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Sridhar et al.

(54) ETHERNET CONNECTIVITY FAULT MANAGEMENT WITH USER VERIFICATION OPTION

(75) Inventors: **Kamakshi Sridhar**, Plano, TX (US); **Ludwig Pauwels**, Beveren (BE); **Sven Ooghe**, Gentbrugge (BE)

Correspondence Address:
Law Office of WILLIAM J. TUCKER
2631 Lakeforest Ct.
Dallas, TX 75214 (US)

(73) Assignee: **ALCATEL LUCENT**, Paris (FR)

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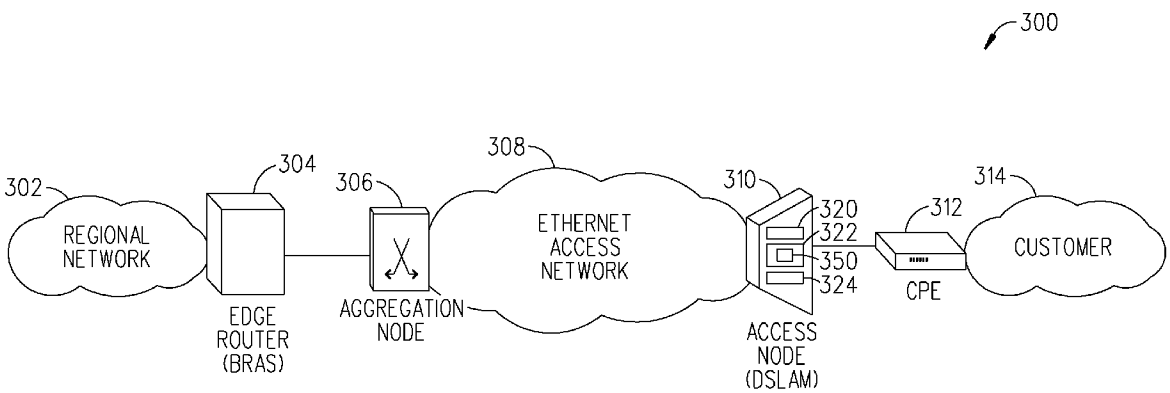
(57) **ABSTRACT**

An access node (e.g., DSLAM, OLT/ONT) is described herein that implements a trust verification method comprising the steps of: (a) filtering an up-stream message initiated by a non-trusted device (e.g., CPE); (b) intercepting the filtered up-stream message if the filtered up-stream message is a connectivity fault management message (e.g., LB message, LBR message, CC message); (c) inserting a trusted identification into the intercepted up-stream message; and (d) outputting the intercepted up-stream message with the inserted trusted identification. Thereafter, a trusted device (e.g., BRAS) receives and analyzes the outputted up-stream message with the inserted trusted identification message to ascertain a trustworthiness of the non-trusted device (e.g., CPE). Several different ways that an access network (e.g., IPTV network) can implement the trust verification method are also described herein.



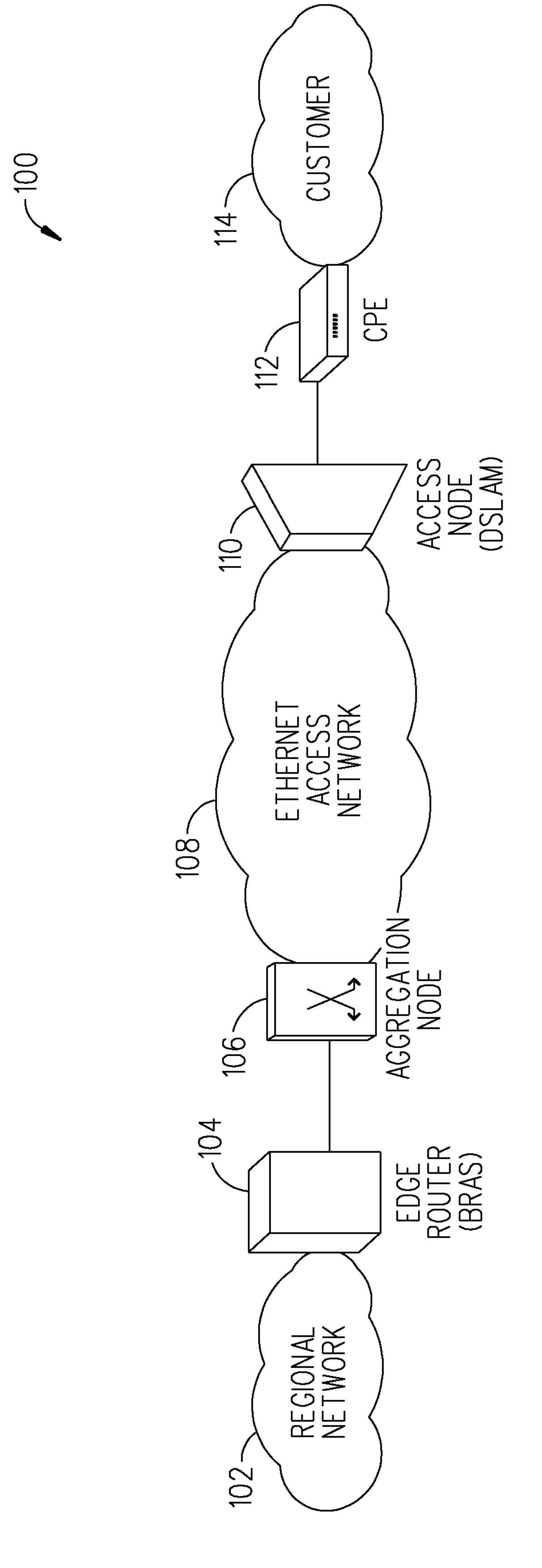


FIG. 1 (PRIOR ART)

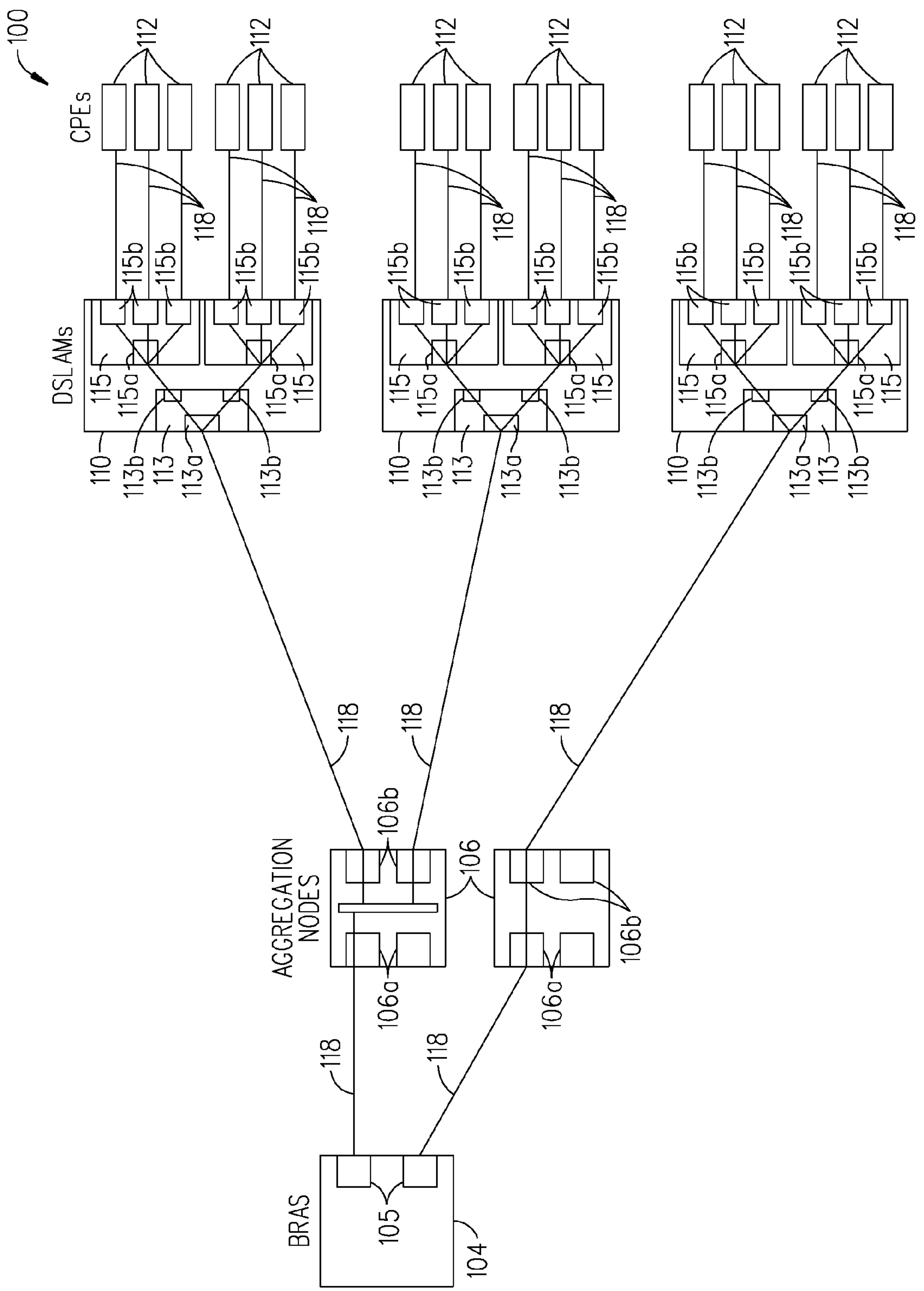


FIG. 2 (PRIOR ART)

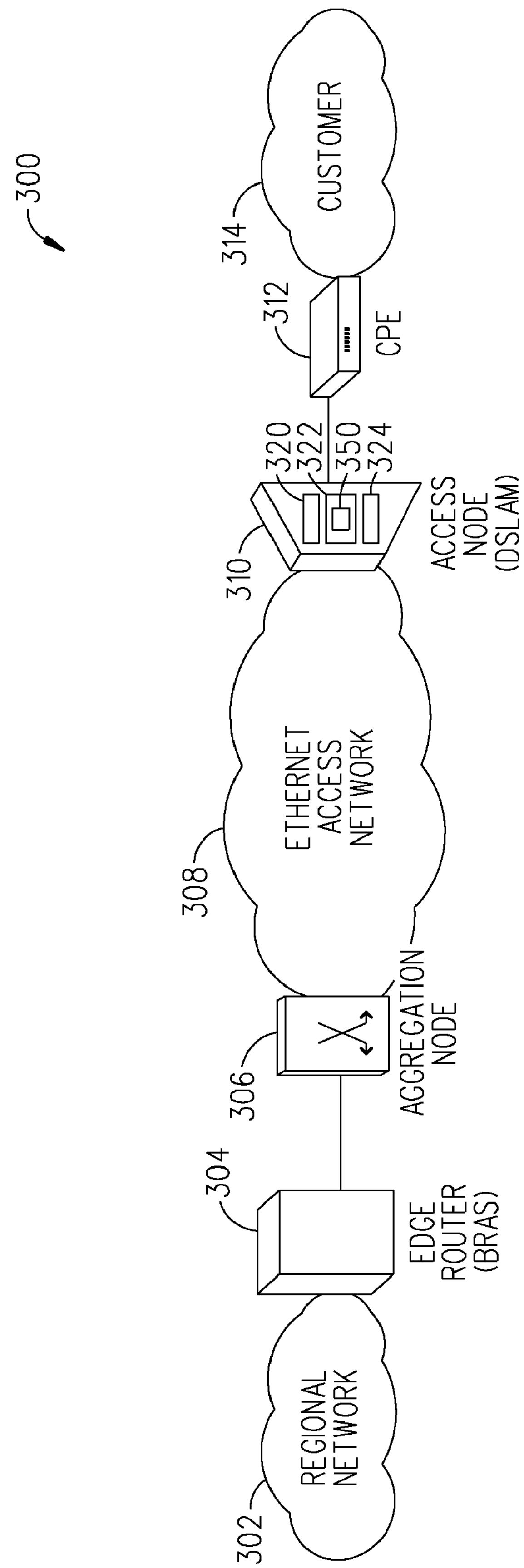

300
CUSTOMER
314
312
CPE
320
322
350
324
310
ACCESS NODE (DSLAM)
308
ETHERNET ACCESS NETWORK
AGGREGATION NODE
306
304
EDGE ROUTER (BRAS)
REGIONAL NETWORK
302

FIG. 3

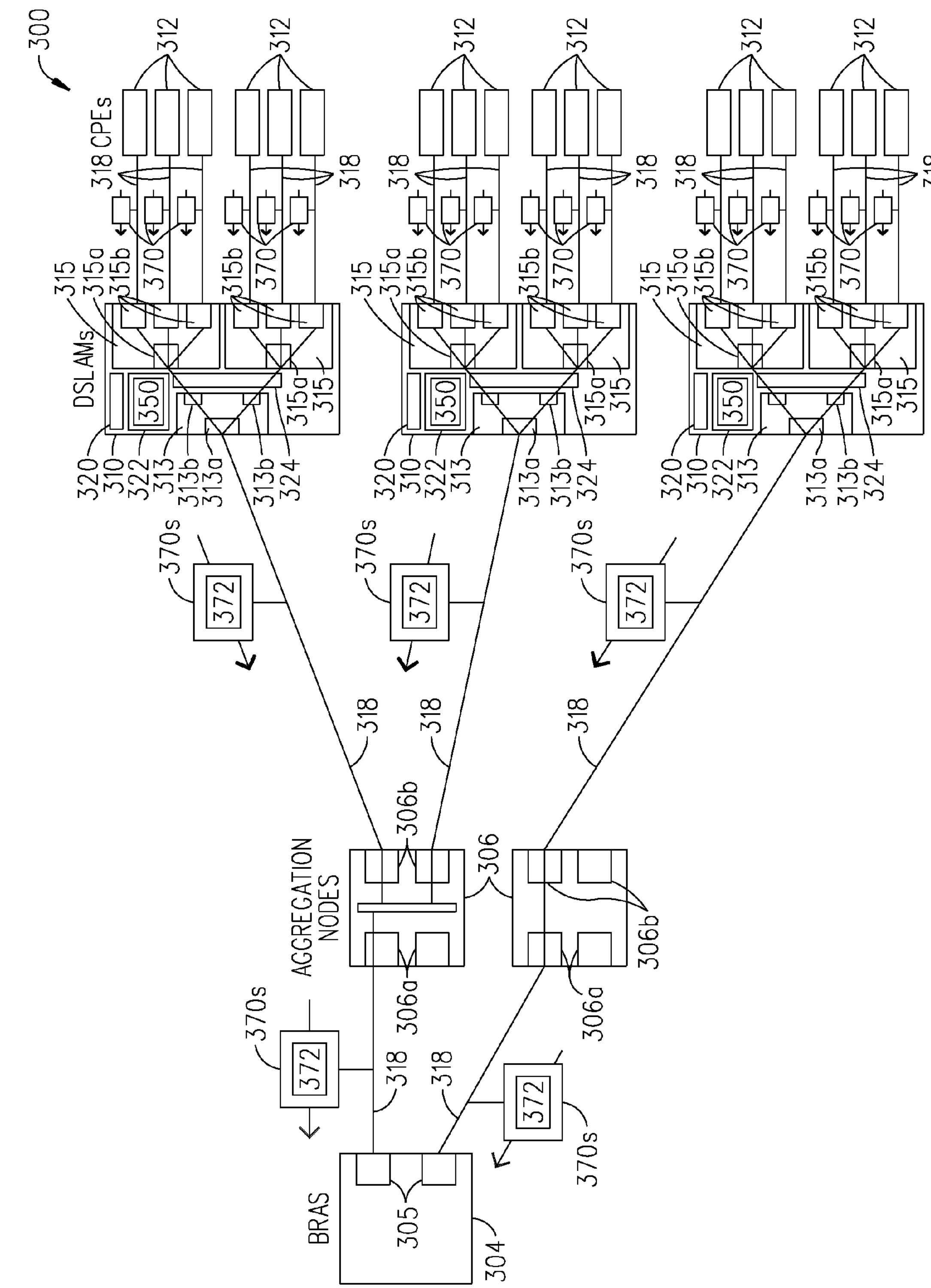

300
312
318 CPEs
318
370
315
315a
315b
DSLAMs
350
320
310
322
313
313b
313a
313b
324
315a
315
372
370s
318
306b
306
AGGREGATION NODES
306a
BRAS
305
304

FIG. 4

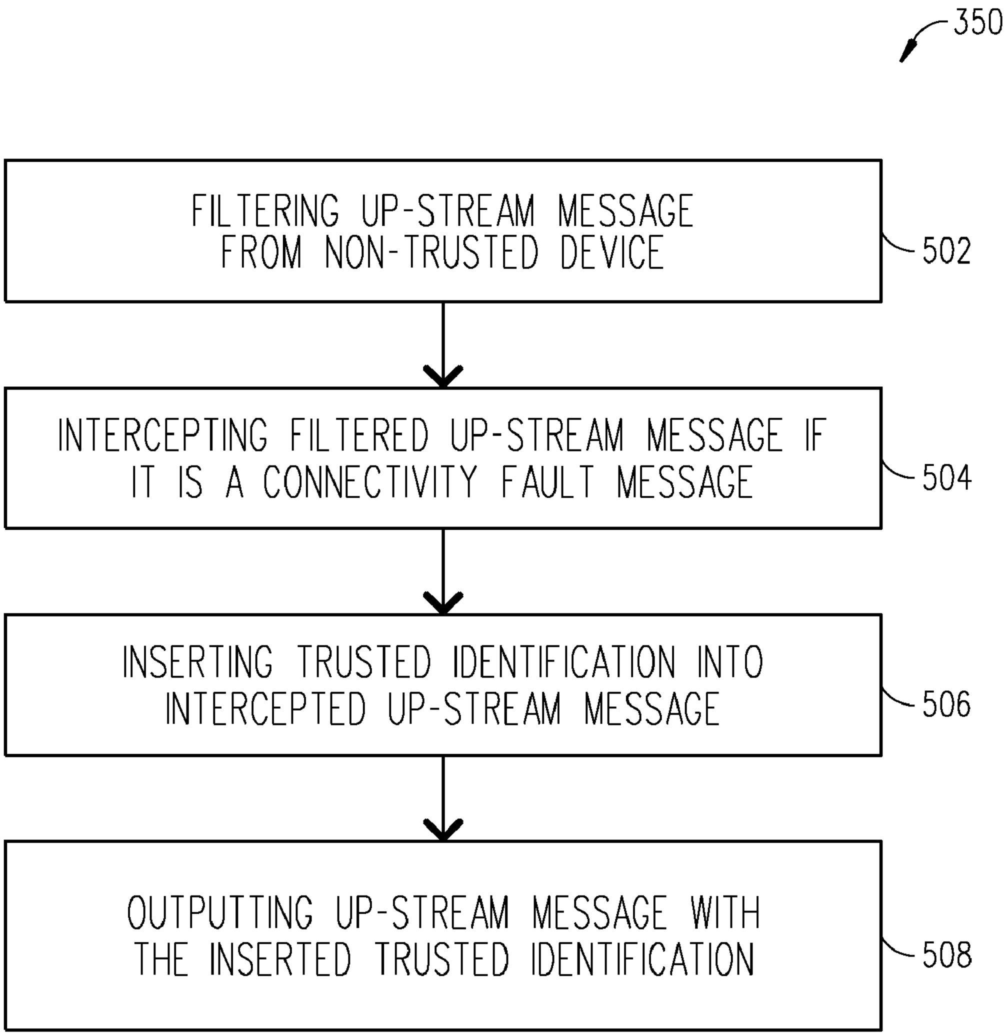

350
FILTERING UP-STREAM MESSAGE FROM NON-TRUSTED DEVICE
502
INTERCEPTING FILTERED UP-STREAM MESSAGE IF IT IS A CONNECTIVITY FAULT MESSAGE
504
INSERTING TRUSTED IDENTIFICATION INTO INTERCEPTED UP-STREAM MESSAGE
506
OUTPUTTING UP-STREAM MESSAGE WITH THE INSERTED TRUSTED IDENTIFICATION
508

FIG. 5

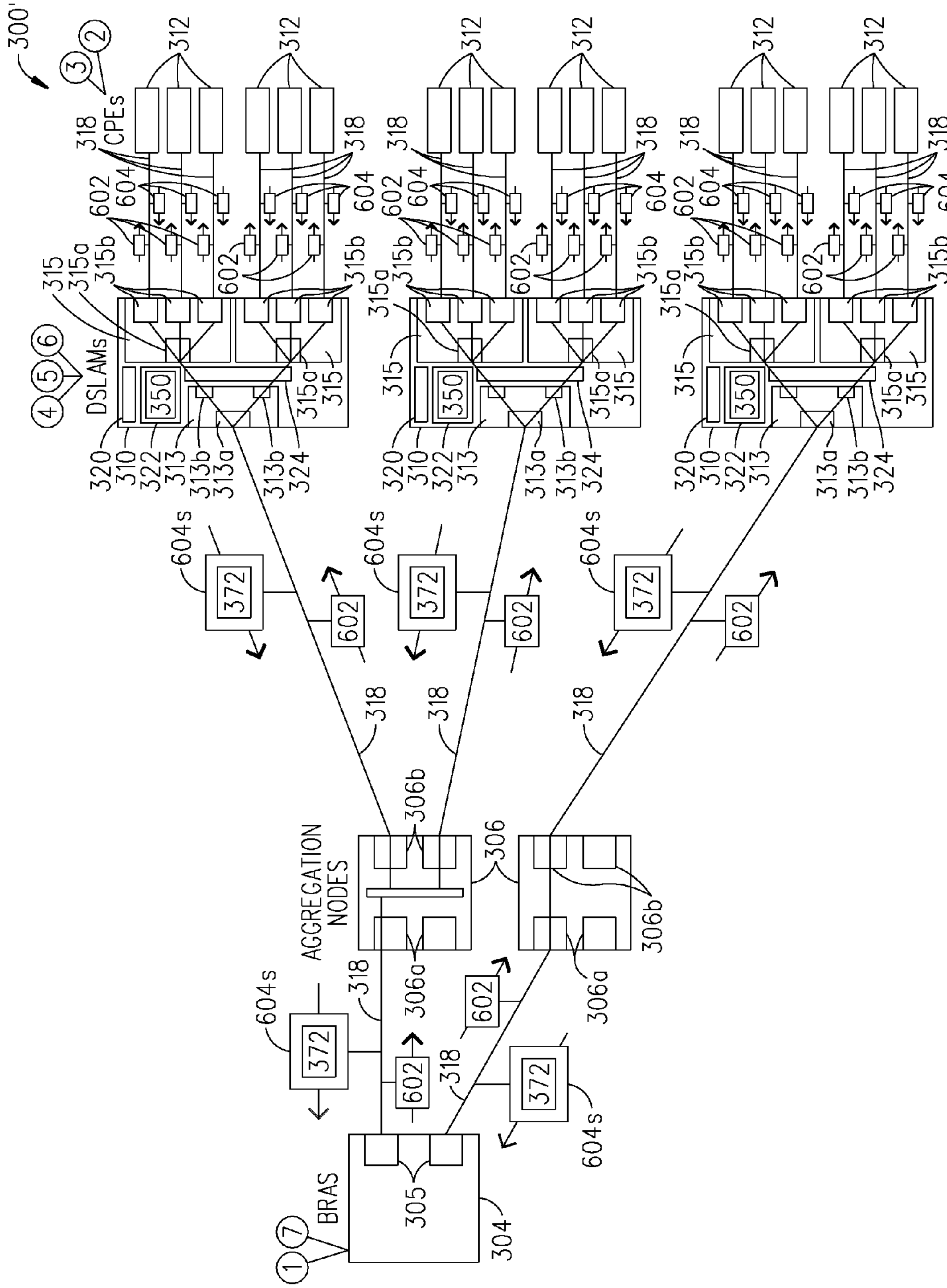

300'
CPEs
DSLAMs
AGGREGATION NODES
BRAS
312
318
602
604
315
315a
315b
320
310
322
313
313a
313b
324
350
372
604s
306
306a
306b
305
304
1
2
3
4
5
6
7

FIG. 6

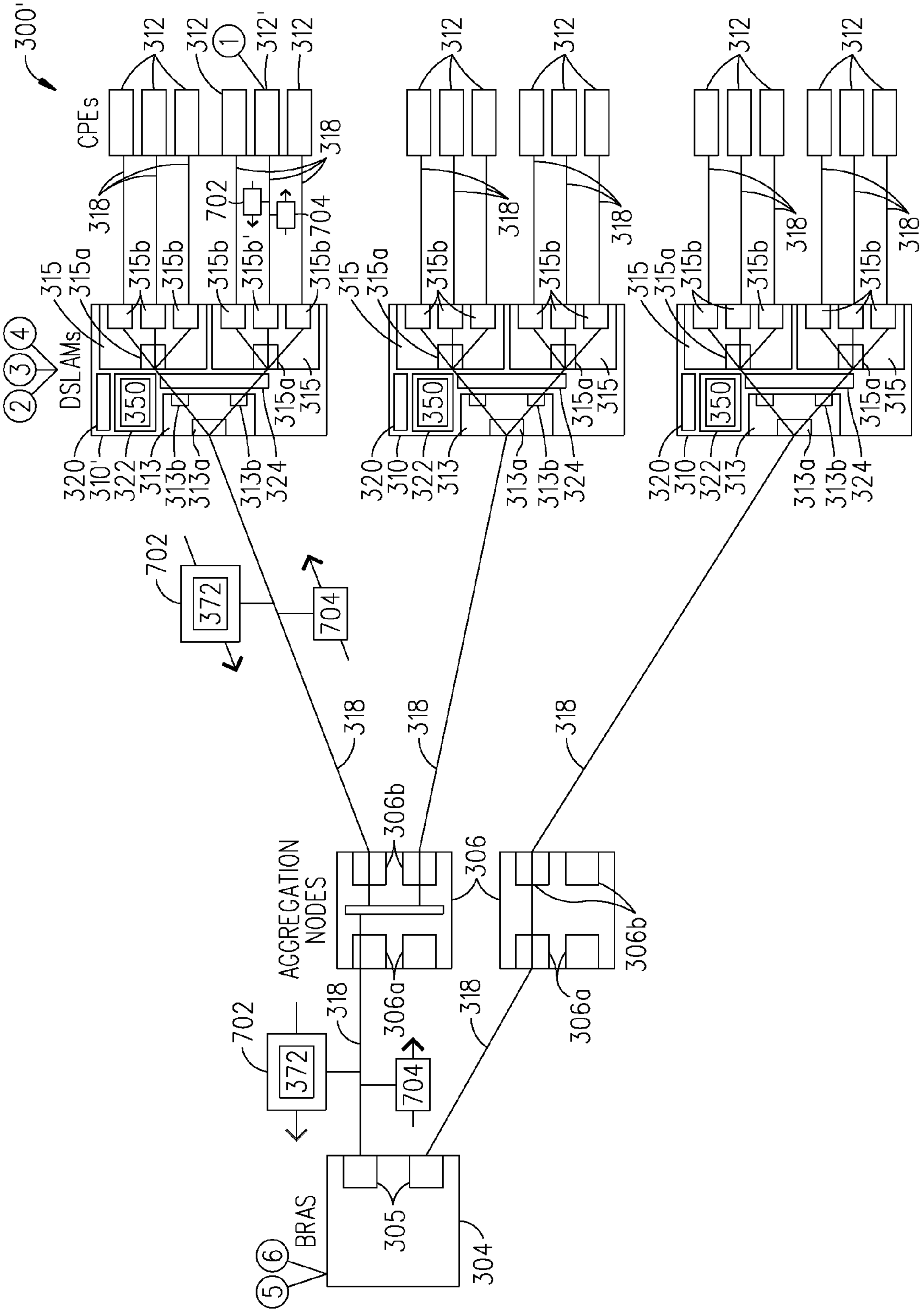


FIG. 7

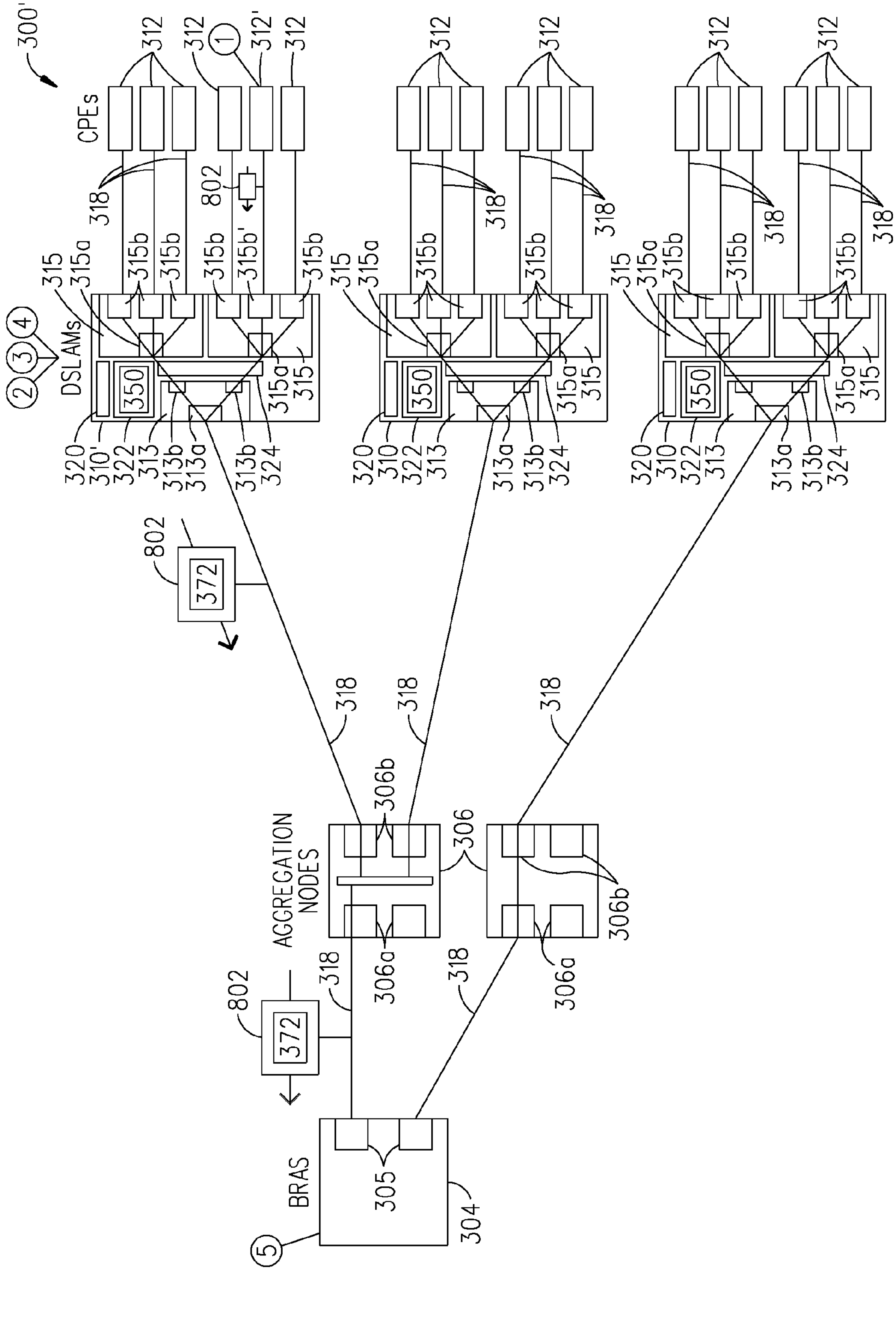

300'''
CPEs
312
312'
1
318
802
DSLAMs
2
3
4
315
315a
315b
315b'
350
320
310'
310
322
313
313a
313b
324
372
AGGREGATION NODES
306
306a
306b
BRAS
305
304
5

FIG. 8

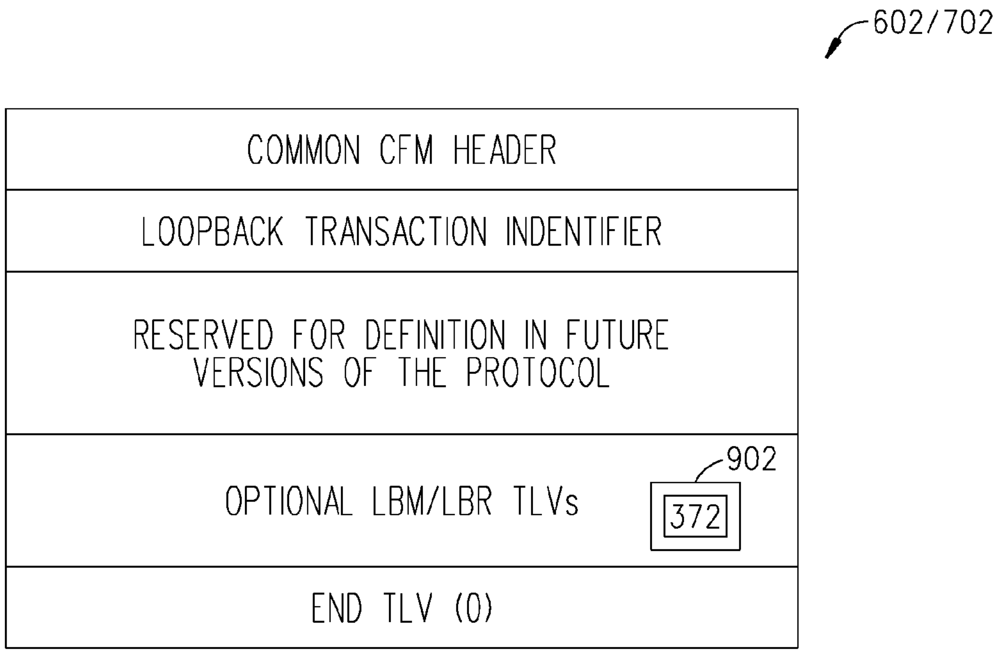

602/702
COMMON CFM HEADER
LOOPBACK TRANSACTION INDENTIFIER
RESERVED FOR DEFINITION IN FUTURE VERSIONS OF THE PROTOCOL
OPTIONAL LBM/LBR TLVs
902
372
END TLV (0)

FIG. 9

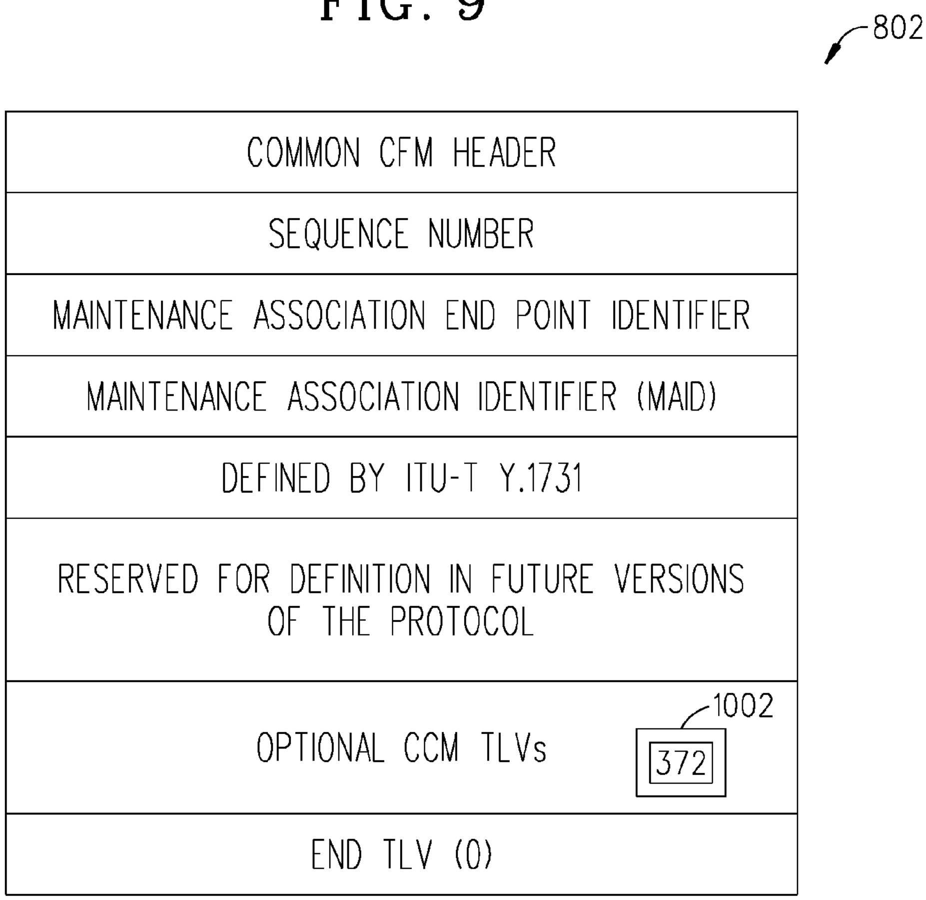

802
COMMON CFM HEADER
SEQUENCE NUMBER
MAINTENANCE ASSOCIATION END POINT IDENTIFIER
MAINTENANCE ASSOCIATION IDENTIFIER (MAID)
DEFINED BY ITU-T Y.1731
RESERVED FOR DEFINITION IN FUTURE VERSIONS OF THE PROTOCOL
OPTIONAL CCM TLVs
1002
372
END TLV (0)

FIG. 10

372

<table>
<tr><td colspan="2">0X0105 (VENDOX-SPECIFIC)</td><td>TAG_LENGTH</td></tr>
<tr><td colspan="3">0X00000DE9 (3561 DECIMAL, i.e. "ADSL FORUM" IANA ENTRY)</td></tr>
<tr><td>0X01</td><td>LENGTH</td><td>AGENT CIRCUIT ID VALUE</td></tr>
<tr><td colspan="3">AGENT CIRCUIT ID VALUE (CONT'D)</td></tr>
<tr><td>0X02</td><td>LENGTH</td><td>AGENT REMOTE ID VALUE</td></tr>
<tr><td colspan="3">AGENT REMOTE ID VALUE (CONT'D)</td></tr>
</table>

FIG. 11

ETHERNET CONNECTIVITY FAULT MANAGEMENT WITH USER VERIFICATION OPTION

TECHNICAL FIELD

[0001] The present invention relates to an access node (e.g., DSLAM, ONT/OLT) and method that enables an edge router (e.g., BRAS) to obtain a trusted verification of an end-user (e.g., CPE) by using in part Ethernet connectivity fault management messages (e.g., LBM messages, LBR messages, CC messages).

BACKGROUND

[0002] The following abbreviations are herewith defined, at least some of which are referred to in the following description associated with the prior art and the present invention.

[0003] BRAS Broadband Remote Access Server

[0004] BTV Broadcast Television

[0005] CC Continuity Check

[0006] DA Destination Address

[0007] DHCP Dynamic Host Configuration Protocol

[0008] DSL Digital Subscriber Line

[0009] DSLAM Digital Subscriber Line Access Multiplexer

[0010] IEEE Institute of Electrical and Electronics Engineers

[0011] IP Internet Protocol

[0012] IPTV Internet Protocol Television

[0013] LAN Local Area Network

[0014] LB Loopback

[0015] LBR Loopback Reply

[0016] LT Line Termination (customer-side of a DSLAM)

[0017] NT Network Termination (network-side of a DSLAM)

[0018] MA Maintenance Association

[0019] MAC Media Access Control

[0020] MD Maintenance Domain

[0021] MEP Maintenance End Point

[0022] OAM Operation, Administration and Maintenance

[0023] OLT Optical Line Termination

[0024] ONT Optical Network Termination

[0025] PON Passive Optical Network

[0026] RGW Residential Gateway

[0027] TLV Type-Length-Value

[0028] TV Television

[0029] Referring to FIGS. **1-2** (PRIOR ART), there are two block diagrams of a traditional access network **100** with Ethernet-based DSL aggregation (e.g., see DSL Forum TR-101). The traditional access network **100** (e.g., IPTV network **100**) includes a regional network **102** which is coupled to an edge router **104** (e.g., BRAS **104** with ports **105**) which is coupled to one or more aggregation nodes **106** (with ports **106***a* and **106***b*). The aggregation node(s) **106** are connected by an Ethernet access network **108** to multiple access nodes **110** (e.g., DSLAMs **110** each of which include a NT card **113** which has NT exterior-facing ports **113***a* and NT interior-facing ports **113***b* and a LT card **115** which has LT interior-facing ports **115***a* and LT exterior facing ports **115***b*). The DSLAMs **110** are connected to multiple CPEs **112** (RGWs **112**) which in turn are associated with multiple customers **114** where there is normally one customer **114** associated with one CPE **112**. In one application, the BRAS **104** transmits BTV traffic **118** (multiple TV channels **118**) at the Ethernet level (level 2) downstream via the aggregation node(s) **106**, the Ethernet access network **108**, the DSLAMs **110**, and the CPEs **112** to the customers **114**. The basic architecture and functionality of the traditional access network **100** is well known to those skilled in the art but for additional details about this type of architecture reference is made to DSL Forum TR-101 Ethernet-based DSL aggregation dated April 2006 (the contents of which are hereby incorporated by reference herein).

[0030] The traditional access network **100** typically implements a connectivity fault management scheme (EthCFM or EthOAM) that has been disclosed in the IEEE 802.1 ag/D8 standard entitled "Virtual Bridged Local Area Networks—Amendment 5: Connectivity Fault Management" Feb. 8, 2007 (the contents of which are incorporated by reference herein). The IEEE 802.1ag/D8 standard specifies protocols, procedures and managed objects that support connectivity fault management. These allow the discovery and verification of a path taken for frames addressed to and from specified network components like the BRAS **104** and the CPEs **112**. As a result, connectivity faults can be detected and isolated to a specific component like one of the DSLAMs **110**. Unfortunately, the traditional access network **100** when implementing this type of connectivity fault management scheme suffers from several problems:

[0031] 1. The BRAS **104** periodically sends a multicast loopback (LB) message towards all of the CPEs **112** so as to discover the currently connected CPEs **112** and to obtain the MAC addresses of the currently connected CPEs **112**. Upon receiving the LB message, the currently connected CPEs **112** respond by sending a unicast loopback response (LBR) message back towards the BRAS **104**. The BRAS **104** receives many LBR messages from the currently connected CPEs **112**. However, there is no current scheme that the BRAS **104** can use when analyzing the received LBR messages to verify the trustworthiness of the corresponding CPEs **112**/customers **114**.

[0032] 2. The CPEs **112** often send CC messages towards the BRAS **104**. Each CC message contains a MD/MA/MEP identification of the corresponding CPE **112**. This MD/MA/MEP identification information is pre-configured at the BRAS **104**. However, it is possible that a hacker can insert incorrect identifiers into CC messages which could disturb the OAM of the operator. For instance, the BRAS **104** could think a customer **114** (or business user **114**) is still available because it receives messages from the MD/MA/MEP, while the customer **114** (or business user **114**) might not be available and the messages are instead sent from a hacker.

[0033] Accordingly, there has been a need and still is a need for addressing these shortcomings and other shortcomings associated with the traditional access network **100** that implements the current connectivity fault management scheme. This need and other needs are satisfied by the present invention.

SUMMARY

[0034] In one aspect, the present invention provides an access node (e.g., DSLAM, OLT/ONT) that implements a trust verification method comprising the steps of: (a) filtering an up-stream message initiated by a non-trusted device (e.g., CPE); (b) intercepting the filtered up-stream message if the filtered up-stream message is a connectivity fault management message (e.g., LB message, LBR message, CC message); (c) inserting a trusted identification into the intercepted up-stream message; and (d) outputting the intercepted up-stream message with the inserted trusted identification. Thereafter, a trusted device (e.g., BRAS) receives the outputted up-stream message with the inserted trusted identification message and is able to ascertain a trustworthiness of the non-trusted device (e.g., CPE).

[0035] In another aspect, the present invention provides a method for obtaining a trusted verification of a non-trusted device (e.g., CPE) which is part of an access system that also includes a trusted edge router (e.g., BRAS) and a trusted access node (e.g., DSLAM, ONT/OLT). The method comprising the steps of: (a) sending a multicast loopback message from the edge router towards the non-trusted device; (b) sending a unicast loopback reply message from the non-trusted device after the non-trusted device receives the multicast loopback message; (c) intercepting the unicast loopback reply message at the access node; (d) inserting a trusted identification into the intercepted unicast loopback reply message at the access node; (e) outputting the unicast loopback reply message with the trusted identification from the access node; (f) receiving the outputted unicast loopback reply message with the trusted identification at the edge router; and (g) enabling the edge router to analyze the received unicast loopback reply message with the trusted identification to ascertain a trustworthiness of the non-trusted device.

[0036] In yet another aspect, the present invention provides a method for obtaining a trusted verification of a non-trusted device (e.g., CPE) which is part of an access system that also includes a trusted edge router (e.g., BRAS) and a trusted access node (e.g., DSLAM, ONT/OLT). The method comprising the steps of: (a) sending a connectivity fault management message (e.g., LB message, CC message) from the non-trusted device towards the edge router; (b) intercepting the connectivity fault management message at the access node; (c) inserting a trusted identification into the intercepted connectivity fault management message at the access node; (d) outputting the connectivity fault management message with the trusted identification from the access node; (e) receiving the outputted connectivity fault management message with the trusted identification at the edge router; and (f) enabling the edge router to analyze information in the received connectivity fault management message with the trusted identification to ascertain a trustworthiness of the non-trusted device.

[0037] Additional aspects of the invention will be set forth, in part, in the detailed description, figures and any claims which follow, and in part will be derived from the detailed description, or can be learned by practice of the invention. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] A more complete understanding of the present invention may be obtained by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

[0039] FIGS. **1-2** (PRIOR ART) are two diagrams of a traditional access network (e.g., IPTV network) which are used to help explain several problems that are solved by the present invention;

[0040] FIGS. **3-4** are two diagrams of an access network (with an Ethernet-based DSL aggregation) which has access nodes (e.g., DSLAMs) that solve the aforementioned problems by implementing a trust verification method in accordance with the present invention;

[0041] FIG. **5** is a flowchart illustrating the basic steps of the trust verification method in accordance with the present invention;

[0042] FIG. **6** is a diagram of an exemplary access network which is used to help explain how the trust verification method can be implemented in accordance with a first embodiment of the present invention;

[0043] FIG. **7** is a diagram of an exemplary access network which is used to help explain how the trust verification method can be implemented in accordance with a second embodiment of the present invention;

[0044] FIG. **8** is a diagram of an exemplary access network which is used to help explain how the trust verification method can be implemented in accordance with a third embodiment of the present invention;

[0045] FIG. **9** is a diagram of a frame format of a LB/LBR message within which a trusted identification is placed by an access node when implementing the trust verification method in accordance with the present invention;

[0046] FIG. **10** is a diagram of a frame format of a CC message within which a trusted identification is placed by an access node when implementing the trust verification method in accordance with the present invention; and

[0047] FIG. **11** is a diagram of an exemplary trusted identification "DHCP option 82" which can be placed within the LB message, LBR message or CC message in accordance with the present invention.

DETAILED DESCRIPTION

[0048] Referring to FIGS. **3-4**, there are two block diagrams of an access network **300** (with an Ethernet-based DSL aggregation) which has access nodes **310** (e.g., DSLAMs **310**) that implement a trust verification method **350** in accordance with the present invention (note: the present invention functions as well in an access network based on a PON model in which the DSLAM is replaced by an OLT and ONT). The access network **300** (e.g., IPTV network **300**) includes a regional network **302** which is coupled to an edge router **304** (e.g., BRAS **304** with ports **305**) which is coupled to one or more aggregation nodes **306** (with input ports **306***a* and output ports **306***b*). The aggregation node(s) **306** are connected by an Ethernet access network **308** to multiple access nodes **310** (e.g., DSLAMs **310** each of which include a NT card **313** which has NT exterior-facing ports **313***a* and NT interior-facing ports **313***b* and a LT card **315** which has LT interior-facing ports **315***a* and LT exterior facing ports **315***b*). The DSLAMs **310** are connected to multiple CPEs **312** (RGWs **312**) which in turn are associated with multiple customers **314** where there is normally one customer **314** associated with one CPE **312**. In one application, the BRAS **304** transmits BTV traffic **318** (multiple TV channels **318**) at the Ethernet level (level 2) downstream via the aggregation node(s) **306**, the Ethernet access network **308**, the DSLAMs **310**, and the CPEs **312** to the customers **314**.

[0049] In the present invention, each access node **310** (which are trusted devices) has a processor **320** that retrieves instructions from a memory **322** and processes those instructions to implement the trust verification method **350** (see the flowchart in FIG. **5**). In particular, each access node **310**

implements the trust verification method **350** by having a filter **324** that filters up-stream messages **370** received from their corresponding CPEs **312** (which are non-trusted devices **312**) (see step **502**). Each access node **310** intercepts the filtered up-stream messages **370** if they are a connectivity fault management message such as, for example, a CCM message, a LB message, or a LBR message (see step **504**) (note **1**: from the standardized IEEE 802.1ag perspective these messages do not normally need processing inside the access node **310**) (note **2**: this step can be enabled or disabled as desired). In one example, each access node **310** can perform the intercepting operation by analyzing an Ethertype of each filtered up-stream message **370** to determine whether or not the filtered up-stream message **370** is a connectivity fault management message. Assuming the filtered up-stream messages **370** are connectivity fault management messages, each access node **310** inserts a trusted identification **372** into the intercepted up-stream messages **370** (see step **506**). Then, each access node **310** outputs the intercepted up-stream messages **370** with the inserted trusted identification **372** towards the BRAS **304** (see step **508**). Thereafter, the BRAS **304** analyzes the information in the received up-stream messages **370** with the trusted identifications **372** to ascertain a trustworthiness of the corresponding CPEs **312**. This is possible because the access nodes **310** are trusted devices and each corresponding trusted identification **372** indicates a user port at the respective access node **310** behind which there is located the corresponding non-trusted CPE **312**.

[0050] Referring to FIG. **6**, there is a block diagram of an exemplary access network **300'** which is used to help explain how the trust verification method **350** can be implemented in accordance with a first embodiment of the present invention. The steps of how this particular embodiment of the trust verification method **350** can be implemented are as follows:

[0051] 1. BRAS **304** sends a multicast LB message **602** towards the CPEs **312**. The DSLAMs **310** do not insert the trusted identifications **372** into the LB message **602** because the LB message **602** is down-stream traffic and the BRAS **304** is a trusted device.

[0052] 2. All of the CPEs **312** receive the LB message **602**.

[0053] 3. All of the CPEs **312** respond by sending unicast LBR messages **604** at spaced out intervals up-stream to the BRAS **304**. The LB message **602** and the LBR messages **604** are described in ITU-T Recommendation Y.1731 entitled “OAM Functions and Mechanisms for Ethernet Based Networks” May 2006 (the contents of which are hereby incorporated by reference herein) (see also FIG. **9**).

[0054] 4. The DSLAMs **310** intercept the unicast LBR messages **604** (see steps **502** and **504**).

[0055] 5. The DSLAMs **310** insert the trusted identifications **372** into the intercepted unicast LBR messages **604** (see step **506**). Each trusted identification **372** indicates the user port **315*b*** at the DSLAM **310** which corresponds to a particular LBR message **604** that was sent by a particular CPE **312**. In one example, the DSLAMs **310** can insert a DHCP option **82** (trusted identification **372**) into the up-stream LBR messages **604**. The DHCP option **82** and other alternative trusted identifications **372** are discussed in greater detail below with respect to FIG. **11**.

[0056] 6. The DSLAMs **310** output the unicast LBR messages **604** with the trusted identifications **372** upstream towards the BRAS **304** (step **508**).

[0057] 7. The BRAS **304** receives the outputted unicast LBR messages **604** with the trusted identifications **372** and analyzes the information within each received unicast LBR message **604** to ascertain a trustworthiness of the corresponding CPE **312**. In addition, the BRAS **304** upon receiving the LBR messages **604** which contain the trusted identification **372** can correlate the LBR messages **604** with subscriber data so the BRAS **304** can obtain additional knowledge about the connected CPEs **312**. Plus, the BRAS **304** can learn the CPE’s MAC address from the source MAC of each LBR message **604**.

[0058] Referring to FIG. **7**, there is a block diagram of an exemplary access network **300"** which is used to help explain how the trust verification method **350** can be implemented in accordance with a second embodiment of the present invention. The steps of how this particular embodiment of the trust verification method **350** can be implemented are as follows:

[0059] 1. A CPE **312'** sends a multicast LB message **702** towards to the BRAS **304**.

[0060] 2. The DSLAM **310'** filters and intercepts the multicast LB message **702** (see steps **502** and **504**).

[0061] 3. The DSLAM **310'** inserts the trusted identification **372** into the intercepted multicast LB message **702** (see step **506**). The trusted identification **372** indicates the particular user port **315*b*'** at the DSLAM **310'** which received the multicast LB message **702** sent by the CPE **312'**. In one example, the DSLAM **310'** can insert a DHCP option **82** (trusted identification **372**) into the received LB message **702**. The DHCP option **82** and other alternative trusted identifications **372** are discussed in greater detail below with respect to FIG. **11**.

[0062] 4. The DSLAM **310'** outputs the multicast LB message **702** with the trusted identification **372** upstream towards the BRAS **304** (step **508**).

[0063] 5. The BRAS **304** receives the outputted multicast LB message **702** with the trusted identification **372** and analyzes the information within the received LB message **702** to ascertain a trustworthiness of the CPE **312'**. In view of this analysis, the BRAS **304** decides whether or not to reply where it may not reply if it does not recognize/identify the particular user interface/port **315*b*'** in the DSLAM **310'** which is associated with the CPE **312'**.

[0064] 6. Assuming the BRAS **304** decides to reply to the received multicast LB message **702** it will send a unicast LBR message **704** back to the CPE **312'**.

[0065] Referring to FIG. **8**, there is a block diagram of an exemplary access network **300'"** which is used to help explain how the trust verification method **350** can be implemented in accordance with a third embodiment of the present invention. The steps of how this particular embodiment of the trust verification method **350** can be implemented are as follows:

[0066] 1. A CPE **312'** sends a multicast CC message **802** towards to the BRAS **304**. The CC message **802** is described in the IEEE 802.1 ag/D8 standard entitled “Virtual Bridged Local Area Networks—Amendment 5: Connectivity Fault Management” Feb. 8, 2007 (the contents of which are incorporated by reference herein) (see FIG. **10**).

[0067] 2. The DSLAM **310'** filters and intercepts the multicast CC message **802** (see steps **502** and **504**).

[0068] 3. The DSLAM **310'** inserts the trusted identification **372** into the intercepted multicast CC message **802** (see step **506**). The trusted identification **372** indicates the particular user port **315*b*'** at the DSLAM **310'** which received the multicast CC message **802** sent by the CPE **312'**. In one example, the DSLAM **310'** can insert a DHCP option **82** (trusted identification **372**) into the CC message **802**. The

DHCP option **82** and other alternative trusted identifications **372** are discussed in greater detail below with respect to FIG. **11**.

[0069] 4. The DSLAM **310'** outputs the multicast CC message **802** with the trusted identification **372** upstream towards the BRAS **304** (step **508**).

[0070] 5. The BRAS **304** receives the outputted multicast CC message **802** with the trusted identification **372** and analyzes the information within the received CC message **802** to ascertain a trustworthiness of the CPE **312'**.

[0071] In each of the embodiments described above, it can be seen that the DSLAMs **310** inclusion of the trusted identification **372** in the upstream continuity check messages **370**, **604**, **702** and **802** provides reliable information to the BRAS **304**. In particular, the BRAS **304** analyzes this reliable information to ascertain a trustworthiness of the corresponding CPEs **312** that sent the particular continuity check messages **370**, **604**, **702** and **802**. If the continuity check messages **370**, **604**, **702** and **802** are LB messages, LBR messages and CC messages, then the DSLAM **310** can insert the trusted identification **372** into an organization specific tag which is configured to contain a vendor specific TLV (see the aforementioned DSL Forum TR-101). FIGS. **9** and **10** respectively illustrated the frame formats of the LB/LBR messages **604** and **702** and the CC messages **802** which are used to indicate where the DSLAM **310** can insert the trusted identification **372** into the organization specific tag **902** and **1002** in accordance with the present invention. In one example, the DSLAM **310** can use a DHCP option **82** as the trusted identification **372** where an exemplary DHCP option **82** has been shown in FIG. **11**. The DHCP option **82** would be placed in the organization specific tag **902** and **1002** (vendor specific TLV) of the respective continuity check message **370**, **604**, **702** and **802**. Alternatively, there are many different types of trusted identifications **372** that could be used instead of the DHCP option **82**. For instance, the trusted identification **372** can be the MD/MA/MEP identification of an MEP within the trusted DSLAM **310**. In fact, the trusted identification **372** can be any type of identification.

[0072] From the foregoing, it should be appreciated that the present invention relates to an access node **310** (e.g., DSLAM **310**) and method **350** for enabling an edge router **304** (e.g., BRAS **304**) to obtain a trusted verification of a non-trusted end device **312** (e.g., CPE **312**) by using a trusted identification **372** and Ethernet connectivity fault management messages (e.g., LBM messages, LBR messages, CC messages). In addition, it should be appreciated that the present invention can be used in an access network (e.g., IPTV network) that is based on a PON model in which the DSLAM **310** would be replaced by an OLT and ONT. In fact, the present invention could be implemented in any network where a trusted device can add a trusted identification to a connectivity fault management message where the trusted identification has a relationship with the interface/port of the trusted device and as such indirectly identifies the non-trusted device that is located behind that interface/port at which the up-stream CFM message would be received.

[0073] An additional feature of the present invention is that if the access network **300** contains a BRAS **304** and DSLAMs **310** that are from the same manufacturer/organization then the IEEE 802.1ag standard would not need to be changed to implement the present invention because the BRAS **304** would be able to inspect the organization specific tag **902** and **1002** and retrieve the trusted identification **372** from the received continuity check messages **370**, **604**, **702** and **802**. However, if the access network **300** contains a BRAS **304** and DSLAM **310** from different manufacturers/organizations then the IEEE 802.1ag standard would need to be changed so that the BRAS **304** will be able to inspect a non-organization specific tag to see if there is a trusted identification **372**. As a result, the present invention may or may not need to be standardized depending on the choice of the frame format for the continuity check messages **370**, **604**, **702** and **802**. In particular, the present invention may or may not need to be standardized depending on where the trusted identification **372** is placed within the continuity check messages **370**, **604**, **702** and **802**.

[0074] Although several embodiments of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it should be understood that the present invention is not limited to the disclosed embodiments, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

1. A method for obtaining a trusted verification of a non-trusted device, said method comprising the steps of:
- filtering an up-stream message initiated by the non-trusted device;
- intercepting the filtered up-stream message if the filtered up-stream message is a connectivity fault management message;
- inserting a trusted identification into the intercepted up-stream message; and
- outputting the intercepted up-stream message with the inserted trusted identification.

2. The method of claim **1**, wherein a trusted device performs the filtering step, the intercepting step, the inserting step and the outputting step.

3. The method of claim **2**, wherein said trusted device includes a Digital Subscriber Line Access Multiplexer or an Optical Line Termination-Optical Network Termination.

4. The method of claim **2**, wherein said trusted identification indicates a user port at the trusted device behind which there is located the non-trusted device, and wherein said trusted identification is a selected one of the following:
- a Dynamic Host Configuration Protocol (DHCP) option **82**; and
- a MD/MA/MEP identification associated with the trusted device.

5. The method of claim **1**, wherein said intercepting step further includes a step of analyzing an Ethertype of the filtered up-stream message to determine whether or not the filtered up-stream message is the connectivity fault management message.

6. The method of claim **1**, wherein said connectivity fault management message includes a continuity check message, a loopback message, or a loopback reply message.

7. The method of claim **1**, wherein said non-trusted device is a consumer premises equipment.

8. An access node, comprising:
- a processor; and
- a memory, where said processor retrieves instructions from said memory and processes those instructions to enable the following:
  - filtering an up-stream message initiated by the non-trusted device;

intercepting the filtered up-stream message if the filtered up-stream message is a connectivity fault management message;

inserting a trusted identification into the intercepted up-stream message; and

outputting the intercepted up-stream message with the inserted trusted identification.

9. The access node of claim **8**, wherein said processor enables the intercepting operation by analyzing an Ethertype of the filtered up-stream message to determine whether or not the filtered up-stream message is the connectivity fault management message.

10. The access node of claim **8**, wherein said connectivity fault management message includes a continuity check message, a loopback message, or a loopback reply message.

11. The access node of claim **8**, wherein said trusted identification indicates a user port at the access node behind which there is located the non-trusted device, and wherein said trusted identification is a selected one of the following:

a Dynamic Host Configuration Protocol (DHCP) option **82**; and

a MD/MA/MEP identification associated with the trusted device.

12. A method for obtaining a trusted verification of a non-trusted device which is part of an access system that also includes a trusted edge router and a trusted access node, said method comprising the steps of:

sending a multicast loopback message from the edge router towards the non-trusted device;

sending a unicast loopback reply message from the non-trusted device after the non-trusted device receives the multicast loopback message;

intercepting the unicast loopback reply message at the access node;

inserting a trusted identification into the intercepted unicast loopback reply message at the access node;

outputting the unicast loopback reply message with the trusted identification from the access node;

receiving the outputted unicast loopback reply message with the trusted identification at the edge router; and

enabling the edge router to analyze the received unicast loopback reply message with the trusted identification to ascertain a trustworthiness of the non-trusted device.

13. The method of claim **12**, wherein:

said access node includes a Digital Subscriber Line Access Multiplexer or an Optical Line Termination-Optical Network Termination; and

said non-trusted device is a consumer premises equipment.

14. The method of claim **12**, wherein said intercepting step further includes a step of analyzing an Ethertype of the unicast loopback reply message to determine whether or not the unicast loopback reply message is a connectivity fault management message.

15. The method of claim **12**, wherein said trusted identification indicates a user port at the access node behind which there is located the non-trusted device, and wherein said trusted identification is a selected one of the following:

a Dynamic Host Configuration Protocol (DHCP) option **82**; and

a MD/MA/MEP identification associated with the trusted device.

16. A method for obtaining a trusted verification of a non-trusted device which is part of an access system that also includes a trusted edge router and a trusted access node, said method comprising the steps of:

sending a connectivity fault management message from the non-trusted device towards the edge router;

intercepting the connectivity fault management message at the access node;

inserting a trusted identification into the intercepted connectivity fault management message at the access node;

outputting the connectivity fault management message with the trusted identification from the access node;

receiving the outputted connectivity fault management message with the trusted identification at the edge router; and

enabling the edge router to analyze information in the received connectivity fault management message with the trusted identification to ascertain a trustworthiness of the non-trusted device.

17. The method of claim **16**, wherein:

said access node includes a Digital Subscriber Line Access Multiplexer or an Optical Line Termination-Optical Network Termination; and

said non-trusted device is a consumer premises equipment.

18. The method of claim **16**, wherein said connectivity fault management message is a continuity check message or a loopback message.

19. The method of claim **16**, wherein said intercepting step further includes a step of analyzing an Ethertype of the connectivity fault management message.

20. The method of claim **16**, wherein said trusted identification indicates a user port at the access node behind which there is located the non-trusted device, and wherein said trusted identification is a selected one of the following:

a Dynamic Host Configuration Protocol (DHCP) option **82**; and

a MD/MA/MEP identification associated with the trusted device.

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