

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Western District of Texas on the following

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

DOCKET NO. 1:23-cv-903	DATE FILED 8/2/2023	U.S. DISTRICT COURT for the Western District of Texas
PLAINTIFF UMBRA TECHNOLOGIES LTD.(UK), UMBRA TECHNOLOGIES LIMITED (CN) & UMBRA TECHNOLOGIES (US) INC., dba UMBRA TECHNOLO		DEFENDANT CISCO SYSTEMS, INC.,
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 10,574,482 B2	2/25/2020	UMBRA Technologies Ltd.
2 US 10,630,505 B2	4/21/2020	UMBRA Technologies Ltd.
3 US 11,108,595 B2	8/31/2021	UMBRA Technologies Ltd.
4 US 11,146,632 B2	10/12/2021	UMBRA Technologies Ltd.
5		

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

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

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

DECISION/JUDGEMENT

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

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Western District of Texas on the following

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

DOCKET NO. 1:23-cv-904	DATE FILED 8/2/2023	U.S. DISTRICT COURT for the Western District of Texas
PLAINTIFF UMBRA TECHNOLOGIES LTD.(UK), UMBRA TECHNOLOGIES LIMITED (CN) & UMBRA TECHNOLOGIES (US) INC., dba UMBRA TECHNOLO		DEFENDANT VMWARE, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 10,574,482 B2	2/25/2020	UMBRA Technologies Ltd.
2 US 10,630,505 B2	4/21/2020	UMBRA Technologies Ltd.
3 US 11,108,595 B2	8/31/2021	UMBRA Technologies Ltd.
4 US 11,146,632 B2	10/12/2021	UMBRA Technologies Ltd.
5		

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

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

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

DECISION/JUDGEMENT

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/000,997	08/31/2021	11108595	2210592.02089US8	4274
23483	7590	08/11/2021		
WILMERHALE/BOSTON 60 STATE STREET BOSTON, MA 02109				

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

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

UMBRA Technologies Ltd., Hong Kong, CHINA;
Jørn Allan Dose KNUTSEN, Oslo, NORWAY;
Carlos Eduardo ORÉ, Saint-Herblain, FRANCE;
Thibaud Auguste Bernard Jean SAINT-MARTIN, Aubignan, FRANCE;
Fred BROUSSARD, Indianapolis, IN;
Joseph E. RUBENSTEIN, Beijing, CHINA;

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

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

23483 7590 04/30/2021
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/000,997	08/24/2020	Jørn Allan Dose KNUTSEN	2210592.02089US8	4274

TITLE OF INVENTION: SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	07/30/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
BATURAY, ALICIA	2441	709-227000

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 03-09 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 Wilmer Cutler Pickering

2 Hale and Dorr LLP

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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

UMBRA TECHNOLOGIES LTD.

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

HONG KONG, CHINA

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

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 08-0219

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

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

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

Authorized Signature /Brian J. Lambson/

Date 2021-07-28

Typed or printed name Brian J. Lambson

Registration No. 72570

Electronic Patent Application Fee Transmittal				
Application Number:		17000997		
Filing Date:		24-Aug-2020		
Title of Invention:		SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
First Named Inventor/Applicant Name:		Jørn Allan Dose KNUTSEN		
Filer:		Brian James Lambson/Lori Roman		
Attorney Docket Number:		2210592.02089US8		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	600	600

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				600

Electronic Acknowledgement Receipt	
EFS ID:	43370530
Application Number:	17000997
International Application Number:	
Confirmation Number:	4274
Title of Invention:	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)
First Named Inventor/Applicant Name:	Jørn Allan Dose KNUTSEN
Customer Number:	23483
Filer:	Brian James Lambson/Nirja Shah
Filer Authorized By:	Brian James Lambson
Attorney Docket Number:	2210592.02089US8
Receipt Date:	29-JUL-2021
Filing Date:	24-AUG-2020
Time Stamp:	14:32:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 600
RAM confirmation Number	E20217SE34030194
Deposit Account	080219
Authorized User	Nirja Shah
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)
37 CFR 1.20 (Post Issuance fees)
37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	2089US8_Issue_Fee_transmittal.PDF	150125	no	1
			092dbf4e77f10dc0d54cae08c98b9b155cce8a57		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	38389	no	2
			22d2b1343ba855307dcf2c5ce8c4ce1092be0378		

Warnings:

Information:

Total Files Size (in bytes):	188514
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

23483 7590 04/30/2021
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

EXAMINER

BATURAY, ALICIA

ART UNIT

PAPER NUMBER

2441

DATE MAILED: 04/30/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/000,997	08/24/2020	Jørn Allan Dose KNUITSEN	2210592.02089US8	4274

TITLE OF INVENTION: SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	07/30/2021

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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)

23483 7590 04/30/2021
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/000,997	08/24/2020	Jørn Allan Dose KNUTSEN	2210592.02089US8	4274

TITLE OF INVENTION: SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$600	\$0.00	\$0.00	\$600	07/30/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
BATURAY, ALICIA	2441	709-227000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

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

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

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

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

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

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/000,997	08/24/2020	Jørn Allan Dose KNUTSEN	2210592.02089US8	4274
23483	7590	04/30/2021	EXAMINER	
WILMERHALE/BOSTON			BATURAY, ALICIA	
60 STATE STREET			ART UNIT	PAPER NUMBER
BOSTON, MA 02109			2441	
DATE MAILED: 04/30/2021				

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 30 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. 17/000,997	Applicant(s) KNUTSEN et al.	
	Examiner ALICIA BATURAY	Art Unit 2441	AIA (FITF) Status Yes

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

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

1. ☒ This communication is responsive to the terminal disclaimer allowed on 20 April 2021.
☐ 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 2-21. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date. <u>herewith</u> .	

/ALICIA BATURAY/ Primary Examiner, Art Unit 2441	
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Allowance

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.
2. Claims 2-21 are allowed.

Reasons for Allowance

3. The following is an examiner's statement of reasons for allowance: Claims 2-21 are allowable over the prior art of record.

The examiner has found that the prior art of record does not teach, suggest, or render obvious, *inter alia*, the specific combination of a method, a system, or a network system for managing a global virtual network, comprising: an access point server configured to connect to one or more endpoint devices via one or more first tunnels; and a control server connected to the access point server via a second tunnel, the control server storing one or more records associated with each of the one or more endpoint devices, wherein the control server is configured to: receive a request for a list of available servers from a first endpoint device among the one or more endpoint devices, the list of available servers including the access point server; retrieve the list of available servers; retrieve the one or more records associated with the first endpoint device; dynamically order the list of available servers for the first endpoint device based on the one or more records associated with the network device; and transmit the ordered list of available servers to the first endpoint device (major difference in the claims not found in the prior art of record) as set forth in the Specification and recited in independent claims 2, 9, and 16.

4. These reasons, in conjunction with the other limitations of the independent claims, put this case in condition for allowance.

5. 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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alicia Baturay whose telephone number is (571) 272-3981. The examiner can normally be reached at 7am – 4pm, Mondays – Thursdays, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wing Chan can be reached on (571) 272-7493. The fax 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).

/Alicia Baturay/
Primary Examiner, Art Unit 2441

April 14, 2021

<i>Examiner-Initiated Interview Summary</i>	Application No. 17/000,997	Applicant(s) KNUTSEN et al.		
	Examiner ALICIA BATURAY	Art Unit 2441	AIA (First Inventor to File) Status Yes	Page 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	Title	Type
ALICIA BATURAY	Primary Examiner	Telephonic
Brian Lambson (Reg. #72,570)	Attorney of Record	

Date of Interview: 15 April 2021

Issues Discussed:

Other

The examiner placed a phone call to Applicants' Representative to ask if it would be possible to file an e-Terminal Disclaimer for this case to expedite prosecution by putting the case into condition for allowance. Applicants' Representative and the clients agreed to do so.

/ALICIA BATURAY/ Primary Examiner, Art Unit 2441	
Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04 Please further see: MPEP 713.04 Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b) 37 CFR § 1.2 Business to be transacted in writing	

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

Notice of References Cited	Application/Control No. 17/000,997		Applicant(s)/Patent Under Reexamination KNUTSEN et al.	
	Examiner ALICIA BATURAY		Art Unit 2441	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-5828847-A	10-1998	Gehr; Chuck Royal	H04L29/06	709/239
*	B	US-7039701-B2	05-2006	Wesley; Ajamu A.	H04L29/06	709/224
*	C	US-7069318-B2	06-2006	Burbeck; Stephen L.	H04L29/12009	709/203
*	D	US-7177929-B2	02-2007	Burbeck; Stephen L.	H04L29/12009	709/200
*	E	US-7870418-B2	01-2011	Sekaran; Dhigha D.	H04L41/147	714/4.1
*	F	US-8544065-B2	09-2013	Archer; Charles Jens	G06F21/79	726/4
*	G	US-8611355-B1	12-2013	Sella; William Thomas	H04L45/42	370/392
*	H	US-8966075-B1	02-2015	Chickering; Roger A.	H04L12/4641	709/225
*	I	US-10331472-B2	06-2019	Wang; Bo	G06F9/45558	1/1
*	J	US-10756929-B2	08-2020	Knutsen; Jorn Allan Dose	H04L45/28	1/1
*	K	US-20020007350-A1	01-2002	Yen, Brian	H04L63/083	705/52
*	L	US-20060179150-A1	08-2006	Farley; PatrickB	H04L29/06	709/228
*	M	US-20070112812-A1	05-2007	Harvey; Richard Hans	H04L61/1517	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC 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.

<i>Notice of References Cited</i>	Application/Control No. 17/000,997		Applicant(s)/Patent Under Reexamination KNUTSEN et al.	
	Examiner ALICIA BATURAY		Art Unit 2441	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20090193428-A1	07-2009	Dalberg; Stevin J	H04L67/1019	718/105
*	B	US-20110185006-A1	07-2011	Raghav; Amritansh	H04L67/24	709/201
*	C	US-20140359704-A1	12-2014	CHEN; Ben Wei	H04L63/0272	726/3
*	D	US-20180013583-A1	01-2018	RUBENSTEIN; Joseph E.	H04L45/64	1/1
*	E	US-20210044453-A1	02-2021	KNUTSEN; Jorn Allan Dose	H04L45/22	1/1
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
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	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.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20210414

<i>Search Notes</i> 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.
	Examiner ALICIA BATURAY	Art Unit 2441

CPC - Searched*		
Symbol	Date	Examiner
H04L12/465,4633,4641; G06F9/4401,4416; G06F21/575; H04L9/08; H04L45/22,28,302,64; H04L63/02,0218,0236,0254,0263,0272	04/14/2021	AB

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
709	249	04/14/2021	AB

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Requested PLUS Search	04/14/2021	AB
Searched EAST (US-PGPUB, USPAT, EPO, JPO, DERWENT, IBM_TDB)	04/14/2021	AB
Conducted Inventor Name Search	04/14/2021	AB
Conducted Class/Subclass Search	04/14/2021	AB
Searched Google Patents	04/24/2021	AB
Conducted Interference Search	04/24/2021	AB

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<i>Search Notes</i> 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.
	Examiner ALICIA BATURAY	Art Unit 2441

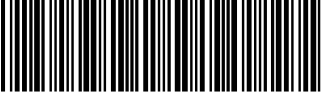
Interference Search			
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PG-PUB	See Search History	04/24/2021	AB

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<i>Index of Claims</i> 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.
	Examiner ALICIA BATURAY	Art Unit 2441

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

CLAIMS									
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47									
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18	19	=							
19	20	=							
20	21	=							

Issue Classification 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.	
	Examiner ALICIA BATURAY	Art Unit 2441	

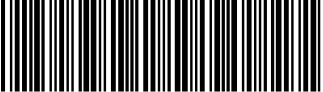
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CPC Combination Sets						
Symbol				Type	Set	Ranking
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NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/ALICIA BATURAY/ Primary Examiner, Art Unit 2441	15 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	2	3

U.S. Patent and Trademark Office

Part of Paper No.: 20210414

Issue Classification 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.
	Examiner ALICIA BATURAY	Art Unit 2441

INTERNATIONAL CLASSIFICATION					
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NON-CLAIMED					
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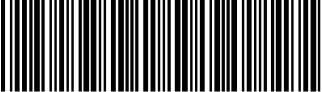
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709	227

CROSS REFERENCES(S)						
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/ALICIA BATURAY/ Primary Examiner, Art Unit 2441	15 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	2	3

U.S. Patent and Trademark Office

Part of Paper No.: 20210414

Issue Classification 	Application/Control No. 17/000,997	Applicant(s)/Patent Under Reexamination KNUTSEN et al.
	Examiner ALICIA BATURAY	Art Unit 2441

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

CLAIMS															
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/ALICIA BATURAY/ Primary Examiner, Art Unit 2441	15 April 2021	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	2	3

U.S. Patent and Trademark Office

Part of Paper No.: 20210414

EAST Search History

EAST Search History (Prior Art)

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S11	1	"7870418".pn.	USPAT	OR	ON	2019/03/07 15:37
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S13	29,01 6	@ad<"20150407" and ((access adj point) same (malfunction\$3 or err\$3 or off or (shut adj down) or updat\$3 or oversubscrib\$3 or suboptimal))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/03/07 15:40
S14	901	@ad<"20150407" and ((access adj point) adj (malfunction\$3 or err\$3 or off or (shut adj down) or updat\$3 or oversubscrib\$3 or suboptimal))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/03/07 15:40
S16	16	@ad<"20150407" and (registry same (status adj flag) same server)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 15:29
S17	6	@ad<"20150407" and (registry same (status adj flag) same list)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 15:29
S18	10	@ad<"20150407" and (server adj availability adj list)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 15:35
S19	2,318	@ad<"20150407" and (server adj availability)	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2019/11/18 15:52

			DERWENT; IBM_TDB			
S20	705	@ad<"20150407" and (availability adj list)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 15:53
S21	71	@ad<"20150407" and ((availability adj list same flag)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 15:54
S22	32	@ad<"20150407" and ((server adj availability) same publish\$5)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 16:17
S23	134	@ad<"20150407" and ((server adj availability) same list)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/18 16:21
S24	37	@ad<"20150407" and (registry same (status adj flag))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 13:44
S25	1,773	@ad<"20150407" and (registry same flag)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 13:58
S26	67	@ad<"20150407" and (registry adj flag)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 13:58
S27	4	@ad<"20150407" and ((registry adj flag) same server)	US- PGPUB; USPAT; EPO; JPO;	OR	ON	2019/11/19 14:03

			DERWENT; IBM_TDB			
S28	48	@ad<"20150407" and ((registry adj flag) and server)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:07
S29	48	@ad<"20150407" and ((registry adj (flag or (dirty adj bit))) and server)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:13
S30	1,505	@ad<"20150407" and ((registry same (flag or (dirty adj bit))) and server)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:15
S31	312	@ad<"20150407" and ((registry same (flag or (dirty adj bit))) same server)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:15
S32	240	@ad<"20150407" and (registry same server same offline)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:18
S33	280	@ad<"20150407" and ((peer-peer or P2P or "peer to peer") same registry)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:21
S34	3	@ad<"20150407" and ((peer-peer or P2P or "peer to peer") same registry same (flag or (dirty adj bit)))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/11/19 14:21
S35	4	(Knutsen.in. or Ore.in. or Saint-Martin.in. or Broussard.in. or Rubenstein.in.) and ((endpoint or (end adj point)) and (access adj point) and (control adj server)).clm.	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2020/04/07 08:53

			DERWENT; IBM_TDB			
S36	15	709/227.ccls. and ((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/07 08:53
S37	1,508	((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/07 08:54
S38	1,020	S37 AND ((H04L67/12 OR H04L67/1097 OR H04L1/0002 OR H04L5/0064 OR H04L43/50 OR H04L63/1408 OR H04L43/026 OR H04L63/0227 OR H04L63/0428 OR H04L63/1416 OR H04L43/0876 OR H04L43/16 OR H04L63/1433 OR H04L63/1491 OR H04L41/0213 OR H04L41/0893 OR H04L41/0896 OR H04L41/5009 OR H04L43/062 OR H04L43/08 OR H04L43/10 OR H04L45/24 OR H04L63/0281 OR H04L63/08 OR H04L63/0884 OR H04L63/10 OR H04L63/101 OR H04L63/145 OR H04L67/10 OR H04L12/14 OR H04L2463/121 OR H04L41/00 OR H04L43/028 OR H04L43/045 OR H04L45/06 OR H04L45/124 OR H04L45/586 OR H04L45/74 OR H04L47/125 OR H04L47/14 OR H04L47/15 OR H04L47/20 OR H04L47/2416 OR H04L61/2007 OR H04L61/6022 OR H04L63/0442 OR H04L63/0823 OR H04L63/102 OR H04L63/104 OR H04L63/108 OR H04L63/123 OR H04L63/1425 OR H04L63/1441 OR H04L63/20 OR H04L67/06 OR H04L67/14 OR H04L67/141 OR H04L69/14 OR H04L69/18 OR H04L69/32 OR H04L9/3234 OR H04L9/3236 OR H04L12/1403 OR H04L12/1482 OR H04L12/1485 OR H04L12/1492 OR H04L12/1496 OR H04L12/1831 OR H04L12/2807 OR H04L12/2816 OR H04L12/2829 OR H04L12/46 OR H04L12/66 OR H04L2209/42 OR H04L2209/56 OR H04L29/04 OR H04L29/06 OR H04L29/06163 OR H04L29/06197 OR H04L29/0621 OR H04L29/06278 OR H04L29/06326 OR	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/07 08:54

		H04L29/08567 OR H04L29/08819 OR H04L29/10 OR H04L41/0836 OR H04L41/0873 OR H04L41/0886 OR H04L41/12 OR H04L41/145 OR H04L41/5006 OR H04L41/5022 OR H04L41/5029 OR H04L41/5054 OR H04L43/06 OR H04L43/0805 OR H04L43/0811 OR H04L43/0888 OR H04L45/22 OR H04L45/38 OR H04L45/42 OR H04L45/54 OR H04L45/566 OR H04L47/11 OR H04L47/122 OR H04L47/2425 OR H04L47/2475 OR H04L47/39 OR H04L47/41 OR H04L47/6255 OR H04L47/803 OR H04L47/805 OR H04L47/822 OR H04L47/824 OR H04L5/001 OR H04L61/1511 OR H04L61/1552 OR H04L61/20 OR H04L61/2046 OR H04L61/2061 OR H04L61/2514 OR H04L61/2575 OR H04L61/30 OR H04L61/6068 OR H04L63/0209 OR H04L63/0245 OR H04L63/0272 OR H04L63/029 OR H04L63/06 OR H04L63/0815 OR H04L63/083 OR H04L63/0876 OR H04L63/105 OR H04L63/126 OR H04L63/14 OR H04L63/18 OR H04L63/205 OR H04L65/1006 OR H04L67/1095 OR H04L67/16 OR H04L67/26 OR H04L67/28 OR H04L67/2861 OR H04L67/306 OR H04L67/34 OR H04L9/14 OR H04L9/30 OR H04L9/32).CPC.)				
S39	3	((peer-peer or P2P or "peer to peer") same registry same (flag or (dirty adj bit)))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/04/07 08:56
S42	6	(Knutsen.in. or Ore.in. or Saint-Martin.in. or Broussard.in. or Rubenstein.in.) and ((endpoint or (end adj point)) and (access adj point) and (control adj server)).clm.	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/21 09:35
S43	15	709/227.ccls. and ((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/21 09:35
S44	1,591	((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT;	OR	ON	2020/07/21 09:35

			EPO; JPO; DERWENT; IBM_TDB			
S45	1,083	S44 AND (H04L67/12 OR H04L67/1097 OR H04L1/0002 OR H04L5/0064 OR H04L43/50 OR H04L63/1408 OR H04L43/026 OR H04L63/0227 OR H04L63/0428 OR H04L63/1416 OR H04L43/0876 OR H04L43/16 OR H04L63/1433 OR H04L63/1491 OR H04L41/0213 OR H04L41/0893 OR H04L41/0896 OR H04L41/5009 OR H04L43/062 OR H04L43/08 OR H04L43/10 OR H04L45/24 OR H04L63/0281 OR H04L63/08 OR H04L63/0884 OR H04L63/10 OR H04L63/101 OR H04L63/145 OR H04L67/10 OR H04L12/14 OR H04L2463/121 OR H04L41/00 OR H04L43/028 OR H04L43/045 OR H04L45/06 OR H04L45/124 OR H04L45/586 OR H04L45/74 OR H04L47/125 OR H04L47/14 OR H04L47/15 OR H04L47/20 OR H04L47/2416 OR H04L61/2007 OR H04L61/6022 OR H04L63/0442 OR H04L63/0823 OR H04L63/102 OR H04L63/104 OR H04L63/108 OR H04L63/123 OR H04L63/1425 OR H04L63/1441 OR H04L63/20 OR H04L67/06 OR H04L67/14 OR H04L67/141 OR H04L69/14 OR H04L69/18 OR H04L69/32 OR H04L9/3234 OR H04L9/3236 OR H04L12/1403 OR H04L12/1482 OR H04L12/1485 OR H04L12/1492 OR H04L12/1496 OR H04L12/1831 OR H04L12/2807 OR H04L12/2816 OR H04L12/2829 OR H04L12/46 OR H04L12/66 OR H04L2209/42 OR H04L2209/56 OR H04L29/04 OR H04L29/06 OR H04L29/06163 OR H04L29/06197 OR H04L29/0621 OR H04L29/06278 OR H04L29/06326 OR H04L29/08567 OR H04L29/08819 OR H04L29/10 OR H04L41/0836 OR H04L41/0873 OR H04L41/0886 OR H04L41/12 OR H04L41/145 OR H04L41/5006 OR H04L41/5022 OR H04L41/5029 OR H04L41/5054 OR H04L43/06 OR H04L43/0805 OR H04L43/0811 OR H04L43/0888 OR H04L45/22 OR H04L45/38 OR H04L45/42 OR H04L45/54 OR H04L45/566 OR H04L47/11 OR H04L47/122 OR H04L47/2425 OR H04L47/2475 OR	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/07/21 09:35

		H04L47/39 OR H04L47/41 OR H04L47/6255 OR H04L47/803 OR H04L47/805 OR H04L47/822 OR H04L47/824 OR H04L5/001 OR H04L61/1511 OR H04L61/1552 OR H04L61/20 OR H04L61/2046 OR H04L61/2061 OR H04L61/2514 OR H04L61/2575 OR H04L61/30 OR H04L61/6068 OR H04L63/0209 OR H04L63/0245 OR H04L63/0272 OR H04L63/029 OR H04L63/06 OR H04L63/0815 OR H04L63/083 OR H04L63/0876 OR H04L63/105 OR H04L63/126 OR H04L63/14 OR H04L63/18 OR H04L63/205 OR H04L65/1006 OR H04L67/1095 OR H04L67/16 OR H04L67/26 OR H04L67/28 OR H04L67/2861 OR H04L67/306 OR H04L67/34 OR H04L9/14 OR H04L9/30 OR H04L9/32).CPC.)				
S48	1	"10756929".pn.	USPAT	OR	ON	2021/04/13 14:28
S49	1	"20210044453".pn.	US-PGPUB	OR	ON	2021/04/13 14:29
S50	9	(H04L12/465,4633,4641.cpc. and G06F9/4401,4416.cpc. and G06F21/575.cpc. and H04L9/08.cpc. and H04L45/22,28,302,64.cpc. and H04L63/02,0218,0236,0254,0263.cpc.)	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/13 15:36
S51	8	(Knutsen.in. or Ore.in. or Saint-Martin.in. or Broussard.in. or Rubenstein.in.) and ((endpoint or (end adj point)) and (access adj point) and (control adj server)).clm.	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/13 15:36
S52	9	(H04L12/465,4633,4641.cpc. and G06F9/4401,4416.cpc. and G06F21/575.cpc. and H04L9/08.cpc. and H04L45/22,28,302,64.cpc. and H04L63/02,0218,0236,0254,0263.cpc.) and ((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/13 15:37
S53	15	709/227.ccls. and ((endpoint or (end adj point)) and (access adj point) and (control adj server))	US- PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/13 15:37
S54	9	(H04L12/465,4633,4641.cpc. and G06F9/4401,4416.cpc. and G06F21/575.cpc. and H04L9/08.cpc. and	US- PGPUB; USPAT;	OR	ON	2021/04/14 15:18

		H04L45/22,28,302,64.cpc. and H04L63/02,0218,0236,0254,0263,0272.cpc.)	EPO; JPO; DERWENT; IBM_TDB			
S55	8	(Knutsen.in. or Ore.in. or Saint-Martin.in. or Broussard.in. or Rubenstein.in.) and ((endpoint or (end adj point)) and (access adj point) and (control adj server)).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 14:44
S56	7	(registry same (status adj flag) same list)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 14:55
S57	56	((access adj point) same (status adj flag))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 14:57
S58	1,730	((endpoint or (end adj point)) and (access adj point) and (control adj server))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 15:10
S59	1,387	((dynamic) adj (order\$3 or generat\$5)) same servers)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 15:20
S60	244	((dynamic) adj (order\$3 or generat\$5)) same (available or online or up) same (servers))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 15:33
S61	358	((dynamic or (real-time) or realtime) adj (order\$3 or generat\$5)) same (available or online or up) same (servers))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/04/15 15:39
S62	13	((dynamic or (real-time) or realtime) adj (order\$3 or generat\$5)) same (available or online or up) same (servers) same (records))	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2021/04/15 15:43

			DERWENT; IBM_TDB			
S63	23	((("KNUTSEN") near3 ("JÃ_rn")) OR (("ORÃ%o") near3 ("Carlos")) OR (("SAINT- MARTIN") near3 ("Thibaud")) OR (("BROUSSARD") near3 ("Fred")) OR (("RUBENSTEIN") near3 ("Joseph"))).INV.	US- PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2021/04/24 11:32

4/24/2021 2:02:03 PM

C:\Users\abaturay\Alicia's Documents\EAST Searches\17000997-CON.wsp

Web Search History

date, time	web site	search string
4/24/2021 12:37:07 PM	Google Patents	Keyword Group 1 [endpoint and (access and point) (control and server)]
4/24/2021 1:06:02 PM	Google Patents	Keyword Group 1 [(access and point) (status and flag)]
4/24/2021 1:17:51 PM	Google Patents	Keyword Group 1 [real-time and generate order online servers]

Bibliographic Data

Application No: 17/000,997

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged: /ALICIA BATURAY/

Examiner's Signature

Initials

Title:

SYSTEMS AND METHODS FOR PROVIDING A GLOBAL
VIRTUAL NETWORK (GVN)

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
08/24/2020	709	2441	2210592.02089US8
RULE			

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CONTINUING DATA

This application is a CON of 15563253 09/29/2017 PAT 10756929

15563253 is a 371 of PCT/US16/26489 04/07/2016

PCT/US16/26489 has PRO of 62151174 04/22/2015

PCT/US16/26489 has PRO of 62144293 04/07/2015

FOREIGN APPLICATIONS

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UNITED STATES

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\$910

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce
Electronic Petition Request	TERMINAL DISCLAIMER TO OBTAIN A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	
Application Number	17000997	
Filing Date	24-Aug-2020	
First Named Inventor	Jørn KNUTSEN	
Attorney Docket Number	2210592.02089US8	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)	
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.		
Owner	Percent Interest	
UMBRA Technologies Ltd.	100%	
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☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ☒ Small Entity ☐ Micro Entity ☐ Regular Undiscounted	
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.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number <u>72570</u> ☐ A sole inventor ☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ☐ A joint inventor; all of whom are signing this request	
Signature	/Brian J. Lambson/
Name	Brian J. Lambson

*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 certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		17000997		
Filing Date:		24-Aug-2020		
Title of Invention:		SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
First Named Inventor/Applicant Name:		Jørn Allan Dose KNUTSEN		
Filer:		Brian James Lambson/Marlaine Williams		
Attorney Docket Number:		2210592.02089US8		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	2814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				170

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 17000997

Filing Date: 24-Aug-2020

Applicant/Patent under Reexamination: KNUTSEN

Electronic Terminal Disclaimer filed on April 20, 2021

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	42500945
Application Number:	17000997
International Application Number:	
Confirmation Number:	4274
Title of Invention:	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)
First Named Inventor/Applicant Name:	Jørn Allan Dose KNUTSEN
Customer Number:	23483
Filer:	Brian James Lambson/Marlaine Williams
Filer Authorized By:	Brian James Lambson
Attorney Docket Number:	2210592.02089US8
Receipt Date:	20-APR-2021
Filing Date:	24-AUG-2020
Time Stamp:	15:21:53
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$170
RAM confirmation Number	E20214JF21471635
Deposit Account	080219
Authorized User	Marlaine Williams
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)
 37 CFR 1.20 (Post Issuance fees)
 37 CFR 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	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33721	no	2
			1b063dfe825ede140891f7b6a3ed3537b93c2ee1		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30728	no	2
			5ce0df66938f150531665a52e47532e8306897ea		

Warnings:

Information:

Total Files Size (in bytes): 64449

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.

PLUS Search Results for S/N 17000997, Searched Thu Apr 15 11:44:22 EDT 2021

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

5647880 71	4760805 53
4379601 55	
4543017 55	
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5240083 55	
5472284 55	
5496409 55	
5559926 55	
5624091 55	
5680561 55	
5682957 55	
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UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/000,997	08/24/2020	J?m Allan Dose KNUTSEN	2210592.02089US8

CONFIRMATION NO. 4274

23483
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

PUBLICATION NOTICE



Title:SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

Publication No.US-2021-0044453-A1

Publication Date:02/11/2021

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 Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, 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 <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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

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



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
17/000,997	08/24/2020	2465	910	2210592.02089US8	20	3

CONFIRMATION NO. 4274

UPDATED FILING RECEIPT



0000000121034675

23483
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

Date Mailed: 11/02/2020

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Jørn Allan Dose KNUTSEN, Oslo, NORWAY;
Carlos Eduardo ORÉ, Saint-Herblain, FRANCE;
Thibaud Auguste Bernard Jean SAINT-MARTIN, Aubignan, FRANCE;
Fred BROUSSARD, Indianapolis, IN;
Joseph E. RUBENSTEIN, Beijing, CHINA;

Applicant(s)

UMBRA Technologies Ltd., Hong Kong, CHINA;

Power of Attorney: The patent practitioners associated with Customer Number 23483

Domestic Priority data as claimed by applicant

This application is a CON of 15/563,253 09/29/2017 PAT 10756929
which is a 371 of PCT/US16/26489 04/07/2016
which claims benefit of 62/151,174 04/22/2015
and claims benefit of 62/144,293 04/07/2015

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

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

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/31/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/000,997**

Projected Publication Date: 02/11/2021

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

Preliminary Class

370

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

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,

page 2 of 4

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 (1-866-999-4258).

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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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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 17/000,997	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	80		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	350		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 240 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	830		TOTAL	
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							

Docket No.: 2210592.02089US8
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Jørn Allan Dose Knutsen et al. Confirmation No.: 4274
Application No.: 17/000,997 Art Unit: 2465
Filed: August 24, 2020 Examiner: Not Yet Assigned
Title: SYSTEMS AND METHODS FOR PROVIDING A GLOBAL
VIRTUAL NETWORK (GVN)

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

PRELIMINARY AMENDMENT UNDER 37 C.F.R. § 1.115

Dear Commissioner:

INTRODUCTORY COMMENTS

Prior to examination on the merits, please amend the above-identified U.S. patent application as follows:

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

Remarks/Arguments begin on page 6 of this paper.

Electronic Patent Application Fee Transmittal				
Application Number:		17000997		
Filing Date:		24-Aug-2020		
Title of Invention:		SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
First Named Inventor/Applicant Name:		Jørn Allan Dose KNUTSEN		
Filer:		Brian James Lambson/Robert Jepsen		
Attorney Docket Number:		2210592.02089US8		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	80	80
UTILITY SEARCH FEE	2111	1	350	350
UTILITY EXAMINATION FEE	2311	1	400	400
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				910

Electronic Acknowledgement Receipt	
EFS ID:	40979838
Application Number:	17000997
International Application Number:	
Confirmation Number:	4274
Title of Invention:	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)
First Named Inventor/Applicant Name:	Jørn Allan Dose KNUTSEN
Customer Number:	23483
Filer:	Brian James Lambson/Robert Jepsen
Filer Authorized By:	Brian James Lambson
Attorney Docket Number:	2210592.02089US8
Receipt Date:	29-OCT-2020
Filing Date:	24-AUG-2020
Time Stamp:	15:50:40
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$910
RAM confirmation Number	E20200SF51105909
Deposit Account	080219
Authorized User	Robert Jepsen
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)					
37 CFR 1.20 (Post Issuance fees)					
37 CFR 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	2089_US8_Response_to_Notice_to_File_Missing_Parts.PDF	72724	no	1
			d95b3640521c0c93d86899b85940bbb8fb75738e		
Warnings:					
Information:					
2		2089_US8_Preliminary_Amendment.PDF	101447	yes	6
			f447726fdb911d4734cdcc02df46896ad2ab10bd		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Applicant Arguments/Remarks Made in an Amendment		6	6	
	Claims		2	5	
	Preliminary Amendment		1	1	
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	37530	no	2
			5560cc5c2ff516d1000f8a348d9591d5e5b514ad		
Warnings:					
Information:					
Total Files Size (in bytes):			211701		

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.

Docket No.: 2210592.02089US8
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Jørn Allan Dose Knutsen et al. Confirmation No.: 4274
Application No.: 17/000,997 Art Unit: 2465
Filed: August 24, 2020 Examiner: Not Yet Assigned
Title: SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL
NETWORK (GVN)

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

RESPONSE TO NOTICE TO FILE MISSING PARTS OF APPLICATION

Dear Commissioner:

In response to the Notice to File Missing Parts of Application – Filing Date Granted mailed September 1, 2020, Applicant submits herewith a Preliminary Amendment and the Filing Fees as required. No new matter is added by this amendment.

Applicant submits the filing fees of: \$910. No other fees are believed due with this submission; however, the Director is hereby authorized to charge any shortfall to Deposit Account 08-0219.

Respectfully submitted,

Dated: October 29, 2020

/Brian J. Lambson/
Brian J. Lambson
Registration No.: 72,570
Attorney for Applicant(s)

Wilmer Cutler Pickering Hale and Dorr LLP
1875 Pennsylvania Avenue, N.W.
Washington, DC 20006
(202) 663-6000 (telephone)
(202) 663-6363 (facsimile)

ActiveCH 73038429v.1

Application No. 17/000,997
Amendment dated October 29, 2020
Preliminary Amendment

Docket No.: 2210592.02089US8

REMARKS

In view of the above amendment, Applicant believes the pending application is in condition for allowance.

Applicant believes no additional fee is due with this response. However, if an additional fee is due, please charge our Deposit Account No. 08-0219, under Order No. 2210592.02089US8 from which the undersigned is authorized to draw.

Respectfully submitted,

Dated: October 29, 2020

/Brian J. Lambson/
Brian J. Lambson
Registration No.: 72,570
Attorney for Applicant(s)

Wilmer Cutler Pickering Hale and Dorr LLP
1875 Pennsylvania Avenue, NW
Washington, DC 20006
(202) 663-6000 (telephone)
(202) 663-6363 (facsimile)

AMENDMENTS TO THE CLAIMS

1. (Canceled).
2. (New) A method comprising:
 - receiving, by one or more computer processors, a request for a list of available servers from a network device;
 - retrieving, by the one or more computer processors, the list of available servers;
 - retrieving, by the one or more computer processors, one or more records associated with the network device;
 - dynamically ordering, by the one or more computer processors, the list of available servers based on the one or more records associated with the network device; and
 - transmitting, by the one or more computer processors, the ordered list of available servers to the network device.
3. (New) The method of claim 2, wherein the network device is an endpoint device.
4. (New) The method of claim 3, wherein at least one server among the list of available servers is an access point server.
5. (New) The method of claim 2, further comprising anticipating a level of demand for at least one server among the list of available servers, and wherein dynamically ordering the list of available servers is further based on the anticipated level of demand.
6. (New) The method of claim 2, wherein dynamically ordering the list of available servers is further based on one or more second ordered lists of available servers transmitted to one or more second network devices.
7. (New) The method of claim 2, wherein dynamically ordering the list of available servers comprises generating ranking information for each server in the list of available servers.

8. (New) The method of claim 2, wherein the one or more records are retrieved based on a unique device identity associated with the network device.
9. (New) A system comprising:
 - a memory storing instructions; and
 - one or more processors coupled to the memory, the one or more processors being configured to execute the instructions, the instructions when executed causing the one or more processors to perform operations comprising:
 - receiving a request for a list of available servers from a network device;
 - retrieving the list of available servers;
 - retrieving one or more records associated with the network device;
 - dynamically ordering the list of available servers based on the one or more records associated with the network device; and
 - transmitting the ordered list of available servers to the network device.
10. (New) The system of claim 9, wherein the network device is an endpoint device.
11. (New) The system of claim 10, wherein at least one server among the list of available servers is an access point server.
12. (New) The system of claim 9, wherein the operations further comprise anticipating a level of demand for at least one server among the list of available servers, and wherein dynamically ordering the list of available servers is further based on the anticipated level of demand.
13. (New) The system of claim 9, wherein dynamically ordering the list of available servers is further based on one or more second ordered lists of available servers transmitted to one or more second network devices.
14. (New) The system of claim 9, wherein dynamically ordering the list of available servers comprises generating ranking information for each server in the list of available servers.

15. (New) The system of claim 9, wherein the one or more records are retrieved based on a unique device identity associated with the network device.
16. (New) A network system for managing a global virtual network, comprising:
an access point server configured to connect to one or more endpoint devices via one or more first tunnels; and
a control server connected to the access point server via a second tunnel, the control server storing one or more records associated with each of the one or more endpoint devices, wherein the control server is configured to:
receive a request for a list of available servers from a first endpoint device among the one or more endpoint devices, the list of available servers including the access point server;
retrieve the list of available servers;
retrieve the one or more records associated with the first endpoint device;
dynamically order the list of available servers for the first endpoint device based on the one or more records associated with the network device; and
transmit the ordered list of available servers to the first endpoint device.
17. (New) The network system of claim 16, wherein the control server is further configured to predict a level of demand for the access point server, and wherein dynamically ordering the list of available servers is further based on the anticipated level of demand.
18. (New) The network system of claim 16, wherein dynamically ordering the list of available servers is further based on one or more second ordered lists of available servers transmitted to one or more second endpoint devices among the plurality of endpoint devices.
19. (New) The network system of claim 16, wherein dynamically ordering the list of available servers comprises generating ranking information for each server in the list of available servers.

20. (New) The network system of claim 16, the one or more records are retrieved based on a unique device identity associated with the first endpoint device.
21. (New) The network system of claim 16, wherein the control server receives tunnel information associated with the one or more first tunnels via the global virtual network, and wherein dynamically ordering the list of available servers is further based on the tunnel information.



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
17/000,997	08/24/2020	Jørn Allan Dose KNUTSEN	2210592.02089US8

CONFIRMATION NO. 4274

FORMALITIES LETTER



23483
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

Date Mailed: 09/01/2020

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

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

- The statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **75** basic filing fee.
- \$ **80** surcharge.
- \$ **330** search fee.
- \$ **380** examination fee.
- \$(**0**) previous unapplied payment amount.
- \$ **865** TOTAL FEE BALANCE DUE.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

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, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".
<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.

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

/tnguyen/

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 17/000,997	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	1	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	785		TOTAL	
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		OTHER THAN SMALL ENTITY	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



UNITED STATES PATENT AND TRADEMARK OFFICE

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Address: COMMISSIONER FOR PATENTS
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
17/000,997	08/24/2020	2465	0.00	2210592.02089US8	1	1

CONFIRMATION NO. 4274

FILING RECEIPT



23483
WILMERHALE/BOSTON
60 STATE STREET
BOSTON, MA 02109

Date Mailed: 09/01/2020

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Jørn Allan Dose KNUTSEN, Oslo, NORWAY;
Carlos Eduardo ORÉ, Saint-Herblain, FRANCE;
Thibaud Auguste Bernard Jean SAINT-MARTIN, Aubignan, FRANCE;
Fred BROUSSARD, Indianapolis, IN;
Joseph E. RUBENSTEIN, Beijing, CHINA;

Applicant(s)

UMBRA Technologies Ltd., Hong Kong, CHINA;

Power of Attorney: The patent practitioners associated with Customer Number 23483

Domestic Priority data as claimed by applicant

This application is a CON of 15/563,253 09/29/2017 PAT 10756929
which is a 371 of PCT/US16/26489 04/07/2016
which claims benefit of 62/151,174 04/22/2015
and claims benefit of 62/144,293 04/07/2015

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

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

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 08/31/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/000,997**

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

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)

Preliminary Class

370

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

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,

page 2 of 4

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 (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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

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

NOT GRANTED

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

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technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Not Yet Assigned		
Filing Date	Concurrently Herewith		
First Named Inventor	Jørn Allan Dose KNUTSEN		
Title	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
Art Unit	N/A		
Examiner Name	Not Yet Assigned		
Attorney Docket Number	2210592.02089US8		
SIGNATURE of Applicant or Patent Practitioner			
Signature	/Brian J. Lambson/	Date (Optional)	August 24, 2020
Name	Brian J. Lambson	Registration Number	72,570
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.			
<input style="width: 20px; height: 20px; margin-right: 5px;" type="checkbox"/> *Total of <u>1</u> forms are submitted.			

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

- ☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 23483
- OR
- ☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☐ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone	Email		

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Umbra Technologies LTD.

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	12/11-2017
Name	Jørn Knutsen		
Title	CEO		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of 1 forms are submitted.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

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

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
Mr. ▾	Jørn	Allan Dose	KNUTSEN	▾	
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Oslo	Country of Residence ⁱ	NO		
Mailing Address of Inventor:					
Address 1		Hoffsjef Lovenskiolds vei 31B			
Address 2					
City	Oslo	State/Province			
Postal Code	N-0382	Country ⁱ	NO		
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
Mr. ▾	Carlos	Eduardo	ORÉ	▾	
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Saint-Herblain	Country of Residence ⁱ	FR		
Mailing Address of Inventor:					
Address 1		4 Allée de Pontpierre			
Address 2					
City	Saint-Herblain	State/Province			
Postal Code	44800	Country ⁱ	FR		
Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr. ▾	Thibaud	Auguste Bernard Jean	SAINT-MARTIN	▾
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Aubignan	Country of Residence ⁱ	FR	

Mailing Address of Inventor:

Address 1	415, Avenue de Cheseaux			
Address 2				
City	Aubignan	State/Province		
Postal Code	84810	Country ⁱ	FR	
Inventor	4	Remove		
Legal Name				

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr. ▾	Fred		BROUSSARD	▾
Residence Information (Select One) ☒ US Residency ☐ Non US Residency Active US Military Service				
City	Indianapolis	State/Province	IN	Country of Residence ⁱ US

Mailing Address of Inventor:

Address 1	11625 Tidewater Dr S			
Address 2				
City	Indianapolis	State/Province	IN	
Postal Code	46236	Country ⁱ	US	
Inventor	5	Remove		
Legal Name				

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr. ▾	Joseph	E.	RUBENSTEIN	▾
Residence Information (Select One) ☐ US Residency ☒ Non US Residency Active US Military Service				
City	Beijing	Country of Residence ⁱ	CN	

Mailing Address of Inventor:

Address 1	Silver Maple Gardens 2-F-602			
Address 2	Dashanzi Caihonglu; Chaoyang District			
City	Beijing	State/Province		
Postal Code		Country ⁱ	CN	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button.

Add

Correspondence Information:

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

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

Customer Number	23483		
Email Address		Add Email	Remove Email

Application Information:

Title of the Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
Attorney Docket Number	2210592.02089US8	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	51	Suggested Figure for Publication (if any)	

Filing By Reference:

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

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

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

Publication Information:

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

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

Representative Information:

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	23483		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15/563253	2017-09-29
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15/563253	a 371 of international	PCT/US16/26489	2016-04-07
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/26489	Claims benefit of provisional	62/151174	2015-04-22
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/26489	Claims benefit of provisional	62/144293	2015-04-07
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

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

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

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

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

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

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Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	UMBRA Technologies Ltd.		
Mailing Address Information For Applicant:			
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
		Application Number	
Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

Assignee 1				
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See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Brian J. Lambson/		Date (YYYY-MM-DD)	2020-08-24
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	2210592.02089US8
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Title of Invention	SYSTEMS AND METHODS FOR PROVIDING A GLOBAL VIRTUAL NETWORK (GVN)		

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Application Number:	17000997
International Application Number:	
Confirmation Number:	4274
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First Named Inventor/Applicant Name:	Jørn Allan Dose KNUTSEN
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2089_US8_Specification.PDF	259210	yes	51
			e52a006d42b7e34fb81bf8b4fced4641498e d837		

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Abstract		51	51	
	Claims		50	50	
	Specification		1	49	
Warnings:					
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2	Drawings-only black and white line drawings	2089_US8_Drawings.PDF	1065383	no	51
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5	Application Data Sheet	2089_US8_ADS.PDF	1256460	no	10
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ABSTRACT

Systems and methods for managing a global virtual network connection between an endpoint device and an access point server are disclosed. In one embodiment the network system may include an endpoint device, an access point server, and a control server. The endpoint device and the access point server may be connected with a first tunnel. The access point server and the control server may be connected with a second tunnel.

What is claimed is:

1. A network system for managing a global virtual network, comprising:
 - an endpoint device;
 - an access point server;
 - a control server;
 - a first tunnel connecting the endpoint device to the access point server; and
 - a second tunnel connecting the access point server to the control server.

**SYSTEMS AND METHODS FOR PROVIDING A
GLOBAL VIRTUAL NETWORK (GVN)**

RELATED APPLICATION

[0001] This application is a continuation of 15/563,253, filed September 29, 2017, which is a U.S. National Stage application under 35 U.S.C. § 371 of International Patent Application No. PCT/US2016/026489, filed April 7, 2016, which claims the benefit of and priority to U.S. Provisional Application No. 62/144,293, filed on April 7, 2015, and U.S. Provisional Application No. 62/151,174, filed on April 22, 2015, each of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

Technical Field

[0002] The present disclosure relates generally to networks, and more particularly, a global virtual network and various associated ancillary modules.

Description of the Related Art

[0003] Human beings are able to perceive delays of 200ms or more as this is typically the average human reaction time to an event. If latency is too high, online systems such as thin-clients to cloud-based servers, customer relationship management (CRM), enterprise resource planning (ERP) and other systems will perform poorly and may even cease functioning due to timeouts. High latency combined with high packet loss can make a connection unusable. Even if data gets through, at a certain point too much slowness results in a poor user experience (UX) and in those instances the result can be refusal by users to accept those conditions in effect rendering poorly delivered services as useless.

[0004] To address some of these issues, various technologies have been developed. One such technology is WAN optimization, typically involving a hardware (HW) device at the edge of a local area network (LAN) which builds a tunnel to another WAN optimization HW device at the edge of another LAN, forming a wide area network (WAN) between them. This technology assumes a stable connection through which the two devices connect to each other. A WAN optimizer strives to compress and secure the data flow often resulting in a speed gain. The commercial driver for the adoption of WAN optimization is to save on the volume of data sent in an effort to reduce the cost of

data transmission. Disadvantages of this are that it is often point-to-point and can struggle when the connection between the two devices is not good as there is little to no control over the path of the flow of traffic through the Internet between them. To address this, users of WAN optimizers often opt to run their WAN over an Multiprotocol Label Switching (MPLS) or DDN line or other dedicated circuit resulting in an added expense and again usually entailing a rigid, fixed point-to-point connection.

[0005] Direct links such as MPLS, DDN, Dedicated Circuits or other types of fixed point-to-point connection offer quality of connection and Quality of Service (QoS) guarantees. They are expensive and often take a significantly long time to install due to the need to physically draw lines from a POP at each side of the connection. The point-to-point topology works well when connecting from within one LAN to the resources of another LAN via this directly connected WAN. However, when the gateway (GW) to the general Internet is located at the LAN of one end, say at the corporate headquarters, then traffic from the remote LAN of a subsidiary country may be routed to the Internet through the GW. A slowdown occurs as traffic flows through the internet back to servers in the same country as the subsidiary. Traffic must then go from the LAN through the WAN to the LAN where the GW is located and then through the Internet back to a server in the origin country, then back through the internet to the GW, and then back down the dedicated line to the client device within the LAN. In essence doubling or tripling (or worse) the global transit time of what should take a small fraction of global latency to access this nearby site. To overcome this, alternative connectivity of another internet line with appropriate configuration changes and added devices can offer local traffic to the internet, at each end of such a system.

[0006] Another option for creating WAN links from one LAN to another LAN involve the building of tunnels such as IPSec or other protocol tunnels between two routers, firewalls, or equivalent edge devices. These are usually encrypted and can offer compression and other logic to try to improve connectivity. There is little to no control over the routes between the two points as they rely on the policy of various middle players on the internet who carry their traffic over their network(s) and peer to other carriers and or network operators. Firewalls and routers, switches and other devices from a number of equipment vendors usually have tunneling options built into their firmware.

[0007] While last mile connectivity has vastly improved in recent years there still exist problems with long distance connectivity and throughput due to issues related to distance, protocol limitations,

peering, interference, and other problems and threats. As such, there exists a need for secure network optimization services running over the top of standard internet connections.

SUMMARY OF THE DISCLOSURE

[0008] A global virtual network (GVN) is a type of network which offers network optimization over the top (OTT) of the internet. It is a disruptive technology which provides a low cost alternative to costly MPLS or dedicated lines. Having a secure tunnel between an end point device (EPD) and an access point server (SRV_AP) linked to the broader GVN global network offers many advantages. The core technologies of the GVN were created to fill gaps where solutions were required but for which technology did not exist.

[0009] In addition to the broader theme of addressing quality of service (QoS) issues related to the network connectivity which improve general performance and enhance user experience, two other main features are that this topology allows for the extension of a network edge into the cloud. Additionally, the EPD acts as a bridge between the broader network and a local area network (LAN) bringing elements of the cloud as a local node extension into the edge of the LAN.

[0010] The disclosed subject matter describes various ancillary modules of the global virtual network which are either facilitated by a GVN or which assist it in its operations. The geographic destination claims have to do specifically with how the CDA and the CPA work, as well as their interactions and coordinated efforts. The geocasting element describes how the GeoD mechanism can offer a reverse-CDN geocasting operation utilizing the topology of the GVN. The tunnels describe what can be done with the plumbing from a higher level. Architecture and algorithm/logic inventions describe component parts. Graphic user interface and related HW and SW frameworks are also outlined as is file transferring.

[0011] Systems and methods for managing a virtual global network connection between an endpoint device and an access point server are disclosed. In one embodiment the network system may include an endpoint device, an access point server, and a control server. The endpoint device and the access point server may be connected with a first tunnel. The access point server and the control server may be connected with a second tunnel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In order to facilitate a fuller understanding of the present disclosure, reference is now made to the accompanying drawings, in which like elements are referenced with like numerals or references. These drawings should not be construed as limiting the present disclosure, but are intended to be illustrative only.

[0013] Fig. 1 illustrates the packet bloat for IP transport packets when headers are added to the data at various layers.

[0014] FIG. 2 illustrates the packet bloat of data and headers at each of the seven layers of the OSI model.

[0015] Fig. 3 shows a block diagram depicting resolution of universal resource locator (URL) via lookup through internet domain name system (DNS) for routing from Host (client) to the numeric IP address of the Host (server).

[0016] Fig. 4 illustrates, in accordance with certain embodiments of the disclosed subject matter, an equation to calculate bandwidth delay product (BDP) for a connection segment or path taking into account various connectivity attributes.

[0017] Fig. 5 illustrates, in accordance with certain embodiments of the disclosed subject matter, the traffic flow path within an end point device (EPD).

[0018] Fig. 6 illustrates, in accordance with certain embodiments of the disclosed subject matter, an over the top (OTT) tunnel created on top of a regular internet connection.

[0019] Fig. 7 illustrates, in accordance with certain embodiments of the disclosed subject matter, a virtual interface for over the top (OTT) tunnels created on top of a regular internet connection.

[0020] Fig. 8 illustrates a conventional embodiment of flow of the Internet traffic.

[0021] Fig. 9 illustrates, in accordance with certain embodiments of the disclosed subject matter, a tunnel (TUN) built between two gateway devices (GWD).

[0022] Fig. 10 illustrates, in accordance with certain embodiments of the disclosed subject matter, the communications between EPD 100, SRV_CNTRL 200, and SRV_AP 300 via the neutral API mechanism (NAPIM) of the GVN via paths API-10A1-10A2, API-10A3-10A2, and API-10A1-10A3.

[0023] Fig. 11 illustrates, in accordance with certain embodiments of the disclosed subject matter, the flow of information required by two peers in a peer pair.

[0024] Fig. 12 illustrates, in accordance with certain embodiments of the disclosed subject matter, a process of building a tunnel.

[0025] Fig. 13 is a flowchart illustrating the logical used to assign a port to an IP address used to build a tunnel in accordance with certain embodiments of the disclosed subject matter.

[0026] Fig. 14 illustrates, in accordance with certain embodiments of the disclosed subject matter, the importance of a server availability list and how IP addresses and ranges are assigned for various devices.

[0027] Fig. 15 illustrates, in accordance with certain embodiments of the disclosed subject matter, elements of a GVN Tunnel from LAN to EPD to SRV_AP to SRV_AP to EPD to LAN, including peering points between ISPs and network edges.

[0028] Fig. 16 illustrates, in accordance with certain embodiments of the disclosed subject matter, a multi-perimeter firewall (MPFW) in the cloud supporting a personal end point device.

[0029] Fig. 17 illustrates, in accordance with certain embodiments of the disclosed subject matter, how tables on the databases of various GVN devices are related to each other and in which way they interact.

[0030] Fig. 18 shows, in accordance with certain embodiments of the disclosed subject matter, a block diagram of technology used by and enabled by a global virtual network (“GVN”).

[0031] Fig. 19 illustrates, in accordance with certain embodiments of the disclosed subject matter, three devices that work together to provide geographic destination services to a client to optimize the retrieval, transfer, and serving of content from servers located in a remote location.

[0032] Fig. 20 further illustrates the operation of the three devices described in Fig. 19 in accordance with certain embodiments of the disclosed subject matter.

[0033] Fig. 21 is an exemplary embodiment which continues to describe the operation of a geographic destination mechanism further explaining the retrieval of a series of files from various types of servers, the clumping together of the retrieved files and the subsequent transmission from the access point server (SRV_AP) to the end point device (EPD).

[0034] Fig. 22 illustrates the prior art of how geocasting works within a content delivery network (CDN).

[0035] Fig. 23 illustrates the analysis and interpretation of periods of tick cycles.

[0036] Fig. 24 describes how a description of two different sets of data can provide information when comparing various dissimilar data sets in accordance with certain embodiments of the disclosed subject matter.

[0037] Fig. 25 illustrates, in accordance with certain embodiments of the disclosed subject matter, the integration of a multi-perimeter firewall with other systems in a GVN.

[0038] Fig. 26 illustrates, in accordance with certain embodiments of the disclosed subject matter, both paths through the open Internet as well as paths which are a combination of network optimized traffic with a blend of global virtual network (GVN) segments over the top (OTT) of the base Internet and open Internet segments.

[0039] Fig. 27 illustrates a GVN using hub and spoke topology with a backbone and octagon routing in accordance with certain embodiments of the disclosed subject matter.

[0040] Fig. 28 illustrates, in accordance with certain embodiments of the disclosed subject matter, a distributed end point administrative cluster (DEPAC) which can be virtually constructed within a global virtual network (GVN) or other similar topology.

[0041] Fig. 29 illustrates the logical construction of a series of tests to be run on the Internet testing various ports and IP addresses in accordance with certain embodiments of the disclosed subject matter.

[0042] Fig. 30 illustrates a mechanism for logging of connectivity traffic activity between various devices operating in a global virtual network (GVN) or other similar topologies in accordance with certain embodiments of the disclosed subject matter.

[0043] Fig. 31 illustrates the traditional thick stack 31-20 layered access between the application layer 31-800 and a network interface card (NIC) 31-000 as compared to a thin stack approach 31-10 which directly accesses the NIC 31-000 in accordance with certain embodiments of the disclosed subject matter.

[0044] Fig. 32 illustrates a simple example databases schema for relating and storing connectivity information from both tests and production environment usage.

[0045] Fig. 33 illustrates, in accordance with certain embodiments of the disclosed subject matter, the usage of custom commands that act as a defensive cushion between a trigger on an application layer such as a button clicked on a graphic user interface and the deep logic and commands to be run as a result of the trigger.

[0046] Fig. 34 is a simplified description of the modules on related devices in a geographic destination mechanism within a global virtual network (GVN) in accordance with certain embodiments of the disclosed subject matter.

[0047] Fig. 35 illustrates, in accordance with certain embodiments of the disclosed subject matter, a few ways how a portable end point device (PEPD) might connect to a global virtual network (GVN) or similar topology.

[0048] Fig. 36 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationship between a portable end point device (PEPD) and an access point server (SRV_AP) 36-300.

[0049] Fig. 37 illustrates, in accordance with certain embodiments of the disclosed subject matter, some of the different types of extensible software that may be run on a portable end point device (PEPD) where the software is stored on a remote device such as an access point server (SRV_AP) to be sent from the SRV_AP to the PEPD.

[0050] Fig. 38 illustrates, in accordance with certain embodiments of the disclosed subject matter, multiple tunnels between devices within a global virtual network (GVN) across multiple regions.

[0051] Fig. 39 illustrates, in accordance with certain embodiments of the disclosed subject matter, the framework for a common code base to be utilized by various types of devices, with each having their own attributes/type and identity.

[0052] Fig. 40 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationships, interaction, and relevance of data to various devices within a global virtual network (GVN).

[0053] Fig. 41 illustrates, in accordance with certain embodiments of the disclosed subject matter, the topology of a global virtual network (GVN) over the top (OTT) of the Internet and various devices operating within it.

[0054] Fig. 42 illustrates, in accordance with certain embodiments of the disclosed subject matter, code both above the web root and below the web root.

[0055] Fig. 43 illustrates, in accordance with certain embodiments of the disclosed subject matter, algorithms incorporating information from external sources with AI knowledge learned internally.

[0056] Fig. 44 illustrates, in accordance with certain embodiments of the disclosed subject matter, a simplified representation of an approach to designing a smarter algorithm by taking into account factors that one has and balancing against one's personal needs.

[0057] Fig. 45 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device (EPD), central control server (SRV_CNTRL), and an access point server (SRV_AP).

[0058] Fig. 46 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device (EPD), central control server (SRV_CNTRL), and an access point server (SRV_AP).

[0059] Fig. 47 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device (EPD), central control server (SRV_CNTRL), and an access point server.

[0060] FIG. 48 illustrates a block diagram of an exemplary computing device according to certain embodiments of the disclosed subject matter.

[0061] Fig. 49 illustrates a process of the downloading of a file in a LAN as well as the downloading a file from the Internet in accordance with certain embodiments of the disclosed subject matter.

[0062] Fig. 50 illustrates the operation of a file transfer manager (FTM) on an end point device (EPD) and of an FTM on an access point server (SRV_AP) in accordance with certain embodiments of the disclosed subject matter.

[0063] Fig. 51 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationship between the physical storage of a file on a secure file storage volume, the saving of information about the file into a relational database (DB), and data relationships between files, file information, and steps in a file transfer process.

DETAILED DESCRIPTION

[0064] In the following description, numerous specific details are set forth regarding the systems, methods and media of the disclosed subject matter and the environment in which such systems, methods and media may operate, etc., in order to provide a thorough understanding of the disclosed subject matter. It will be apparent to one skilled in the art, however, that the disclosed subject matter may be practiced without such specific details, and that certain features, which are well known in the art, are not described in detail in order to avoid complication of the disclosed subject matter. In addition, it will be understood that the examples provided below are exemplary, and that it is contemplated that there are other systems, methods, and media that are within the scope of the disclosed subject matter.

[0065] A global virtual network (GVN) offers secure network optimization services to clients over the top (OTT) of their standard internet connection. This is an overview of the constituent parts of a GVN as well as a description of related technologies which can serve as GVN elements. GVN elements may operate independently or within the ecosystem of a GVN such as utilizing the GVN framework for

their own purposes, or can be deployed to enhance the performance and efficiency of a GVN. This overview also describes how other technologies can benefit from a GVN either as a stand-alone deployment using some or all components of a GVN, or which could be rapidly deployed as an independent mechanism on top of an existing GVN, utilizing its benefits.

[0066] A software (SW) based virtual private network (VPN) offers privacy via a tunnel between a client device and a VPN server. These have an advantage of encryption and in some cases also compression. But here again there is little to no control over how traffic flows between VPN client and VPN server as well as between the VPN server and host server, host client or other devices at destination. These are often point-to-point connections that require client software to be installed per device using the VPN and some technical proficiency to maintain the connection for each device. If a VPN server egress point is in close proximity via quality communication path to destination host server or host client then performance will be good. If not, then there will be noticeable drags on performance and dissatisfaction from a usability perspective. It is often a requirement for a VPN user to have to disconnect from one VPN server and reconnect to another VPN server to have quality or local access to content from one region versus the content from another region.

[0067] A Global Virtual Network (GVN) is a type of computer network on top of the internet providing global secure network optimization services utilizing a mesh of devices distributed around the world securely linked to each other by advanced tunnels, collaborating and communicating via Application Program Interface (API), Database (DB) replication, and other methods. Traffic routing in the GVN is always via best communication path governed by Advanced Smart Routing (ASR) powered by automated systems which combine builders, managers, testers, algorithmic analysis and other methodologies to adapt to changing conditions and learning over time to configure and reconfigure the system.

[0068] The GVN offers a service to provide secure, reliable, fast, stable, precise and focused concurrent connectivity over the top of one or more regular Internet connections. These benefits are achieved through compression of data flow transiting multiple connections of wrapped, disguised and encrypted tunnels between the EPD and access point servers (SRV_AP) in close proximity to the EPD. The quality of connection between EPD and SRV_AP's is constantly being monitored.

[0069] A GVN is a combination of a hardware (HW) End Point Device (EPD) with installed software (SW), databases (DB) and other automated modules of the GVN system such as Neutral Application Programming Interface Mechanism (NAPIM), back channel manager, tunnel manager, and more features which connect the EPD to distributed infrastructure devices such as access point server (SRV_AP) and central server (SRV_CNTRL) within the GVN.

[0070] Algorithms continually analyze current network state while taking into account trailing trends plus long term historical performance to determine best route for traffic to take and which is the best SRV_AP or series of SRV_AP servers to push traffic through. Configuration, communication path and other changes are made automatically and on the fly with minimal or no user interaction or intervention required.

[0071] Advanced Smart Routing in an EPD and in an SRV_AP ensure that traffic flows via the most ideal path from origin to destination through an as simple as possible “Third Layer” of the GVN. This third layer is seen by client devices connected to the GVN as a normal internet path but with a lower number of hops, better security and in most cases lower latency than traffic flowing through the regular internet to the same destination. Logic and automation operate at the “second layer” of the GVN where the software of the GVN automatically monitors and controls the underlying routing and construct of virtual interfaces (VIF), multiple tunnels and binding of communication paths. The third and second layers of the GVN exist on top of the operational “first layer” of the GVN which interacts with the devices of the underlying Internet network.

[0072] The cloud from a technical and networking perspective refers to devices or groups or arrays or clusters of devices which are connected and are available to other devices through the open internet. The physical location of these devices is not of significant importance as they often have their data replicated across multiple locations with delivery to/from closest server to/from requesting client utilizing content delivery network (CDN) or other such technology to speed connectivity which enhances user experience (UX).

[0073] In some embodiments, the disclosed subject matter is related to increasing utility value of firewalls (FW) by extending perimeters into the cloud. A firewall is a device primarily designed to protect an internal network against the external threats from an outside network, as well as protecting the leakage of information data from the internal network. A firewall has traditionally been placed at

the edge between one network such as a local area network (LAN) and another network such as its uplink to a broader network. Network administrators have sensitivities about the placement and trustworthiness of a FW because of their reliance on it to secure their networks.

[0074] Fig. 1 illustrates the packet bloat for IP transport packets when headers are added to the data at various layers. At the Application Layer 1-L04, the data payload has an initial size as indicated by Data 1-D4. The size of the packet is indicated by Packet Size 1-PBytes. At the next layer, Transport Layer 1-L03, the Packet Size 1-PBytes has the original size of the data 1-D4 which is equal to Data UDP 1-D3. It further includes bloat of Header UDP 1-H3. At the next layer, Internet Layer 1-L02 the body payload Data IP 1-D2 is a combination of 1-D3 and 1-H3. It increases 1-PBytes by Header IP 1-H2. At the Link Layer 1-L01, Frame Data 1-D1 is a combination of 1-H2 and 1-D2. It further increases 1-PBytes by Header Frame 1-H1 and Footer Frame 1-F1.

[0075] Fig. 2 illustrates the packet bloat of data and headers at each of the seven layers of the OSI model. The original data 2-D0 grows at each level Application OSI Layer 7 2-L7 with the addition of headers such as Header 2-H7. At each subsequent layer down from layer 7 to layer 1, the data layer is a combination of the previous upper level's layer of Data and Header combined. The total packet bloat in an OSI model at the Physical OSI Layer 2-L1 is denoted by Packet Size 2-PBytes.

[0076] Fig. 3 shows a block diagram depicting resolution of universal resource locator (URL) via lookup through internet domain name system (DNS) for routing from Host (client) to the numeric IP address of the Host (server). A content request or push from host (client) source 101 to host (server) target 301 as files or streams or blocks of data flows in the direction of 001. The response 002 of content delivery from host (server) target 301 to host (client) source 101 as files or streams or blocks of data. The host (client) source 101 in Client-Server (C - S) relationship that makes request to access content from a remote host (server) or sends data to remote host (server) via a universal resource locator (URL) or other network reachable address.

[0077] The connection from the host client to the internet is marked as P01 – connection from client 101 to POP 102 directly facing or can be located in a local area network (LAN) which then connects to the internet via a point of presence (POP) can be referred to as the last mile connection. The point of presence (POP) 102 which represents connection provided from an end point by an internet service provider (ISP) to the internet via their network and its interconnects. If the URL is a domain name

rather than a numeric address, then this URL is sent to domain name system (DNS) server 103 where the domain name is translated to an IPv4 or IPv6 or other address for routing purposes.

[0078] Traffic from client 101 to server 301 is routed through the Internet 120 representing transit between POPs (102 and 302) including peering, backhaul, or other transit of network boundaries.

[0079] The connection P02 from POP 102 to DNS 103 to look up a number address from a universal resource locator (URL) to get the IPv4 address or other numeric address of target server can be directly accessed from the POP 102, or via the Internet 120. The connection P03 from POP 102 of an ISP to the Internet 120 can be single-honed or multi-honed. There is a connection P04 from the Internet 120 to the ISP's or internet data center's (IDC) internet-facing POP 302. The connection P05 from the POP 302 of the server to the host 301 can be direct or via multiple hops.

[0080] The lookups from name to numeric address via domain name systems is a standard on the Internet today and assumes that the DNS server is integral and that its results are current and can be trusted.

[0081] Fig. 4 illustrates, in accordance with certain embodiments of the disclosed subject matter, an equation to calculate bandwidth delay product (BDP) 4-080 for a connection segment or path taking into account various connectivity attributes. The further the distance between the two points and/or other factors which increase latency impact the amount of data that the line can blindly absorb before the sending device knows receives back a message from the recipient device about whether or not they were able to accept the volume of data.

[0082] In short, the BDP 4-080 calculation can represent a measure of how much data can fill a pipe before the server knows it is sending too much at too fast a rate.

[0083] The Bandwidth 4-000 can be measured in megabits per second (Mbps) and Granularity 4-002 can be unit of time relative to one second. To accurately reflect BDP 4-080, the Bytes 4-020 are divided by the number of Bits 4-022 of a system. Latency 4-050 is a measurement of round trip time (RTT) in milliseconds (ms) between the two points.

[0084] So for example, BDP 4-080 of the following network path with these attributes - Bandwidth 4-000 of 10 GigE using Granularity 4-022 of one second, on an eight bit system over a path with Latency 4-050 of 220 ms - can be calculated as follows:

$$\frac{10,000,000,000}{1} * \frac{1}{8} * 0.220 = 275,000,000 \text{ bits OR } 33,569.3 \text{ MB}$$

[0085] Therefore on a 10 GigE line, the sending device could theoretically send 33,569.3 megabytes of information (MB) in the 220 ms before a message can be received back from the recipient client device.

[0086] This calculation can also be the basis of other algorithms such as one to govern the size of a RAM buffer, or one to govern the time and amount of data that is buffered before there is a realization of a problem such as an attack vector. The throttling down by host server could lead to underutilized pipes but the accepting too much data can also lead to other issues. The calculation of BDP 4-080 and proactive management approach to issues leads to efficient utilization of hardware and network resources.

[0087] Fig. 5 illustrates, in accordance with certain embodiments of the disclosed subject matter, the traffic flow path within an end point device (EPD). The traffic flows between the LAN 5-000 and the end point device (EPD) 5-100 over connection 5-CP00. End point device (EPD) 5-100 flows to the point of presence (POP) 5-010 over connection 5-CP06. The point of presence (POP) 5-010 is connected to the Internet 5-020 via connection 5-CP08.

[0088] Fig. 6 illustrates, in accordance with certain embodiments of the disclosed subject matter, an over the top (OTT) tunnel created on top of a regular internet connection. Fig. 6 is similar to Fig. 5 and additionally shows an access point server (SRV_AP) 6-300. The access point server (SRV_AP) 6-300 includes a tunnel listener TNL0 6-380. The end point device (EPD) 5-100 includes a tunnel manager TMN0 6-180. A tunnel TUN0 6-CP80 is constructed that connects the tunnel manager TMN0 6-180 and the tunnel listener TNL0 6-380. The tunnel is constructed over-the-top (OTT) of the regular internet connection 6-CP06 and 6-CP08.

[0089] Fig. 7 illustrates, in accordance with certain embodiments of the disclosed subject matter, a virtual interface for over the top (OTT) tunnels created on top of a regular internet connection. Fig. 7

is similar to Fig. 6 and additionally includes a virtual interface (VIF) as a hook point on each device EPD 7-100 and SRV_AP 7-300 for multiple tunnels to be built between two. This figure also shows multiple tunnels 7-CP80, 7-CP82, and 7-CP84 between EPD 7-100 and SRV_AP 7-300. A main advantage of the virtual interface VIF0 7-170 and VIF0 7-370 on each device respectively is that this approach enables clean structural attributes and a logical pathway for more complex constructs of tunnels and subsequent routing complexity.

[0090] Certain other advantages with regards to timing and flow control will be described in subsequent figures below.

[0091] Fig. 8 illustrates a conventional embodiment of flow of the Internet traffic. In Fig. 8, the traffic through the Internet is from a Host (client) Origin 8-101 connected to a local area network (LAN) 8-102 to a point of presence (POP) 8-103 of an Internet service provider (ISP) to the Internet 8-301 to a POP 8-204 of an Internet data center (IDC) 8-203 to a load balancer 8-202 routing traffic to a Host (server) Target 8-201.

[0092] The client and the server both have little to no control over the routes that their traffic takes through the Internet and other networks between them.

[0093] Fig. 9 illustrates, in accordance with certain embodiments of the disclosed subject matter, a tunnel (TUN) built between two gateway devices (GWD). In Fig. 9, GWD A1 and GWD B1 are each located between the edges EDGE-1 and EDGE-2 of their internal networks and the open Internet. The TUN connects the two local area networks (LAN) into a broader wide area network (WAN). The GWD A1 receives its connectivity from an Internet service provider ISP-1 and GWD B1 from ISP-3. A key point is that while the TUN offers security and other benefits, there are potential negative issues because traffic from ISP-1 destined for ISP-3 must transit through the network of ISP-2.

[0094] Congestion due to saturation, packet loss, or other issues can occur at peering points PP-01 and/or at PP-02 or within the network of ISP-2. Because neither GWD A1 nor GWD B1 is a client of ISP-2, they have to reach ISP-2 via complaining to their respective ISP of ISP-1 or ISP-3.

[0095] Another thing to note is that while the Internet path may consist of many hops such as, for example, external hop (EH) EH1 through EH17, within the TUN there will be only one hop at each of the end points of the tunnel. The tunnel is an encrypted path over the top (OTT) of the open Internet.

[0096] Fig. 10 illustrates, in accordance with certain embodiments of the disclosed subject matter, the communications between EPD 10-100, SRV_CNTRL 10-200, and SRV_AP 10-300 via the neutral API mechanism (NAPIM) of the GVN via paths API-10A1-10A2, API-10A3-10A2, and API-10A1-10A3.

[0097] For tunnels TUN10-1, TUN10-2, and TUN10-3 to be built between EPD 10-100 and SRV_AP 10-300 as well as for tunnels from EPD 10-100 to other SRV_AP servers such as TUN10-4 and from other EPDs to SRV_AP 10-300 via TUN10-5, each device in the peer pair requires certain information per tunnel.

[0098] The NAPIM mechanism stores relevant credentials, coordinates and other information for each side of a peer pair to utilize when building new tunnels via the Tunnel Managers 2110 and 2310. The server availability mechanism 2222 on the SRV_CNTRL 10-300 evaluates the performance of various tunnels tested on the EPD side via Tunnel Tester 2112 and the SRV_AP side by Tunnel Tester 2312. The information from the tests is relayed to the Connectivity Analyzer 2288 on the SRV_CNTRL 10-200. Test results include assigned IP address and port combinations, ports used, results from historical combinations use, results from port spectrum tests, and other related information.

[0099] Server availability lists present the EPD 10-100 with a list of IP addresses and ports which could be utilized by the Tunnel Manager to build new tunnels. The SRV_AP 10-300 and other SRV_AP servers noted on the list will be notified listen for connection attempts to be made by EPD 10-100.

[00100] Server availability prioritizes the list of SRV_AP IP address and port combinations based on expected best performance of the tunnels to be built while also looking at current load of available SRV_AP servers, balancing assigned lists given to other EPDs as well as other available information.

[00101] Fig. 11 illustrates, in accordance with certain embodiments of the disclosed subject matter, the flow of information required by two peers in a peer pair. The peers can either be a Client (C) and a Server (S), or a Peer to another Peer in a P-2-P topology. For simplicity of labeling and descriptions within this example embodiment, the C to S and P-2-P represent the same type of two peer

relationship, with C to S described herein. The GVN mainly uses C to S relationships between devices but its methods and technology can also be applied to P-2-P peer pairs for tunnel building.

[00102] An encrypted tunnel by its nature is a secure communication path through which data can flow. When the Client and the Server are separated by distance and the connection between them is over the open, unencrypted Internet, an encrypted tunnel is an ideal channel through which to safely exchange data. If there is a human network administrator at either end, they can program devices. But there exists a challenge on how to relay security information like pass phrases, keys and other information. Some may use a voice phone call to coordination, others a series of postings through secure web sites to share information or other methods. Manually setting up a single tunnel can be a task. Administering multiple tunnels can become onerous.

[00103] To automatically build a series of encrypted tunnels between two devices in a peer pair there exists a need to securely share information. The tunnel information also needs to be current and securely stored on a device. Furthermore, during the establishment process, there exist threats which must be addressed. While a tunnel is up, other threats exist which need to be addressed.

[00104] SRV_CNTRL 11D00 is a central server which contains Repository managing information in Database tables, files stored in a Secure File Storage system, lists in memory and other related information. The SRV_CNTRL also has algorithms and mechanisms to evaluate certain data to generate information reports.

[00105] Client Device 11D01 represents a device which will initiate the building of a tunnel by “dialing” the connection to the Server device via a specific IP Address and Port. There can be many Client devices 11D01 concurrently connected to the GVN with similar software and configuration with a differentiating factor between Clients of unique device Identity, UUID’s, and also unique information per tunnel per Client.

[00106] Server Device 11D02 represents a device which will be listening for client connection attempts on specific IP Addresses and Ports. If the Client follows correct protocol and establishment sequence, and presents correct credentials and other security information, the Server will allow the Client to build a tunnel to it. There can be many Server devices 11D02 concurrently connected to the

GVN with similar software and configuration with a differentiating factor of unique device Identity, UUID's, and other unique information.

[00107] Tunnel Info 11S2 shows the information stored on a Client Device 11D01 and a Server Device 11D02. Each device can establish multiple tunnels and each tunnel will have its own set of Tunnel Information and Security Information. Some tunnel information sets may be used for building of current active tunnels and other tunnel info sets may be held in reserve for future tunnels.

[00108] Certain information between the C and S is equivalent such as a pass-phrase which one will present to the other, and other information will be different depending on applicability. Information requirements for building of a tunnel between two points can include: client / server topology and settings; IP and port of each end point to be used by the tunnel; tunnel metrics including MTU size, protocol, and other information used for its operations; keys, pass phrases and other information about security protections used for the tunnel; SSL certificates and other information for protecting the information exchange pre-tunnel UP; and other information. The information is shared between devices using specific API Action calls of the Neutral API of the GVN.

[00109] Before Tunnel 11S0 describes the process of receiving and sharing information between devices 11D01 and 11D02 and the repository 11D00 on SRV_CNTRL and back to devices 11D01 and 11D02. API Communication Paths API-CP0, API-CP2, API-CP4, and API-CP6 represent Request-Response information exchange with the arrows representing the direction of the flow of information from one device to another device.

[00110] Server 11D02 reports information to Receive Info C-0 module of the SRV_CNTRL 11D00 device via path API-CP0. SRV_CNTRL 11D00 receives information from servers and stores relevant Identity, Tunnel, Current Load and other information in its repository. For example, algorithms and AI logic on SRV_CNTRL 11D00 analyze server load and based on current and anticipated demand from Client 11D01 devices, Server Availability C-1 matrix is updated. The Server Availability C-1 information may be conveyed by database replication through the API of the GVN to Clients 11D01 via Share Info C-6 module via API call path API-CP6, by direct file sharing via GVN, or other method.

[00111] Client 11D01 reports information to Receive Info C-0 module of the SRV_CNTRL 11D00 device via path API-CP2. This information will be stored in the repository of SRV_CNTRL 11D00. Specific tunnel information from a Client 11D01 can be shared with Server 11D02 by Share Info C-6 module via path API-CP4.

[00112] SRV_CNTRL 11D00 compiles a current List of Clients 11C-4 per server which it publishes to Server 11D02 via Share Info C-6 via path API-CP4.

[00113] If either Client 11D01 or Server 11D02 detects problems in establishment of tunnel utilizing current tunnel information, one or the other device can request a new set of tunnel information to be generated by SRV_CNTRL via API-CP2 or API-CP0 respectively. New tunnel info sets can be shared via Share Info C-6 with both peers in a peer pairing with Client 11D01 info sent via API-CP4 and Server D02 info sent via API-CP6.

[00114] The List of Clients C-4 and the current state of a Server 11D02 will have a direct impact on the Server Availability C-2.

[00115] Each Server 11D02 needs to organize, secure and coordinate its List of Clients C-4 which will attempt to build new tunnels to shared resources of Server 11D02. This information will be fluid and need to be updated regularly via secure API calls to SRV_CNTRL 11D00.

[00116] The need to securely harmonize info between devices is essential to protect the integrity of tunnels between them.

[00117] Tunnel Build S4 phase describes the process of tunnel establishment via Share Info C-6. Refer to Fig. 11 for the steps taken between Client and Server to build the tunnel. The path TP0 represents path between Client 11D01 and Info Exchange C-10 and from Info Exchange C-10 to Server 11D02 via path 11TP2.

[00118] Establishment Threats C-8 refers to threats to Info Exchange C-10 during tunnel establishment. If the signature of the tunnel type is visible, then there may be threats during the tunnel establishment C-8 such as fake Transport Layer Security (TLS) handshakes from illegitimate actors in the middle, TLS errors on handshake, Port and IP identification resulting in blocking or obstructing,

time outs due to filtering devices, reset packets sent by ISP or firewall or device in the middle, or other threats.

[00119] If the Info Exchange C-10 is successful, the Build Tunnel C-12 step will be taken with routes applied and other related actions to enable the tunnel TUN to be securely built between Client 11D01 and Server 11D02.

[00120] Tunnel UP S6 describes the period during normal flow of traffic through a tunnel. It is essential to convey information between devices and there exists a need on SRV_CNTRL 11D00 to manage unique info for various Client 11D01 and Server 11D02 devices, as well as for multiple tunnels to be built between them.

[00121] The exchange of information between devices has to be a regular occurrence as there exists a recurring need to make fresh, new dynamic tunnels. Some ports on an IP address may be blocked or become blocked and simply changing the port for that IP address will allow the tunnel to be built and for data to flow. Furthermore, each tunnel needs one or more unique ports per IP Address to avoid collisions between tunnels. When a Client 11D01 device requests new tunnel information to be created, a random port number is generated and the port availability for that specific IP address on the target Server 11D02 is checked against two or more factors including; if that port is already in use by an existing tunnel (either an operational one or one on standby which could be made operational), and if that port has been used by that specific Client 11D01 / Server 11D02 peer pair in the past and if it has been blocked. In both cases, a new random number will be generated. There are 65,536 ports available per IP address with a certain number reserved for specific services. A floor for example of 5,500 would leave available 60,036 ports which could be used by the random number generator with a min of 5001 and max of 65536. When a tunnel is dismantled and the port is marked as blocked for a peer pair, it is made available to other peer pairs to utilize. This freeing up of ports is necessary to avoid exhaustion of ports. Therefore the tracking IP and Port combinations by SRV_CNTRL 11D00 is essential.

[00122] A tunnel can help with its own establishment through steps but it also has limitations. While secure, most tunnels are visible during establishment. The handshake and signature of what kind of tunnel it is may be visible during operation. Manually set keys are cumbersome and not often

changed and if used for too long, the risk that they can be broken increases; therefore keys should be re-keyed with new ones on a frequent basis.

[00123] Automated systems need to ensure that information such as new keys, ports to IP Addresses and other info can be created and that this information is available to both sides of the peer pair so that tunnels can be built and rebuilt. Both sides have to be configured & ready to be able to build tunnels. Therefore, the exchange of info between peer pairs needs to be secure or integrity of the security of the tunnel itself is compromised.

[00124] While tunnel is up and pushing traffic, operational threats C-14 exist. The tunnel signature may be visible (e.g. if the tunnel is sniff-able and not obfuscated). The structure of the tunnel may be known if type of tunnel is able to be discovered. This risks the stream of packets being grabbed and brute force key breaking being used to decrypt the contents of the tunnel. Or a reset signal can break tunnel if the reset code or other tunnel control codes are known. Therefore to maintain tunnel security and integrity between Client 11D01 and Server 11D02 devices in a peer pair, the updating and sharing of information needs to be automated and secure.

[00125] The GVN structure allows devices to be enabled for automated secure tunnel establishment between peer pairs based on most current information. A combination of security features and methodologies offer self-reinforcing protections.

[00126] Fig. 12 illustrates, in accordance with certain embodiments of the disclosed subject matter, a process of building a tunnel. The example shown in Fig. 12 demonstrates managers, modules, processes, databases (Db), storage devices (HFS), paths and other features for the communication between three pertinent players in the tunnel building and managing process.

[00127] In this example, a single tunnel TUN0 12-CP80 is built between an end point device (EPD) 12-100 and an access point server (SRV_AP) 12-300. The tunnel is initiated by the Tunnel Manager (Builder) 12-D110 on the EPD 12-100. It “dials” a specific point on an IP address which is being listened to by the Tunnel Manager (Listener) 12-D310 on the SRV_AP 12-300.

[00128] The three main steps between the builder and the listener are the handshake (12-S1), the information exchange (12-S2) and the tunnel build process (12-S3).

[00129] There are also other communications paths described such as path 12-CP02 which could be a direct SSH or equivalent type of direct device-to-device communication.

[00130] An API path 12-PA1 between EPD 12-100 and a central control server (SRV_CNTRL) 12-200 and another API path 12-PA2 between SRV_AP 12-300 and SRV_CNTRL 12-300 can be utilized to securely share information about the tunnel, about the peers EPD 12-100 and SRV_AP 300, or other related information via SRV_CNTRL 12-300.

[00131] Within each device, the Tunnel Managers collaborate with other modules and managers such as Device Manager 12-D120 and 12-D320, as well as others.

[00132] Paths 12-TP01 to 12-TP02 between EPD 12-100 and SRV_AP 300 can represent another dedicated tunnel for information exchange in addition to the tunnel for data traffic TUN0 12-CP80.

[00133] Fig. 13 is a flowchart illustrating the logical used to assign a port to an IP address used to build a tunnel in accordance with certain embodiments of the disclosed subject matter. The flow takes into account various factors when selecting the port and IP address to use.

[00134] The first step is to gather parameters 13-010 for the port to IP address assignment by checking to see if desired port and IP_Address have been specified to be used by a specific device by its Device_ID, and other factors. The parameters also delineate a floor value and a roof value for port number, and more governing settings.

[00135] The “logic gate IP + Port specified? 13-020” step checks to see if there is a request for a specific port attached to a specific IP address for a server device by Device_IP.

[00136] If the port and IP address have been specified, then the availability for their use is accepted and logic follows path Yes 13-P022. If a preferential port and IP are not specified then logic follows path No 13-P030 to random number generator for a random port to be generated within range 13-030.

[00137] A lookup is done at step 13-050 to check against current and historical use (via path 13-B102 to Db Registry 13-B100) for that port to IP address mapping to see if the port is free or if it is currently in use. A secondary check is done by looking at historical use to see if it indicates if that port

and IP combination has been used in the past by this device or other devices, and if so, if that use proved to be relatively problematic. Some unstable or unreliable ports due to filtering or congestion through devices or other reasons can be marked as being problematic. If there is also a trend for blocking of problematic ports for other devices, then the port to IP address combination can be marked as unavailable.

[00138] If the port is not available at step 13-060, the process of generating a port to IP address mapping is restarted via junction point 13-012.

[00139] If the port is available, then the port to IP address will be assigned for use at step 13-100. This assignment will be saved in the Db registry 13-B100 via path 13-B112. Next, the Port to IP Address assignment is published via an API call 13-120 so that relevant devices know about the availability status of the port. The last step is to log the assignment 13-130 of port to IP address including the logic used and other factors which could assist in improving the efficiency of future port assignments.

[00140] Fig. 14 illustrates, in accordance with certain embodiments of the disclosed subject matter, the importance of a server availability list and how IP addresses and ranges are assigned for various devices. Although IPv6 offers a huge range of possible IP addresses, the IPv4 standard has a finite amount of both public and private IP addresses. This has an influence on which EPDs can connect which SRV_APs.

[00141] In this figure, EPD 14-100 builds tunnels with SRV_APs 14-300, 14-302 and 14-306. EPD 14-102 builds tunnels with SRV_APs 14-300, 14-304, and 14-308.

[00142] This example demonstrates how the internal IP range 10.10.191.0 through 10.10.191.255 can be used on two SRV_APs 14-302 and 14-304, and IP range 10.10.192.0 through 10.10.192.255 can be used on both SRV_AP 14-306 and 14-308.

[00143] Therefore for example, 10.10.191.18 can but used by EPD 14-100 to build a tunnel to SVR_AP 14-302 and at the same time 10.10.191.18 can also be used by EPD 14-102 to connect with SRV_AP 14-304.

[00144] EPD 14-100 and EPD 14-102 do not have to directly interact with each other to avoid conflicts because the server availability list published for each EPD in coordination with the TUN manager will assign IP address (internal and external) combinations for EPDs to connect with SRV_APs without any conflicts.

[00145] Fig. 15 illustrates, in accordance with certain embodiments of the disclosed subject matter, elements of a GVN Tunnel from LAN to EPD to SRV_AP to SRV_AP to EPD to LAN, including peering points between ISPs and network edges,. This illustrates an end-to-end GVN tunnel(s) between edges of two LANs via two SRV_APs and it also further illustrates more information about different Internet Service Providers (ISP) carrying traffic over certain portions of the Internet between EH-3 and EH-15.

[00146] EDGE-1 is the demarcation point for network access connection between the devices of LAN-1 and the POP of ISP-1. PP-01 is the point where peering occurs between the ISP-1 and ISP-2 networks. PP-02 is the point where peering occurs between the networks of ISP-2 and ISP-3. EDGE-2 is the demarcation point for network access connection between devices of LAN-2 and the POP of ISP-3.

[00147] Some advantages can be realized by placing SRV_AP-1 at PP-1 so that this SRV_AP directly can peer with both ISP-1 and ISP-2. More advantages can be realized by placing SRV_AP-2 at PP-2 so that this SRV_AP can directly peer with both ISP-2 and ISP-3. If the network of ISP-2 is not ideal, it is possible for traffic to be alternatively routed around ISP-2 by the GVN through another route or line or ISP or carrier.

[00148] The hop count through the neutral Third Layer of the GVN is eight. The distance between ISPs is not to scale. Furthermore, it is likely that there could be more hops within the network of an ISP but for simplicity sake, the quantity illustrated has been limited.

[00149] Fig. 16 illustrates, in accordance with certain embodiments of the disclosed subject matter, a multi-perimeter firewall (MPFW) in the cloud supporting a personal end point device. This figure shows portable devices which would hook into the GVN from a mobile location and where 16-M1 boundary is the edge between a personal area network (PAN) 16-010 and the GVN.

[00150] This figure shows the topology of a personal end point device (PEPD) 16-130 with some of its connectivity and other functionality distributed in the cloud. This figure further describes firewall operations distributed into the cloud along with those other operations performed in the cloud on behalf of a local device such as a personal end point device (PEPD) 16-130. Where a PEDP 16-130 is a less powerful and more portable device than an end point device (EPD), it can still take advantage of the personal area network connectivity afforded by a GVN, including features such as advanced smart routing (ASR), multi-perimeter firewalls, and more.

[00151] The key point illustrated is that the personal device spreads its need for processing power into the cloud. The modules residing on the PEPD include hardware components for processor CPU 106, memory RAM 108, and network interface NIC 102. The operating system is a minimal O/S 110 to provide a platform for system software System SW 112 and a Connectivity 172 module. This basic configuration is enough to allow the PEPD 16-130 to build a tunnel 16-TUN2 between itself and an access point server SRV_AP 16-300.

[00152] The component parts at the SRV_AP 16-300 hardware components for processor CPU 306, memory RAM 308, and network interface NIC 302. The operating system O/S 310 is a more extensive install than O/S 110. O/S 310 provides a platform for system software System SW 312 and a Connectivity 372 module for the SRV_AP 16-300. Advanced smart routing (ASR) 350 module and other modules 370 offer functionality both to the SRV_AP 16-300 and to the connected PEPD-16-130.

[00153] The PEPD 16-130 may be dependent on the tunnel 16-TUN2 to be up and able to carry traffic to realize cloud based ASR, FW and other operational functionality.

[00154] Fig. 17 illustrates, in accordance with certain embodiments of the disclosed subject matter, how tables on the databases of various GVN devices are related to each other and in which way they interact. For example, the repository database DB_2300 on the SRV_CNTRL has various tables on it related to devices and the interaction between devices via the neutral API mechanism (NAPIM) of the GVN. Tables such as Device Registry DBT_2310 in database DB_2300 is designated as REPO_ACTIVE which means that it receives information from many sources, is read/write and is able to be queried as the source of information for selective or full replication to tables such as Device Identity DBT_2102 as a part of the database EPD Local Db DB_2100. This table DBT_2101 has the

designation SEL_REP+W which allows for selective replication from DBT_2310 as well as for it to report relevant identity back to the device registry.

[00155] The control and release of information is governed by data managers. Database table type designators include REGULAR for normal, read/write tables, as REP_INFO for read only, replicated tables, as SEL_REP read only, partially replicated tables with only related rows, as REPOS_ACTIVE a table combined from all sources on repository for device registry DBT_2310 such as identities. Other possibilities include LOGGING from source tables to be combined on the database DB2800 on SRV_LOGS. These designations for tables are for example only and may be different in real world use and there are many more tables and other types based on use.

[00156] Fig. 18 shows, in accordance with certain embodiments of the disclosed subject matter, a block diagram of technology used by and enabled by a global virtual network (“GVN”) including the GVN core elements G0, GVN modules G100, and technology enabled G200 by the global virtual network GVN. The GVN core includes an overview of the mechanism G1 and its constituent component parts of Topology G2, Construct G3, Logic G4, and Control G5 layers. The GVN core G0 also incorporates the relations to and with GVN Elements G6.

[00157] The GVN can include plug-in and/or stand-alone GVN modules G100 including but not limited to: Neutral API Mechanism (“NAPIM”) G102, described in PCT International Application No. PCT/US16/12178, which is incorporated herein by reference in its entirety; Geodestination (“Geo-D”) G104, described in PCT International Application No. PCT/US15/64242, which is incorporated herein by reference in its entirety; Advanced Smart Routing (“ASR”) G106, Connect G108, and other modules G110 described in U.S. Provisional Application US62/151,174, which is incorporated herein by reference in its entirety.

[00158] The GVN also provides a platform which can enable other technologies including but not limited to: Network Tapestry G202; MPFWM G204; Network Slingshot G206; Network Beacon G208, Granularity of a tick G210, and other technologies G212. These are described in in U.S. Provisional Application 62/174,394 and U.S. Provisional Application 62/266,060, which are incorporated herein by reference in their entireties.

[00159] GVN Modules (G100) and Technology (G200) enabled by GVN can operate on top of an existing GVN, as a component part of a GVN, or can be independent and utilize all or some isolated parts of a GVN to support their own stand-alone operations.

[00160] Fig. 19 illustrates, in accordance with certain embodiments of the disclosed subject matter, three devices that work together to provide geographic destination services to a client to optimize the retrieval, transfer, and serving of content from servers located in a remote location.

[00161] The devices are an end point device (EPD) 19-100, an access point server (SRV_AP) 19-300, and in a supporting capacity, a central control server (SRV_CNTRL) 19-300.

[00162] A content delivery agent (CDA) 19-D120 operates on the EPD 19-100, and a content pulling agent operates on the SRGV_AP 19-300.

[00163] The CDA 19-D120 coordinates with the advanced smart routing (ASR) 19-D102 module on the EPD 19-100 as well as with the cache manager 19-D130.

[00164] CPA 19-D320 communicates with the URL lookup and DNS cache manager 19-D310 and it directly provides instructions and receives information from the Remote Fetcher BOT (RFBOT) 19-D328, as well as coordinating its actions with the cache manager 19-D330 on the SRV_AP 19-300.

[00165] The CPA 19-D320 receives instructions from the CDA 19-D120 to contact a content server to retrieve content from a target server.

[00166] Fig. 20 further illustrates the operation of the three devices described in Fig. 19 in accordance with certain embodiments of the disclosed subject matter. The three devices, which constitute a geographic destination mechanism, include an end point device (EPD) 20-100, an access point server (SRV_AP) 20-300, and a central control server (SRV_CNTRL) 20-200.

[00167] The content pulling agent (CPA) 20-D320 receives instructions from the content delivery agent (CDA) 20-D120 that the Client 20-800 connected to the EPD 20-100 has requested geographic destination fetching and retrieval of content from a content server 20-600 that is located in the region where the SRV_AP 20-300 resides.

[00168] The CPA 20-D320 receives the instructions from the CDA 20-D120 to fetch content from a URL. The CPA 20-D320 passes this information to the remote fetcher BOT (RFBOT) 20-D328 to do a lookup of the URL to see if its DNS information is locally cached at 20-D310. If it is cached and the information is not stale, then the cached information is used. If the information is not in the cache, or if it is stale, a fresh lookup will be made to DNS server 20-604. The results will be returned and stored in 20-D310. The RFBOT 20-D328 notifies the CPA 20-D320 that it has successfully obtained DNS information. The CPA 20-D320 instructs the RFBOT 20-D328 to contact the content server 20-600 and it fetches the content file(s) from that server. The RFBOT 20-D328 passes the content to the CPA 20-D320 for parsing to seek for more content links which are embedded in the fetched content. The CPA 20-D320 then collaborates with the URL Lookup and DNS cache manger 20-D310 and as well as with the RFBOT 20-D328 to fetch information about the network coordinates of the server(s) where the other content resides. For examples, an assets server 20-602 may host images, CSS, JavaScript, and other related assets files. Streaming files may be served from streaming specific servers 20-606, files may be served from file servers 20-610, and included content from third parties will be available from their servers 20-608.

[00169] Fig. 21 is an exemplary embodiment which continues to describe the operation of a geographic destination mechanism further explaining the retrieval of a series of files from various types of servers, the clumping together of the retrieved files and the subsequent transmission from the access point server (SRV_AP) 21-200 to the end point device (EPD) 21-100.

[00170] After the content files are successfully retrieved by the RFBOT 21-D328, they are passed to the Cache Manager 21-D330. The information about each file as well as the manifest of all of the files retrieved is analyzed by the content pulling agent (CPA) 21-D320. This information is conveyed to the cache manager 21-D330 as well as to the cache manager 21_D130 on the EPD 21-100.

[00171] The manifest of content file information is further shared with the content delivery agent (CDA) 21-120 on the EPD 21-100. The CDA 21-120 communicates with the cache manager 21-130 to expect and receive the clump of files from 21700 to be de-clumped and individually served from a local host on the 21-100 to serve clients connected and in close proximity to the EPD 21-100.

[00172] In many respects, this operates like a reverse of content delivery network.

[00173] Fig. 22 illustrates the prior art of how geocasting works within a content delivery network (CDN) where a server in one region S 22-00 has content like streaming video that clients located in another region such as C 22-20, C 22-22, and/or C 22-24 desire to retrieve said content. There are bandwidth and latency issues that impede the transporting of the information over a long distance from S 22-00 located in one region to the clients in another region.

[00174] To mitigate the negative effects, the owner of S 22-00 may set up a geocasting server (GS) such as GS 22-10 to buffer content from S 22-00 or act as a streaming reflector for live streams from S 22-00 to be efficiently served by GS 22-10 to the clients C 22-20, C 22-22, and/or C 22-24.

[00175] Fig. 23 illustrates the analysis and interpretation of periods of tick cycles. Artificial intelligence can assist in future calculations to estimate how long the processing and post processing times of a tick will take based on quantities of items to process taking into account system resources and other factors.

[00176] Per period calculated metrics with data from current period, short term and long term historical data can be plotted on a standard deviation curve based on the various cyclical trends. Notation of lows, highs, averages and other analysis can indicate whether current performance is in line with expectations or is better, worse, or otherwise different than previous experience.

[00177] This data gathering and contextual analysis assists artificial intelligence (AI) algorithms in decision making.

[00178] Current period 13-T08 can be compared with short term 13-T18 and long term 13-T28 performance data.

[00179] Fig. 24 describes how a description of two different sets of data can provide information when comparing various dissimilar data sets in accordance with certain embodiments of the disclosed subject matter.

[00180] A key point is that while Group 1 has A, B, C, D, and F sets of data, Group 2 contains data sets A, C, D, and E. Information from the direct comparison where there is an overlap for sets A, C, and D can provide a contrast or corroboration of characteristics of the sets being compared.

[00181] And a comparison of the results of B set against E set may also provide insight into differences and alternatives which could be considered.

[00182] An intelligent algorithm which will be presented with different sets of data at different times needs to be able to compare sets which overlap between groups as well as being able to take into account how to analyze sets which are in one group and not in the other group, and to weight this into the results.

[00183] Fig. 25 illustrates, in accordance with certain embodiments of the disclosed subject matter, the integration of a multi-perimeter firewall with other systems in a GVN. Acts of information warfare are always occurring. Whether they are by nation state, by corporate players, hackers, or other actors, these attacks are relentless and according to trends, the threats are increasing. Utilizing the topology described herein, there exists the possibility to integrate information about live attacks which is detected by passive firewalls or other such monitoring middle devices on the internet aggregated and reported by security provider companies or organizations. Whether the nature of the attack is an intrusion, phishing attack, attempt to steal intellectual property, DDoS attack, or other threat known or unknown, the key point is to protect one's network.

[00184] Fig. 25 shows request / response (REQ / RESP) API loops between various devices. These information loops can share information that a cloud firewall such as CFW-DPI 25-142LB or CFW-SPI 25-144LB learns about traffic flowing through it which is reported to SRV_CNTRL 25-200. The information loops can share information about attacks in other localities by passing information from SRV_CNTRL 25-200 to the cloud firewall such as CFW-DPI 25-142LB or CFW-SPI 25-144LB. Furthermore the information stored in the database Db 25-B200 on SRV_CNTRL 25-200 can also contain heuristic patterns, signatures of known threats, as well as information from global internet monitoring feeds to be shared. Visibility for a human administrator can also be made available from a hosted instance on EPD 25-100 via a graphic user interface (GUI) on the Client 25-018 via path 25-GUI-AJAX.

[00185] The flexibility of this information exchange topology also allows for performance monitoring, billing module for cloud-based scalable use of firewall resources, systems administration, and other purposes.

[00186] A graphic user interface (GUI) hosted on either the end point device (EPD) 25-100 or on the central control server (SRV_CNTRL) 25-200 can provide information about the operations of the firewalls and also offer point and click control surfaces for users to utilize.

[00187] Fig. 26 illustrates, in accordance with certain embodiments of the disclosed subject matter, two paths – one through the open Internet as well as another path which is a combination of network optimized traffic via global virtual network (GVN) segments over the top (OTT) of the base Internet combined with open Internet segments.

[00188] One path is through the open Internet from hop P0-1 through P0-14 via Internet local 26-CPT140 to Internet trans-regional 26-CPT340 to Internet local 26-CPT240.

[00189] The other path is also from hop P0-1 through P0-14 but differs from the previous path as it goes from tunnel OTT last mile to GVN's SRV_AP 26-CPT100 to long distance connectivity via GVN tunnel 26-CPT300 to EIP to target via Internet in remote region 26-CPT200.

[00190] Metrics about each block of network segments such as a measure of time $\Delta t = 26\text{-TZ ms}$ for long distance connectivity via GVN tunnel 26-CPT300 offer a quantifiable value which can be compared. Algorithmic analysis can compare paths such as starting at 26-D00. One analysis of Measure Internet QoS 26-D10 can look at the end-to-end open Internet path and the other can look at Measure GVN QoS 26-D20. A compare and contrast evaluation is run at Connectivity Internet vs GVN 26-D30.

[00191] If the open Internet is better (26-DP40), then that path is used. If the GVN optimized path is better (DP-DP50), then that is used. This is only one embodiment for illustration purpose and is not limiting.

[00192] Fig. 27 illustrates a GVN using hub and spoke topology with a backbone and octagon routing in accordance with certain embodiments of the disclosed subject matter. Fig. 27 shows the network topology of a GVN in two different regions 27-RGN-A and 27-RGN-B and how the regions are connected via paths 27-P0A and 27-P0B through global connectivity 27-RGN-ALL. In addition, Fig. 27 shows the hub & spoke connections in each of the two regions.

[00193] SRV_BBX 27-280 and SRV_BBX 27-282 are backbone exchange servers and provide the global connectivity. SRV_BBX may be one or more load-balanced servers in a region serving as global links. Access point servers (SRV_AP) 27-302, 27-304 and 27-306 in 27-17-RGN-A connect to SRV_BBX 27-280. The central, control server (SRV_CNTRL) 27-200 serves all of the devices within that region and it may be one or more multiple master SRV_CNTRL servers. End point devices (EPD) 27-100 through 27-110 will connect with one or more multiple SRV_AP servers through one or more multiple concurrent tunnels.

[00194] This figure also shows multiple egress ingress points (EIP) 27-EIP420, 27-EIP400, 27-EIP430, and 27-EIP410 in each region as added spokes to the hub and spoke model with paths to and from the open internet. This topology can offer EPD connections to an EIP in remote regions routed through the GVN. In the alternative this topology also supports EPD connections to an EIP in the same region, to and an EPD in the same region, or to an EPD in a remote region. These connections are securely optimized through the GVN.

[00195] Fig. 28 illustrates, in accordance with certain embodiments of the disclosed subject matter, a distributed end point administrative cluster (DEPAC) 28-800 which can be virtually constructed within a global virtual network (GVN) 28-000 or other similar topology.

[00196] Traffic between devices is carried within encrypted tunnels and these tunnels join devices together into a broader network over the top (OTT) of the base Internet.

[00197] There are two types of end points described herein, an end point device (EPD) such as 28-120 behind which is a local area network (LAN) or a portable end point device (PEPD) such as 28-150 behind which is a personal area network (PAN).

[00198] Other devices described herein are access point servers (SRV_AP) such as 28-308 and a central control server (SRV_CNTRL) 28-200.

[00199] This topology offers security both for traffic through the tunnels as well as by concealing the IP address of the device as its traffic egresses to the Internet via a remote egress ingress point (EIP).

[00200] Best and most efficient routing for traffic within a GVN 28-100 can be routed by an advanced smart routing (ASR) mechanism.

[00201] Fig. 29 illustrates the logical construction of a series of tests to be run on the Internet testing various ports and IP addresses in accordance with certain embodiments of the disclosed subject matter. It allows for a specification of a range of ports to run on a specific IP Address via data array 29-BT030.

[00202] A counter keeps track of tests 29-030. The results of each test are saved in an array 29-090 which is then returned and logged at step 29-800.

[00203] This algorithm can be used to test inventory of available IP and Ports assigned for production, to test and analyze IP and Port performance to the same access point server (SRV_AP) to compare them. It is useful to look at the results of current tests versus the performance logs of production connectivity both to establish a baseline and to assess whether tests results are within an expected performance range. And also to monitor network connectivity during tests to make sure tests do not affect performance of other connectivity.

[00204] Fig. 30 illustrates a mechanism for logging of connectivity traffic activity between various devices operating in a global virtual network (GVN) or other similar topologies in accordance with certain embodiments of the disclosed subject matter. Such devices can include an end point device (EPD) 30-100, and access point servers (SRV_AP) 30-300 and 30-320.

[00205] A meter point of logging (MPoL) on network interfaces and virtual interfaces and tunnel interfaces logs both inbound and outbound traffic for each device.

[00206] So for example the tunnel TUN0 30-T00 between EPD 30-100 and SRV_AP 30-300 has four such points of logging: on EPD 30-100 MPoL (inbound) 30-108 and MPoL (outbound) 30-106 and on SRV_AP 30-300 MPoL (inbound) 30-308 and MPoL (outbound) 30-306.

[00207] There exists a direct relation between the outbound MPoL on one device and the inbound MPoL on the device to which it is connected.

[00208] So for example, the outbound MPoL 30-306 on SRV_AP 30-300 measures traffic sent to the EPD 30-100 and the direct correlation via path 30-P108 to the inbound MPoL 30-108. The

aggregate totals of traffic sent can be compared to the amount of traffic received on the other end. The amounts should be equal to each other. If the amount received is less than the amount transmitted, then this indicates loss. From a fairness perspective on a consumption billing mechanism, if traffic is billed on the EPD 30-100, it should be based on the traffic received on the inbound 30-108. Conversely traffic that reaches the SRV_AP 30-300 from the EPD 30-100 should be billed based on the amount received by the inbound MPoL 30-308 on the SRV_AP 30-300.

[00209] If a situation exists where the traffic received on an inbound MPoL is greater than the traffic sent its corresponding outbound MPoL, this can indicate either an error or a malfunction or a data injection by a malicious player in the middle.

[00210] The difference between a bandwidth (BW) billing model and a consumption (CONS) billing model are that in a Bandwidth Model 30-1008, the traffic may be shaped to an amount which is less than the carrying BW capacity of the line 30-1002. Conversely in a consumption based model there is no shaping of the BW and the max bandwidth 30-1086 may actually exceed the rated BW carrying capacity of the line 30-1002.

[00211] The advantages of a BW model 30-1008 are that unlimited data traffic up to the amount in Mbps of the paid BW tunnel. There is a relatively high cost barrier for this and the actual utilization is usually only during certain hours with wasted capacity at other times.

[00212] The advantages of a CONS model 30-1088 are that there is no throttling of tunnel so it can reach or even exceed the rated BW carrying capacity of the line. This model is advantageous because data will transfer as fast as possible and it is billed on a pay as you go basis. And paid by the gigabyte GB transferred it can offer a low barrier to entry for consumers.

[00213] Fig. 31 illustrates the traditional thick stack 31-20 layered access between the application layer 31-800 and a network interface card (NIC) 31-000 as compared to a thin stack approach 31-10 which directly accesses the NIC 31-000 in accordance with certain embodiments of the disclosed subject matter.

[00214] The advantages of a thin stack over thick stack are that it is faster, consumes less resources, and therefore can process relatively more network connectivity interactions.

[00215] Fig. 32 illustrates a simple example databases schema for relating and storing connectivity information from both tests and production environment usage.

[00216] Those experienced in the art will see its advantages. The tables, the fields, labels and other information are provided for reference only and may differ in the various production deployments.

[00217] The Server Availability 32-280 module examines current allocation of IP address and port combinations while taking account actual use, load, and other factors of the live production environment. It further analyzes the potential impact of assigned but standby allocations to predict the impact of those resource demands going live.

[00218] When a device makes a request to the server availability module, what it is really asking for is a list of available servers, and specifically an IP and port which it could utilize to in the present or in the future to build a tunnel to. Each tunnel has specific information which needs to be known to each pair in the tunnel building process as defined by tables under Tunnel information 32-220.

[00219] The list of server availability is tied to Connectivity Info used to make tunnels 32-210 by both device ID 32-P288 and device type ID 32-P220.

[00220] The Peer_Origin_ID refers to the ID of the originating device making the tunnel.

[00221] The Peer_Target_ID refers to the ID of the listening device to which the tunnel will be made. In most cases, Device_ID field in the array 32-BT020 is equivalent to the Peer_Origin_ID field in the 32-BT020.

[00222] The List of Server Availability is therefore a list which can be utilized by all devices but for which a contextual list for one certain device is easily retrieved with contextual records relevant to it. The field Flag_State in array 32-BT020 is significant because it can indicate the state of this information, if it is unused, in production, retired, blocked or otherwise marked.

[00223] The server availability mechanism 32-280 considers many factors balancing demand for resources by clients such as EPDs wanting to building tunnels against available resources of SRV_AP's which they would connect with.

[00224] This governing mechanism ensures that automatic jumps of tunnels from many EPDs to one specific device do not occur. For example, if all EPDs share the same list of server availability, without an influence on how an EPD picks which servers to connect with, there are scenarios where too many EPDs connect with some SRV_APs and too few to others. And when the EPDs connected to the oversaturated SRV_AP realize that they are receiving less than optimal connectivity, if they share the same list, by jumping to the next server on the list, they will be causing a wobbly shifting of the problem down the line.

[00225] Server availability addressing this sort of scenario by ranking best SRV_APs in order contextually for that specific EPD, and when generating the list, taking into account a holistic view and predictively spreading load in anticipation of demand pressures on the production environment.

[00226] Fig. 33 illustrates, in accordance with certain embodiments of the disclosed subject matter, the usage of custom commands that act as a defensive cushion between a trigger on an application layer such as a button clicked on a graphic user interface and the deep logic and commands to be run as a result of the trigger.

[00227] The deeper a trigger's code execution can penetrate, the more risk of compromise to the system. This presents a conundrum because on one hand, an unprivileged client should not have deep access. Yet, certain scripts that a user will want to trigger will need to delve deep or they will be rendered moot and not take effect when executed.

[00228] This figure has sufficient labelling so that a reader with reasonable skill in this area will be able to understand the information flow.

[00229] The step executing custom command 33-200 presumes that the triggering user has limited rights only to the Custom Commands 33-L20 execution level and not below. These limited rights preclude the ability to run sensitive commands, to access deep folders or files, or otherwise harm or penetrate deeper levels of the system. The path 33-P150 to "custom command is privileged to call deeper scripts and commands 33-D150" defines a sequence and series of steps that will allow the specific custom command to run the intended specific functionality in a safe and secure manner.

[00230] At "O/S installed packages + configs" 33-12, the embedded commands within the custom command may be able to evoke control over deep O/S level functionality but in a controlled

manner. The lowest possible level commands may also be evoked but in a controlled manner and only based on the contents of an untampered custom command.

[00231] Therefore, the triggering user cannot dig deeper than 33-L20 and has no right to call sensitive commands, however by the action of calling a custom command to which they are allowed access, the contents of the custom command file can be run at an elevated rights state without compromising the security of the system, with only the calling and potentially the result of the custom command being available to the triggering client 33-800.

[00232] Fig. 34 is a simplified description of the modules on related devices in a geographic destination mechanism within a global virtual network (GVN) in accordance with certain embodiments of the disclosed subject matter. It describe interaction between content delivery agent (CDA) and the content pulling agent (CPA).

[00233] While the CDA and CPA and associated modules are designed to run independently, there exists a flow of information between them which trigger operations of each.

[00234] For example, the ASR module on the EPD 34-D120 will be able to advise the CDA 34-D110 that a URL is to be fetched from the remote region where the SRV_AP 34-300 is located. The CDA 34-D110 will communicate with the CPA 34-D310 via path 34-CP310 that it desires the geographic destination mechanism to fetch this content and all associated content at that URL from the remote region.

[00235] The CPA 34-D310 instructs the remote fetcher BOT (RFBOT) 34-D312 to do a look-up at 34-D350 to find the exact target server and to have the RFBOT 34-D312 fetch that content. CPA 34-D310 parses the content for embedded links to more included content which it then asks the RFBOT 34-D312 to fetch.

[00236] The subsequently pulled content is inventoried by the CPA 34-D310 for two purposes. First is to send the manifest and the retrieved data to the cache manager 34-D330, as well as a copy of the manifest back to the CDA 34-D110.

[00237] This collaboration is useful because the CDA 34-D110 is able to coordinate with the cache manager 34-D130 to expect the receipt of the fetched data and can compare the data received

against the manifest created by the CPA 34-D310. There are efficiency gains realized by this controlled approach as well as security advantages because the received data must match the manifest or red flags could trigger scrutiny of either possible malfunction or malicious man-in-the-middle type of data alteration attack.

[00238] The SRV_CNTRL 34-200 is useful as a neutral channel for information conveyance between devices, and also for holistic management of the chained caches on various devices.

[00239] Fig. 35 illustrates, in accordance with certain embodiments of the disclosed subject matter, a few ways how a portable end point device (PEPD) such as 35-150 or 35-152 might connect to a global virtual network (GVN) 35-000 or similar topology. In this example, the PEPD 35-150 has multiple connection options to three different devices. First to two different access point servers (SRV_AP) 35-304 via paths 35-T10B to 35-T10A in a region close to it, as well as to SRV_AP 35-300 in another region via paths 35-T12A to 35-T12B. A third option for PEPD 35-150 is to EPD 35-100 via 35-T12A to 35-T12C.

[00240] The PEPD may connect to as many SRV_AP servers as its resources and its rights via a server availability mechanism permit. However, for a PEPD 35-150 to connect to an EPD 35-100, they must have a relationship between them such as what would exist if both belonged to the same distributed end point area cluster (DEPAC) and rights were granted for the PEPD to connect to that EPD.

[00241] Fig. 36 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationship between a portable end point device (PEPD) 36-150 and an access point server (SRV_AP) 36-300. It further describes some of the modules on each of the aforementioned devices. The PEPD 36-150 will typically have a comparatively smaller amount of physical resources such as processing power 36-106, RAM 36-102, storage 36-H100, and other system attributes. An SRV_AP 36-300 can be a cloud based dynamic virtualized instance offering huge amounts of RAM 36-302, processing power 36-306, storage 36-H300, and other resources.

[00242] The PEPD 36-150 will typically have a minimal operating system 36-110, simple security suite 36-114, minimalized system software 36-120 and generally a small footprint. This

barebones approach ensures that there exists a balance between functionality required and other related factors such as cost, battery consumption, physical size, and more.

[00243] One solution is for a virtual software container 36-160 to be available on the PEPD 36-150 which is able to either download and run software locally, or to act as a hook point for a symbolic link between local system and software run on a remote location such as on the SRV_AP 36-300.

[00244] This arrangement is possible and secured by a tunnel TUN0 between the two devices through which not only data traffic can flow through but also software commands, queries, results, and other functionality which can be remotely run.

[00245] There exist several advantages to this approach as mentioned but others may also exist.

[00246] Fig. 37 illustrates, in accordance with certain embodiments of the disclosed subject matter, some of the different types of extensible software that may be run on a portable end point device (PEPD) 37-150 where the software is stored on a remote device such as an access point server (SRV_AP) 37-300 to be sent from 37-158 to the PEPD 37-150.

[00247] The first type is core software stored and running on the PEPD 37-150 such as software downloaded and locally executed 37-1520. Another type is remotely run distributed software 37-1300 which tethers the PEPD 37-150 to an SRV_AP 37-300 where the software is run.

[00248] There exist many advantages to this mechanism, including efficient use of PEDP resources, as well as ensuring that the most recent version of software is up and running.

[00249] Another element is the protection of the intellectual property of the producer of the software due to the fact that some physically lives in one location and run with results used by a software hook point in another location. In such a topology, both devices would have to be accessed to have visibility to the complete framework, codebase, and run-time attributes.

[00250] Fig. 38 illustrates, in accordance with certain embodiments of the disclosed subject matter, multiple tunnels between devices within a global virtual network (GVN) across multiple regions. The EPD 38-100 is in one location 38-M0. SRV_APs in region 38-M2 include SRV_AP 38-300, SRV_AP 38-302, and SRV_AP 38-304. SRV_APs in region 38-M3 SRV_AP 38-310, SRV_AP 38-312, and SRV_AP 38-314. Advanced smart routing (ASR) is used to manage routing over the

multiple tunnels and paths between the EPD 38-100 and the various SRV_AP devices. ASR can mitigate the risk of looping, wrong geographic destination routing, ASR remote redirect backtrack, broken links between SRV_APs, regions, and other problems.

[00251] Fig. 39 illustrates, in accordance with certain embodiments of the disclosed subject matter, the framework for a common code base to be utilized by various types of devices, with each having their own attributes/type and identity.

[00252] A hardware UUID 39-110 utilized by a device identity module 39-100, related to device related records stored in a database 39-B100, and calling an identity class 39-120 sets up many different contextual relationships for that specific device.

[00253] Within the scope of a common code framework, by a device knowing about its own identity from a few sources via 39-100, it can glean many things such as its role 39-310, its type 39-300, which elements of the base code pertain to it 39-200, which applications it should load and execute 39-800.

[00254] Knock on logical next steps are that by knowing device type 39-300, device type specific modules 39-320 can be loaded, and these along with device role 39-310, can trigger O/S specific modules to be loaded 39-500 to sustain operations for that type of device.

[00255] Device type 39-300 and role 39-310 also have impact on peering peer pair relationships 39-520, as well as on operations and integration 39-600.

[00256] Once the environment specific to that device is operational, applications 39-800 can be run contextually for that specific device.

[00257] It should be evident to readers with sufficient skill in this area.

[00258] Fig. 40 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationships, interaction, and relevance of data to various devices within a global virtual network (GVN).

[00259] The Port and IP Address Manager 40-200 will use various data about tunnels 40-270, about servers 40-220, and other factors to assign resources for server availability 40-260 to then utilize and dole out to various devices.

[00260] There are logical relationships between data such as a list of Devices 40-110, and Servers 40-220, and how modules interact with each other to use this information.

[00261] Internal Subnet Manager [EPD_subnets]+[SRV_AP subnets]+[Infrastructure subnets] 40-300 uses this information to both calculate subnet ranges which could be used while avoiding conflicts and also “reserving” ranges to ensure no future conflicts; both in automatic settings and also in messaging to administrators regarding use.

[00262] The global virtual network (GVN) relies on various devices which work together to weave together a network type over the top (OTT) of the Internet. A registry 40-B100 keeps track of devices, of their relationships, their specifications, their type, and other factors. Core elements of the system include modules and managers that work together to construct and efficiently manage the GVN construct.

[00263] The advanced smart routing (ASR) Manager 40-500 looks at both the base internet connectivity as well as the network within the GVN layer OTT the internet. In order for automated systems to operate efficiently and effectively, Port and IP Address Manager 40-200 and Internal Subnet Manager 40-300 interact with various other modules.

[00264] Server Availability 40-260 looks at the tunnels 40-270, their IP and port use 40-276, reviews connectivity tests 40-158, both current and historical, calculates port availability based on usage per IP Address, the IP addresses assigned to servers 40-122, devices 40-210, and other factors to manage how server resources are utilized and assigned.

[00265] The server availability module’s main benefit is to catalog the resources usage, IP addresses and ports of access point servers (SRV_AP) and to look at which devices 40-210 such as end point devices (EPD) that would like to connect to SRV_AP’s to build tunnels (TUNs) 40-270 with them. The server availability module calculates and compiles a custom-made list of IP Addresses and Ports which are contextually designed to provide best options for EPD’s to utilize. The tunnel registry 40-150 allows Server Availability to review Db: Connectivity Tests 40-158 and based on current and

historical conditions to weigh and rank best connectivity options for both tunnels 40-270 to be built and for routing via ASR 40-500.

[00266] Distributed end point administrative clusters (DEPAC) 40-250 are an extension of the construct of a GVN. DEPACs allow for the linking of the local area network (LAN) and personal area network (PAN) subnets behind EPD and portable end point devices (PEPD) 40-210 into a broader connected network by joining the subnets together 40-300. The Internal subnet manager needs to positively know about EPD subnets, SRV_AP subnets for tunnels, and other related infrastructure subnets 40-300, so that when it assigns new ones and stitches an edge of one subnet with another one into as broader fabric, by knowing about ones currently in use, it ensures that there are no conflicts of overlapping assignments of subnets.

[00267] The Db of IP address assignments 40-120 provides the information to be used by the internal subnet manager 40-300. The DEPAC clusters 40-250 have member devices 40-210 and each device has an identity 40-212 unique to it.

[00268] There are also relationships between Users 40-280, and devices 40-210 based on device identity 40-212 governed by an identity class or similar logic 40-282. Users can therefore administer DEPAC clusters.

[00269] The described topology allows for automatic and manually assisted construct of tunnels 40-270, with efficient routing thanks to ASR Manager 40-500, and other factors.

[00270] If a device is malfunctioning, needs to be updated, is oversubscribed, or is in another state which is not optimal, a device flag 40-112 for that device can be set to something other than “available” so that the Server Availability module 40-260 can know that that device is not available to be assigned to new server availability lists which would be published to other devices to utilize.

[00271] Other benefits are that analysis of historical use can be compared with current conditions and AI algorithms used to make decisions pertaining to routing, to resource allocation, and other factors.

[00272] Centralized real-time monitoring of connectivity, resources use, and other factors is made possible by accessing the data in the database registry 40-B100 and displaying it in a GUI.

[00273] Administration is made easier by automated systems which utilize information provided by GVN modules and managers to build and manage elements of the construct.

[00274] Deep analysis is possible for traffic flow, paths as set by ASR, server availability 40-260 and other modules not displayed here. This not only facilitates visibility on past and current use, but can serve as a basis for predictive cognitive analytics of how a future connectivity will operate.

[00275] Fig. 41 illustrates, in accordance with certain embodiments of the disclosed subject matter, the topology of a global virtual network (GVN) over the top (OTT) of the Internet and various devices operating within it. Some examples of devices include end point devices (EPD) such as EPD 41-110, portable end point devices (PEPD) such as 41-152, access point servers (SRV_AP) such as 41-308, and central control server (SRV_CNTRL) such as 41-200, and more.

[00276] There are also egress ingress points (EIP) such as 41-318 between a GVN device such as SRV_AP 41-308 and the Internet such as 41-018.

[00277] In Fig. 41, there also exists another layer representing two independent distributed end point administrative clusters DEPAC0 and DEPAC2.

[00278] The members of DEPAC0 are PEPD 41-150, EPD 41-102, and EPD 41-106.

[00279] The members of DEPAC2 are EPD 41-100, PED 41-152, EPD 41-110, and EPD 41-108.

[00280] DEPAC members connect to each other through existing GVN pathways and only connect subnets together and link internal tunnels joining local area networks (LANs) and personal area networks (PANs) into a wider wide area network (WAN).

[00281] Fig. 42 illustrates, in accordance with certain embodiments of the disclosed subject matter, code both above the web root 42-Bound2 and below the web root 42-Bound0.

[00282] The bare minimum of code should be stored in files within folders which are directly accessible from the open internet below the web root 42-Bound0.

[00283] Sensitive files including configuration file, classes, functions, credentials, sensitive info, and other files are stored above the web root 42-Bound2.

[00284] While it may be argued that the server side script package (parser) 42-D110 should process the sensitive code within files when they are retrieved, there are instances when a malfunction or misconfiguration or hacking could allow the file to be downloaded which gives direct visibility to the embedded code which should have been executed.

[00285] The only server side code included in the files stored below should be relative links to files above the web root 42-Bound4.

[00286] The terms above and below refer to file paths such as:

/volume/folder/instance/code/secure/** secure folders and paths here

/volume/folder/instance/code/public/http/ALL_here_is_on_open_internet_HTTP

/volume/folder/instance/code/public/https/ALL_here_is_on_open_internet_HTTPS

The web root(s) in the above examples are:

/volume/folder/instance/code/public/http/

/volume/folder/instance/code/public/https/

[00287] Anything above those is only accessible from within the server, not reachable via internet. And all files and folders within the http and https folders are reachable.

[00288] Fig. 43 illustrates, in accordance with certain embodiments of the disclosed subject matter, algorithms incorporating information from external sources with AI knowledge learned internally.

[00289] The step Start checking veracity of Info 43-000 does so by source and type of info.

[00290] Defined patterns 43-102 can be validated by 43-P108 to become rules. Warnings 43-122 based on information from others may either be disregarded or they too could become rules 43-112.

[00291] Fig. 44 illustrates, in accordance with certain embodiments of the disclosed subject matter, a simplified representation of an approach to designing a smarter algorithm by taking into

account factors that one has and balancing against one's personal needs. In this "juices" example, the "blend something together 44-130" step can be described as a process which is important to focus on to achieve the desired result. The "analysis of needs met 44-140" determines if best result has been achieved if the process should run again with slightly different inputs and methods to get closers to desired result.

[00292] In some embodiments, based on haves and needs for best income, during the process elements may be utilized which are not incorporated in the product of the final process but still have an impact on the result. To extend the juice example out, a citrus peel can cheer a person up (e.g., the maker of the juice) when peeling the fruit but it is ultimately discarded and not used. Another example is that apple and orange are both good for one's health but citrus may not be ideal for someone with an acidity condition.

[00293] Key point is for an algorithm to be flexible and to take into account various conditions, processes, inputs, and outputs taking a holistic approach to evaluation.

[00294] Fig. 45 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device EPD 45-100, central control server SRV_CNTRL 45-200, and an access point server SRV_AP 45-300. This figure also illustrates database 5100 on EPD 45-100, database 5200 on SRV_CNTRL 45-200, repository database 5202 on SRV_CNTRL 45-200, and database 5300 on SRV_AP 45-300. The figure is hierarchical, with lowest level hardware devices at the bottom, and subsequent systems, components, modules and managers built on top of lower layers. Files and data are stored on the Hierarchical File System (HFS) attached storage devices 45-H100 on EPD 45-100, 45-H200 on SRV_CNTRL 45-200, and 45-H300 on SRV_AP 45-300. The components illustrated in these systems diagrams all operate independently but may also rely on information about other devices that they interact with.

[00295] RAM stands for random access memory, CPU for central processing unit (which can also include sub-processors), NIC for network interface card, Db for database software, DNS for domain name system, HOST for hosting software, API for application programming interface, ASR for advanced smart routing, GeoD for geodestination, GVN for global virtual network, CDA for content delivery agent, CPA for content pulling agent, and RF BOT for remote fetcher bot. There may be additional modules, managers, systems, or software components.

[00296] Fig. 46 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device EPD 46-100, central control server SRV_CNTRL 46-200, and an access point server SRV_AP 46-300. This figure further identifies subsystems for each device such as EPD sub-sys 46-1000 for EPD 46-100, SRV_CNTRL Sub-sys 46-2000 for CNTRL 46-200, and SRV_AP sub-sys 46-3000 for SRV_AP 46-300. Subsystems have been identified by function and are indicated with prefixes including FW for firewall related subsystems, TUN for tunnel related subsystems, VIF for virtual interface related subsystems, SRV_Avail for the server availability list and related subsystems, BUFF Mgr for buffer management and related subsystems, LOG for the logging module and related subsystems, and CONNECTIVITY for general connectivity operations.

[00297] Fig. 47 illustrates, in accordance with certain embodiments of the disclosed subject matter, some system modules and components for an end point device EPD 47-100, central control server SRV_CNTRL 47-200, and an access point server SRV_AP 47-300. Subsystems have been identified by function and are indicated with prefixes including Connectivity for general connectivity operations, ASR for advanced smart routing, API for application programming interface, LOG for the logging module and related subsystems, GeoD for the geodestination module and related subsystems, SRV_Avail for server availability list and related subsystems, Buffer for buffer management and related subsystems.

[00298] FIG. 48 illustrates a block diagram of an exemplary computing device 4800 according to certain embodiments of the disclosed subject matter. In some embodiments, the computing device 4800 can be any suitable device disclosed in the current invention. The computing device 4800 can include at least one processor 4802 and at least one memory 4804. The processor 4802 can be hardware that is configured to execute computer readable instructions such as software. The processor 4802 can be a general processor or be an application specific hardware (e.g., an application specific integrated circuit (ASIC), programmable logic array (PLA), field programmable gate array (FPGA), or any other integrated circuit). The processor 4802 can execute computer instructions or computer code to perform desired tasks. The memory 4804 can be a transitory or non-transitory computer readable medium, such as flash memory, a magnetic disk drive, an optical drive, a programmable read-only memory (PROM), a read-only memory (ROM), a random access memory (RAM), or any other memory or combination of memories.

[00299] In some embodiments, the memory 4804 includes a module 4806. The processor 4802 can be configured to run the module 4806 stored in the memory 4804 that is configured to cause the processor 4802 to perform various steps that are discussed throughout the disclosed subject matter.

[00300] Fig. 49 illustrates a process of the downloading of a file in a LAN as well as the downloading a file from the Internet in accordance with certain embodiments of the disclosed subject matter. It compares and contrasts the file served by EPD at LAN edge 49-880 to file served by remote server 49-840.

[00301] Downloading a file within a LAN 49-880 offers total control over firewalls, filtering, as well as relatively high bandwidth (BW), ultra-low latency, an a small number of hops, and other advantages.

[00302] Downloading from a remote server on the open internet has very little to no control over the path in the middle and there can also be filtering from firewalls or constrictions due to middle devices.

[00303] By optimizing the traffic in the middle, many issues get resolved. However, the download BW is still constricted by the last mile connection or the smallest peering point or network segment.

[00304] Therefore the download of file 49-810 from a remote server from a remote internet 49-050 will in most cases be slower than downloading a file 49-800 from the LAN 49-020.

[00305] Fig. 50 illustrates the operation of a file transfer manager (FTM) on an end point device (EPD) 50-100 and of an FTM 50-360 on an access point server (SRV_AP) 50-300 in accordance with certain embodiments of the disclosed subject matter.

[00306] The client 50-000 initiates the upload transfer of a file 50-800 to the server 50-350 via the path 50-P000 to LAN 50-020 to EPD 50-100 which routes the traffic through a global virtual network (GVN) 50-020 over an optimized, long distance 50-980 to SRV_AP 50-300 to 50-P050 to the Internet in the remote region 50-050 and on to the server 50-350 via path 50-P350. The server 50-350 accepts the connection from client 50-000 and begins the process of receiving the file in multi-part attachments sent within a stream of packetized payloads.

[00307] For files larger than a certain size set by a threshold parameter variable, the original upload stream of file 50-800 from the client 50-000 is detected at step 1 50-10 by the FTM 50-160 and this file stream is then captured and pulled into the file cache 50-180 on the EPD 50-100. As this network path is an extremely short distance with super-low latency 50-920, the remaining data in the file upload completes uploading very quickly thus reducing the upload time from the client's perspective. This has the advantage of freeing the client up. The FTM 50-160 maintains the stream of the upload to server 50-350 and sends this data from file cache 50-180 while receiving and after having already received the complete file, it continues the upload on behalf of the client until the upload is complete.

[00308] At step 1 50-10, the original stream is detected, and only after the server accepts the connection and opens up a valid socket is the stream deemed as valid.

[00309] At step 2 50-12, the upload stream is redirected into the local file cache 50-180 to accumulate there at the high rate of speed of the LAN 50-020. It will also continue to be sending the upload stream to server 50-350 via the optimized GVN topology, including transit at step 3 50-28 to the file cache 50-380 on the SRV_AP 50-300 in the remote region in close proximity to the target server 50-350.

[00310] The FTM 50-360 on SRV_AP 50-300 maintains the connection and sends the file 50-810 to the server 50-350 as fast as it can via path 50-P350. Step 5 50-32 notes that this is where the connection is kept alive and healthy, and where the file 50-810 will egress the GVN at a short distance and low latency 50-950 between the SRV_AP 50-300 and the server 50-350.

[00311] Fig. 51 illustrates, in accordance with certain embodiments of the disclosed subject matter, the relationship between the physical storage of a file on a secure file storage volume 51-H750, the saving of information about the file into a relational database (DB) such as 51-B700, and data relationships between files, file information, and steps in a file transfer process. When a file is sent from a client 51-000 to a server 51-350 via an upload stream capture, and chained caching of the file by saving it in a file cache 51-180 close to the source file, pushing the file to the next file cache 51-380, and then saved to the server 51-350 governed by file transfer manager (FTM) 51-360. A multi-dimensional array 51-BT030 describing info about the file (File_Info), the path through the GVN that the file should take (File_Path), as well as Meta data (File_Meta), and destination information

(Dest_Info). The destination info includes target device type, credentials if required, and other information.

[00312] The sub-array for file path multi-dimensional array 51-BT050 includes information about the origin, the target, as well as the intermediary hops.

[00313] There is a sub-array describing the characteristics of each hop 51_BT-070 includes information about the device, its type, a code or hostname for it, and other information. This sub-array is also linked to table: devices 51-730.

[00314] The table: Files 51-720 contains information about the file, including a universal unique identifier for the file 51-722. The file name on the physical storage can be the UUID 51-722 with a symbolic link via table: files 51-720 of the UUID to the file info record including the name of the file.

[00315] It is to be understood that the disclosed subject matter is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The disclosed subject matter is capable of other embodiments and of being practiced and carried out in various ways. In addition, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[00316] As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, systems, methods and media for carrying out the several purposes of the disclosed subject matter. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the disclosed subject matter.

[00317] Although the disclosed subject matter has been described and illustrated in the foregoing exemplary embodiments, it is understood that the present disclosure has been made only by way of example, and that numerous changes in the details of implementation of the disclosed subject matter may be made without departing from the spirit and scope of the disclosed subject matter, which is limited only by the claims which follow.

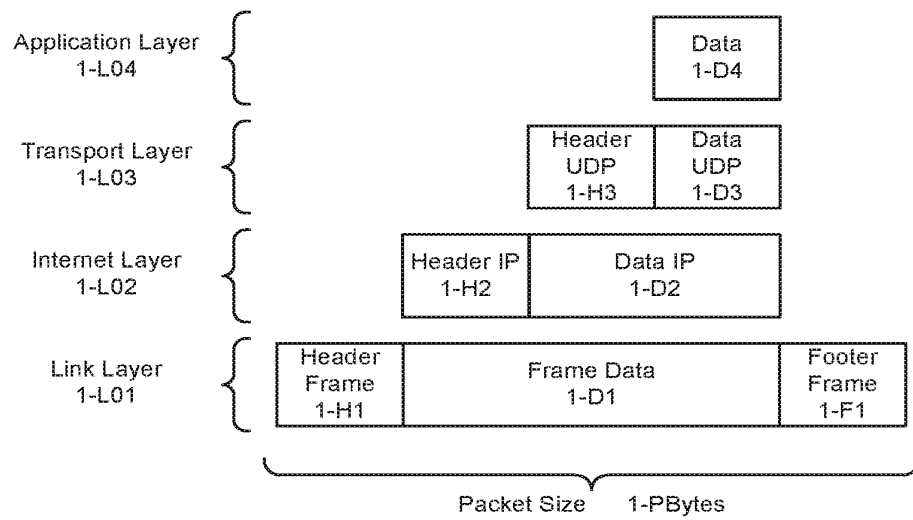


FIG. 1

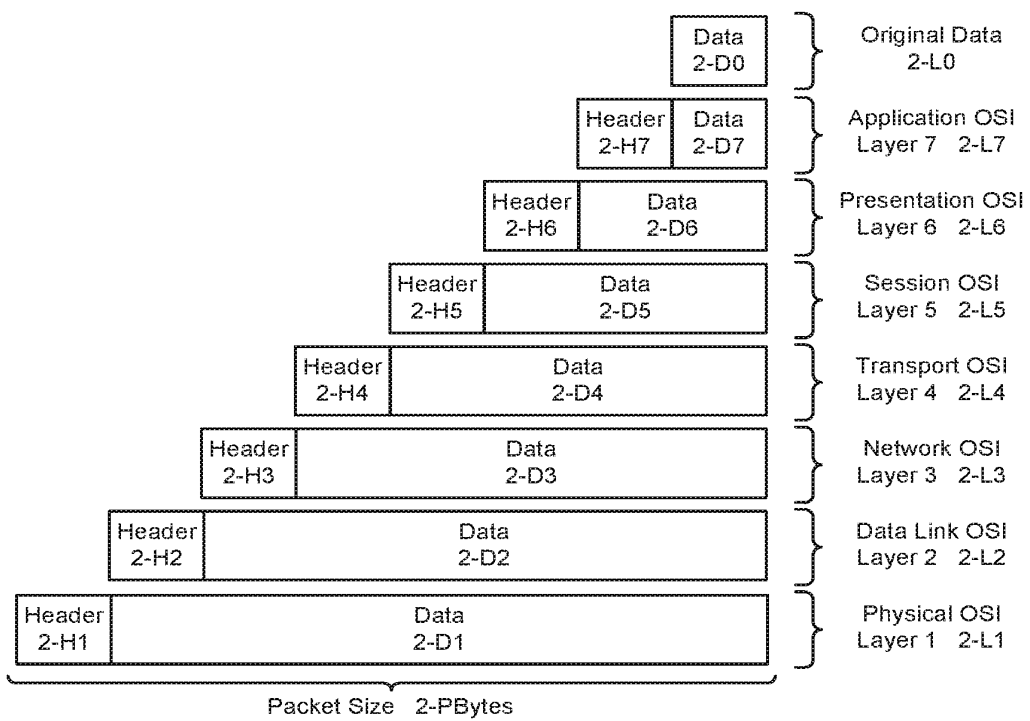


FIG. 2

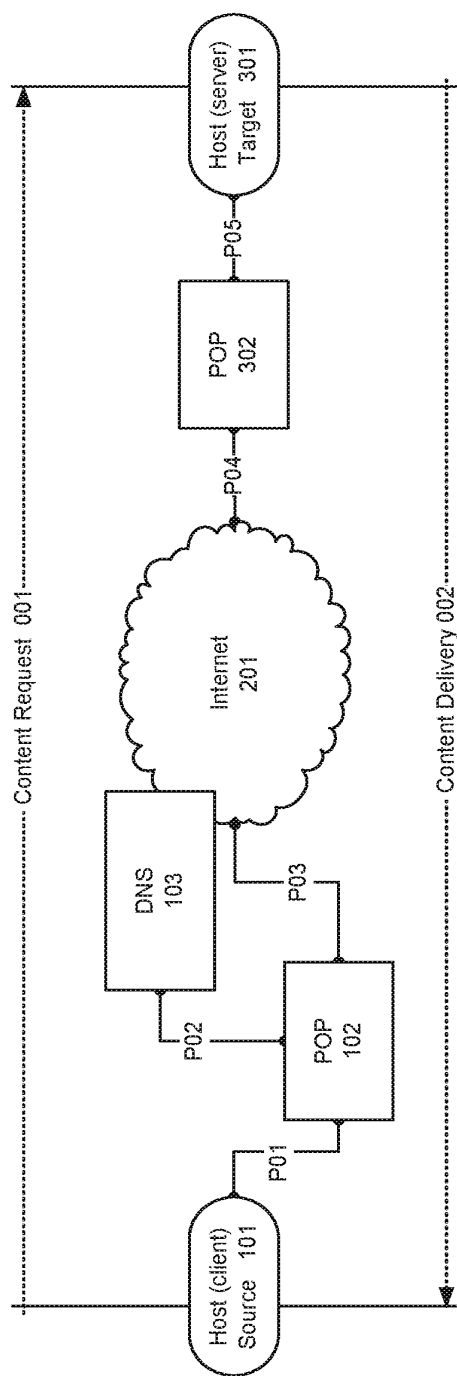


FIG. 3

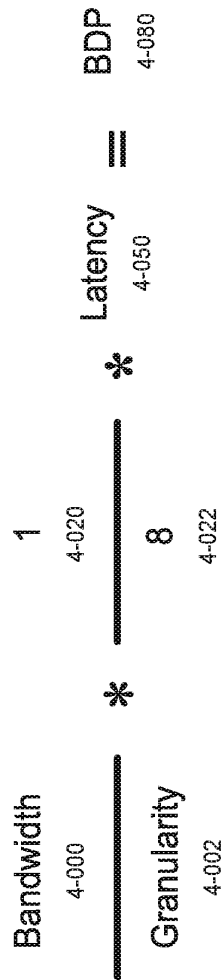


FIG. 4

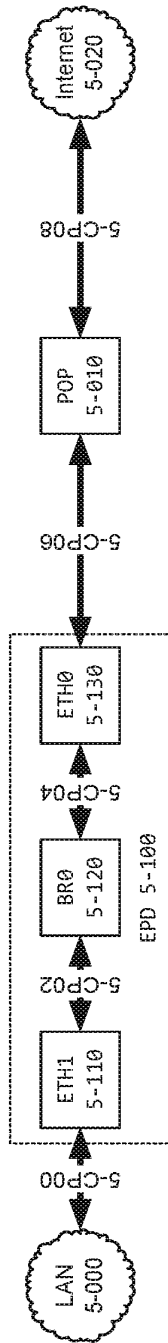


FIG. 5

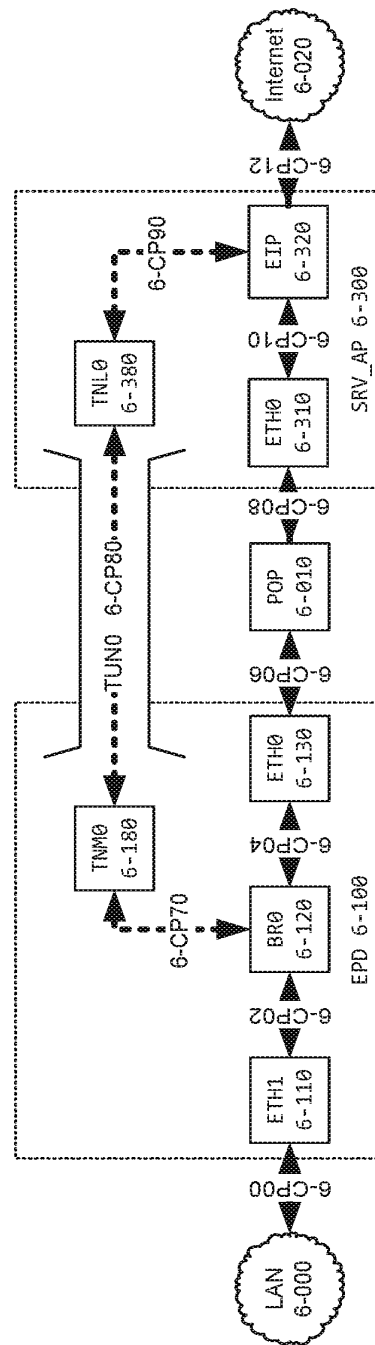
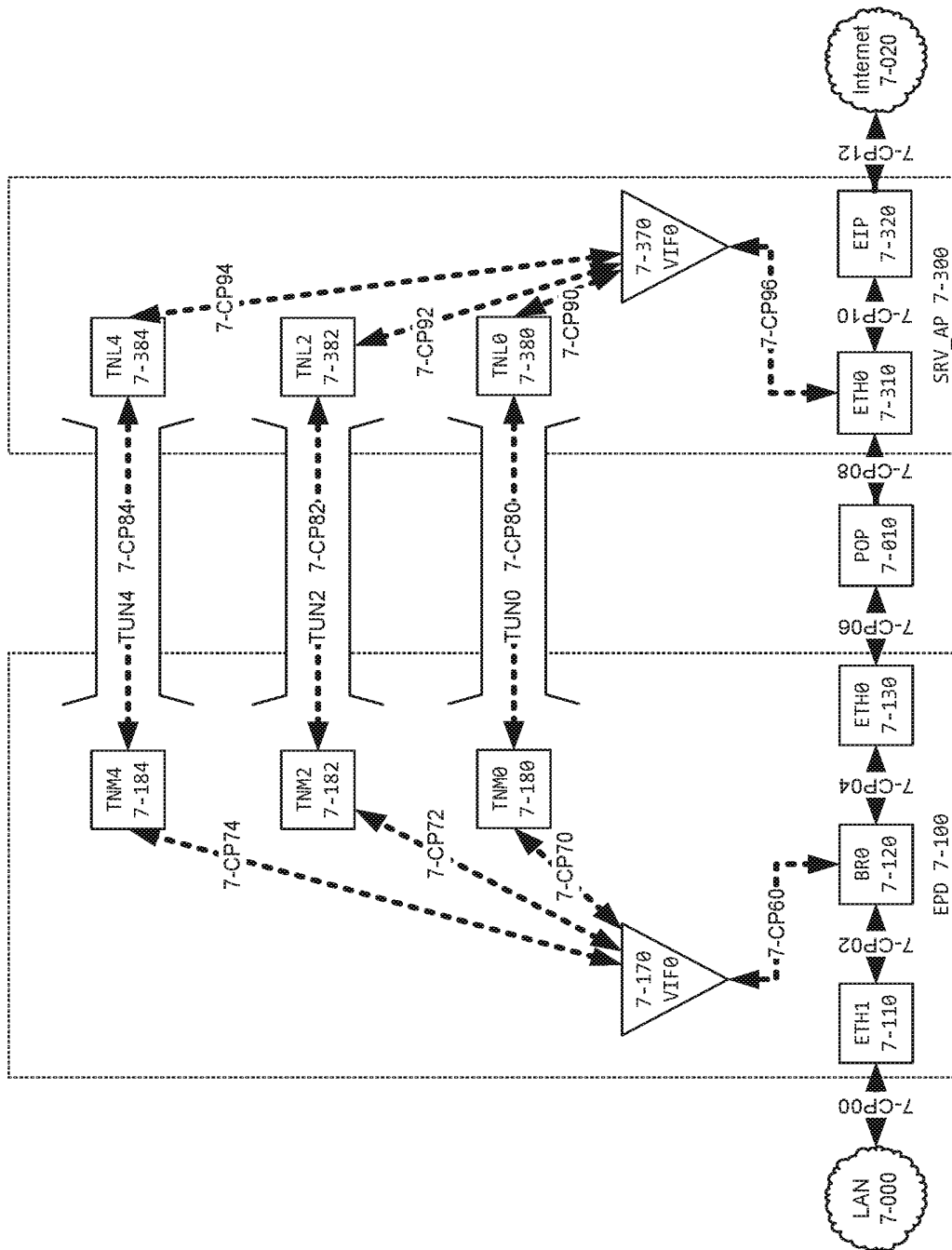


FIG. 6



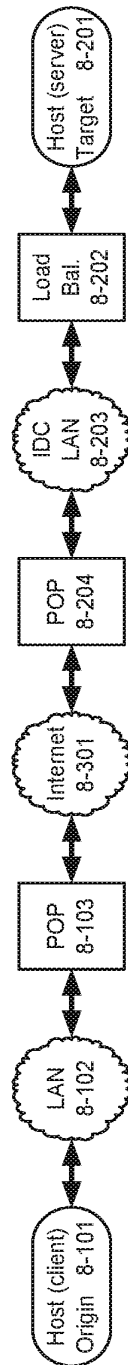


FIG. 8

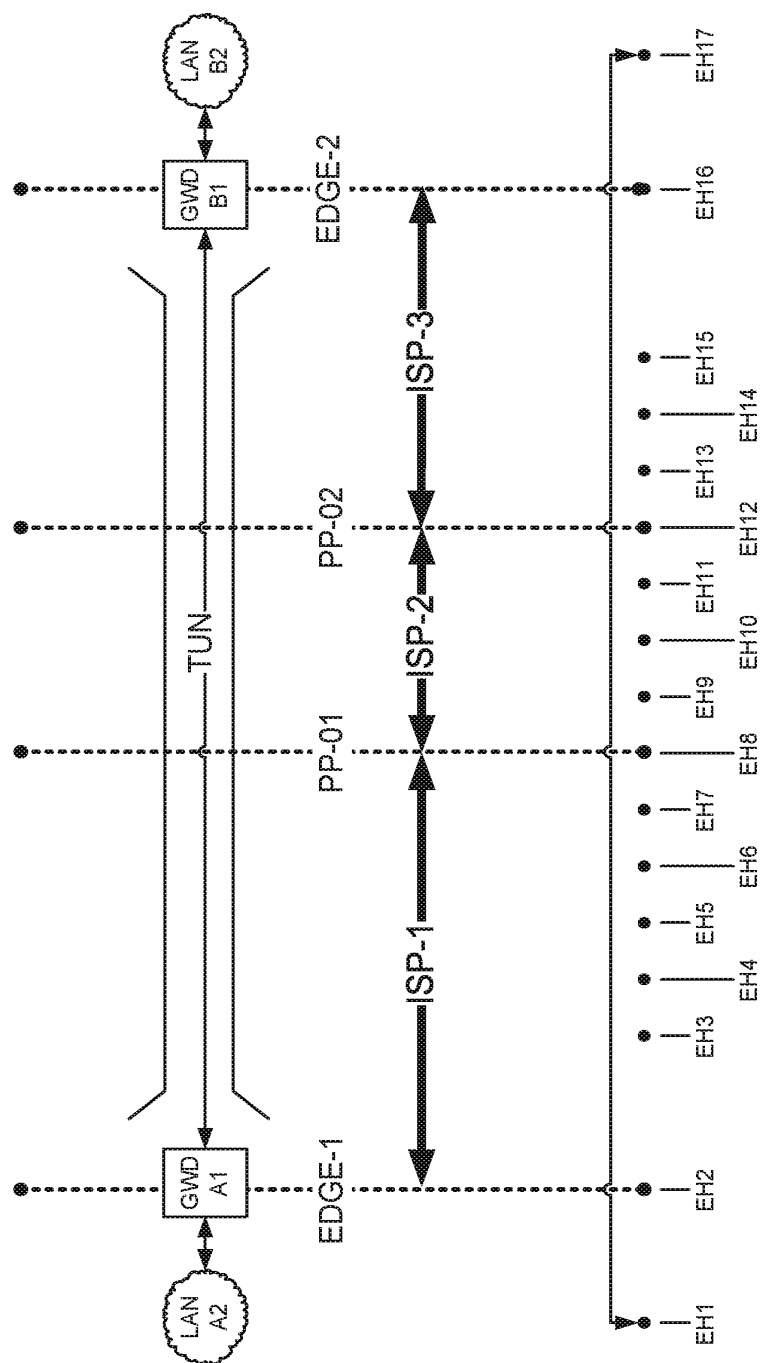


FIG. 9

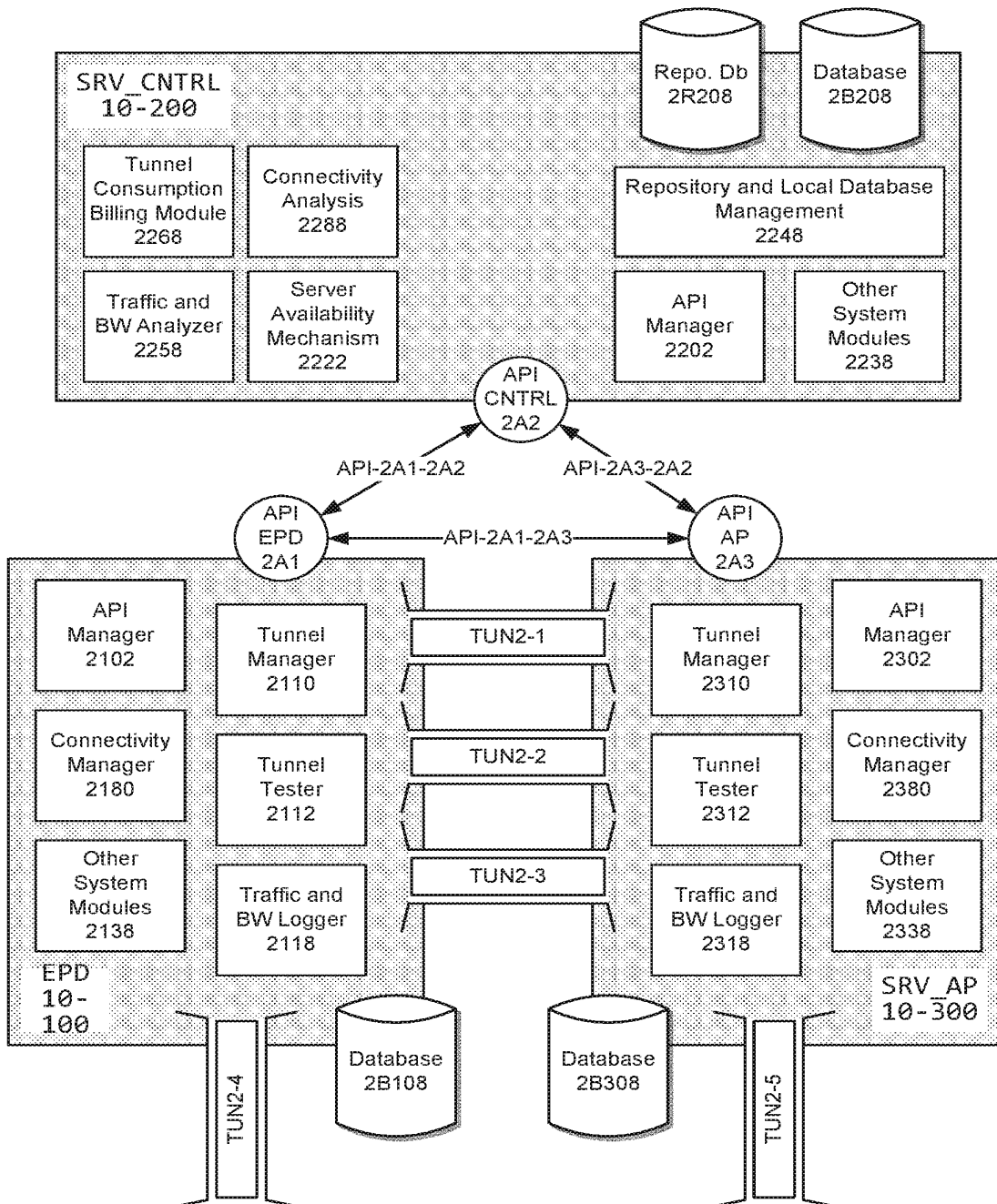


FIG. 10

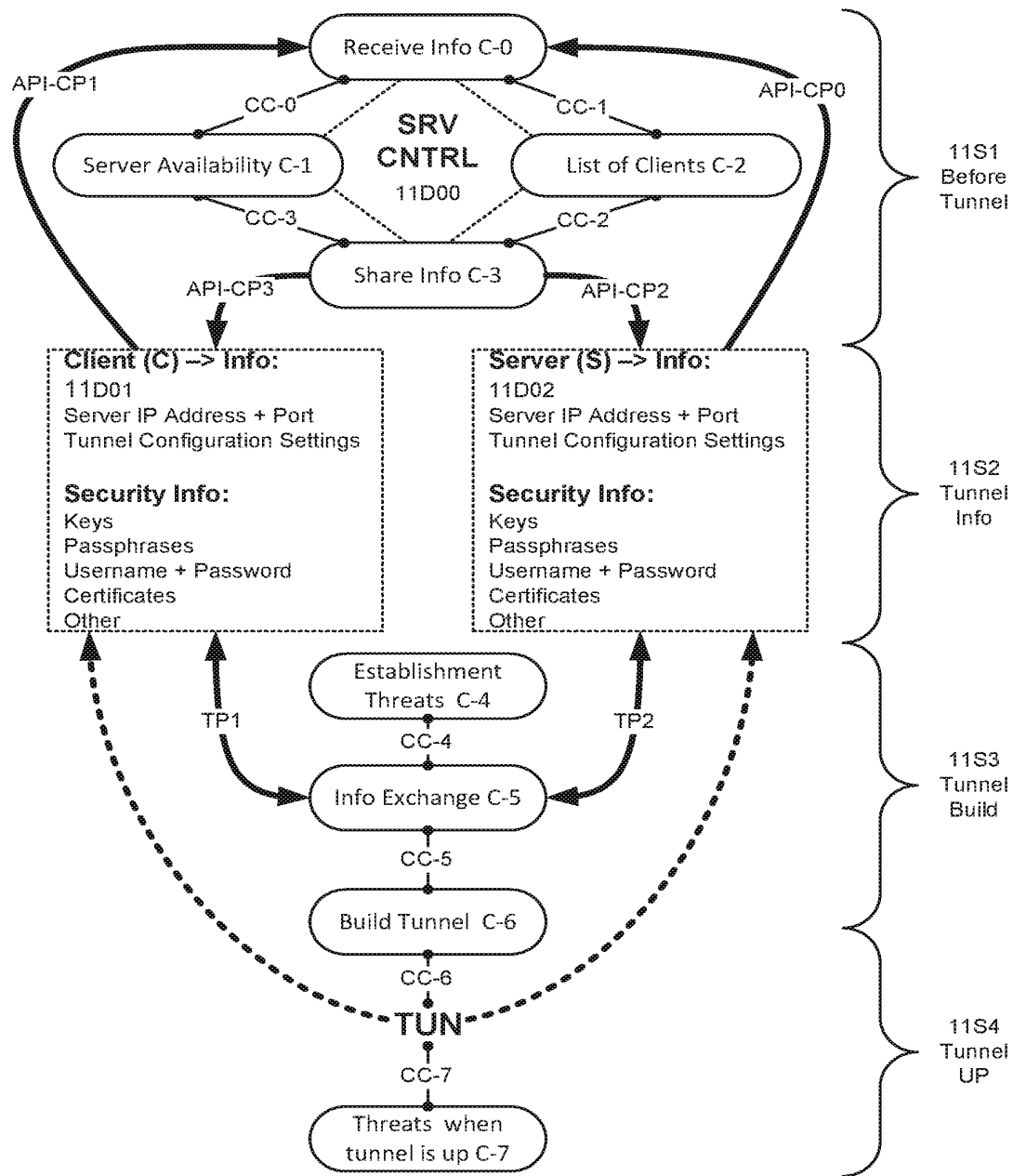


FIG. 11

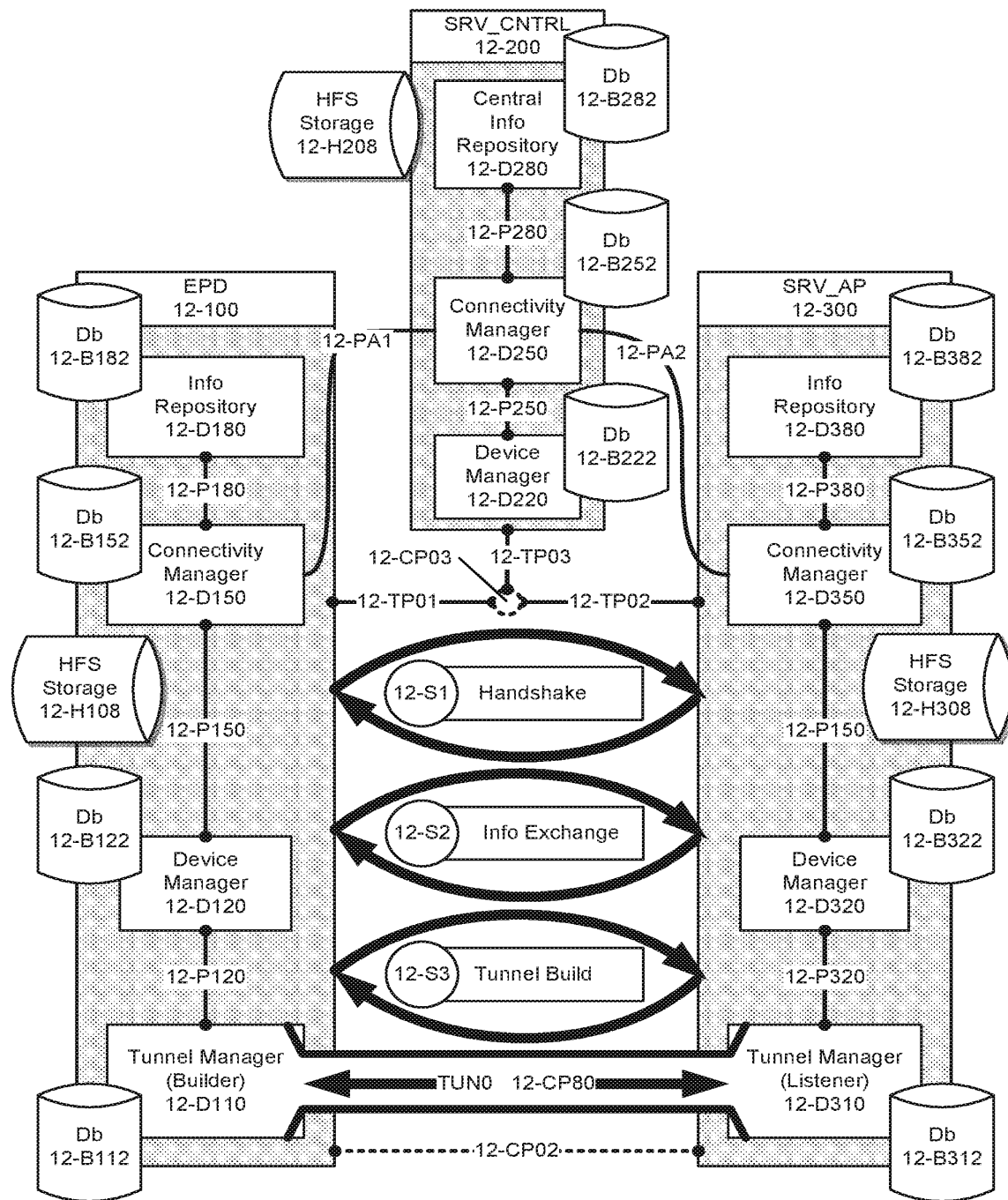


FIG. 12

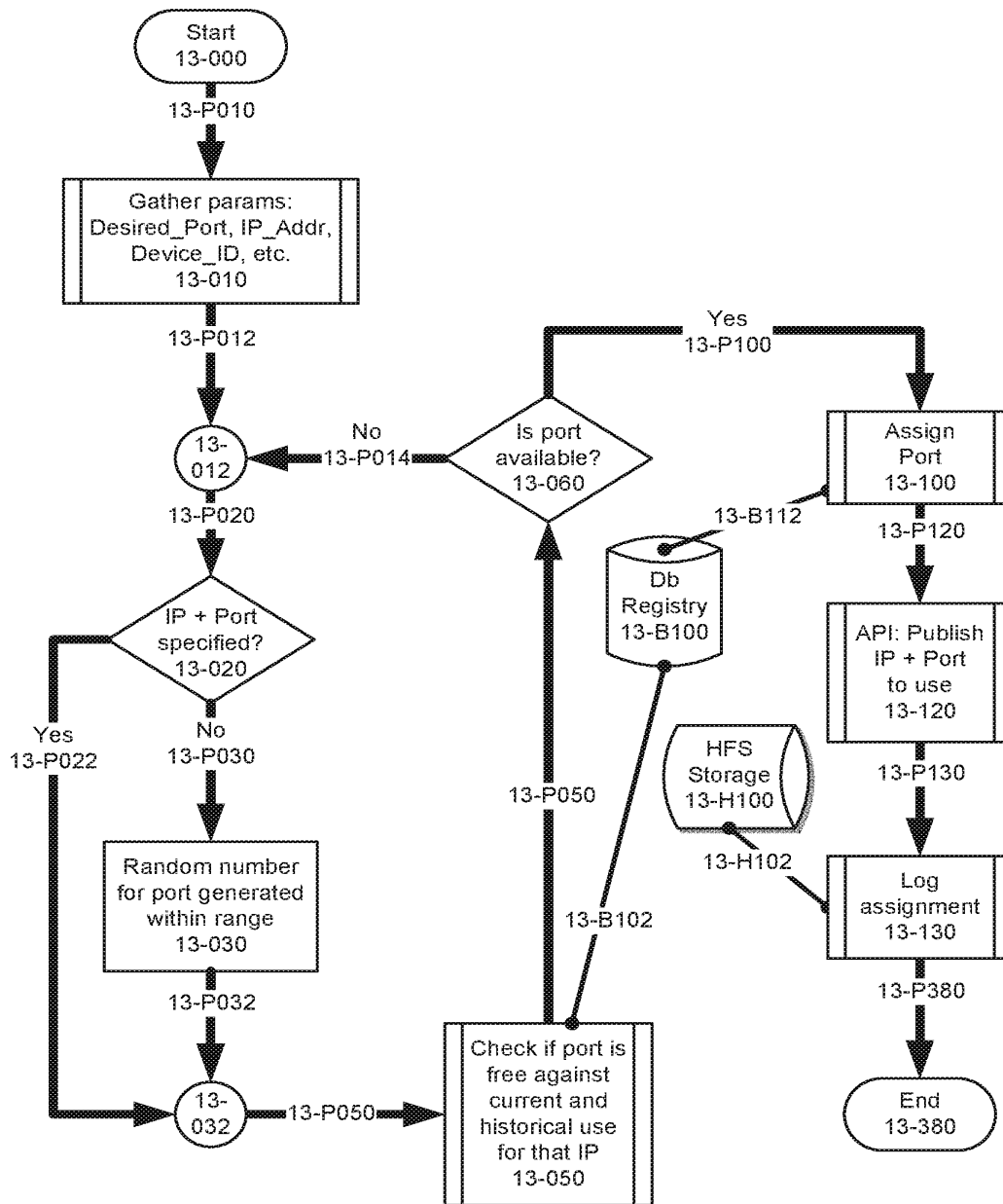


FIG. 13

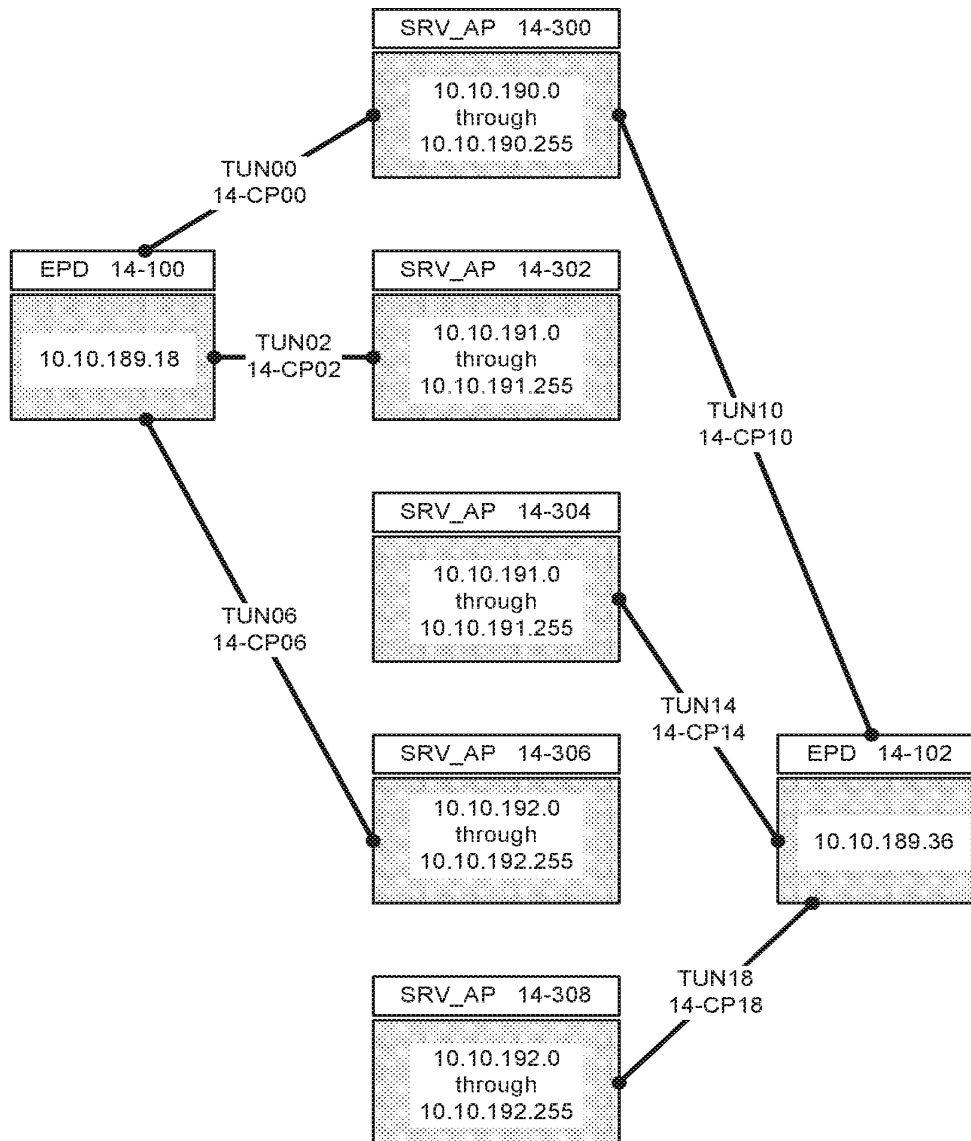


FIG. 14

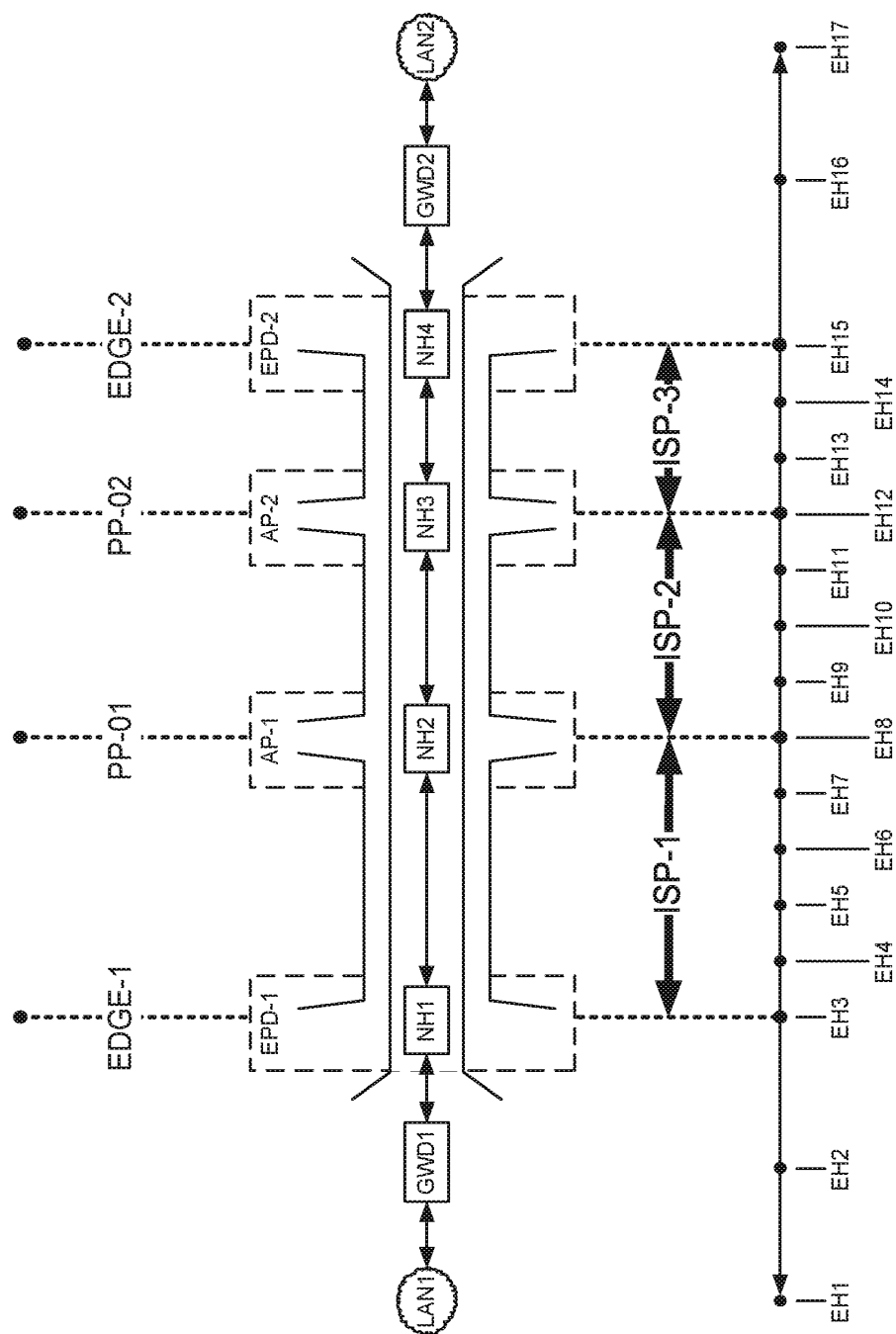


FIG. 15

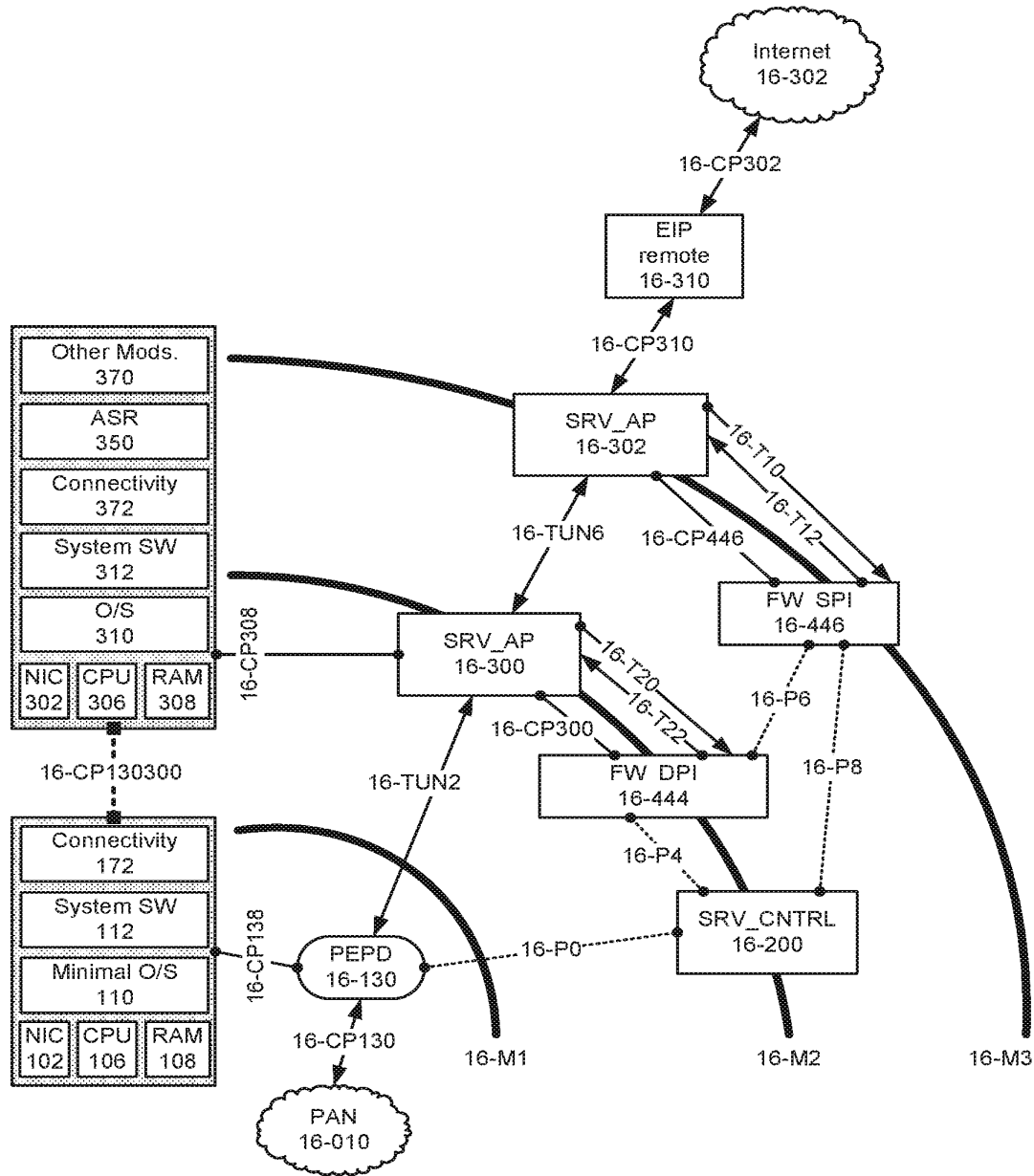


FIG. 16

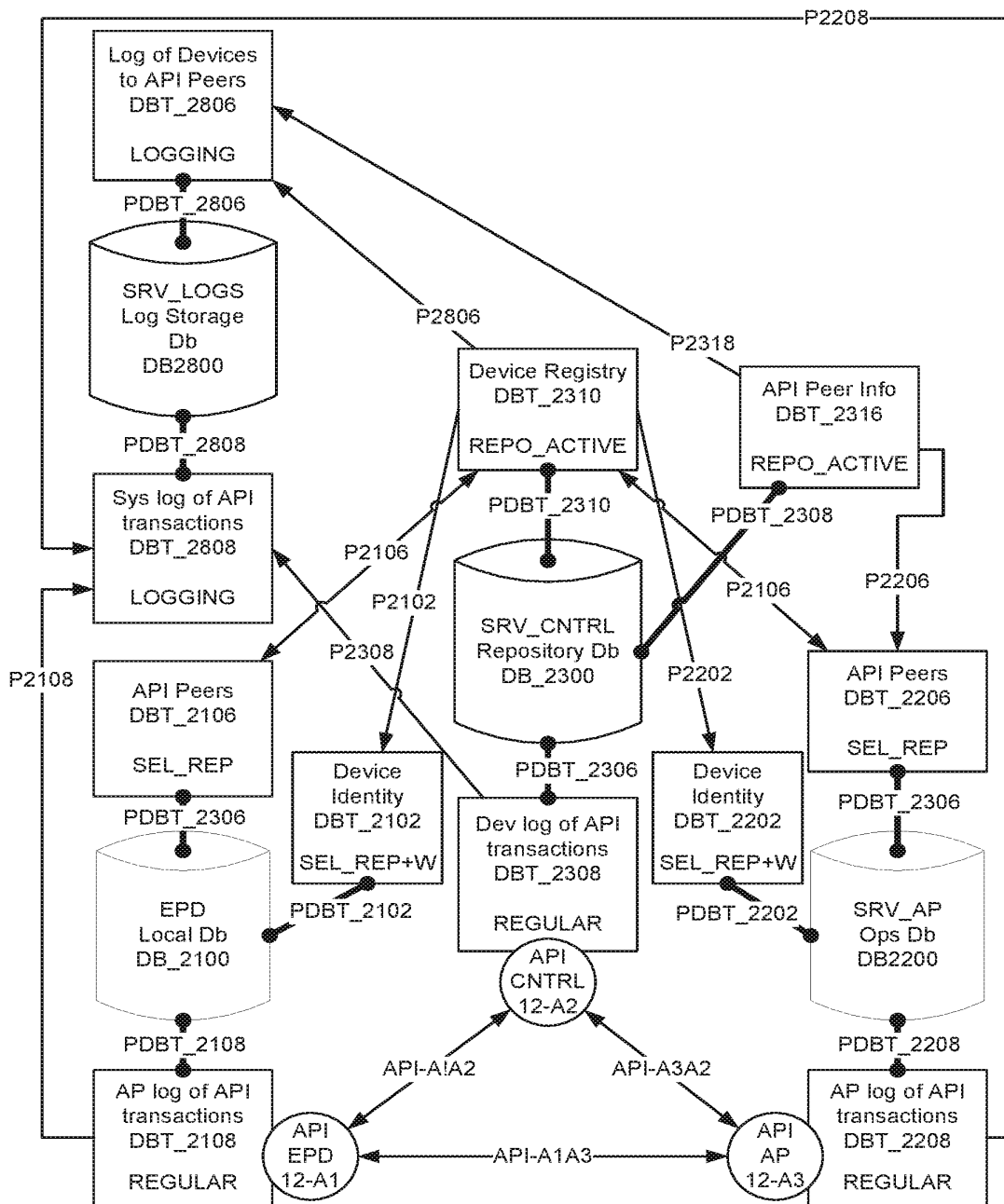


FIG. 17

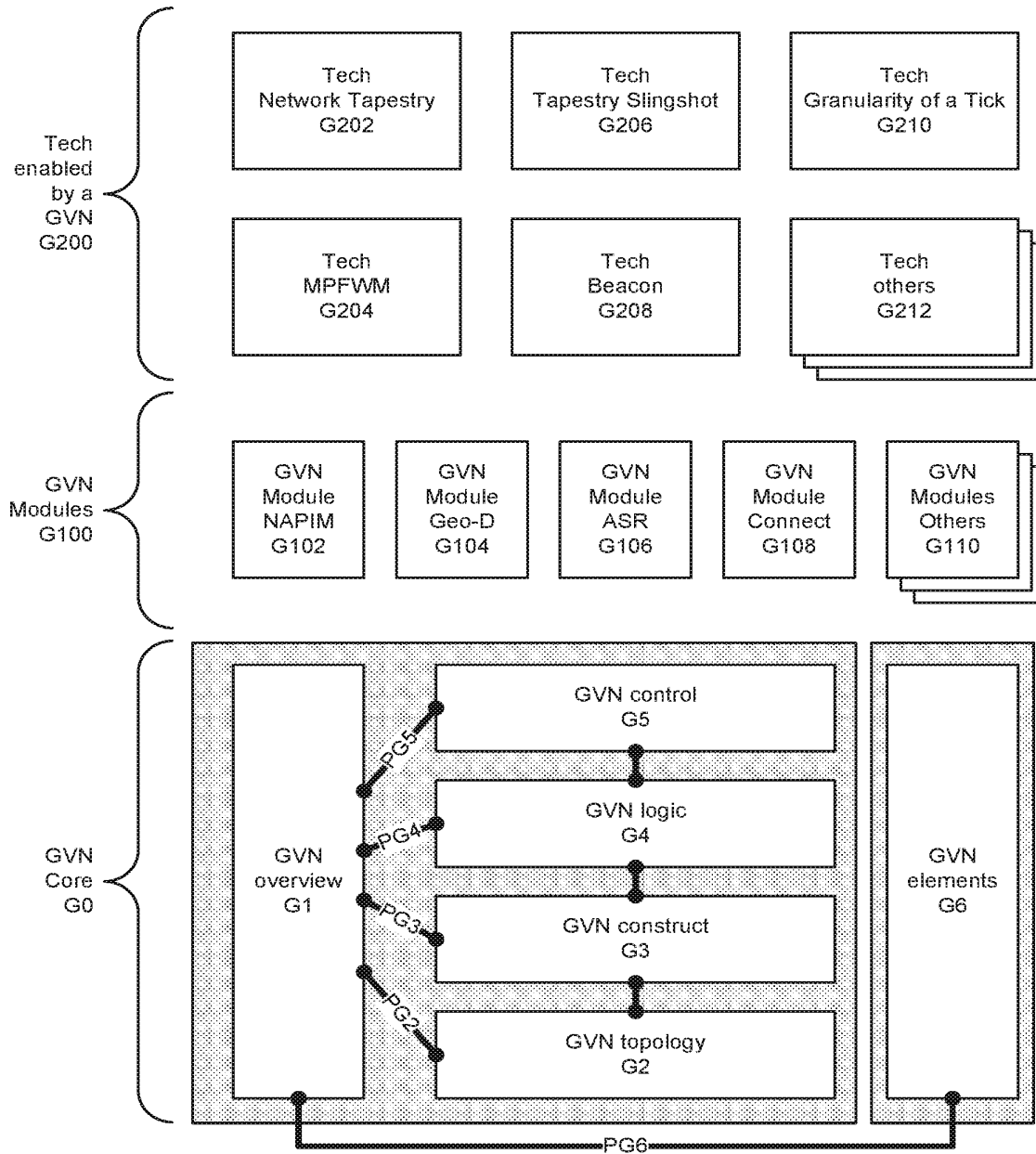


FIG. 18

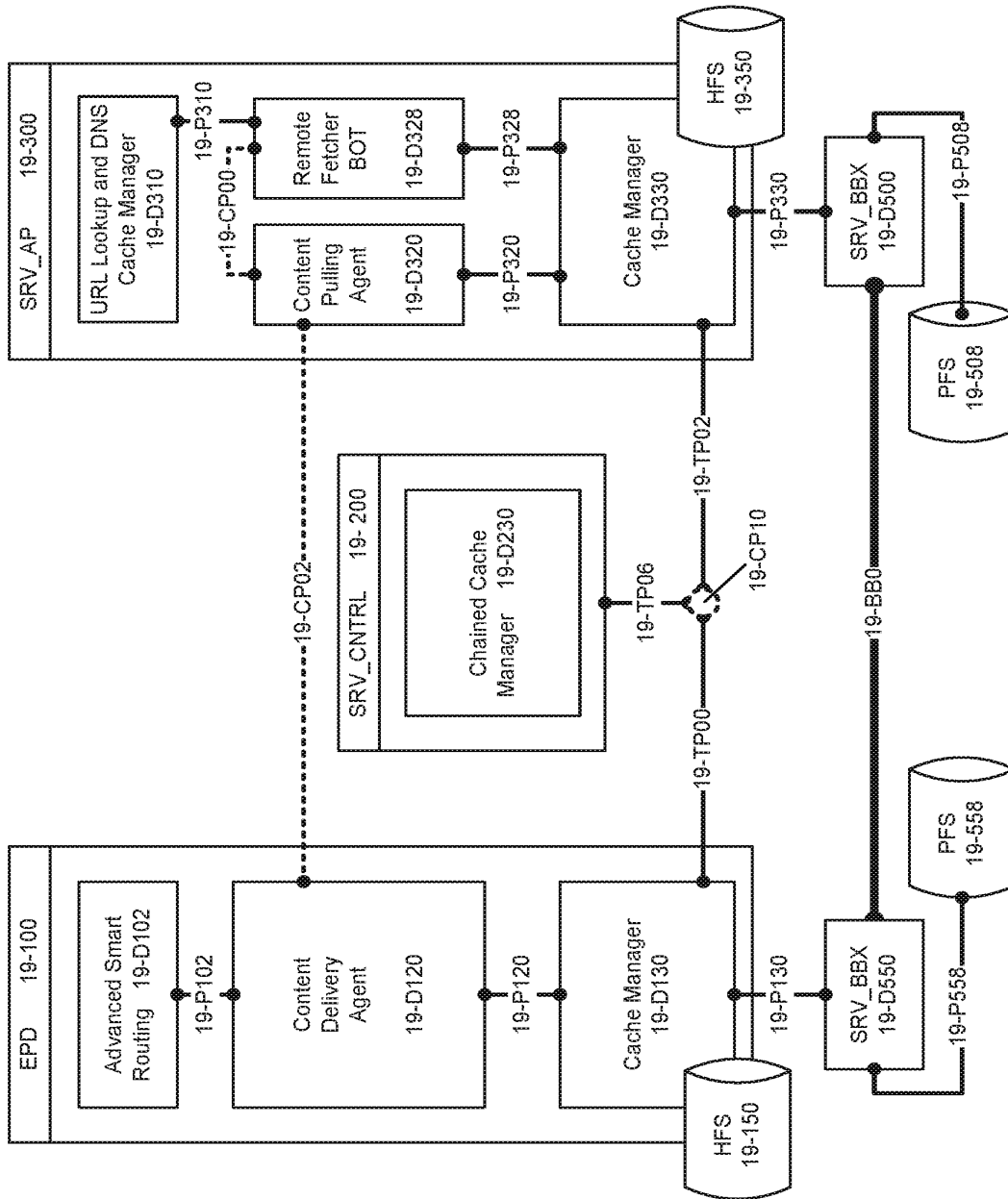


FIG. 19

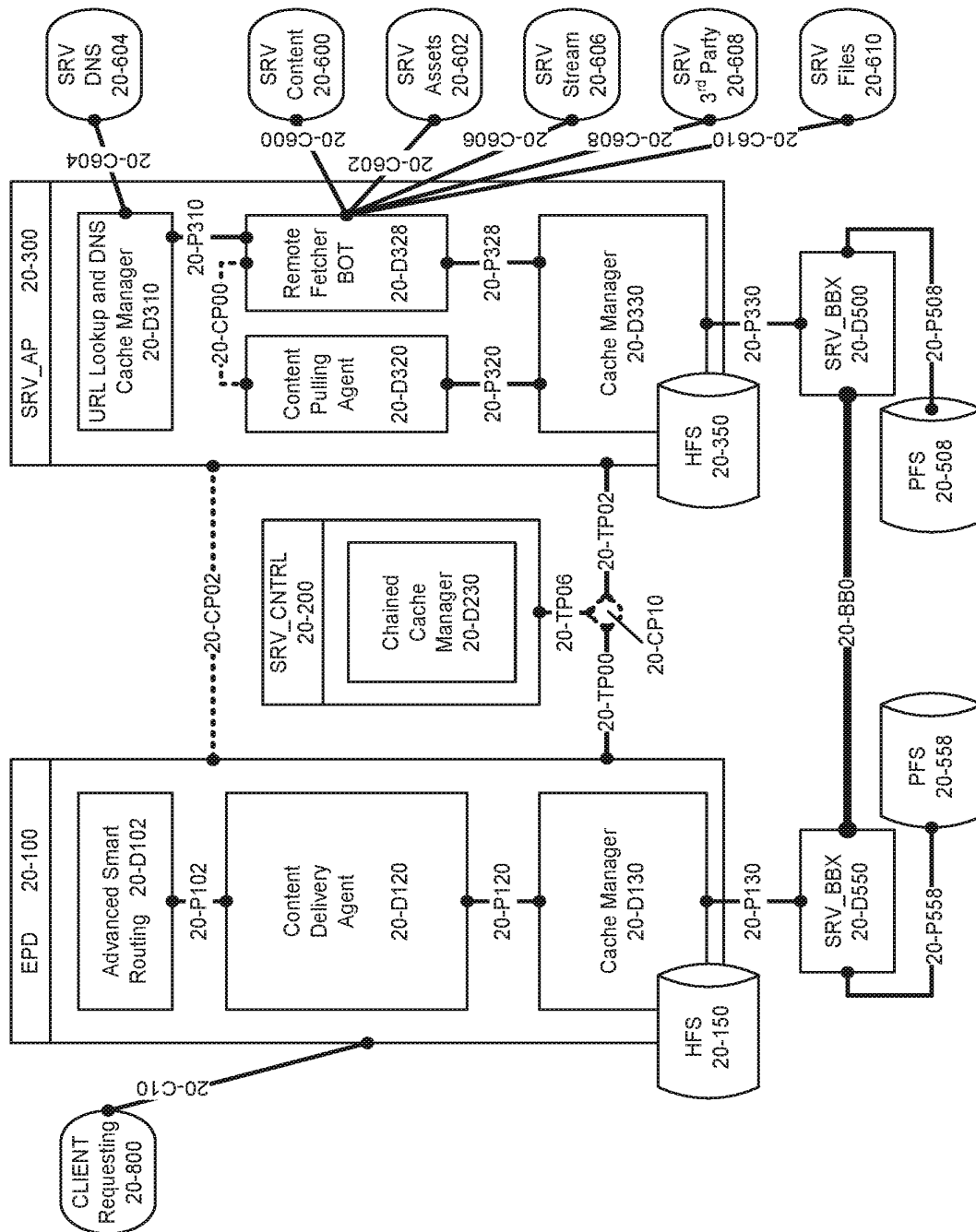
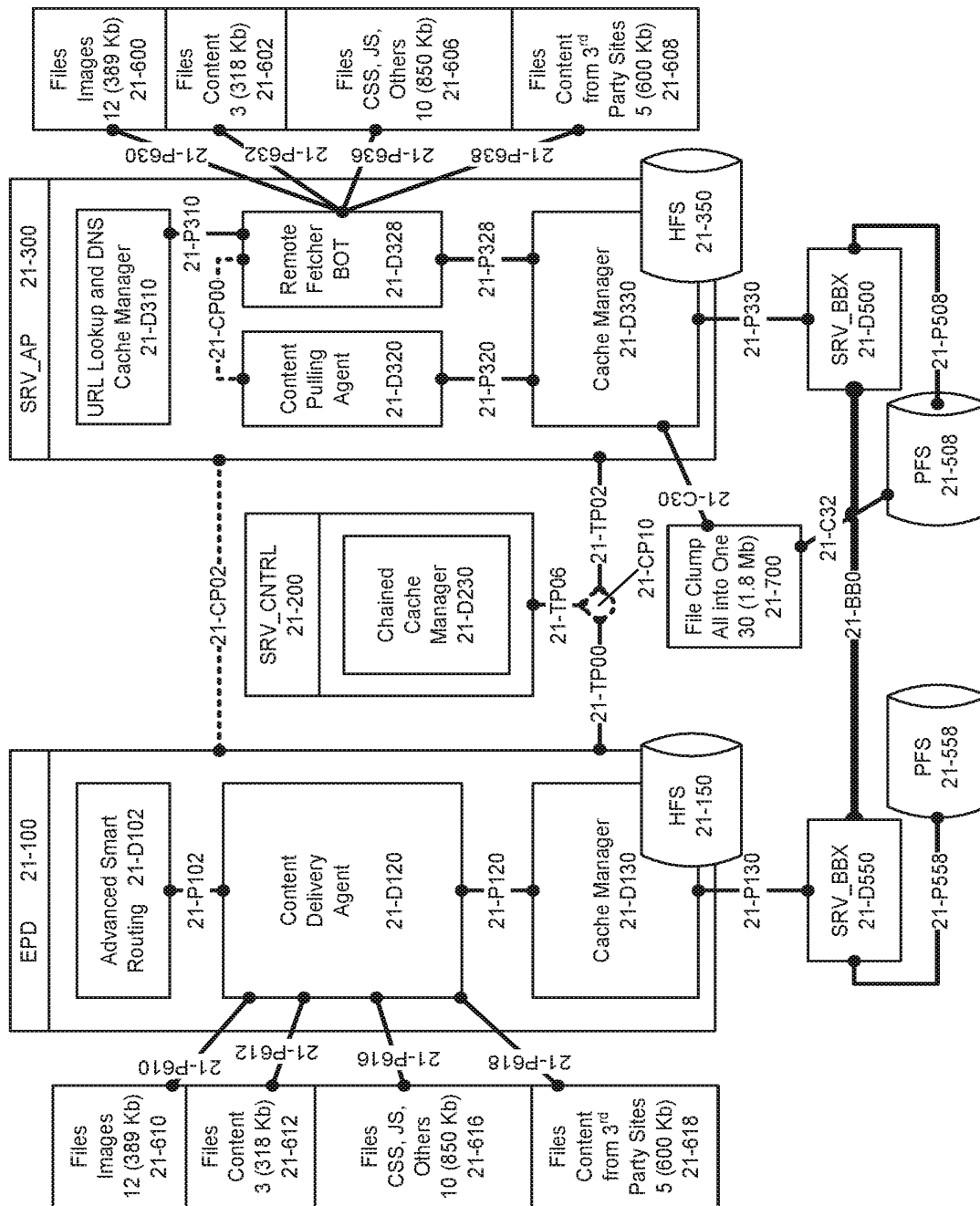


FIG. 20



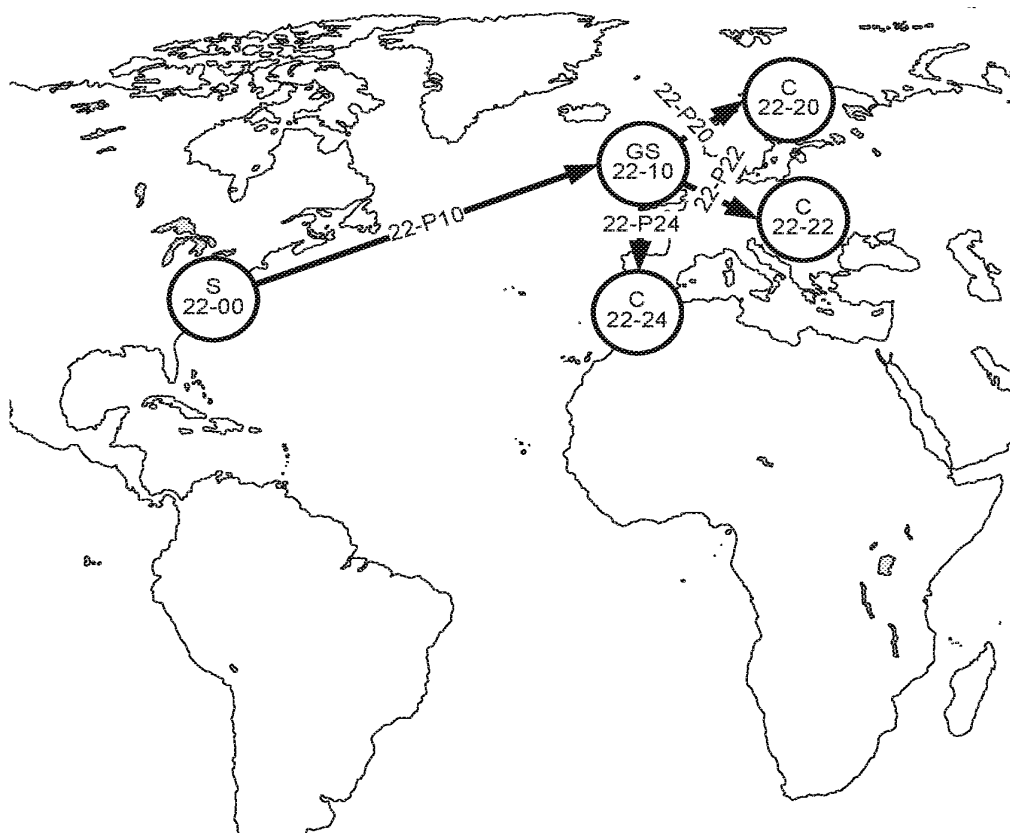


FIG. 22

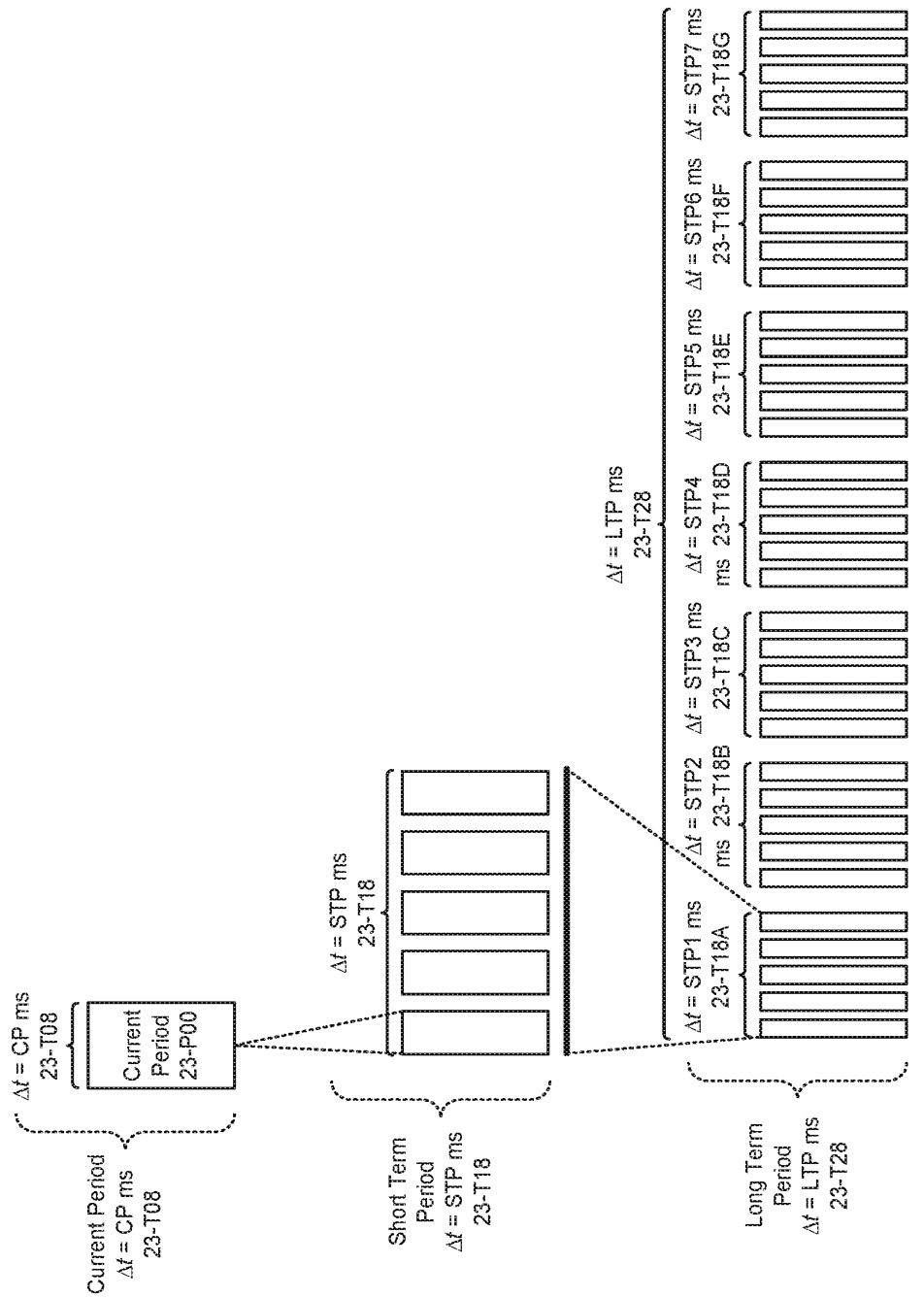


FIG. 23

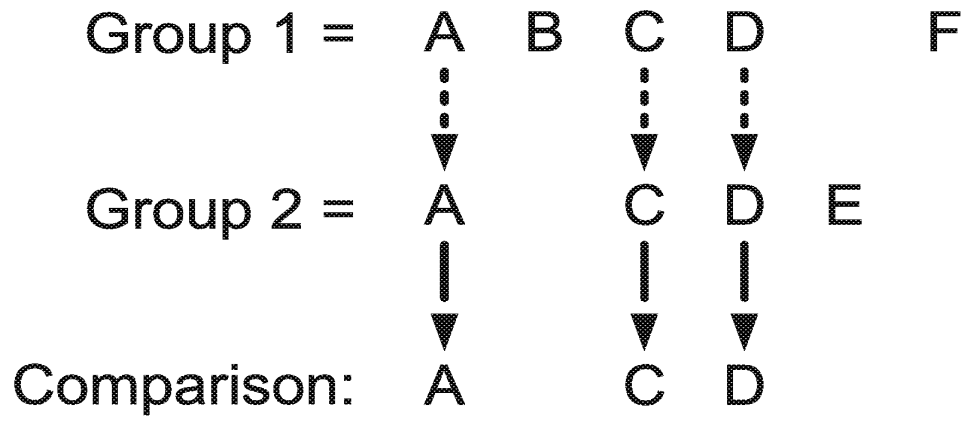


FIG. 24

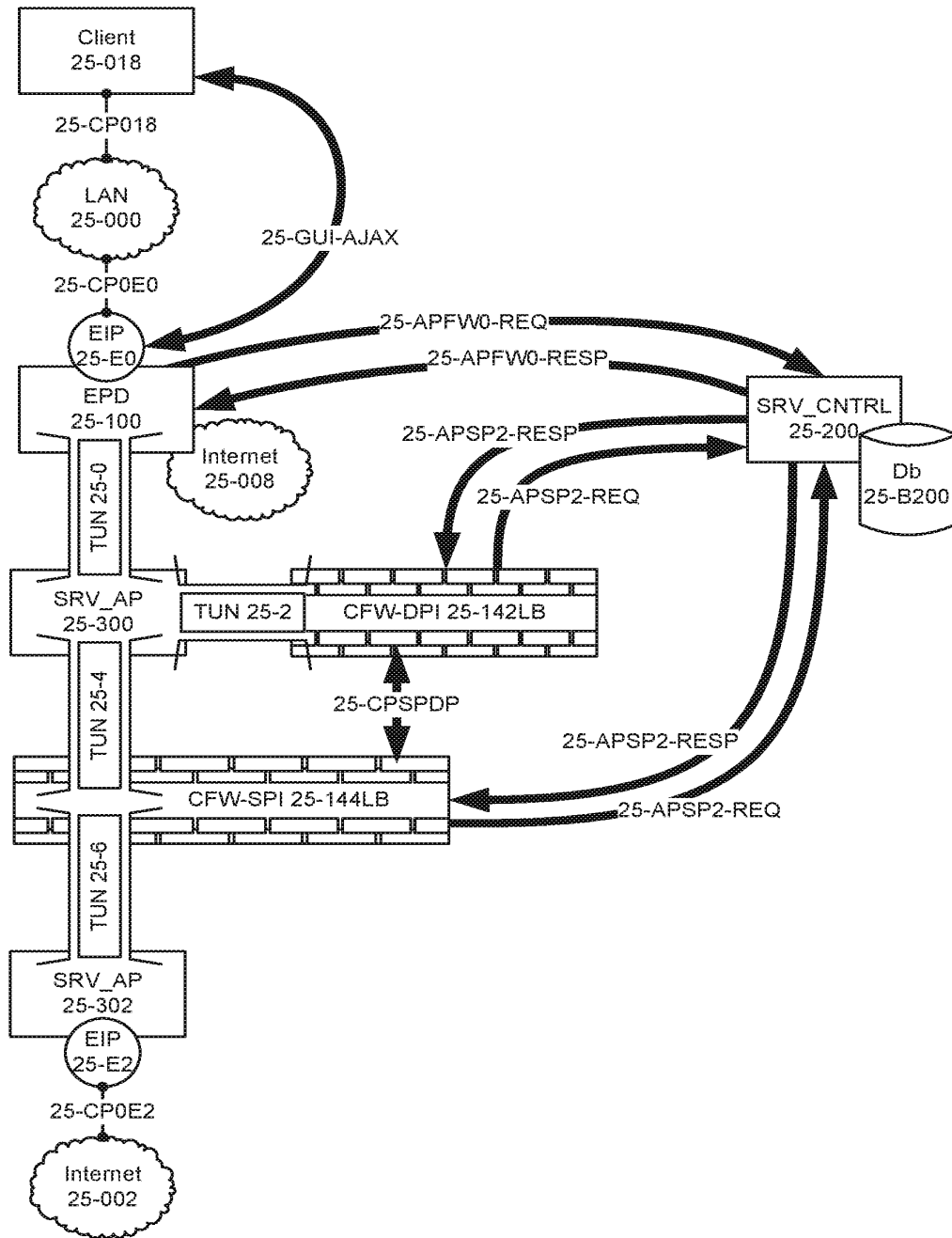


FIG. 25

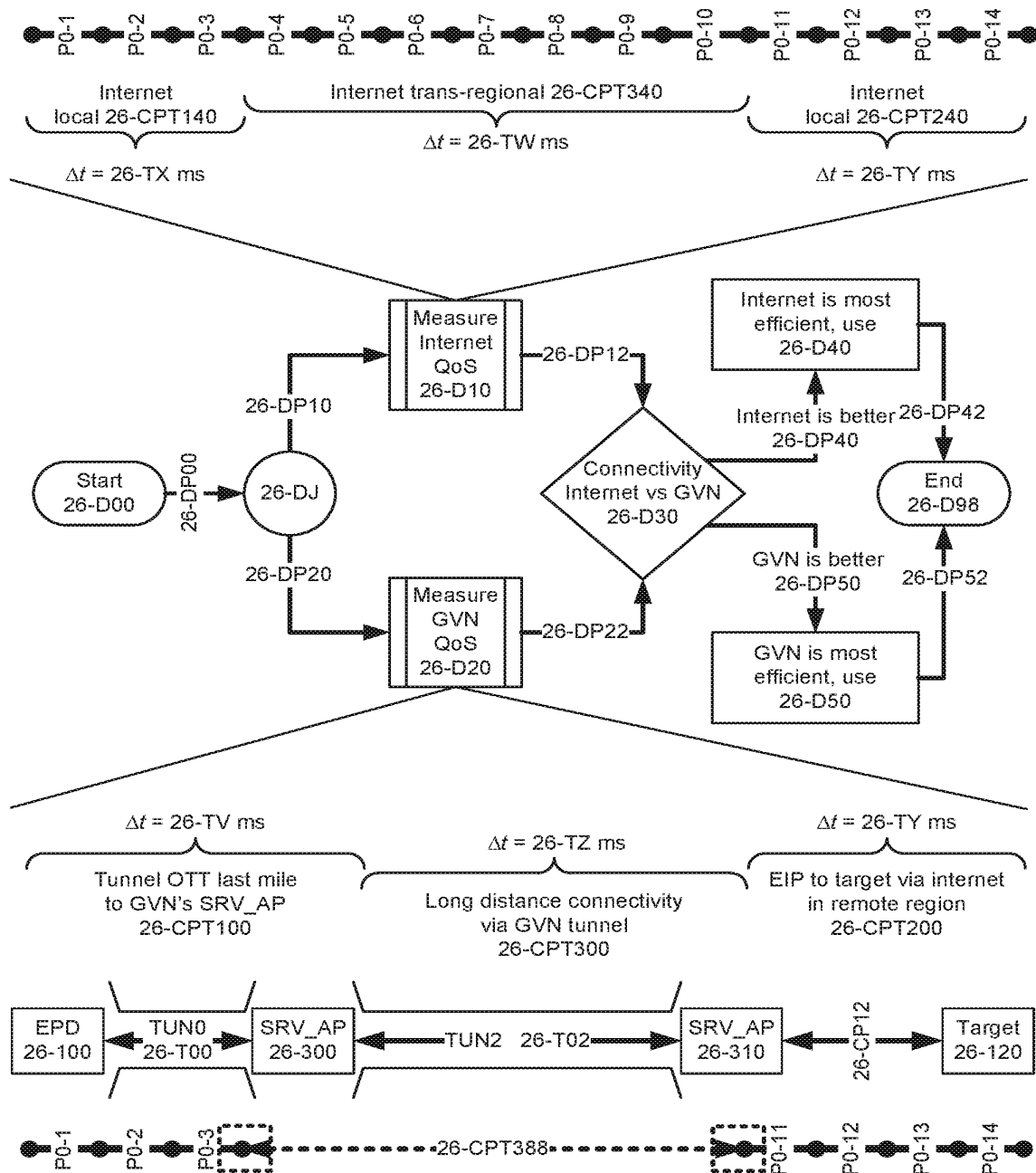


FIG. 26

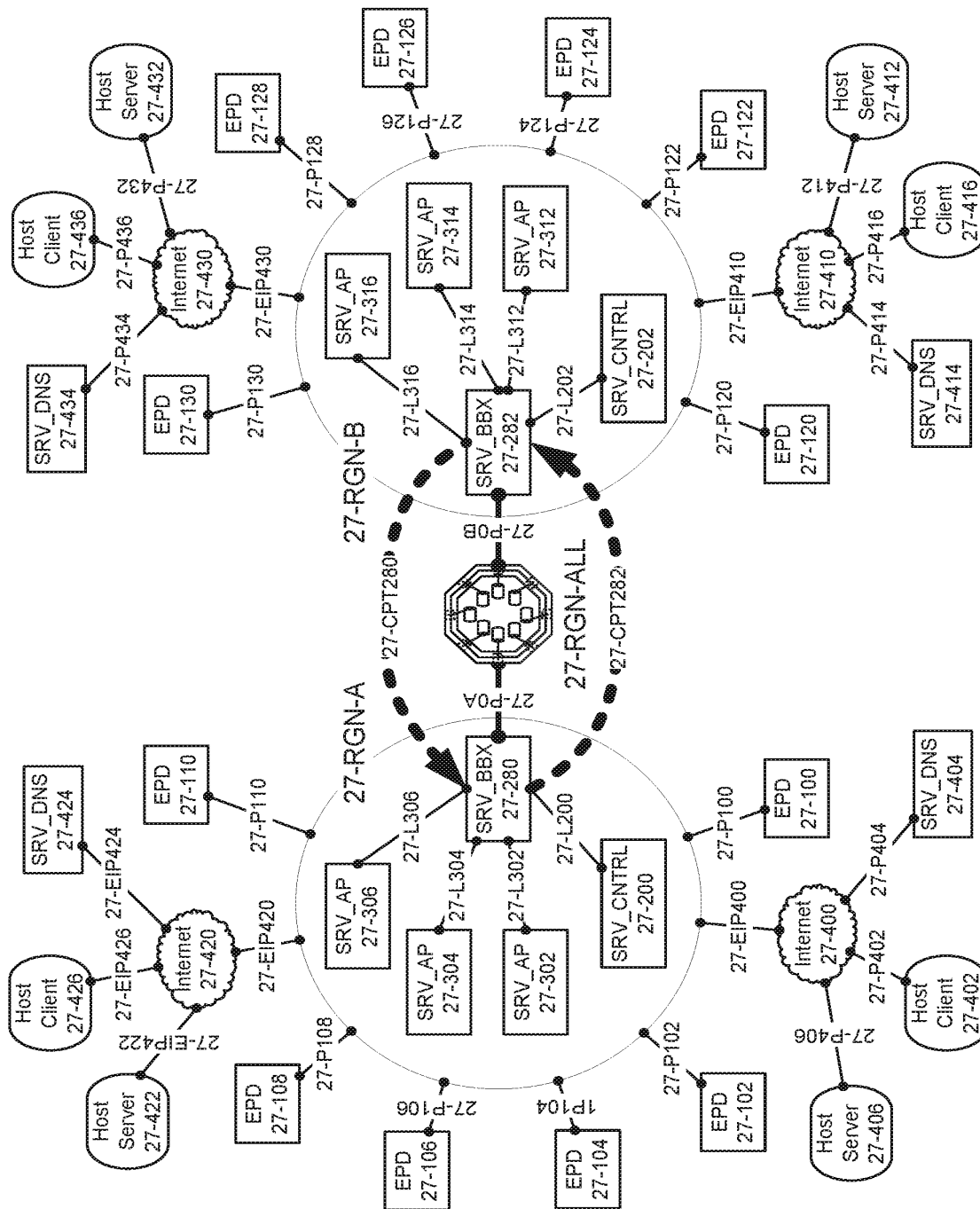
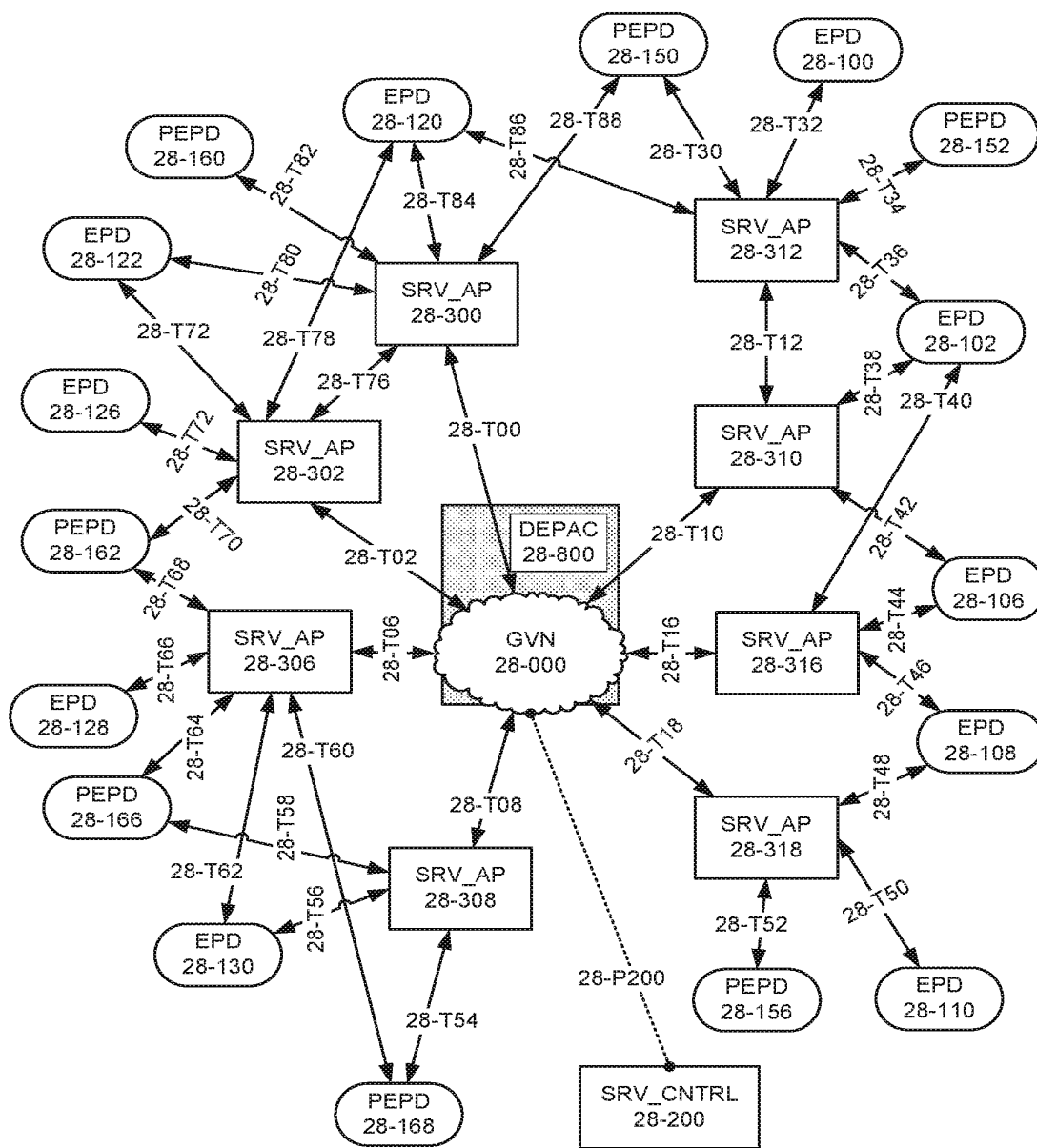


FIG. 27



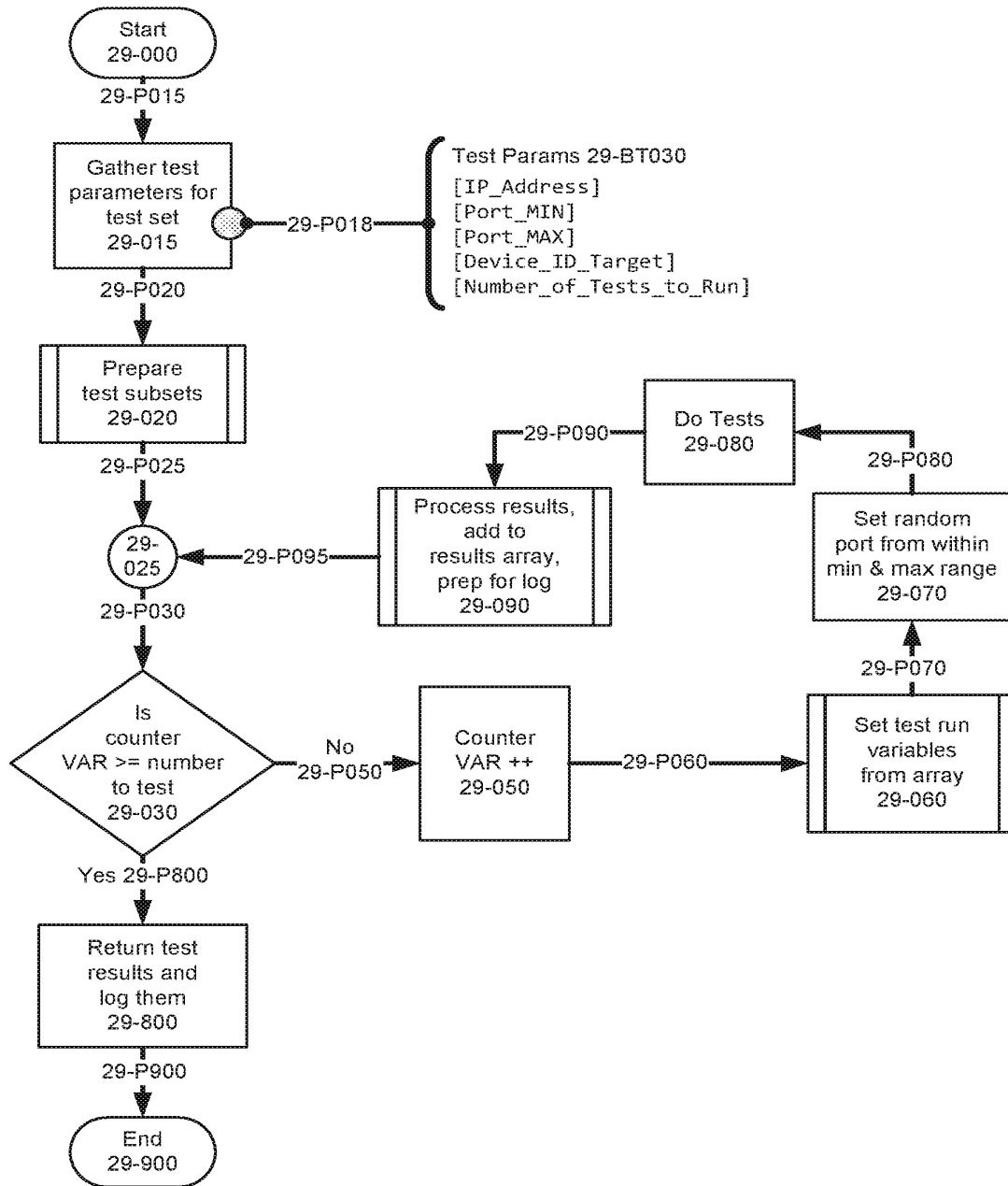


FIG. 29

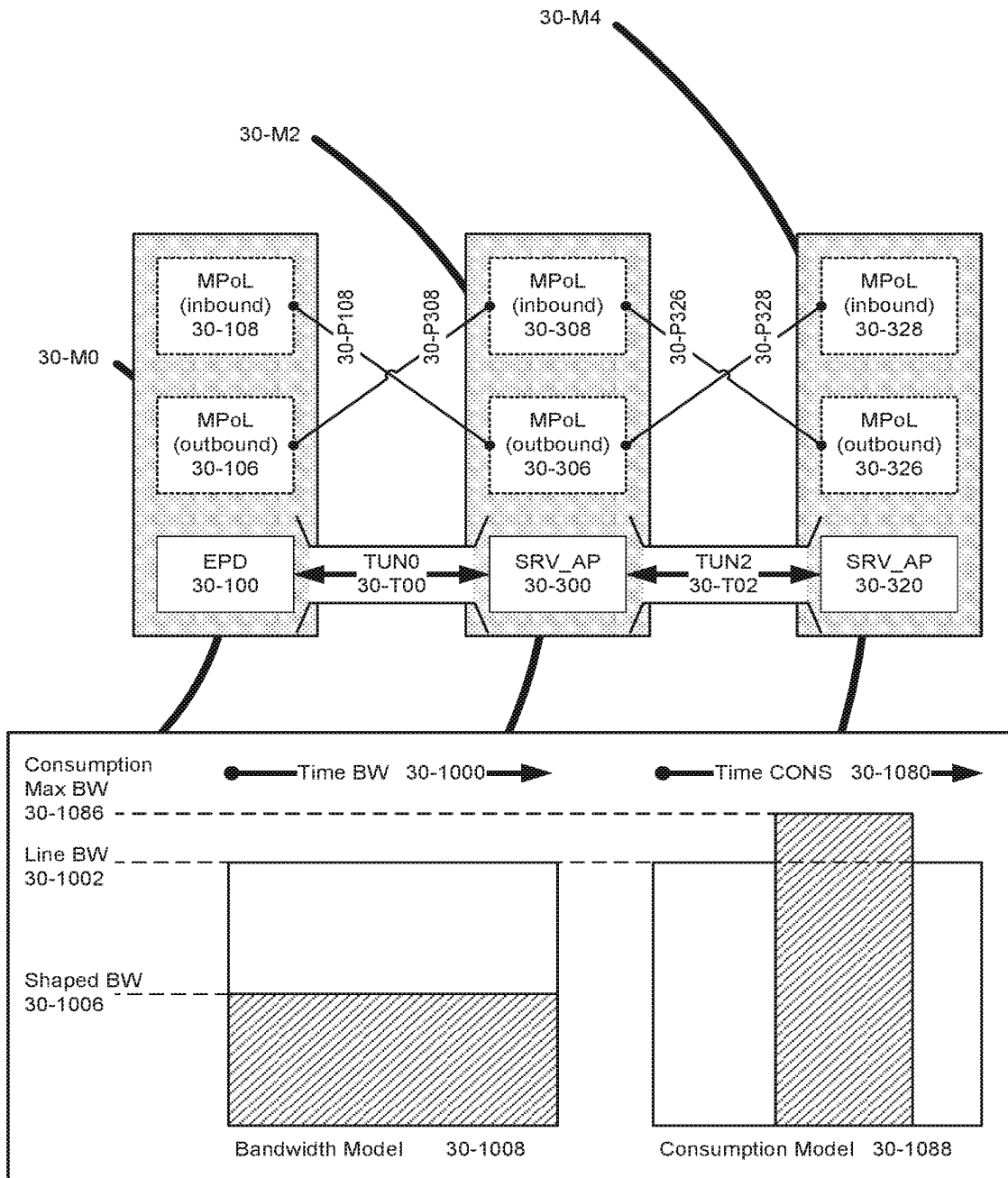


FIG. 30

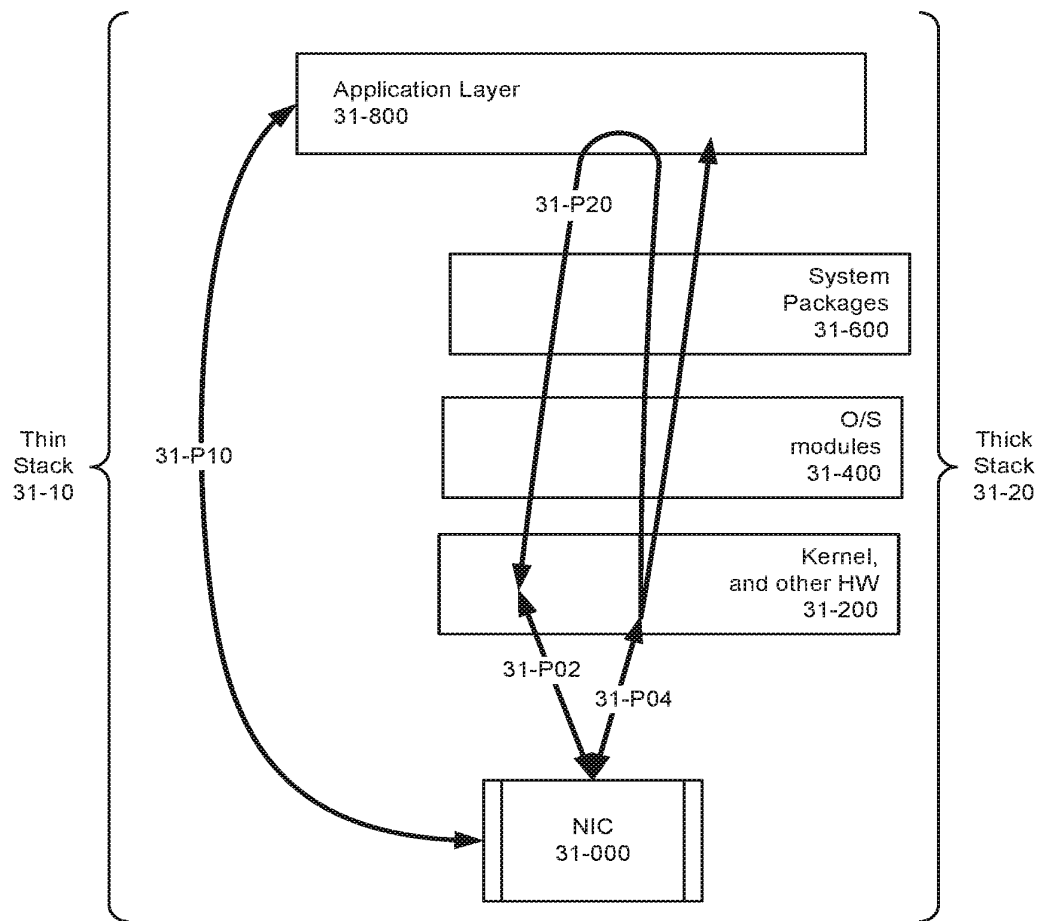


FIG. 31

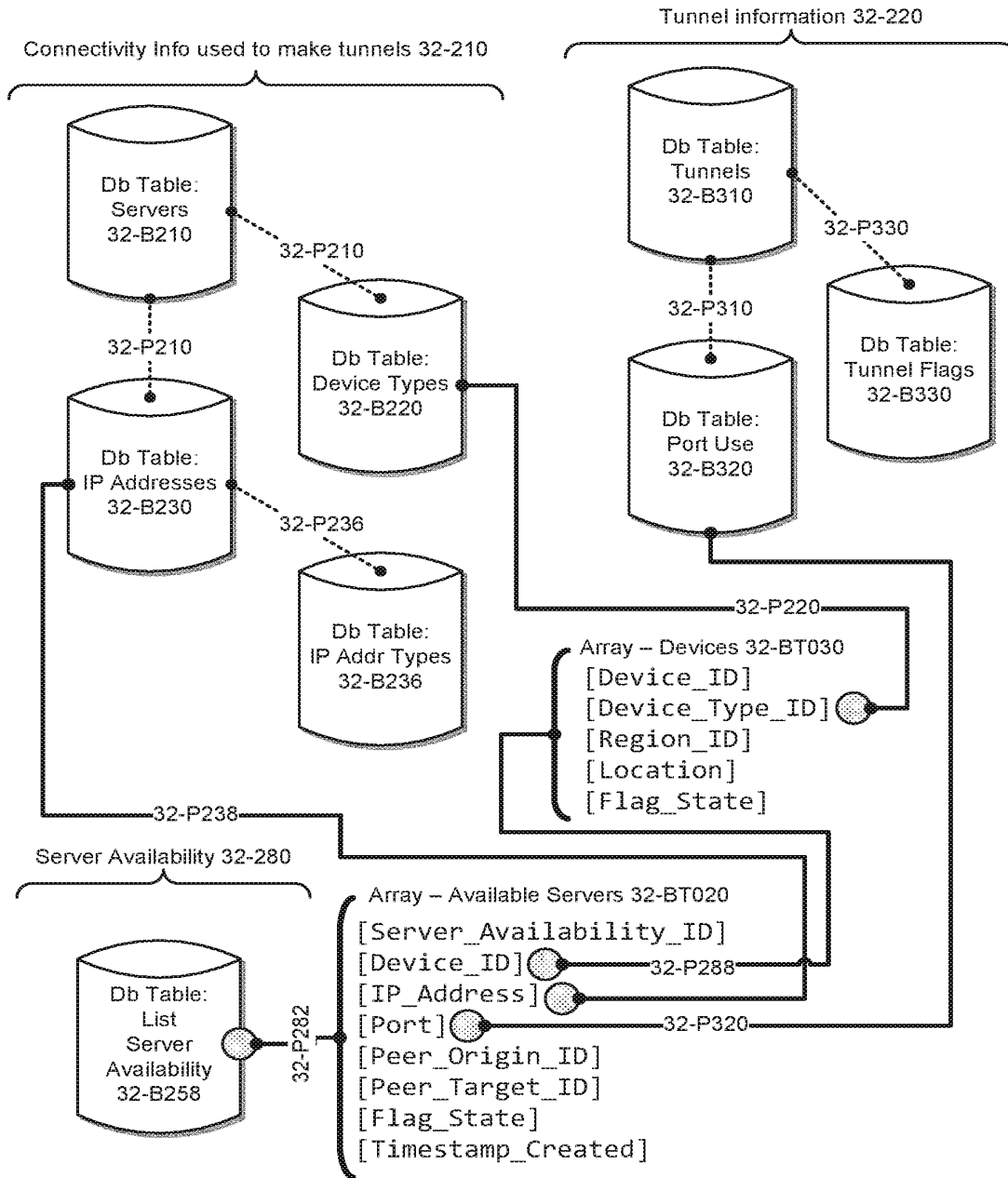


FIG. 32

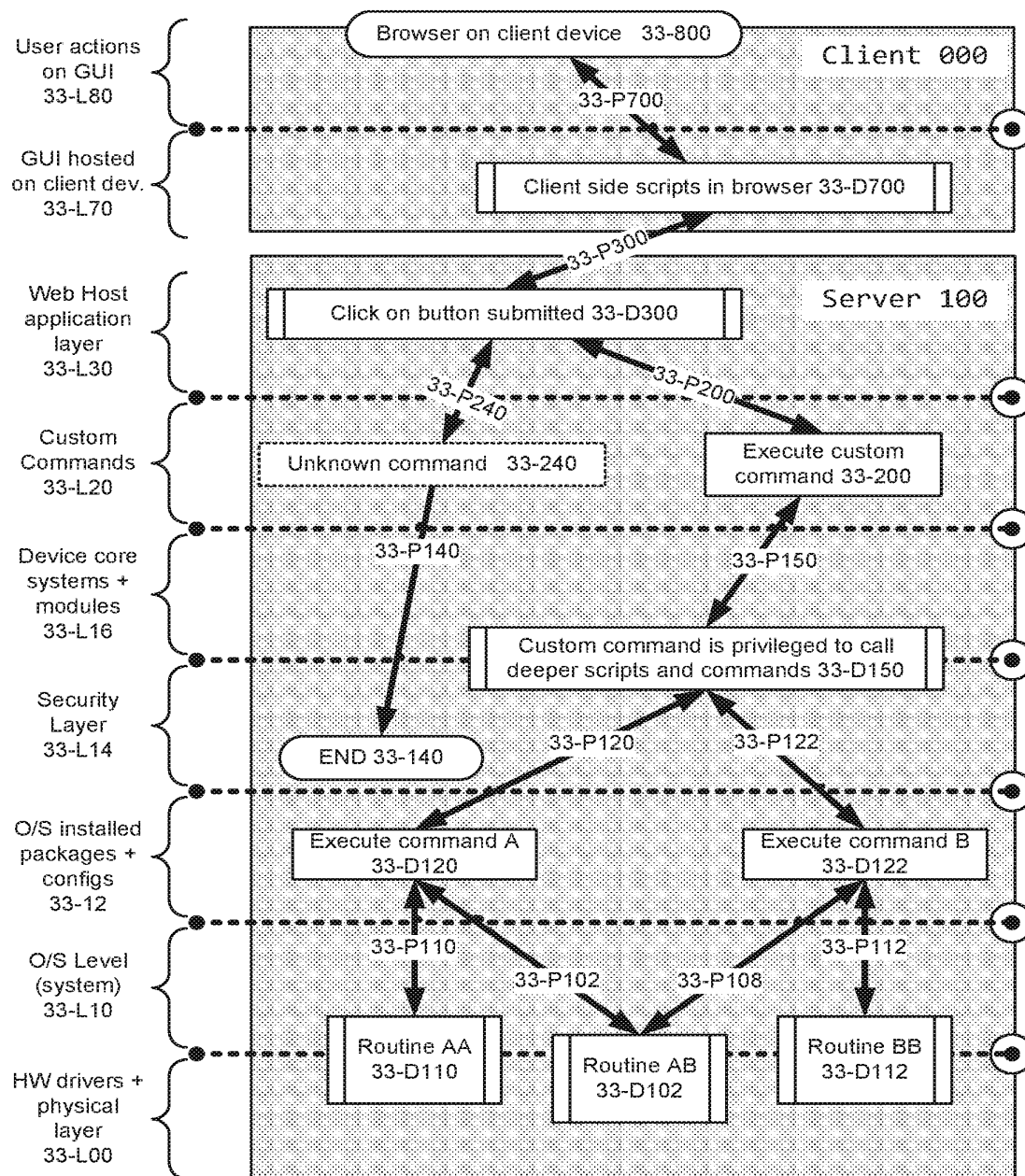


FIG. 33

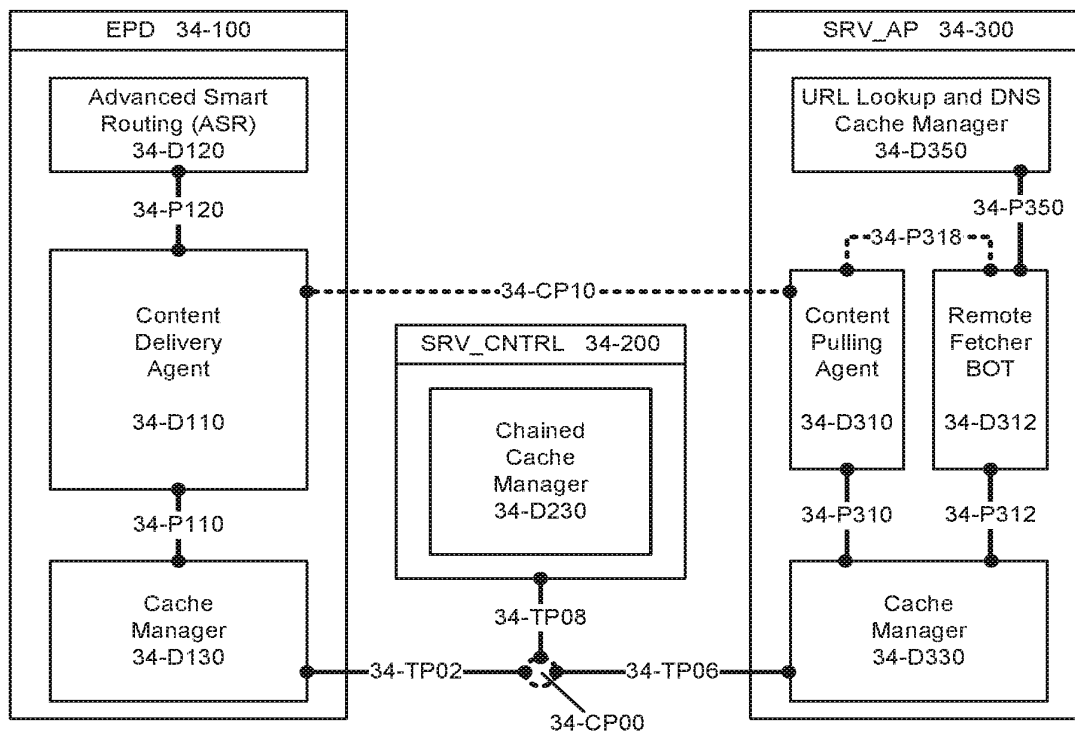
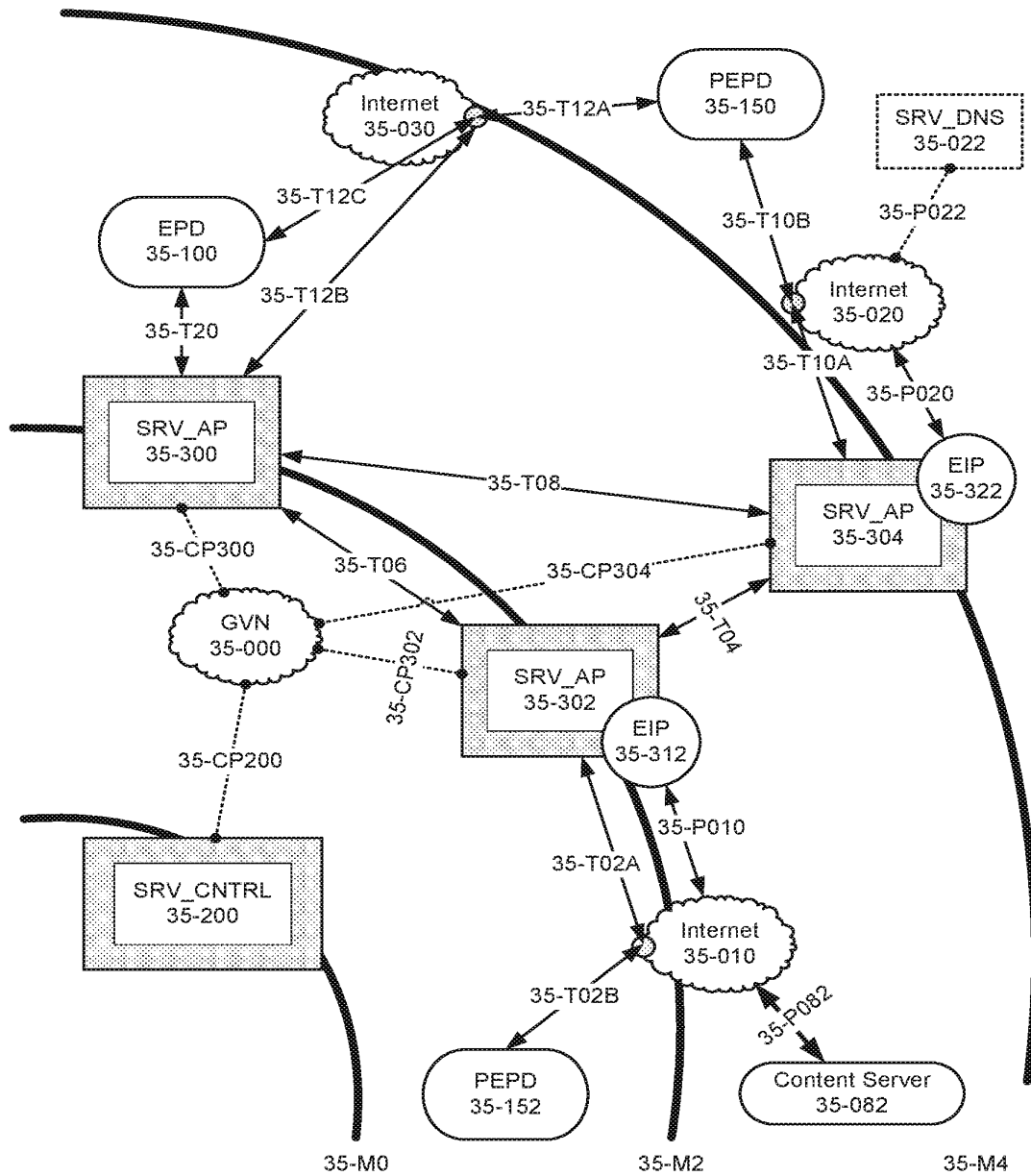


FIG. 34



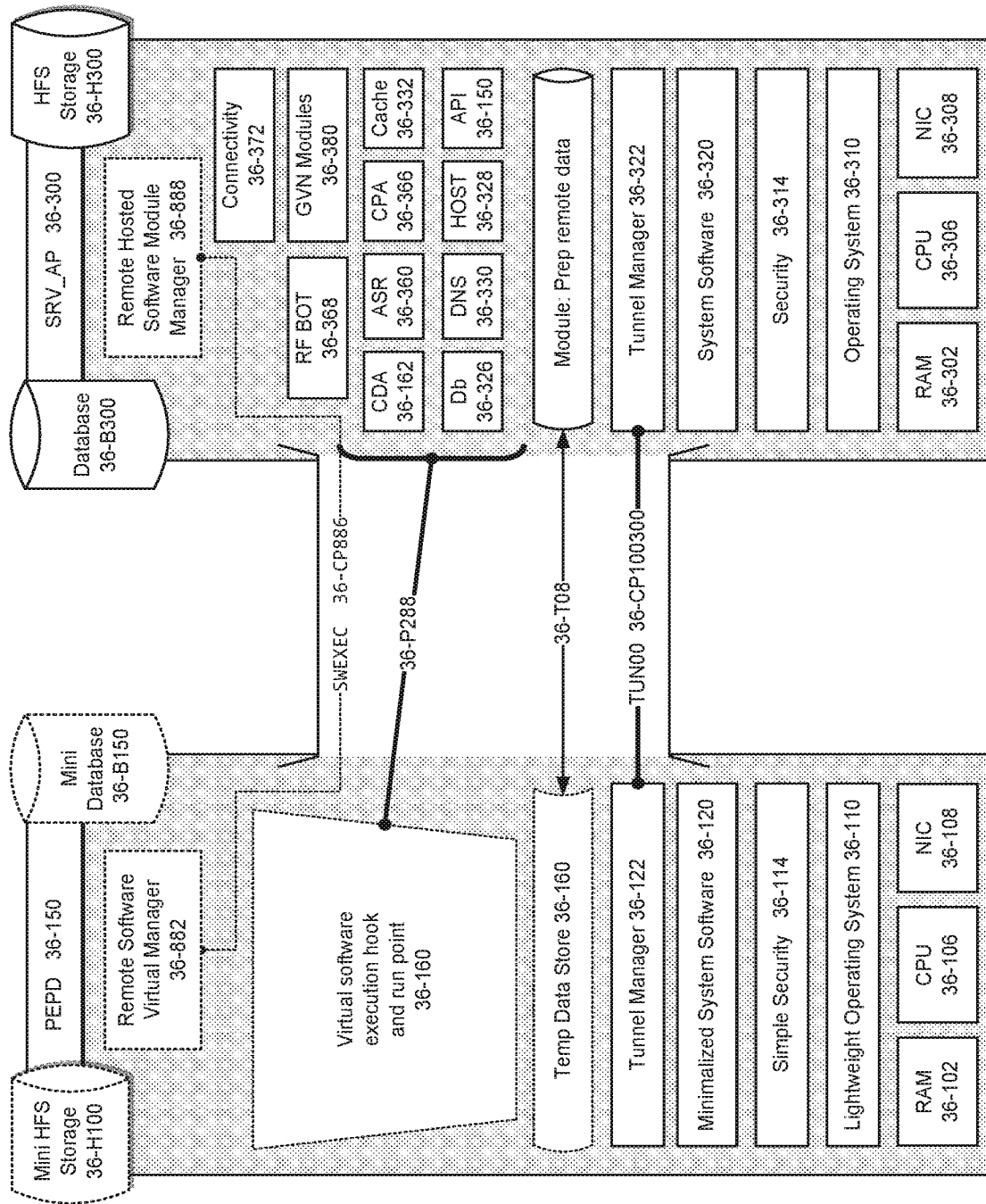


FIG. 36

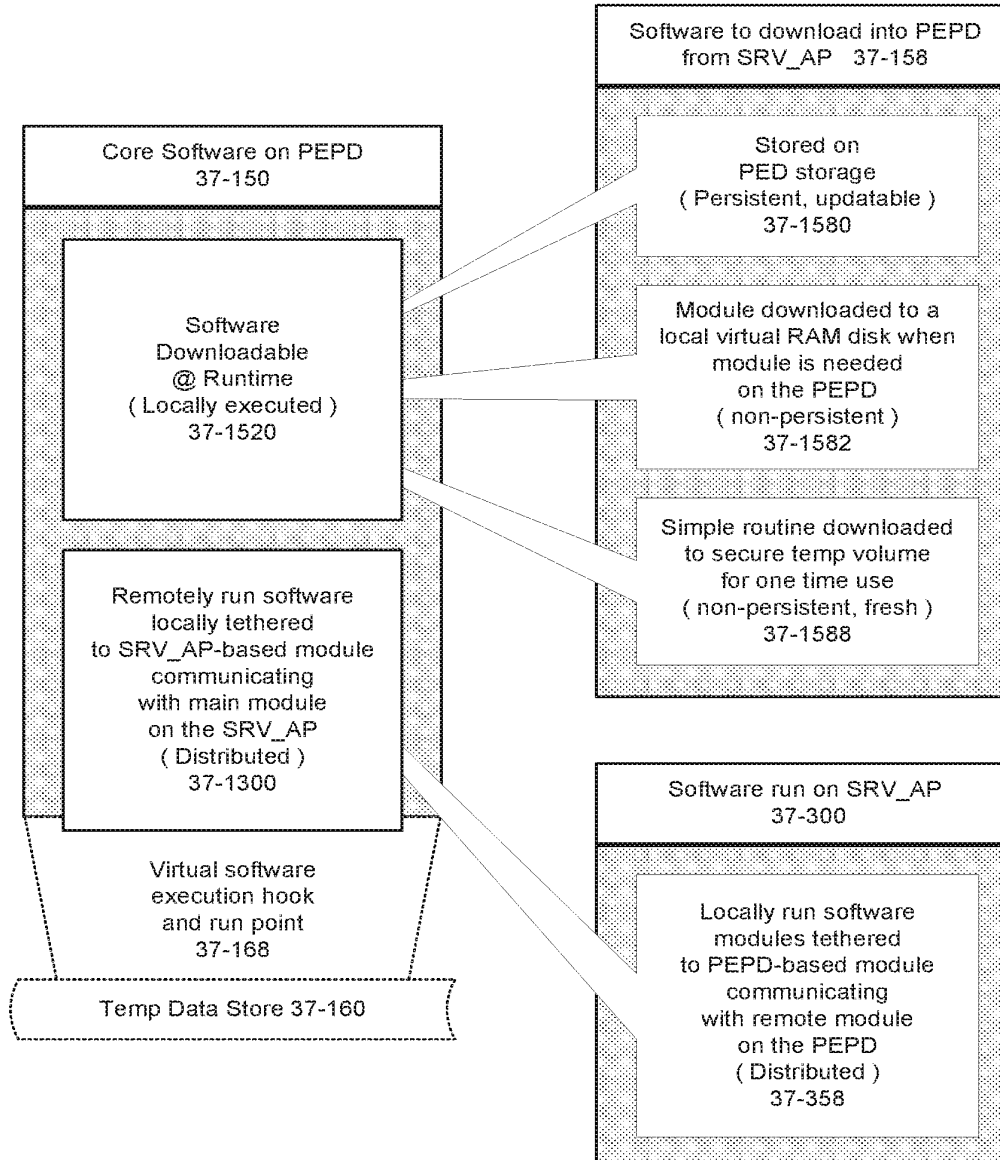


FIG. 37

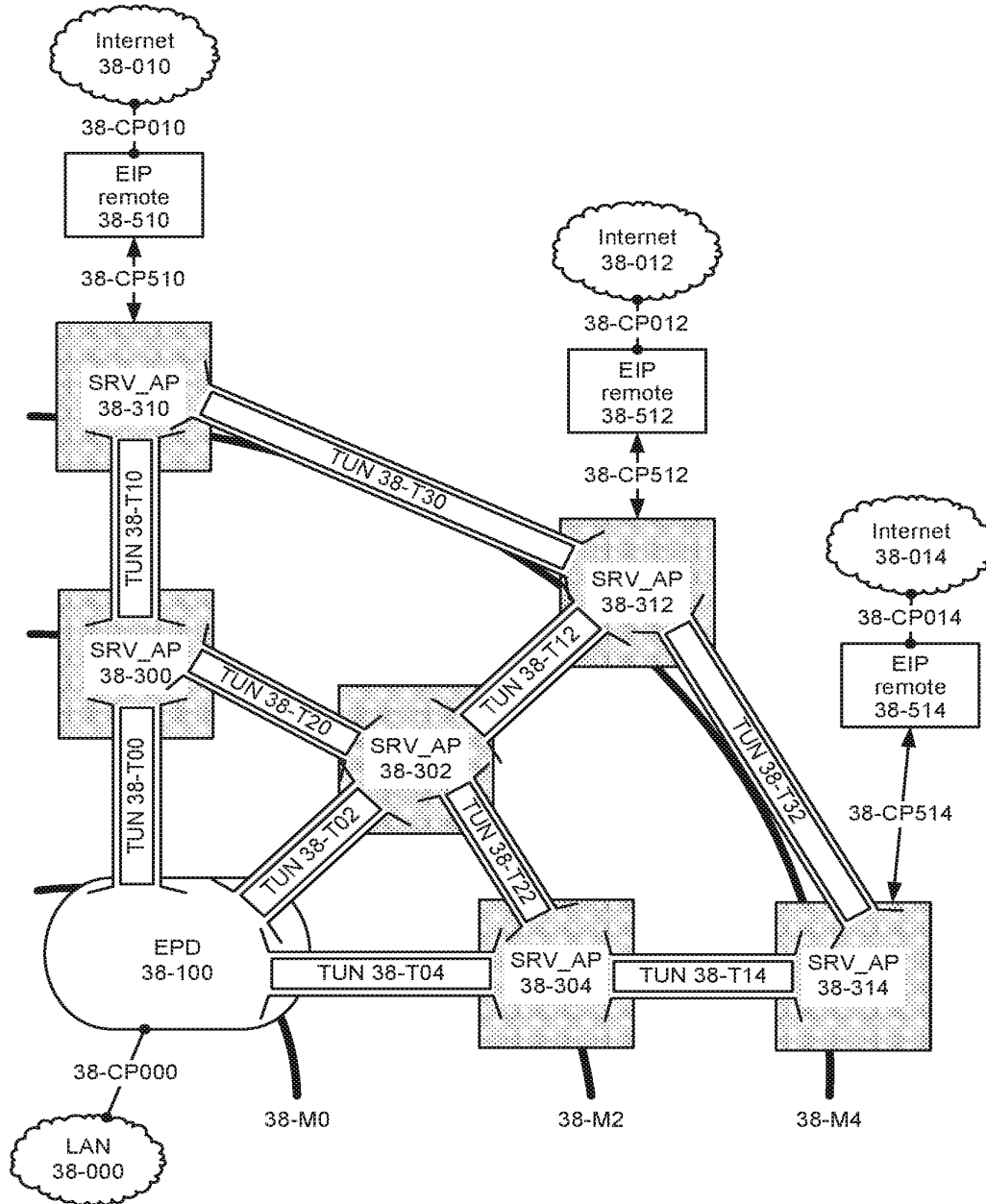


FIG. 38

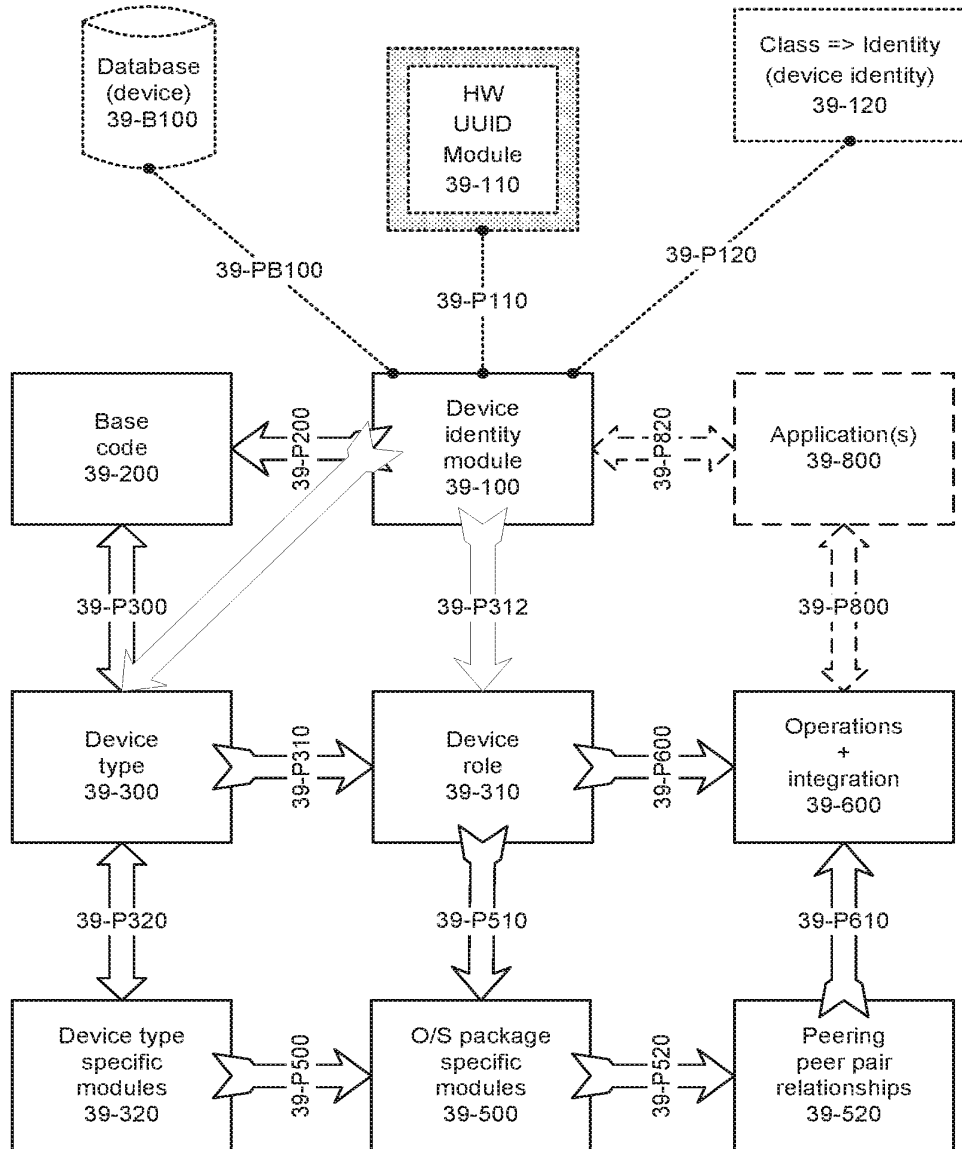


FIG. 39

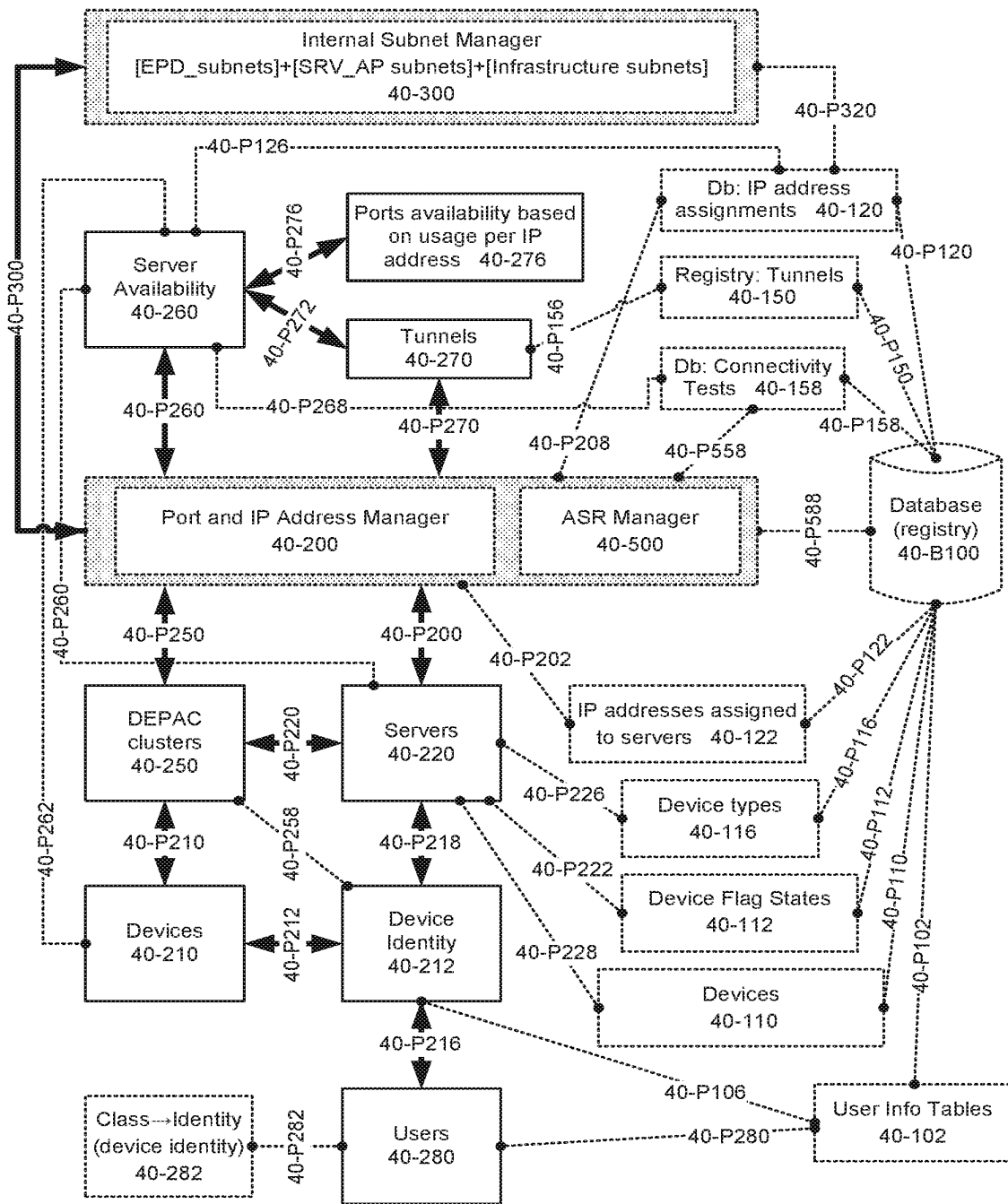
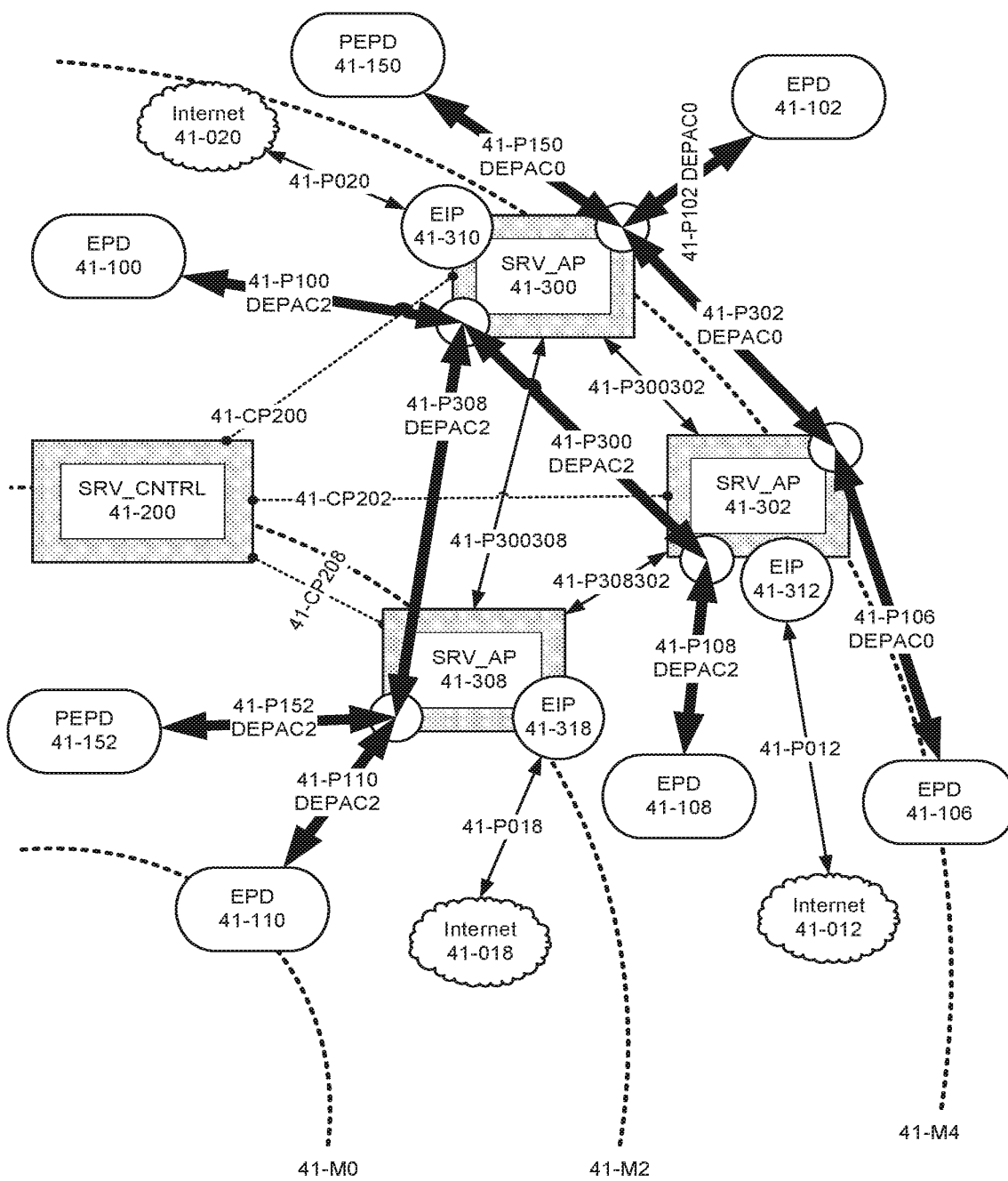


FIG. 40



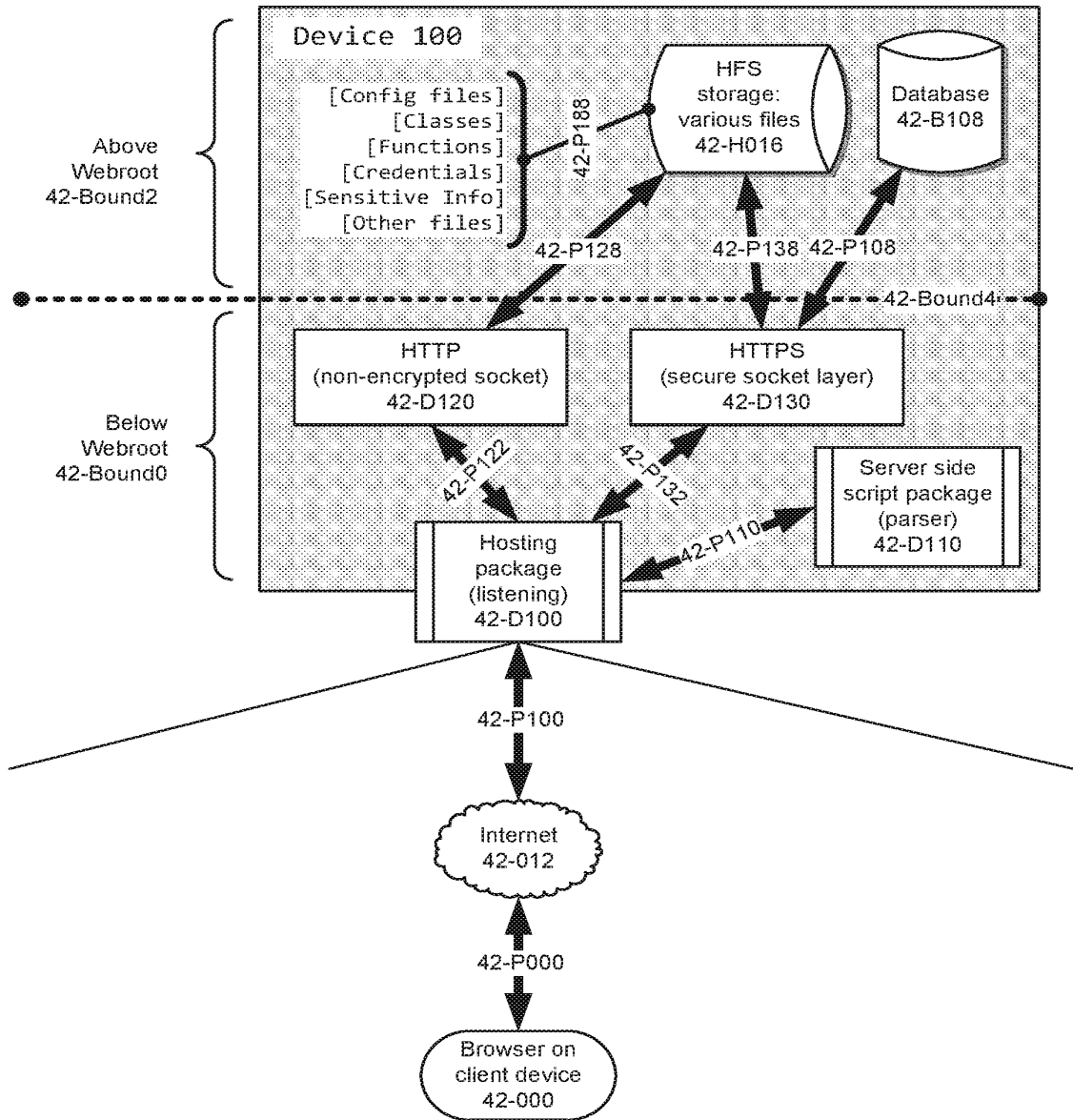


FIG. 42

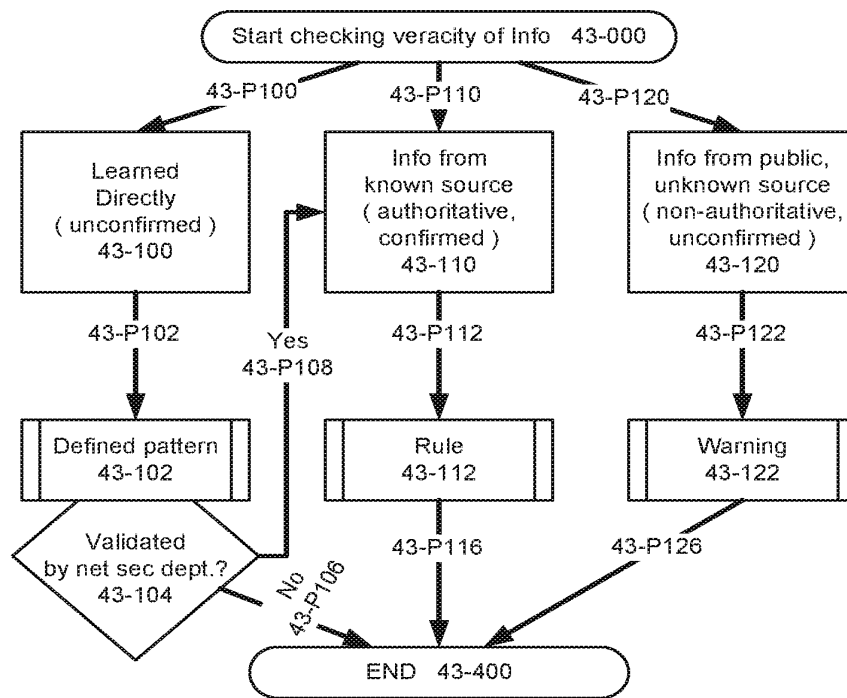


FIG. 43

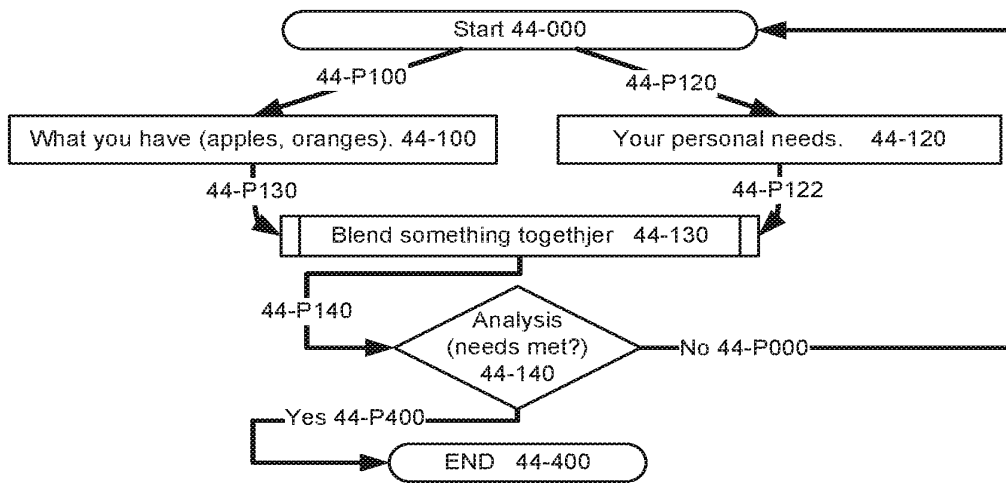


FIG. 44

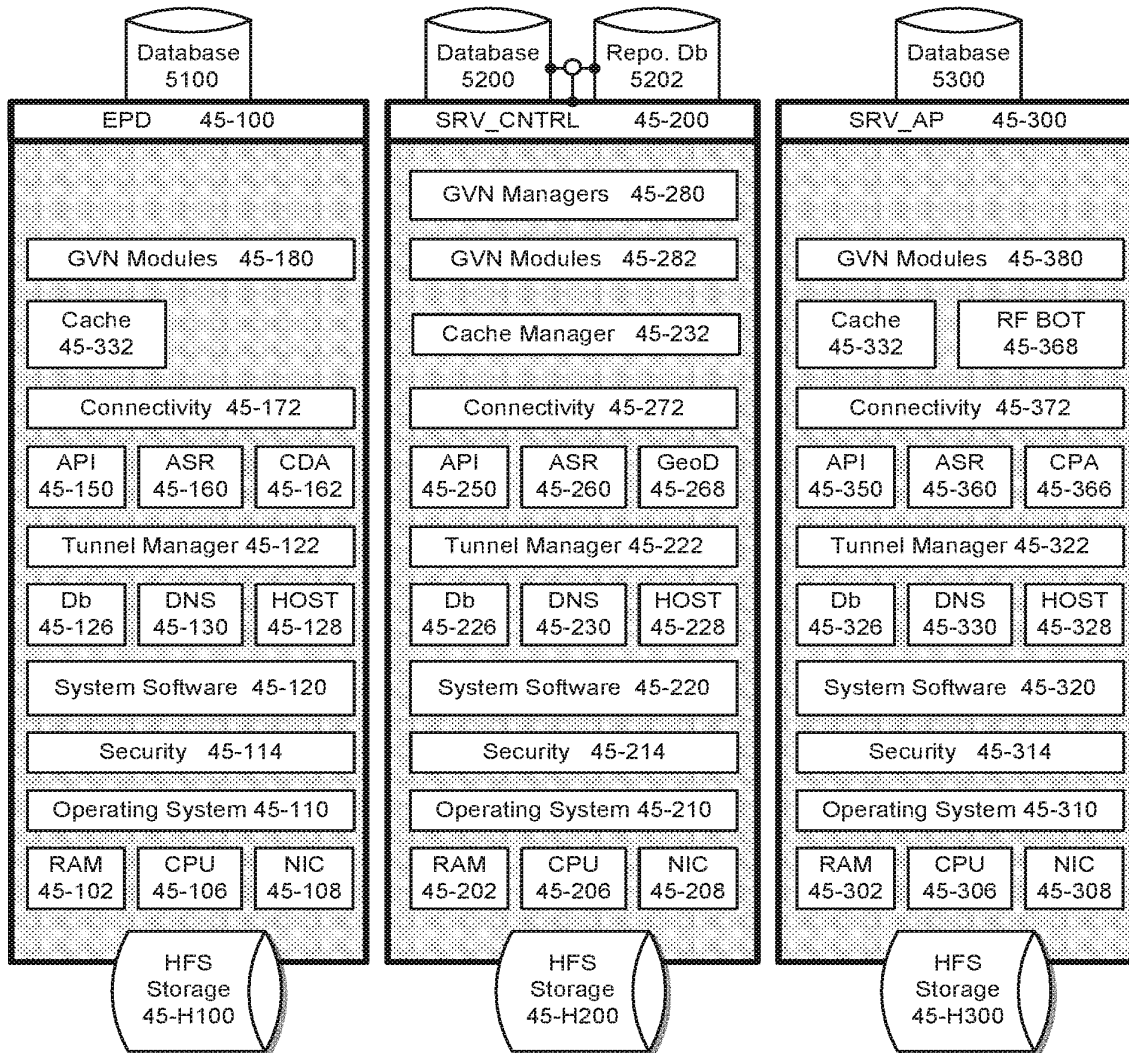


FIG. 45

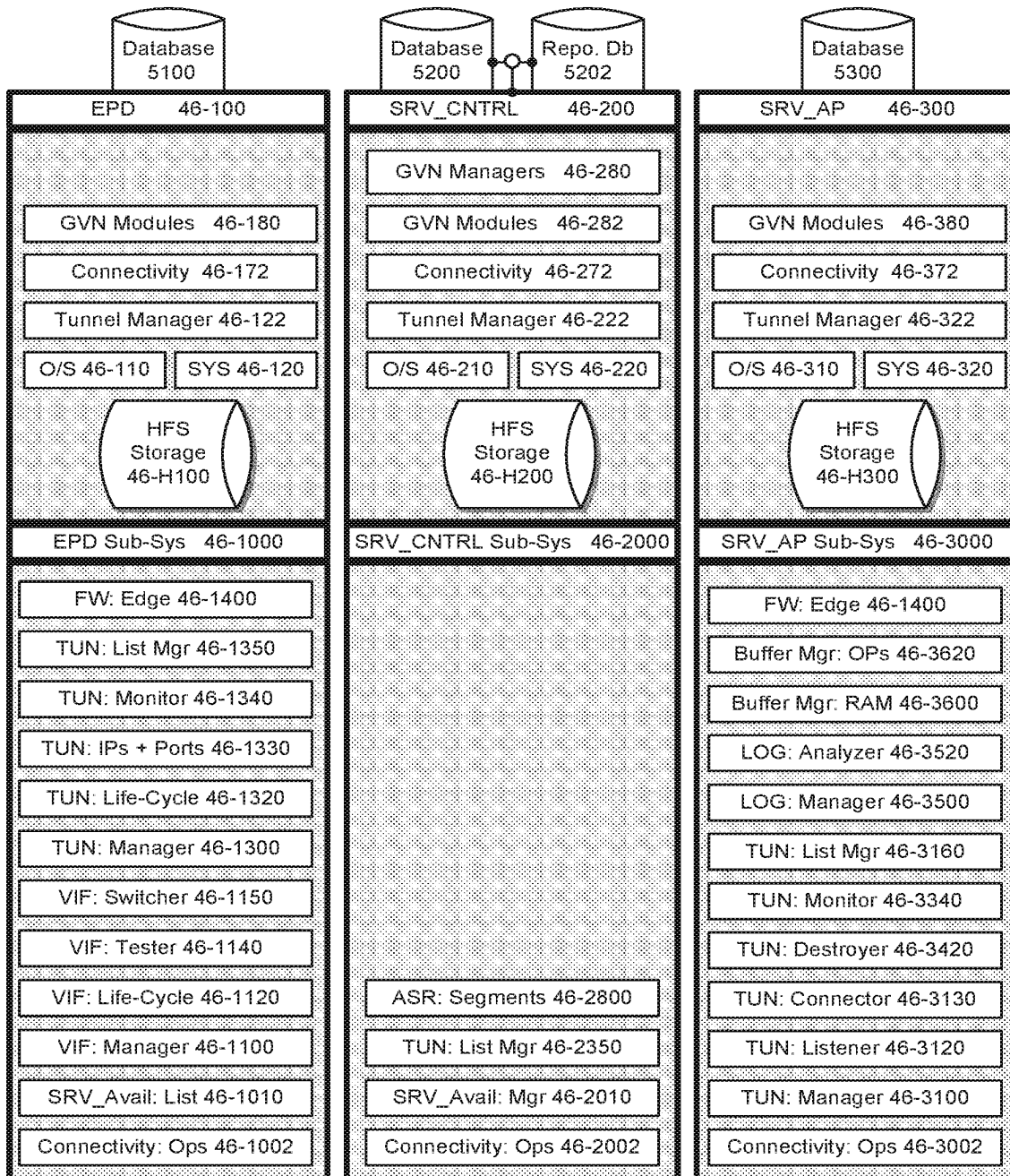


FIG. 46

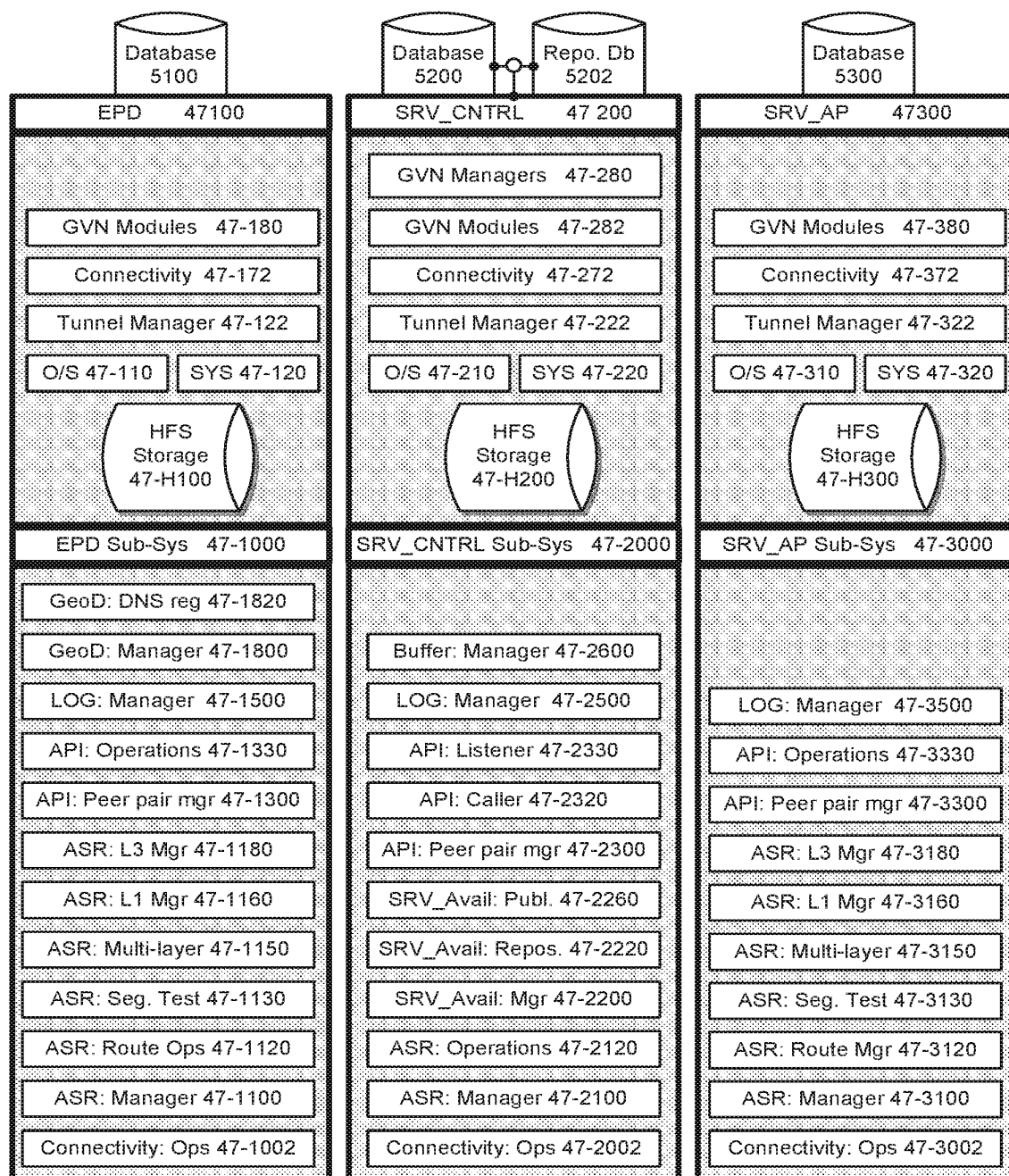


FIG. 47

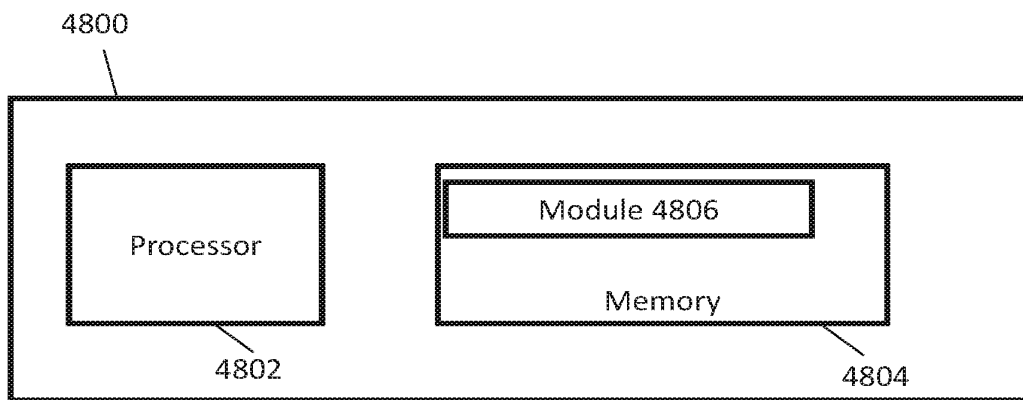


FIG. 48

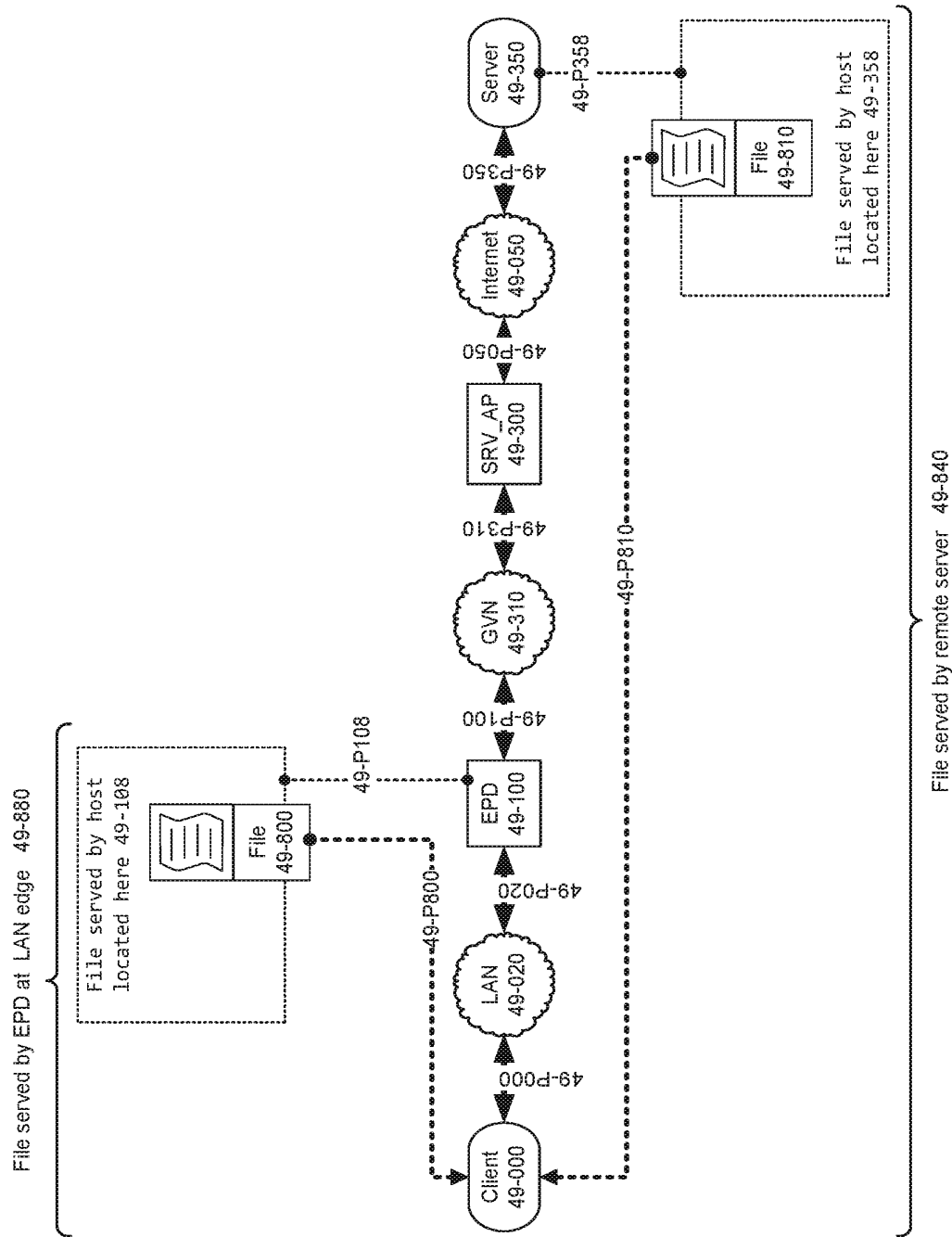


FIG. 49

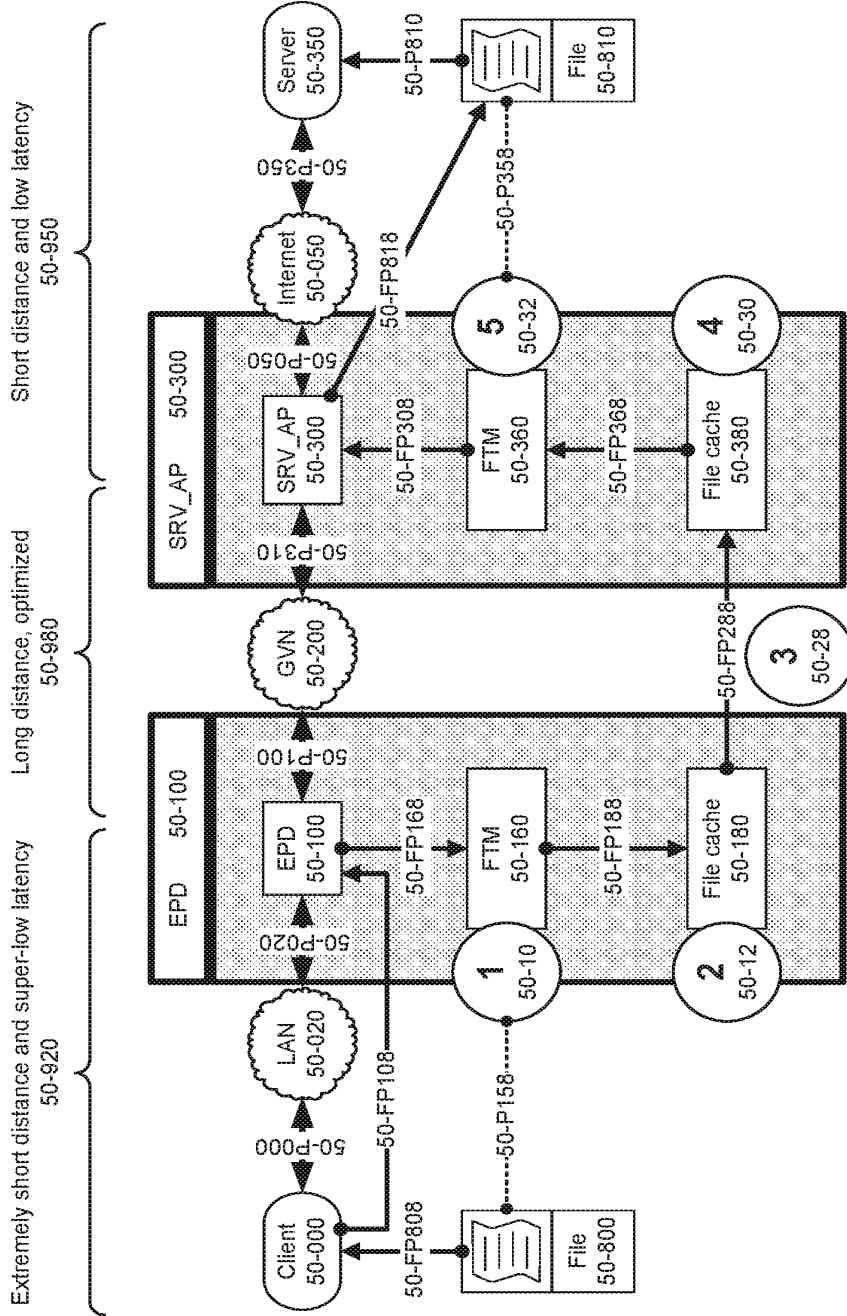


FIG. 50

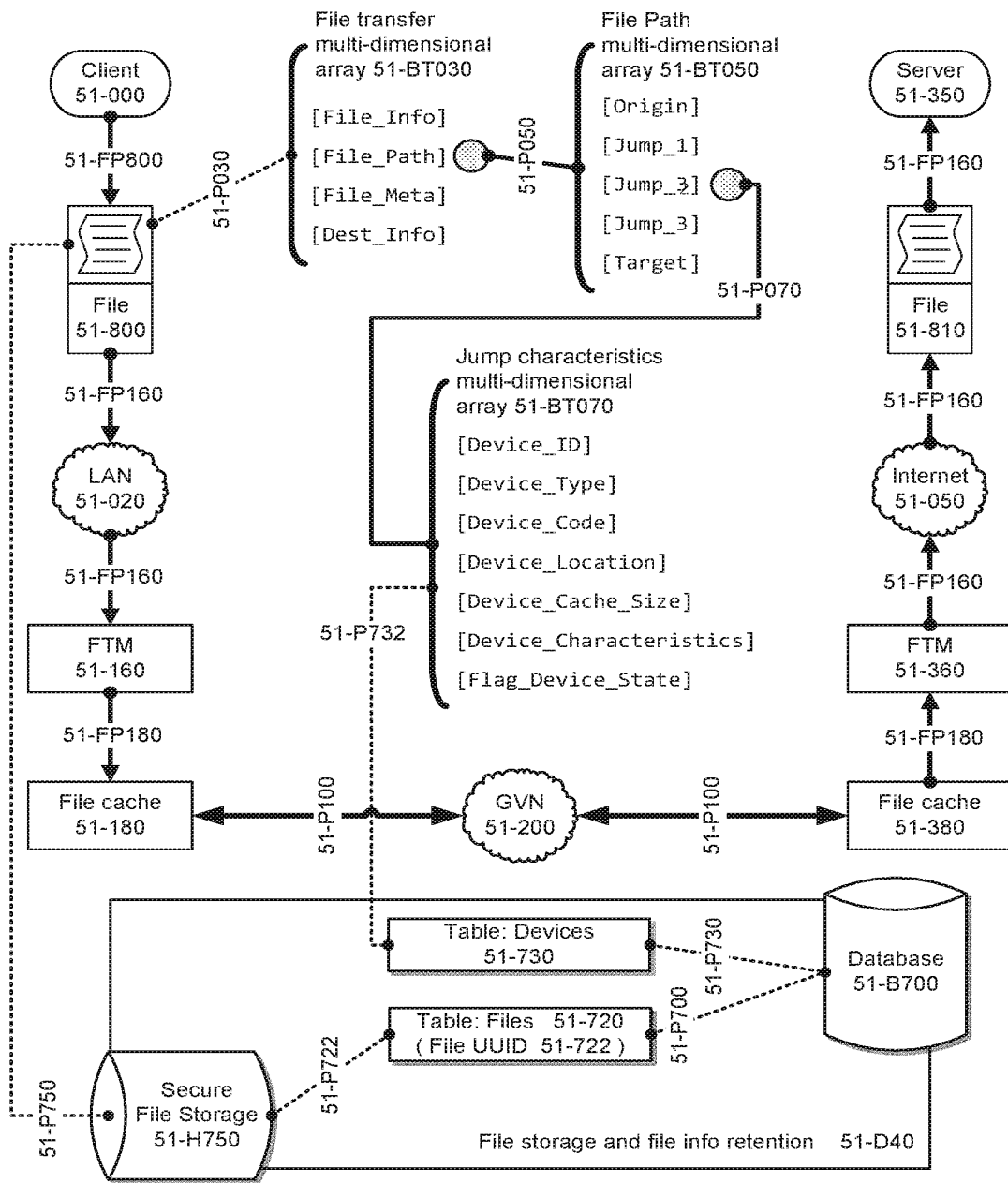


FIG. 51

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of
Invention

COMMUNICATION SYSTEMS AND METHODS

As the below named inventor, I hereby declare that:

This declaration ☐ The attached application, or
is directed to:

☒ United States application or PCT international application number 15/563,253
filed on 09/29/2017

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001
by fine or imprisonment of not more than five (5) years, or both.

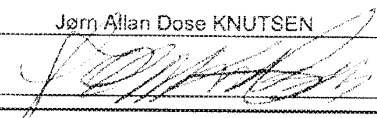
WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

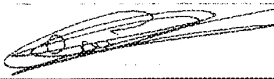
Inventor: Jørn Allan Dose KNUTSEN

Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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Title of Invention	COMMUNICATION SYSTEMS AND METHODS
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LEGAL NAME OF INVENTOR Inventor: <u>Carlos Eduardo ORÉ</u> Date (Optional) _____ Signature:  _____ Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

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LEGAL NAME OF INVENTOR

Thibaud Auguste Bernard Jean SAINT-

Inventor: MARTIN

Date (Optional) : _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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LEGAL NAME OF INVENTOR

Inventor: Fred BROUSSARD

Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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Invention

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filed on 09/29/2017

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by fine or imprisonment of not more than five (5) years, or both.

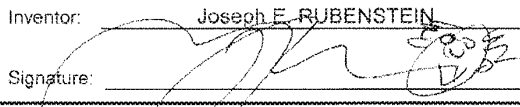
WARNING:

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LEGAL NAME OF INVENTOR

Inventor: Joseph E. RUBENSTEIN

Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.