Tier 2, Tier 3, …, Tier *j*. Each tier of servers may comprise a number of servers organized into server groups (sometimes referred to as server clusters). The Tier 1 servers are also referred to as edge servers, and Tier 1 is sometimes also referred to as the "edge" or the "edge of the CDN." The Tier 2 servers (when present in a CDN) are also referred to as parent servers.

[0018] For example, in the CDN **100** of **Fig. 1**, Tier 1 has *n* groups of servers (denoted "Edge Server Group 1", "Edge Server Group 2", …, "Edge Server Group *n*"); tier 2 (the parent servers' tier) has *m* server groups (the *i*-th group being denoted "Parent Server Group *i*"); and tier 3 has *k* server groups, and so on. Preferably each tier has the same number of server groups.

[0019] **Fig. 2** shows the logical organization / grouping of servers in a CDN of **Fig. 1**. In the exemplary CDN of **Fig. 2**, each tier of servers has the same number (*n*) of server groups. Those of skill in the art will know and understand, upon reading this description, that each server group may have the same or a different number of servers. Additionally, the number of servers in a server group may vary dynamically. For example, additional servers may be added to a server group to deal with increased load on the group.

[0020] The servers in a server group may be homogenous or heterogeneous, and each server in a server group may comprise a cluster of physical servers sharing the same name and/or network address. An example of such a cluster is described in co-pending and co-owned patent application no. 61/064,339 (titled "Load-balancing cluster", filed 02/28/2008), the entire contents of which are incorporated herein by reference for all purposes.

[0021] Servers in the same tier and the same group are referred to as peers or peer servers.

[0022] A typical CDN has only one or two tiers of servers. A CDN with only one tier will have only edge servers, whereas a CDN with two tiers will have edge servers and parent servers. (At a minimum, a CDN should have at least one tier of servers – the edge servers.)

[0023] The grouping of servers in a tier may be based, e.g., on their physical or geographical location. For example, a particular CDN may have

six groups – four groups of servers in the United States, group 1 for the West Coast, group 2 for the mid-west, Group 3 for the northeast and Group 4 for the south east; and one group each for Europe and Asia.

[0024] A particular CDN server is preferably in only one server group.

[0025] In general, some or all of the servers in each tier can exchange data with some or all of the servers in each other tier. Thus, some or all of the parent servers can exchange information with some or all of the edge servers. For the sake of simplicity, in the drawings, each tier of servers is shown as being operationally connectable to each other tier. In some CDNs, however, it may be preferable that the servers in a particular tier can only exchange information with other servers in the same group (i.e., with peer servers) and/or with other servers in the same group in a different tier. For example, in some CDNs, the edge servers in edge server group *k*, can exchange information with each other and with all servers in parent server group *k*, and so on.

[0026] A content provider's / customer's server (or servers) are also referred to as origin servers. A content provider's origin servers may be owned and/or operated by that content provider or they may be servers provided and/or operated by a third party such as a hosting provider. The hosting provider for a particular content provider may also provide CDN services to that content provider.

[0027] A CDN may also include a CDN origin/content cache tier which may be used to cache content from the CDN's subscribers (i.e., from the CDN subscribers' respective origin servers). Those of skill in the art will know and understand, upon reading this description, that a CDN can support one or more subscribers, i.e., that a CDN can function as a shared infrastructure supporting numerous subscribers. The CDN origin tier may also consist of a number of

servers, and these servers may also be organized (physically and logically) into a number of regions and/or groups. The server(s) in the CDN origin tier obtain content from the subscribers' origin servers, either on an as needed basis (a pull) or in advance (via a push).

[0028] A popularity service **102** (described in greater detail below) is associated with one or more of the server groups in one or more tiers. In a presently preferred exemplary embodiment, some of the parent server groups have popularity services **102** associated therewith. Although shown as a separate component of the group, the popularity service **102** may be integrated into one of the servers in the group. In some cases, the popularity service may have its own server, distinct from any of the CDN servers. The terms "popularity service" and "popularity server" are used interchangeable herein.

[0029] In operation, when a client requests content that is to be served using a content delivery framework, the client may be served that content from a server in the CDN or, in some cases, from the subscriber/customer's origin server.

[0030] A client may be directed to a CDN and/or to a server in the CDN in any manner using any kind of server selector system **104**. As understood by those of skill in the art, the server selector system **104** generally operates to direct a client's requests for content to an appropriate server in order for that content to be served to the requesting client. An appropriate server may be one which is close to the client (by some measure of cost) and/or one which is not too heavily loaded. All sorts of conditions may be applied to the term "appropriate", and all sorts of information and tests, both static and dynamic, may be used to determine an appropriate server. The server selector system **106** may, e.g., include or operate fully or partially in Domain Name Service

(DNS) servers, standalone devices, or a combination thereof. For example, the server selector system **106** may comprise a single level DNS server that selects an appropriate server based at least in part on some combination of the location of the requesting client and the load on some or all of the CDN servers. Those of skill in the art will know and understand, upon reading this description, that a client's location in a network such as the Internet may sometimes only be roughly determined, and the term "location of the client" is generally taken to be a network location corresponding to the client's network service provider.

[0031] Although shown as a component in the drawings, the server selector **106** may comprise numerous components. For example, some or all of the server selection may be based on anycast routing, and the server selector **106** may then include routers and associated tables.

[0032] In a presently preferred embodiment the server selector **106** is an intelligent traffic manager (ITM) / adaptive traffic controller (ATC) such as described in co-pending U.S. patent application no. 10/259,497, filed 09-30-2002, and titled "Configurable Adaptive Global Traffic Control And Management," (published as US 2003-0065762 A1); and in U.S. patent application no. 11/976,648, filed 10-26-2007, titled "Policy-based content delivery network selection," (collectively the "ITM applications"), the entire contents of each of which have been incorporated herein by reference for all purposes. In some embodiments the server selector **106** may include a "best" or "optimal" server selector such as disclosed in U.S. Patent No. 6,185,598 titled, "Optimized Network Resource Location," the entire contents of which are incorporated herein by reference for all purposes. The '598 patent refers to CDN servers as so-called repeater servers, and describes a so-called "Best Repeater Selector (BRS) mechanism".

[0033] **Fig. 3** shows a content delivery framework **300** with a two-level hierarchical CDN consisting of a tier of edge servers (Tier 1) and a tier of parent servers (Tier 2). Some or all of the edge servers can communicate with some or all of the parent servers. The edge servers are divided into *n* edge server groups, and the parent servers are divided into *m* parent server groups. In a presently preferred embodiment, the value of *m* is equal to the value of *n*, *i.e.*, in this presently preferred embodiment there are the same number of edge server groups as there are parent server groups. A CDN origin/content cache tier stores subscriber content which it obtains from the various subscribers' origin servers. At least one of the parent server groups (in the drawing, Group 1) has a popularity service **102-1** associated therewith. Preferably more than one parent server group has an associated popularity service, and more preferably each parent server group has an associated popularity service.

[0034] Although shown in a parent tier, the popularity service may located anywhere in the system, including in the edge tier.

[0035] The popularity service may be used by certain, though not necessarily all, content. When only certain content uses the popularity service, content should be designated in order to use the popularity service.

[0036] Some or all of the edge servers in a group may use a popularity service to manage the long-tail content of various subscribers. Each edge server that uses a popularity service is referred to as being bound to that popularity service. An edge server that is bound to a popularity service is sometimes referred to herein as a "longtail coserver."

[0037] **Figs. 4** and **5** show the operation of the popularity services of the CDN of **Fig. 3**.

[0038] When a client **106** requests content (e.g., using an HTTP GET request), that request is directed (e.g., by server selector **104-1**) to an edge server in order for the content to be served to the client. For certain designated content a popularity check is interposed into the fill side of the caching operation. **Figure 4** illustrates the flow of messages and data in the content delivery framework **300**, and **Fig. 5** is a flowchart show operation of the popularity services of the CDN of **Fig. 4.** For the sake of this particular explanation, assume that the client's request has been directed to edge server **108**. (Those of skill in the art will know and understand, upon reading this description, that the client's initial request may be directed to any tier in the CDN hierarchy, including, e.g., to the parent tier.) This server is selected using the server selection mechanisms **104-1** associated with the CDN, e.g., using one or more DNS servers and selecting an edge server based on such factors as the location of the requesting client, the load on the network, network traffic conditions, CDN policies, subscriber policies, and the like.

[0039] A client **104** requests content from an edge server **108** (at **500** in **Fig. 5**). The request from the client **104** arrives at edge server **108** (**S1** in **Fig. 4**). The edge server **108** checks to see if object is present (locally or on a peer) and fresh (at **502**). If so, the edge server **108** serves the object to the client **104** from the cache (**S2**, **504)**, obtaining the object from a peer, if necessary.

[0040] In some embodiments, the system may distinguish between on-net and off-net peers and same-switch peers. An on-net peer is a peer on the same backbone network; an off-net peer is a peer located on a different backbone network; and a same-switch peer is a peer directly connected to the same switch as the agent performing the check. In some embodiments, the edge server **108** may only look for the object on some of its peers (e.g., only on same-switch peers) (at **502**).

[0041] If the object is not available on the edge server **108** or on a peer, the edge server **108** ascertains whether this object is served based on its popularity (i.e., whether this object has been designated so that the object's popularity will be used to determine where it will be served from) (at **506**). If so, then the request is sent to the popularity service **102** associated with the edge server **108**, in this case, to the popularity server for the this group (**S3a**).

[0042] The determination as to whether this object is designated to be served from a different location, depending on its popularity (at **506**), may be made based, at least in part, on the name (hostname) used to request the object.

[0043] It is preferably to allow for a mix of edge servers, some performing popularity checking (as described above), while others do not. For those that are not running the popularity service, the name (hostname) used to request an object will resolve to a parent server (that may or may not provide popularity services). If the parent server does not provide popularity services, then the content will be obtained by the edge server from that parent server, and the content will be served to the client. On the other hand, if that parent server does provide popularity services, it can determine whether or not the edge server is a Longtail coserver based, e.g., on the IP (Internet Protocol) address of the edge server. For no-coservers, the parent server can handle the request without any popularity processing.

[0044] A request for content may be an initial request for an object or it may be a request for another part of an object, the initial part having already been served to the client. If the request is for the first part of the object (at **508**), e.g., the request includes a request for the first byte of the resource (i.e., it is not a range request that starts after the beginning of the file), the popularity service **102** determines (as described below) if the object is currently popular.

First, the popularity count for the current period is incremented (at **510**). Based on its determination, the popularity service **102** returns one of three possible responses to the edge server **108** (**S3b**):

1. If the object has not reached a first / minimal level of popularity (at **512**): the popularity service sends the edge server an instruction (e.g., HTTP 302) to redirect the client's request to the origin server (or to the CDN origin cache) (if origin redirects are enabled) (at **514**).

2. If the object's popularity has exceeded the first / minimal level of popularity but has not yet exceeded a second, mid-tier threshold (at **516**): the popularity service sends the edge server an instruction (e.g., HTTP 302) to redirect the client's request to a parent server (if mid-tier redirects are enabled) (at **518**).

3. If the object's popularity has exceeded the mid-tier threshold (i.e., the object is popular): The popularity service sends the edge server an instruction to serve the content itself (at **520**). In a presently preferred implementation, the popularity service sends the edge server a redirect (HTTP 302) with a "follow me" flag set, to the origin server or, if there is one, to the parent tier.

[0045] If the edge server **108** receives a redirect from the popularity service **102** without the "follow me" flag set (cases 1 and 2 above), it simply forwards the redirect to the client **104** (**S4a**, **522**, **524**). If the edge server **108** receives a "follow me" redirect, it obtains and caches the resource (at **526**) and serves it to the client (at **528**).

[0046] If the popularity service **102** is unreachable, unresponsive, or returns a status code indicating an error (other than HTTP 404), the object is served out of the edge's cache server (and an alert condition is raised).

[0047] Once content has been cached at an edge server, the edge server will send notifications (e.g., in the form of revalidations) to the popularity service every time it gets another request for that content. E.g., with reference to the flowchart of **Fig. 5**, if the edge server **108** determines (at **502**) that it has the requested content (or can obtain it from a peer), then, in addition to serving the content (at **504**), it also instructs the popularity server to increment the objects popularity count for the current period (at **530**). This process keeps the popularity servers up to date on the relative popularity of content being served in their region.

[0048] In presently preferred embodiments, the server selection mechanism **104** does not rendezvous clients to parent servers/caches. In other words, in these embodiments, client requests are always initially directed by the server selection mechanism to an edge server. In these cases, when a request for a resource arrives at a parent server/cache, that request should preferably be served (and filled if necessary) unconditionally (since any request from a client is assumed to be the result of a redirect served by an edge server).

[0049] In an embodiment where the server selector **104** can direct client requests directly to parent servers (or to any tier other than the edge tier), a server obtaining a client request may choose to redirect that request, e.g., based on popularity. However, those of skill in the art will know and understand, upon reading this description, that it is advisable to track the redirection of a request to avoid circular and/or infinite redirection. One way to avoid such a problem is to limit the number of levels of redirection (i.e., to limit the number of redirects to follow). In a presently preferred implementation, if no final server is selected after following, e.g., thirty two redirects, an error is issued. In some embodiments, if no final sever is selected after a predefined number of

redirects, then the last server reached may be used to serve the content. One way to prevent looping is to use different server names (aliases) or IP addresses when redirecting requests so that a server receiving a request can tell whether or not it is a redirect. Those of skill in the art will know and understand, upon reading this description, that information can be transferred between servers using, e.g., HTTP headers or the like.

[0050] Those of skill in the art will know and understand, upon reading this description, that in a multi-tier CDN, the popularity service may be located at any tier, or there may be popularity services at more than one tier.

[0051] The middle (Parent) tier is optional.

[0052] Step (4a) may reply with content (if popular), or with a redirect to a parent or origin server (if not), in which the client will make another request (5a or 5b) to that tier to obtain the content.

[0053] If the request is an HTTP GET request or the like, it is forwarded to the popularity service . HTTP POST requests should always be forwarded directly to the origin, since that is where they will need to be processed, and the response to a POST request should not be cached. It may sometimes be preferable to direct GET requests to a different origin server than POST requests.

[0054] While the invention has been described with reference to the HTTP protocol, those of skill in the art will know and understand, upon reading this description, that different and/or other protocols may be used and are contemplated by the inventors. HTTP is described in various documents, e.g., Hypertext Transfer Protocol -- HTTP/1.1, RFC 2616, Network Working Group, the entire contents of which are incorporated herein by reference.

[0055] Those of skill in the art will know and understand, upon reading this description, that different thresholds may be established for each tier in the CDN. Further, those of skill in the art will know and understand, upon reading this description, that each content item may have its own thresholds associated therewith. In this manner, the system can check all content for popularity, with the default thresholds being zero. In this manner, every request will automatically cause the popularity to exceed the threshold and will cause the content to be cached.

[0056] By positioning Popularity Servers regionally (paired with parent cache servers), popularity and cache tiers can be managed independently, on a regional basis. Content that is popular in one region / group may not be popular in another region/group (especially if each region / group corresponds to a geographic and/or political region).

[0057] We consider it desirable that rendezvous to popularity servers prioritize so-called "regional" proximity, so that clients within the same region will tend to cast their popularity "votes" within that region and get consistent treatment of popular resources. However, if there are multiple parent cache servers available, there will generally be no attempt to rendezvous particular clients to particular parents.

DEFINING & MEASURING POPULARITY

[0058] In preferred embodiments, popularity of an object/resource is measured based on the number of times that object/resource is requested in various time periods. **Fig. 6** is an exemplary data structure for maintaining the popularity data for a particular popularity server. The data structure **600** in **Fig. 6** is a so-called tally hash structure.

[0059] In preferred embodiments, some or all edge servers are associated with (or bound to) popularity servers. An edge server that is bound to a popularity server is sometimes referred to as a bound Longtail coserver. Each popularity server in the system allocates a tally hash structure 800 per bound Longtail coserver. A configuration provides the number of resource (hash) slots to allocate. For a presently preferred implementation, the number of hash slots is on the order of 100 million slots per coserver. Each slot is divided into a number of time buckets, preferably 16 time buckets, each bucket being represented by, e.g., a 4-bit unsigned integer. Those of skill in the art will know and understand, upon reading this description, that the selection of the size of the value in each time bucket depends on policy decisions about bounds for the popularity thresholds, and for keeping very popular resources at the edge. The size, however, is heavily influenced by a need for compactness. One 8-byte word can store all time buckets for one resource slot, and therefore, 800 MB would be required per property, and five to eight such properties could be managed per popularity server without paging.

[0060] Each time bucket represents a time period, preferably a number of seconds.

[0061] The mapping of requests/content to slots is based on some function of the object name and perhaps other information associated with the request for the object. Preferably the mapping of objects to slots is based on a hash or message digest function (such as MAD or the like) over the object name (and preferably including some parts of the query string). Each slot may therefore represent one or more resources. Each time a query/request arrives at a popularity server for an object, the hash is computed and the slot in the table 800 (for the appropriate co-server) is determined, and the counts in that slot are used. In event of a hash collision, it is therefore possible that one bucket will

be receiving and representing counts for more than one object. Since this result is generally undesirable (since it could result in cache fills and edge caching of unpopular objects), the number of buckets should be chosen to be as large as practical.

[0062] Those of skill in the art will know and understand, upon reading this description, that different and / or other data structures may be used to implement the popularity counting. For example, since in most cases the total number of resources is expected to far exceed the number of popular resources, a balanced b-tree may be preferable to a hash table. In addition, it is possible to reduce the size of the hash slot by using only some part of the of the hash. However, reducing the number of bytes of the hash used can result in more name collisions.

[0063] Although described above with respect to popularity, those of skill in the art will know and understand, upon reading this description, that other factors may be used along with (or instead of) popularity to determine whether or not to redirect requests. A rule base may be used to augment and/or override the popularity measures for certain resources. The rules in the rule base may be static or dynamic and may be set by the CDN administrator and/or the subscriber. For example, a subscriber may not want to pay for certain content to be served from the edge, regardless of its popularity, and may set a rule accordingly (this particular result could also be achieved by setting the thresholds for that particular content to prevent it from ever being cached at the edge).

[0064] Occasional log mining could be used to look for hash collisions in actual subscriber content libraries, and the hash function and bucket sizes could be tuned as needed.

[0065] At each time bucket boundary, the popularity service will logically "rotate" the buckets and zero out the oldest tally data for each object.

[0066] Whenever a coserver's enrollment in the popularity service changes (added or dropped, or perhaps hints changed), the data structures are to be updated.

[0067] The popularity of a given object may be determined as a weighted sum of its popularity over successive time periods. More recent time periods may be given higher weights.

[0068] In order to determine which content is to be managed by the popularity service, the CDN operator and/or the subscriber may specify:

- The tiers at which the content will be managed – edge, intermediate (i.e., parent), or origin (subscriber's or storage tier). In order to be meaningful, at least one of intermediate and origin service should be enabled.
- content that is to be managed based on its popularity, rather than simply always being served from a cache.

[0069] There are several reasons why a publisher /subscriber may not want the so-called "long-tail" content served from a caching CDN service, for example:

- If cache fills are done from the subscriber's origin server and the subscriber pays for cache fill bandwidth, unnecessary fills for unpopular resources increase bandwidth costs without providing any value.
- Serving an unpopular resource through a CDN cache adds latency (due to the cache fill), and risks forcing actually popular resources out of

cache, potentially causing thrashing. The result is lower efficiency and the risk of degraded service.

[0070] For related or similar reasons, a CDN provider generally also does not want to serve long-tail content from an edge cache:

- If cache fills are done from origin storage, unnecessary cache fills consume bandwidth both from the storage and cache systems, increasing (doubling) the internal cost to serve. This lowers efficiency, requiring relatively more bandwidth internally to serve the same content to the outside.
- The second argument above also applies from the CDN's perspective: a CDN operator wants to minimize latency as well as the risk of thrashing in order to satisfy all of its subscribers.

NAMES, ADDRESSES & CONFIGURATION DATA

[0071] As is well known, each server in a network may be addressed by means of one or more network address (e.g., Internet Protocol or IP addresses). Each server in a network may also be known by one or more names (so-called hostnames – fully qualified domain names). Hostnames may be mapped to one or more IP addresses. A hostname may correspond to (and thus resolve to) more than one server.

[0072] A system such as ITM (described in the ITM patent applications mentioned above), allows a kind of hostname (called a supername) to refer to multiple servers, and resolves the supername to a nearby server.

[0073] Preferably the server selection mechanism is ITM, and each popularity server will have supername that resolves to reach nearby popularity server.

[0074] When a popularity server shares or is co-located with a parent server, the parent server may use the name by which it was addressed to determine whether to direct a request to the popularity service. That is, parent cache servers that provide popularity service may recognize requests that use one of the aliases reserved for popularity requests, and call into the popularity service to make the fill/no fill decision and return a redirect as described above.

[0075] As noted earlier, if the server selector mechanism does not send initial requests to non-edge servers, then all parent cache servers must recognize requests that have been redirected and serve the requested resource, filling it from the origin (or another tier), if necessary.

[0076] A servers hostnames are also referred to as its aliases. Each Longtail coserver preferably has at least two aliases (three if a parent cache/server tier is used): the published supername, the hostname used for popularity service requests, and (if used) the hostname used for parent cache redirects.

[0077] Popularity servers will preferably be reached via an ITM supername, and ITM will monitor for the service's availability across the set of servers. Popularity servers should be reached using real IP addresses, and not virtual IPs, and will not necessarily be redundant within a cluster. Redundancy can be provided by having multiple servers per supername. However, preferably there will be no attempt to synchronize the popularity tallies on popularity servers, with the expected desirable effect of managing popularity separately on a "regional" basis, the granularity being determined by the number and distribution of popularity servers deployed. Should a popularity server fail, this could cause a discontinuity in popularity responses as a new

server becomes active for a given edge location, but this may be mitigated (for very popular resources) by periodic background refreshes.

[0078] Information about the resources and caching strategy include the following:

– the expected total number of resources associated with this coserver.

– the number of buckets used to store hit counts for each resource.

– the number of seconds that each bucket represents. Every time this interval goes by, the count in the oldest bucket is thrown out and a new bucket is started with a count of zero.

– when the sum of all buckets for a given resource reaches this number on any popularity server, the parent caches (if any) that use that server will start to cache the resource.

– when the sum of all buckets for a given resource reaches this number on any popularity server, the edge caches that use that server will start to cache the resource.

– the hash algorithm to apply to the resource names (optional). If not specified, a default algorithm (e.g. MD5) will be used.

– the maximum number of this coserver's resources that should be in cache at an edge at any given time. This value may be ignored in certain embodiments.

– the maximum number of this coserver's resources that should be in cache at a parent at any given time. This value may be ignored in certain embodiments.

[0079] Preferably resources should not be pre-expired on parent cache servers, as that will cause unnecessary requests to the origin server or queries to peer caches.

[0080] Those of skill in the art will know and understand, upon reading this description, that a decision to serve at a given tier that is based only on popularity counts, will not take into account capacity to serve at that tier – so this scheme could overload an origin server or parent tier if they do not have sufficient capacity. Further, if popularity is measured in terms of absolute thresholds on numbers of requests, and if the library is sufficiently large, this could cause cache thrashing at the parent or edge tiers.

[0081] Authentication with the origin cache or server, if needed, should be done by the server that receives the initial request from the client. During processing of a redirected request.

[0082] Various documents, including patents and patent applications, have been incorporated by reference into this application. In case of any conflict between an incorporated document and the present application, the present application, including any definitions herein, will control.

[0083] Thus is provided a feature that allows a CDN to be responsive to increasing or decreasing "popularity" of content by shaping where in the CDN content is positioned and served from.

[0084] The foregoing description has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment or embodiments discussed were chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of

ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly and legally entitled.

CLAIMS:

We claim:

1. A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

at a first server in said first tier of servers, obtaining a request from a client for a resource;

if said resource is available at said first server or at a peer of said first server, serving the resource to the client;

otherwise, if said resource is not available at said first server or at a peer of said first server, determining whether said resource is popular, and

if the resource is determined to be popular, then said first server obtaining said resource and said first server serving the resource to the client, otherwise,

if the resource is determined not to be popular, directing said client to a second server, said second server not in said first tier of servers, and

said second server serving the resource to the client.

2. The method of claim 1 wherein the network further comprises a second tier of servers, distinct from said first tier of servers, and wherein said second server is in said second tier of servers.

3. The method of claim 1 wherein the second server is a content provider's origin server.

4. The method of claim 1 wherein the step of determining whether said resource is popular comprises:

determining whether a current popularity value for said resource exceeds a first predetermined popularity threshold.

5. A method of content delivery in a content delivery network comprising at least a first tier of servers, the method comprising:

(A) at a first server in said first tier of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being distinct from said first tier of servers, said redirecting being based, at least in part, on a current popularity value for said resource.

6. The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said servers in said first tier, and wherein said second server is in said second tier of servers.

7. The method of claim 5 wherein the network further comprises a second tier of servers, said servers in said second tier being distinct from said serves in said first tier, and wherein said second server is an origin server.

8. A content delivery framework comprising:

a plurality of edge servers forming a first tier of servers; and

a plurality of parent servers forming a second tier of servers, said parent servers being distinct from said edge servers; and

at least one popularity service constructed and adapted to obtain information from at least some of said edge servers about requests for content, and to provide said edge servers with information about which tier of servers should handle those requests for content, said popularity service making its determinations based, at least in part, on a measure of popularity of requested content.

9. A method of content delivery in a content delivery network comprising a plurality of tiers of servers, including at least a first tier of servers and a second tier of servers, the method comprising:

(A) at a first server in one tier of said tiers of servers, obtaining a request from a client for a resource;

(B) if said resource is not available at said first server or at a peer of said first server, then selectively redirecting the request from the client to a second server in the network, said second server being in a tier distinct from said one tier containing said first server, said redirecting being based, at least in part, on a current popularity value for said resource.

10. A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises

a plurality of parent servers, and wherein said first server is a parent server in said second tier and said second server is an edge server in said first tier.

11. A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said first server is an edge server in said first tier and said second server is a parent server in said second tier.

12. A method as in claim 9 wherein said first tier of servers comprises a plurality of edge servers and said second tier of servers comprises a plurality of parent servers, and wherein said plurality of tiers of servers further comprises an origin tier, and wherein said first server is a parent server in said second tier and said second server is a server in said origin tier.

ABSTRACT OF THE DISCLOSURE

A content delivery network has at least a first tier of servers. A content delivery method includes, at a first server in the first tier of servers, obtaining a request from a client for a resource. If the resource is available at the first server or at a peer of the first server, then the resource is served to the client from the first server. Otherwise, it is determined whether the resource is popular, and if the resource is determined to be popular, then the first server obtains the resource and the first server serves the resource to the client. If the resource is determined not to be popular, the client is directed to a second server, not in the first tier of servers, and the second server serves the resource to the client. The second server may be in a second tier of servers or it may be an origin server.

Application Data Sheet

Correspondence Information

Correspondence Customer Number:: 75948

Representative Information

Representative Customer Number:: 75948

Application Information

Application Type::	Regular
Subject Matter::	Utility
Title ::	Handling Long-tail Content in a Content Delivery Network (CDN)
Attorney Docket Number::	2711-0161
Suggested Drawing Figure::	3
Total Drawing Sheets::	6
Small Entity?::	No

Assignee Information

Assignee name::	Level 3 Communications, LLC
Street of mailing address::	1025 Eldorado Blvd.
City of mailing address::	Broomfield
State or Province of mailing address::	CO
Country of mailing address::	US
Postal or Zip Code of mailing address::	80021

Applicant Information

Applicant Authority Type:: Inventor
Primary Citizenship Country:: Australia
Status:: Full capacity
Given Name:: David
Family Name:: Fullagar
City of Residence:: Boulder
State or Province of Residence:: CO
Country of Residence:: US
Street of mailing address:: 775 Cherryvale Rd.
City of mailing address:: Boulder
State or Province of Mailing Address:: CO
Country of mailing address:: US
Postal or Zip Code of mailing address:: 80303

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full capacity
Given Name:: Laurence
Family Name:: Lipstone
City of Residence:: Calabasas
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 22724 Sparrow Dell Dr.
City of mailing address:: Calabasas
State or Province of Mailing Address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 91302

Applicant Authority Type:: Inventor
Primary Citizenship Country:: UK
Status:: Full capacity
Given Name:: Christopher
Family Name:: Newton
City of Residence:: Thousand Oaks
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 981 Via Colinas
City of mailing address:: Thousand Oaks
State or Province of Mailing Address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 91362

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

POWER OF ATTORNEY, CORRESPONDENCE ADDRESS AND REVOCATION OF PRIOR POWERS

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

Sir:

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

Power of Attorney: I hereby appoint the practitioners associated with customer number **75948**, individually and collectively, as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

I authorize Davidson Berquist Jackson & Gowdey, LLP to delete names/numbers of persons no longer with the Firm and to act and rely on instructions from and communicate directly with the entity who first sent this case to them and by whom I hereby declare that I have consented after full disclosure to be represented unless/until I instruct Davidson Berquist Jackson & Gowdey, LLP in writing to the contrary.

Correspondence Address: Please recognize or change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to the address associated with Customer Number **75948**.

Assignee Name and Address:

Level 3 Communications, LLC
1025 Eldorado Blvd.
Broomfield, Colorado 80021

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

SIGNATURE of Assignee of Record The individual whose signature and title is supplied below is authorized to act on behalf of the assignee			
Signature		Date	12/24/2008
Name	Robert M. Yates	Telephone	720-888-2283
Title	Senior Vice President, Assistant General Counsel		

Application Data Sheet

Correspondence Information

Correspondence Customer Number:: 75948

Representative Information

Representative Customer Number:: 75948

Application Information

Application Number::	12408681
Application Type::	Regular
Subject Matter::	Utility
Title ::	Handling Long-tail Content in a Content Delivery Network (CDN)
Attorney Docket Number::	2711-0161 (IP 0137-US-U1)
Suggested Drawing Figure::	3
Total Drawing Sheets::	6
Small Entity?::	No

Assignee Information

Assignee name::	Level 3 Communications, LLC
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State or Province of mailing address::	CO
Country of mailing address::	US
Postal or Zip Code of mailing address::	80021

Applicant Information

Applicant Authority Type:: Inventor
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Status:: Full capacity
Given Name:: David
Family Name:: Fullagar
City of Residence:: Boulder
State or Province of Residence:: CO
Country of Residence:: US
Street of mailing address:: 775 Cherryvale Rd.
City of mailing address:: Boulder
State or Province of Mailing Address:: CO
Country of mailing address:: US
Postal or Zip Code of mailing address:: 80303

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Status:: Full capacity
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City of Residence:: Calabasas
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 22724 Sparrow Dell Dr.
City of mailing address:: Calabasas
State or Province of Mailing Address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 91302

Applicant Authority Type:: Inventor
Primary Citizenship Country:: UK
Status:: Full capacity
Given Name:: Christopher
Family Name:: Newton
City of Residence:: Thousand Oaks
State or Province of Residence:: CA
Country of Residence:: US
Street of mailing address:: 981 Via Colinas
City of mailing address:: Thousand Oaks
State or Province of Mailing Address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 91362

Domestic Priority Information

Application::	Continuation Type::	Parent Application::	Parent Filing Date::
This application	An application claiming the benefit under 35 USC 119(e)	12408681	04/04/08

Electronic Acknowledgement Receipt

EFS ID:	5010230
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	75948
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	2711-0161 (IP 0137-US-U1)
Receipt Date:	21-MAR-2009
Filing Date:	
Time Stamp:	14:20:42
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	Application Data Sheet	2711_0161_Suppl_ADS.pdf	129957 ccbc4abede820212651 7f7236a4952fec41b02ac	no	3

Warnings:	
Information:	

This is not an USPTO supplied ADS fillable form	
Total Files Size (in bytes):	129957

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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

PTO/SB/06 (12-04)

Filing Date: 03/21/2009

Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number **12/408,681**

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY		OR	LARGE 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	**330**
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	**540**
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	**220**
TOTAL CLAIMS (37 CFR 1.16(i))	**12** minus 20 =	**0**	X$ 26		OR	2X$52	**0**
INDEPENDENT CLAIMS (37 CFR 1.16(h))	**4** minus 3 =	**1**	X$110			1X$220	**220**
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195			390	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	**1310**

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDI-TIONAL FEE ($)		RATE ($)	ADDI-TIONAL FEE ($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

		(Column 1)		(Column 2)	(Column 3)			OR		
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDI-TIONAL FEE ($)		RATE ($)	ADDI-TIONAL FEE ($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	X =		OR	X =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X =		OR	X =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T 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.

Electronic Acknowledgement Receipt

EFS ID:	5010213
Application Number:	12408681
International Application Number:	
Confirmation Number:	9965
Title of Invention:	HANDLING LONG-TAIL CONTENT IN A CONTENT DELIVERY NETWORK (CDN)
First Named Inventor/Applicant Name:	David Fullagar
Customer Number:	75948
Filer:	Brian Siritzky
Filer Authorized By:	
Attorney Docket Number:	2711-0161 (IP 0137-US-U1)
Receipt Date:	21-MAR-2009
Filing Date:	
Time Stamp:	13:17:30
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1090
RAM confirmation Number	5552
Deposit Account	501860
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

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		2711_0161_Application.pdf	457271 9a2f66deaee50a891fb261cb991dbb4b77b40289	yes	28

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Specification	1	23
Claims	24	27
Abstract	28	28

Warnings:

Information:

2	Application Data Sheet	2711_0161_ADS.pdf	67039 2edf3025b243724c00cd6b1558e9eb061f7352ad	no	3

Warnings:

Information:

This is not an USPTO supplied ADS fillable form

3	Power of Attorney	POA_75948.pdf	68984 2c8421e76483f62f512f896114eaac2702b829c3	no	1

Warnings:

Information:

4	Transmittal of New Application	2711_0146_AppFilingReq-Rule_53_f_No_Dec.pdf	324976 83a03afa411670ed30b2b4dbefdb8ffd54960133	no	3

Warnings:

Information:

5	Drawings-only black and white line drawings	2711_0161_Drawings.pdf	636913 8a3a3e2504c30bb0f88cd87ac25d6b7c96297e25	no	6

Warnings:

Information:

6	Fee Worksheet (PTO-06)	fee-info.pdf	33266 1299e6c9e2c83154ab660417dc57f79c2bad7d70	no	2

Warnings:

Information:	
Total Files Size (in bytes):	1588449

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.

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