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Drab et al.

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(54) **QUALITY OF SERVICE FOR SIP-BASED DATA**

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H04L 12/927 (2013.01)

(52) **U.S. Cl.**
CPC ***H04L 47/805*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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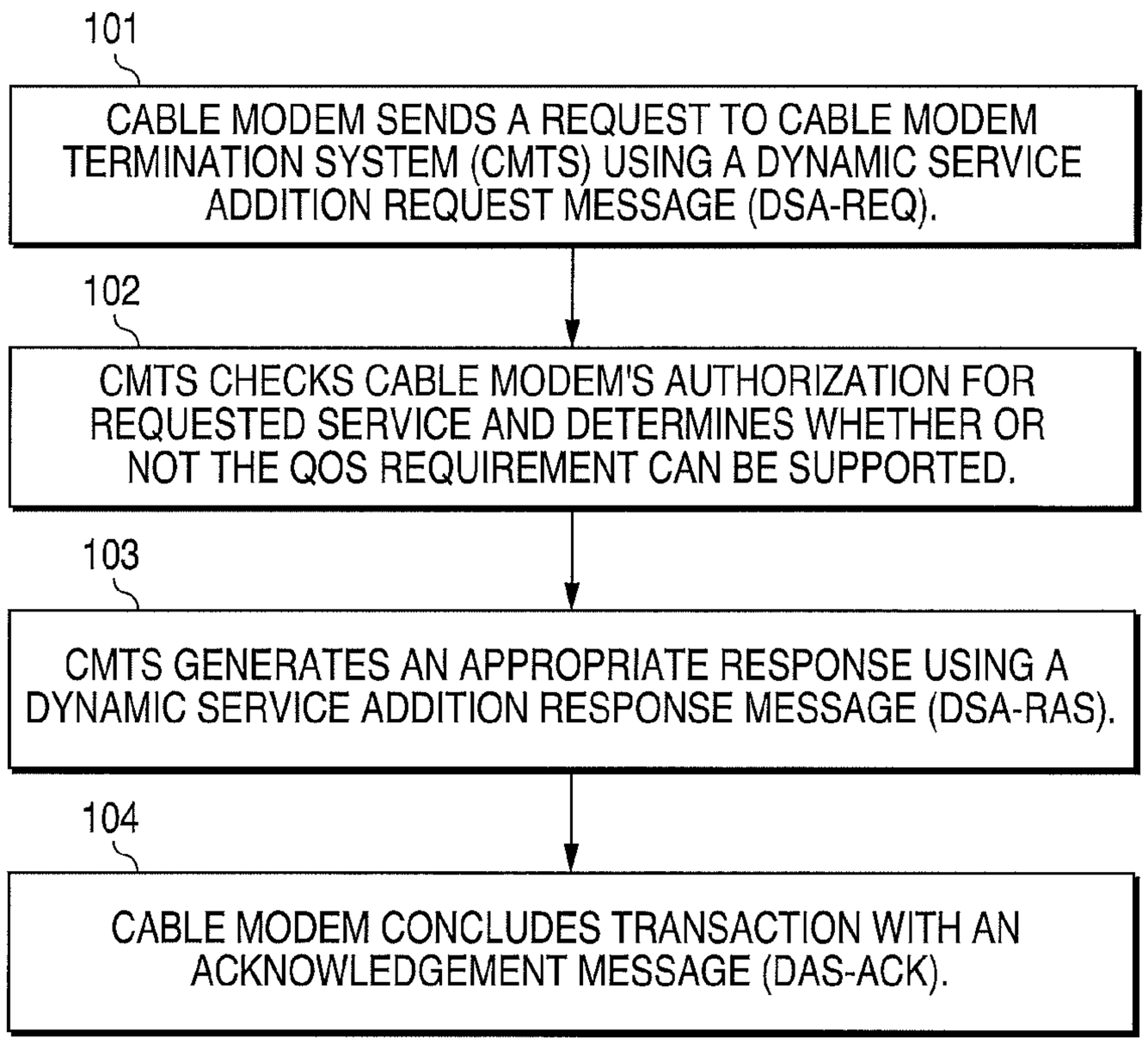
(57) **ABSTRACT**

A method and system for providing Quality of Service (QoS) for Session Initiation Protocol (SIP)-based signaling and traffic are disclosed. The method can facilitate the management of Quality of Service in a Session Initiation Protocol-based communication on a cable network by using a built-in Dynamic Service feature to set up, enforce, modify, and tear down Quality of Service enabled service flows for SIP-based signaling and multimedia traffic over the cable system. The system can include a cable modem that is configured to recognize SIP-based signaling and traffic on a CM/Multimedia Terminal Adapter interface. The disclosed method and system can facilitate the provision of SIP-based services utilizing the inherent features of a cable network.

32 Claims, 3 Drawing Sheets



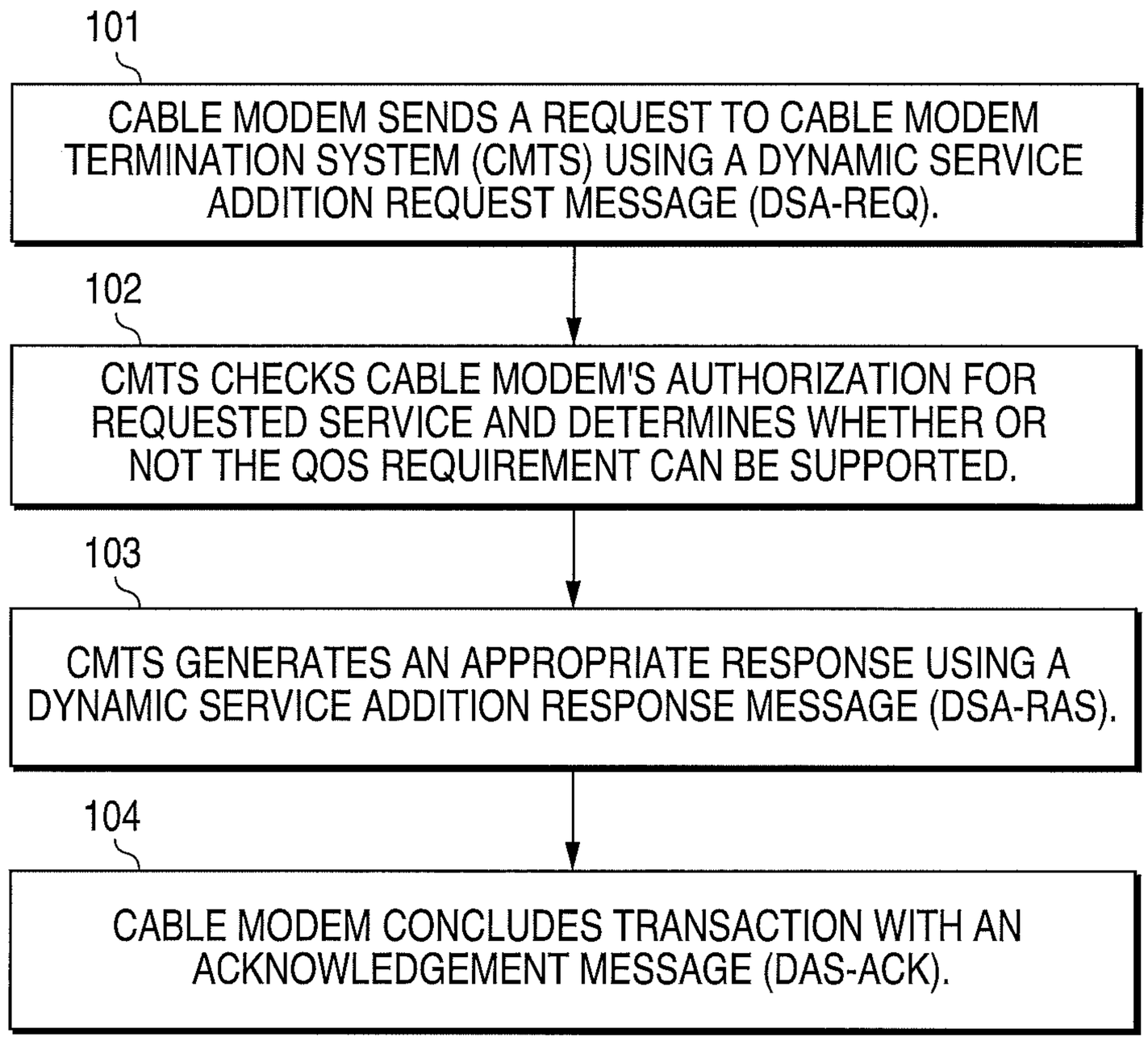

101
CABLE MODEM SENDS A REQUEST TO CABLE MODEM TERMINATION SYSTEM (CMTS) USING A DYNAMIC SERVICE ADDITION REQUEST MESSAGE (DSA-REQ).
102
CMTS CHECKS CABLE MODEM'S AUTHORIZATION FOR REQUESTED SERVICE AND DETERMINES WHETHER OR NOT THE QOS REQUIREMENT CAN BE SUPPORTED.
103
CMTS GENERATES AN APPROPRIATE RESPONSE USING A DYNAMIC SERVICE ADDITION RESPONSE MESSAGE (DSA-RAS).
104
CABLE MODEM CONCLUDES TRANSACTION WITH AN ACKNOWLEDGEMENT MESSAGE (DAS-ACK).

FIG. 1

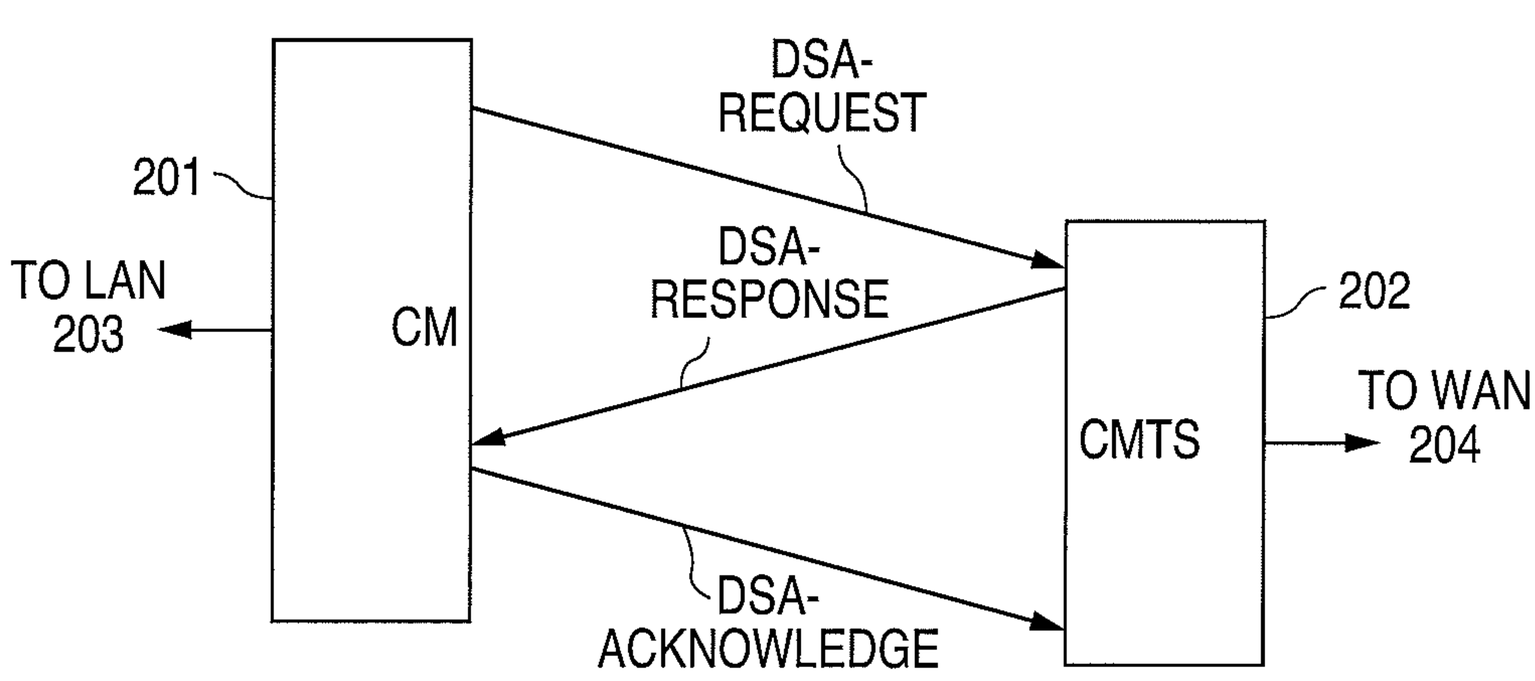

201
TO LAN
203
CM
DSA-
REQUEST
DSA-
RESPONSE
DSA-
ACKNOWLEDGE
CMTS
202
TO WAN
204

FIG. 2

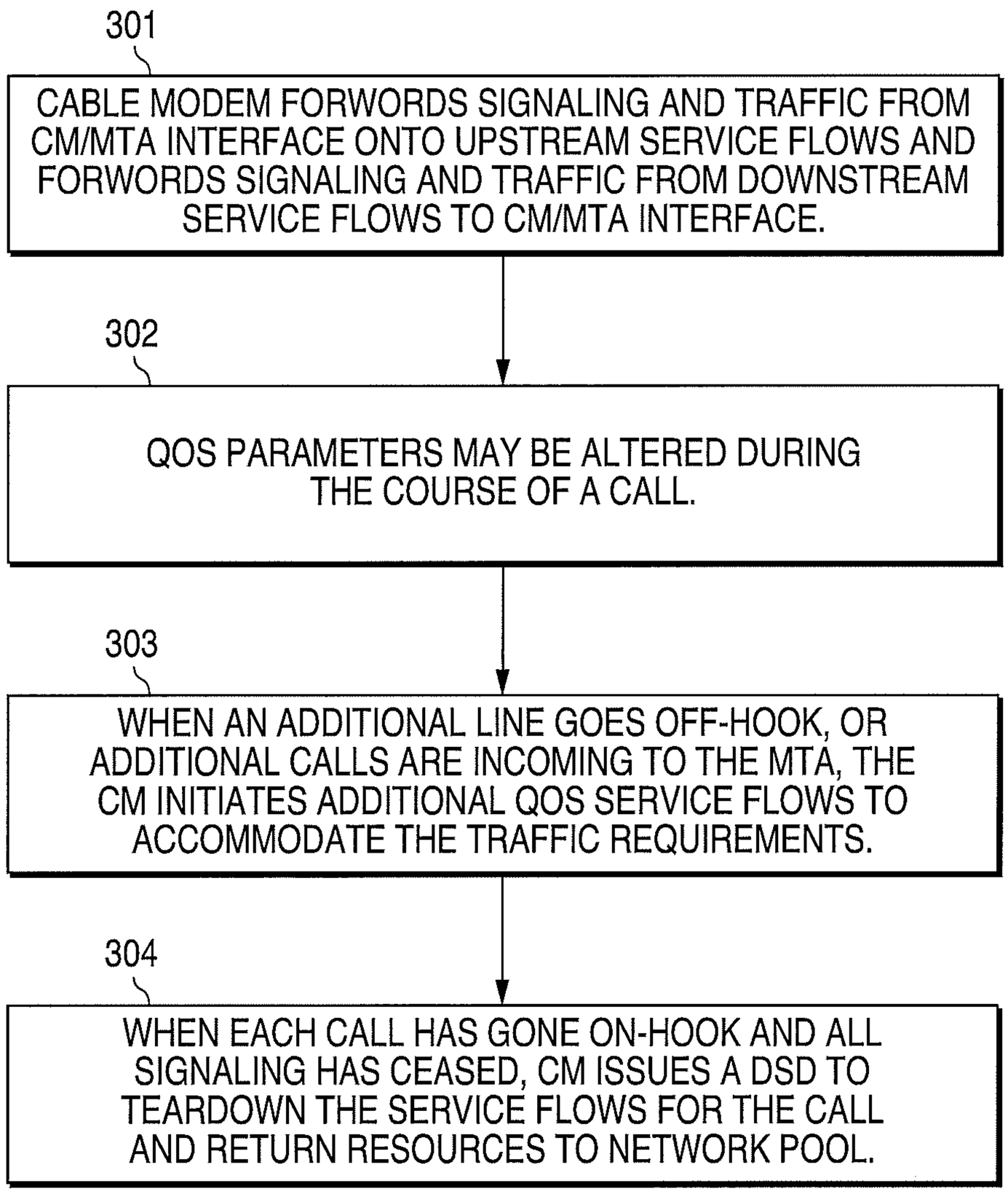

301
CABLE MODEM FORWORDS SIGNALING AND TRAFFIC FROM CM/MTA INTERFACE ONTO UPSTREAM SERVICE FLOWS AND FORWORDS SIGNALING AND TRAFFIC FROM DOWNSTREAM SERVICE FLOWS TO CM/MTA INTERFACE.
302
QOS PARAMETERS MAY BE ALTERED DURING THE COURSE OF A CALL.
303
WHEN AN ADDITIONAL LINE GOES OFF-HOOK, OR ADDITIONAL CALLS ARE INCOMING TO THE MTA, THE CM INITIATES ADDITIONAL QOS SERVICE FLOWS TO ACCOMMODATE THE TRAFFIC REQUIREMENTS.
304
WHEN EACH CALL HAS GONE ON-HOOK AND ALL SIGNALING HAS CEASED, CM ISSUES A DSD TO TEARDOWN THE SERVICE FLOWS FOR THE CALL AND RETURN RESOURCES TO NETWORK POOL.

FIG. 3

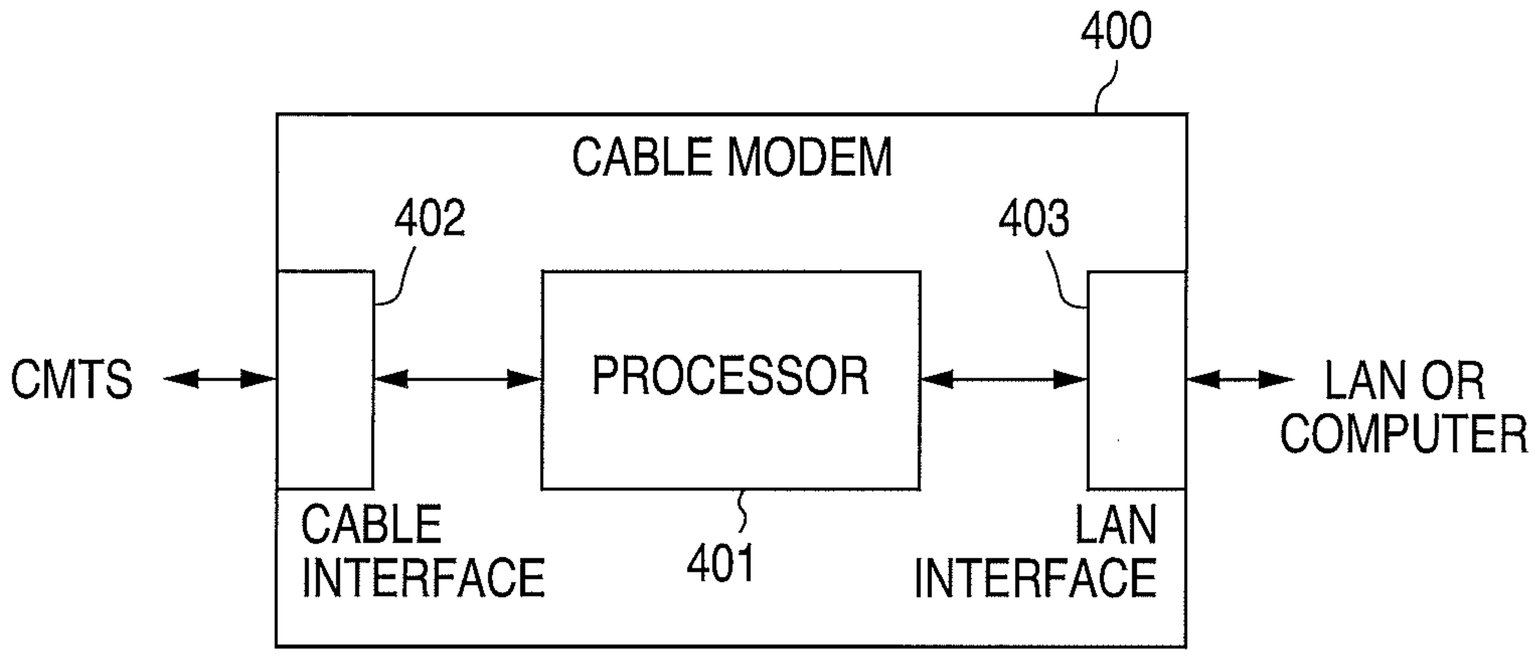

400
CABLE MODEM
402
403
CMTS
PROCESSOR
LAN OR
COMPUTER
CABLE
INTERFACE
401
LAN
INTERFACE

FIG. 4

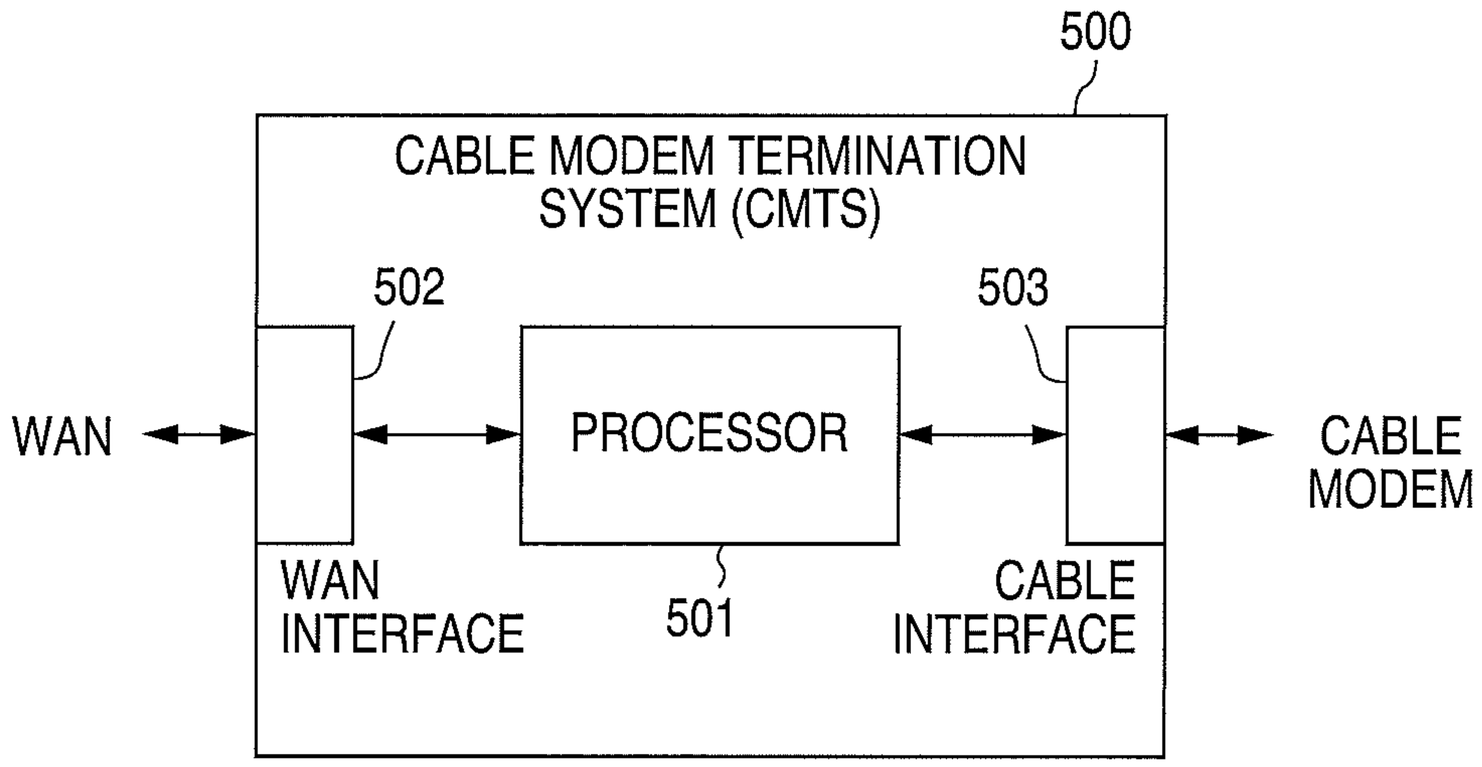

500
CABLE MODEM TERMINATION
SYSTEM (CMTS)
502
503
WAN
PROCESSOR
CABLE
MODEM
WAN
INTERFACE
501
CABLE
INTERFACE

FIG. 5

QUALITY OF SERVICE FOR SIP-BASED DATA

TECHNICAL FIELD

The present invention relates generally to network communications.

BACKGROUND

It is well known for cable multiple system operators (MSOs) to provide Session Initiation Protocol (SIP)-based services, such as telephony or other multimedia applications, to their subscribers. When SIP-based services are provided, a minimum quality of service (QoS) is desired in order for the service to be useful to the subscriber. According to contemporary practice, some MSOs use QoS elements within their networks to allow subscriber SIP-based services and devices to request and receive the desired QoS from the cable network. However, other MSOs have not implemented such QoS elements in their networks and therefor are unable to provide the desired QoS to their subscribers.

The implementation of QoS elements in cable networks can be time consuming, disruptive to the network, and expensive. QoS elements can conflict with other elements in a network, sometimes making their implementation undesirable. MSOs that do not implement such QoS elements need to be able to provide the desired QoS to SIP-based services by utilizing only the inherent features of their cable network. As such, it is beneficial to provide a method and system for providing quality of service (QoS) for Session Initiation Protocol (SIP)-based signaling and traffic that does not require the use of QoS elements.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flow chart showing a method for creating an upstream and/or a downstream service flow, according to an example of an embodiment;

FIG. **2** is a diagram showing message flow according to an example of an embodiment;

FIG. **3** is a flow chart showing a method for forwarding signaling and traffic from the CM/MTA interface onto upstream Service Flows and forwarding signaling and traffic from downstream Service Flows to the CM/MTA interface after the upstream and downstream Service Flows are established and activated, according to an example of an embodiment;

FIG. **4** is a block diagram of a cable modem according to an example of an embodiment; and

FIG. **5** is a block diagram of a cable modem termination system (CMTS) according to an example of an embodiment. Embodiments of the present invention and their advantages are best understood by referring to the detailed description that follows. It should be appreciated that like reference numerals are used to identify like elements illustrated in one or more of the figures.

DETAILED DESCRIPTION

Overview

A method and system for providing Quality of Service (QoS) for Session Initiation Protocol (SIP)-based signaling and traffic are disclosed. The method can utilize the built-in dynamic service (DSx) features (such as those of DOCSIS 1.1) to set up, enforce, modify, and tear down Quality of Service (QoS) enabled service flows for SIP-based signaling and multimedia traffic over a cable system. A modem, such as a cable modem (CM) can be configured to recognize the SIP-based signaling and traffic on the Cable Modem/Multimedia Terminal Adapter (CM/MTA) interface and automatically request network resources.

A method and system for providing Quality of Service (QoS) for Session Initiation Protocol (SIP)-based signaling and traffic that does not require the use of QoS elements. Thus, MSOs that do not implement such QoS elements can provide the desired QoS to SIP-based services by utilizing only the inherent features of their cable network.

DESCRIPTION OF EXAMPLE EMBODIMENTS

Referring now to FIG. **1**, a Cable Modem (CM) is configured to recognize the SIP-based signaling and traffic on the CM/Multimedia Terminal Adapter (MTA) interface and to automatically request network resources.

A cable modem wishing to create an upstream and/or a downstream service flow having a particular QoS requirement sends a request to the cable modem termination system (CMTS) using a dynamic service addition request message (DSA-REQ), as indicated in block **101**. The particular QoS can be determined from the type of data contained in a service flow, from experience (empirically), or from a subjective determination (such as an estimate or guess from a system administrator).

The CMTS checks the cable modem's authorization for the requested service and determines whether or not the QoS requirement can be supported, as indicated in block **102**. The CMTS then generates an appropriate response using a dynamic service addition response message (DSA-RAS), as indicated in block **103**. The cable modem concludes the transaction with an acknowledgement message (DAS-ACK), as indicated in block **104**.

An embodiment of the method does not require a special Trivial File Transfer Protocol (TFTP) configuration file for the cable modem in order to pre-provision the QoS Service Flows. Instead, in order to request appropriate resources from the network, the cable modem is given "a priori" knowledge of the bandwidth requirements for signaling messages and for each line of traffic supported.

Referring now to FIG. **2**, the message flow according to an example of an embodiment of the method is shown. A cable modem **201** communicates with a cable modem termination system **202** so as to facilitate communication between local area network **203** and wide area network **204**. Communication between cable modem **201** and cable modem termination system **202** can include a DSA request, a DSA response, and a DSA acknowledgement, as discussed above. In order to facilitate a common admission response, an upstream and a downstream service flow can be included in a single DSA-REQ. Both service flows can be either accepted or rejected together.

Referring now to FIG. **3**, after the upstream and downstream Service Flows are established and activated, the cable modem forwards signaling and traffic from the CM/MTA interface onto these upstream Service Flows and forwards signaling and traffic from downstream Service Flows to the CM/MTA interface, as indicated in block **301**.

The QoS parameters may be altered during the course of a call, as indicated in block **302**. For example, if additional bandwidth is required to accommodate a change in codec or media type, then the QoS parameters may be altered via the DSC mechanism. When an additional line goes off-hook, or additional calls are incoming to the MTA, the CM initiates additional QoS Service Flows to accommodate the traffic

requirements, up to the number of lines supported, as indicated in block **303**. When each call has gone on-hook, and all signaling has ceased, the network resources are no longer required, and the CM can issue a DSD to tear-down the Service Flows for the call and return the resources to the network pool, as indicated in block **304**.

Thus, an embodiment of the method utilizes the built-in Dynamic Service (DSx) features of DOCSIS 1.1 to set up, enforce, modify, and tear down Quality of Service QoS enabled Service flows for SIP-based signaling and multimedia traffic over the DOCSIS cable system.

Referring again to FIG. **2**, the cable modem **201** can be configured to recognize the SIP-based signaling and traffic in the CM/Multimedia Terminal Adapter (MTA) interface and to automatically requests network resources. The cable modem **201** can forward signaling and traffic from the CM/MTA interface onto the upstream Service Flows and can forward signaling and traffic from the downstream Service Flows to the CM/MTA interface.

Referring now to FIG. **4**, a cable modem **400** can have a processor **401** that communicates with a CMTS (such as CMTS **500** of FIG. **5**) via a cable interface **402** and communicates with a LAN or a computer via a LAN interface **403**. The processor **400** can be configured to take advantage of built-in dynamic service (DSx) features to set up, enforce, modify, and tear down Quality of Service (QoS) enabled service flows for SIP-based signaling and multimedia traffic over a cable system. In this manner, the cable modem **400** can be configured to recognize the SIP-based signaling and traffic on the Cable Modem/Multimedia Terminal Adapter (CM/MTA) interface and automatically request network resources.

More particularly, the processor **401** can be configured to set up Quality of Service enabled service flow for SIP-based signaling and multimedia traffic over the cable system, enforce Quality of Service enabled service flow for SIP-based signaling and multimedia traffic over the cable system, and tear down Quality of Service enabled service flow for SIP-based signaling and multimedia traffic over the cable system.

Referring now to FIG. **5**, a cable modem termination system **500** can have a processor **501** that communicates with a cable modem (such as cable modem **400** of FIG. **4**) via a cable interface **503** and communicates with a WAN (such as the Internet) via WAN interface **502**.

The CMTS **500** can process a request issued by the cable modem **400** (FIG. **4**), wherein the request uses a dynamic service addition request message (DSA-REQ) to create an upstream and/or a downstream service flow. The CMTS **500** can check the cable modem's authorization for the requested service, check if a Quality of Service requirement can be supported, and generate an appropriate response using a dynamic service addition response message (DSA-RAS).

One or more embodiments provide QoS for the SIP-based equipment and service on a cable network that does not have a native SIP capability. According to one or more embodiments, the cable operator is not required to implement on install special equipment or methodologies. The intelligence needed to practice one or more embodiments can be placed within the cable modem element rather than requiring the use of external network elements with a particular MSO may or may not have.

Therefore, it should be understood that the invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is not intended to be exhaustive or to limit the invention to the precise form disclosed. It should be understood that the invention can be practiced with modification and alteration and that the invention be limited only by the claims and the equivalents thereof.

The invention claimed is:

1. A method comprising:

using a built-in Dynamic Service feature of a cable modem to:

set up a Quality of Service (QoS) enabled service flow for Session Initiation Protocol (SIP)-based signaling and multimedia traffic over a cable system without implementing QoS elements in a cable network, wherein the cable network provides desired QoS to SIP-based services by only using the built-in Dynamic Service feature of the cable modem, wherein the cable modem recognizes the SIP-based signaling and multimedia traffic, and automatically requests network resources based on apriori knowledge of QoS requirements using the built-in Dynamic Service feature of the cable modem;

enforce the QoS enabled service flow for the SIP-based signaling and multimedia traffic over the cable system; and

tear down the QoS enabled service flow for the SIP-based signaling and multimedia traffic over the cable system.

2. The method as recited in claim **1**, further comprising using the built-in Dynamic Service feature to modify the QoS enabled service flow for the SIP-based signaling and multimedia traffic over the cable system.

3. The method as recited in claim **1**, wherein the cable modem is configured to recognize the SIP-based signaling and traffic on a Cable Modem (CM)/Multimedia Terminal Adapter (MTA) interface.

4. The method as recited in claim **1**, wherein the cable modem is configured to recognize the SIP-based signaling and traffic on a CM/MTA interface and to automatically request network resources.

5. The method as recited in claim **1**, further comprising establishing a bi-directional Service Flow for SIP signaling messages.

6. The method as recited in claim **1**, further comprising creating upstream and downstream Service Flows with QoS when the cable modem recognizes a SIP signaling message on a CM/MTA interface.

7. The method as recited in claim **1**, further comprising sending a request to a cable modem termination system (CMTS) using a dynamic service addition request message (DSA-REQ) to create a service flow, wherein the service flow is one of an upstream flow, a downstream flow, and a combination thereof.

8. The method as recited in claim **1**, further comprising concluding setting up the QOS enabled service flow with a dynamic service addition acknowledgement message (DSA-ACK).

9. The method as recited in claim **1**, further comprising including an upstream and a downstream service flow in a single DSA-REQ in order to facilitate a common admission response.

10. The method as recited in claim **9**, wherein both the upstream and downstream service flows are either accepted or rejected together.

11. The method as recited in claim **1**, further comprising forwarding signaling and traffic from a CM/MTA interface onto upstream Service Flows and forwarding signaling and traffic from downstream Service Flows to the CM/MTA interface after upstream and downstream Service Flows have been established and activated.

12. The method as recited in claim 1, further comprising altering Quality of Service parameters during a call.

13. The method as recited in claim 1, further comprising the cable modem initiating additional Service Flows to accommodate traffic requirements when an additional line goes off-hook or additional calls are incoming to a multimedia terminal adapter.

14. The method as recited in claim 13, further comprising using a dynamic service feature to tear-down the additional Service Flows for the additional calls and returning the network resources to a network pool after all calls have gone on-hook and all signaling has ceased.

15. A method comprising processing a request issued by a cable modem without implementing quality of service (QoS) elements in a cable network, wherein the cable network provides desired QoS to Session Initiation Protocol (SIP)-based services by only using a built-in Dynamic Service features of the cable modem, wherein the cable modem recognizes SIP-based signaling and traffic, and automatically requests network resources based on apriori knowledge of QoS requirements using the built-in Dynamic Service features of the cable modem, wherein the request uses a dynamic service addition request message (DSA-REQ) to create a service flow, wherein the service flow is one of an upstream flow, a downstream flow, and a combination thereof.

16. The method as recited in claim 15, further comprising:

checking an authorization of the cable modem for the requested service, wherein the cable modem requests the service using the built-in Dynamic Service feature of the cable modem without the use of QoS elements;

checking if a QoS requirement can be supported; and

generating an appropriate response using a dynamic service addition response message (DSA-RSP).

17. A device comprising:

a cable modem having a processor, the processor being configured to:

facilitate setting up a Quality of Service (QoS) enabled service flow for Session Initiation Protocol (SIP)-based signaling and multimedia traffic over a cable system without implementing QoS elements in a cable network, wherein the cable network provides desired QoS to SIP-based services by only using built-in Dynamic Service features of the cable modem, wherein the cable modem recognizes the SIP-based signaling and multimedia traffic, and automatically requests network resources based on apriori knowledge of QoS requirements using the built-in Dynamic Service features of the cable modem;

facilitate enforcing the Quality of Service enabled service flow for the SIP-based signaling and multimedia traffic over the cable system; and

facilitate tearing down the Quality of Service enabled service flow for the SIP-based signaling and multimedia traffic over the cable system.

18. The device as recited in claim 17, further comprising a built-in Dynamic Service feature configured to modify the QoS enabled service flow for the SIP-based signaling and multimedia traffic over the cable system.

19. The device as recited in claim 17, wherein the SIP-based signaling and multimedia traffic is communicated via the cable modem and the cable modem is configured to recognize the SIP-based signaling and traffic on a Cable Modem (CM)/Multimedia Terminal Adapter (MTA) interface.

20. The device as recited in claim 17, wherein the SIP-based signaling and multimedia traffic is communicated via the cable modem and the cable modem is configured to recognize the SIP-based signaling and traffic on a CM/Multimedia Terminal Adapter interface and to automatically request network resources.

21. The device as recited in claim 17, wherein the processor is configured to facilitate establishing a bi-directional Service Flow for SIP signaling messages.

22. The device as recited in claim 17, wherein the processor is configured to facilitate creating upstream and downstream Service Flows with QoS when the cable modem recognizes a SIP signaling message on a CM/MTA interface.

23. The device as recited in claim 17, wherein the processor is configured to facilitate sending a request to a cable modem termination system (CMTS) using a dynamic service addition request message (DSA-REQ) to create a service flow, wherein the service flow is one of an upstream flow, a downstream flow, or a combination thereof.

24. The device as recited in claim 17, wherein the processor is configured to facilitate concluding setting up the QoS enabled service flow with a dynamic service addition acknowledgement message (DSA-ACK).

25. The device as recited in claim 17, wherein the processor is configured to forward signaling and traffic from a CM/MTA interface onto upstream Service Flows and forward signaling and traffic from downstream Service Flows to the CM/MTA interface after the upstream and downstream Service Flows have been established and activated.

26. The device as recited in claim 17, wherein the processor is configured to alter Quality of Service parameters during a call.

27. The device as recited in claim 17, wherein the processor is configured to initiate additional Service Flows to accommodate traffic requirements when an additional line goes off-hook or additional calls are incoming to a multimedia terminal adapter.

28. The device as recited in claim 27, wherein the processor is configured to facilitate using a dynamic service feature to tear-down the additional Service Flows for the additional calls and returning the network resources to a network pool after all calls have gone on-hook and all signaling has ceased.

29. A device comprising:

a cable interface;

a WAN interface;

a processor in communication with the cable interface and the WAN interface, the processor being configured to process a request that is made automatically for network resources based on apriori knowledge of Quality of Service (QoS) requirements without implementing QoS elements in, a cable network, wherein the cable network provides desired QoS to Session Initiation Protocol (SIP)-based services by only using built-in Dynamic Service features of the device, wherein the request is made by using a dynamic service addition request message (DSA-REQ) to create a service flow, wherein the service flow is one of an upstream flow, a downstream flow, and a combination thereof.

30. The device as recited in claim 29, wherein:

the processor is configured to facilitate checking an authorization of the cable modem for the requested service, wherein the cable modem requests the service using the built-in Dynamic Service feature of the cable modem without using QoS elements;

the processor is configured to facilitate checking if a QoS requirement can be supported; and

the processor is configured to facilitate generating an appropriate response using a dynamic service addition response message (DSA-RSP).

31. A device comprising:

means for setting up a Quality of Service (QoS) enabled service flow for Session Initiation Protocol (SIP)-based signaling and multimedia traffic over a cable system without implementing QoS elements in a cable network, wherein the cable network provides desired QoS to SIP-based services by only using a built-in Dynamic Service features of the device, wherein the SIP-based signaling and multimedia traffic are recognized, and network resources are automatically requested based on apriori knowledge of QoS requirements using the built-in Dynamic Service features of the device;

means for enforcing the Quality of Service enabled service flow for the SIP-based signaling and multimedia traffic over the cable system; and

means for tearing down the Quality of Service enabled service flow for the SIP-based signaling and multimedia traffic over the cable system.

32. A device comprising:

a cable interface;

a WAN interface;

means for processing a request that is made automatically for network resources based on apriori knowledge of Quality of Service (QoS) requirements without implementing QoS elements in a cable network, wherein the cable network provides desired QoS to Session Initiation Protocol (SIP)-based services by only using a built-in Dynamic Service features of the device, wherein the request is made by using a dynamic service addition request message (DSA-REQ) to create a service flow, wherein the service flow is one of an upstream flow, a downstream flow, and a combination thereof.

* * * * *