WEB SERVICES INTERFACE

Applicant: ROCKSTAR CONSORTIUM US LP, Plano, TX (US)

Inventors: John Storrie, Maidenhead (GB); William Hern, Reading (GB); Anthony Waters, Maidenhead (GB)

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ABSTRACT

A Call Session Control Function (CSCF) entity in an IP Multimedia Subsystem (IMS) network comprises a first interface for interfacing with other entities and uses signalling in an Extensible Markup Language (XML) format. The other entities that the CSCF interfaces with can be located outside the IMS network, such as servers supporting third party IT or web-based applications, or within the IMS network. The CSCF directs XML-based service requests by filtering XML messages received via the first interface.
Fig. 1
Fig. 4

Rule check function

- Rule 1
  - Create ACR
  - Append data to ACR
  - Close ACR

- Rule 2

- Rule N

Rules Database

XML Data from Application

Accounting Request (ACR)
Fig. 5
Music On Hold Filtering: XML Based

http://www.audioMessage.com

s=sip:ws010101@nortel.com

Fig. 9
Call Hold Event Result

<sip:ws01@nortel.com>

<?xml version="1.0" encoding="utf-8"?>
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
<soap:Body>
<audioCall xmlns="http://www.csapi.org/schema/audioCall/v2_0/local">
<audioMessage>PlayAudioMessage</audioMessage>
<audioURL>onHold@nortel.com</audioURL>
<address>sip:ws02@wsg.dev</address>
<charging>UK£0.10</charging>
</audioCall>
</soap:Body>
</soap:Envelope>

MOH Server
musicOnHold@nortel.com

133

132
Bearer Path
WEB SERVICES INTERFACE
CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation of copending U.S. patent application Ser. No. 11/536,139, filed Sep. 28, 2006, the disclosure of which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] This invention relates to an IP Multimedia Subsystem (IMS) communications network and to implementing applications, such as web services, within such a network.

BACKGROUND TO THE INVENTION

[0003] The IP Multimedia Subsystem (IMS) is a Next Generation Networking (NGN) architecture for telecom operators, standardised by the Third Generation Partnership Project (3GPP), which can provide multimedia services to mobile and fixed terminals. IMS uses SIP (Session Initiation Protocol) based signalling and Internet Protocol (IP) connectivity.

[0004] A number of CSCF (Call Session Control Function) entities are used to establish a session within the IMS network and process SIP signalling packets. The CSCF entities are the Proxy-CSCF (P-CSCF), Interrogating-CSCF (I-CSCF) and Serving-CSCF (S-CSCF). FIG. 1 shows part of an IMS network which includes the S-CSCF. The S-CSCF is responsible for handling registration processes, making routing decisions and maintaining session states.

[0005] Application servers (AS) within an IMS network can host and execute applications which provide services. An Application Server interface with the S-CSCF via an IMS Service Control (ISC) interface which uses SIP signalling. Services can include call related services such as Call waiting, Call holding, Call forwarding, Call transfer, Call blocking services. Applications can also provide services such as notifying a user of particular information, such as stock prices or football results. Applications can be provided by the operator of the IMS network, with the application being hosted and executed by a SIP Application Server within the IMS network.

[0006] Alternatively, an application can be provided by a third party service provider external to the IMS network, as shown in FIG. 1. An Application Server 30 within the IMS network, called an Open Service Architecture Service Capability Server (OSA SCS), can provide IMS network resources to implement the external service. The S-CSCF communicates with the OSA SCS via an IMS Service Control (ISC), SIP-based, signalling interface 24. An OSA gateway 14 acts as an intermediary between the OSA SCS 30 and an Application 42 in the IT environment 40. Alternatively, the OSA gateway 14 can interface directly with the S-CSCF 22. An Application can interface directly with the OSA Gateway 14 via an OSA Application Programming Interface (OSA API), which typically uses Parlay over CORBA. Application 41 interfaces with OSA Gateway 14 in this manner. For Applications which use XML, a Parlay-X interface is used and a Parlay-X gateway 16 is required. Application 42 uses a Parlay-X interface to communicate with the Parlay-X gateway 16. The Parlay-X gateway uses a Parlay interface to communicate with the OSA gateway 14. IT-based applications or web-based services typically exchange data in an XML format, and so the arrangement of gateways shown in FIG. 1 is usually required. It can be seen that, with the current architecture, two gateway elements are required whenever an application 42 which uses an XML-based messaging format is connected to the IMS network. This considerably increases the complexity of implementing applications provided by third parties.

[0007] The present invention seeks to provide an alternative way of implementing applications in an IMS network.

SUMMARY OF THE INVENTION

[0008] A first aspect of the present invention provides a Call Session Control Function (CSCF) entity for use in an IP Multimedia Subsystem (IMS) network, the Call Session Control Function (CSCF) entity comprising:

[0009] a first interface for interfacing with other entities, wherein the first interface is arranged to use signalling in an Extensible Markup Language (XML) format.

[0010] The world of IT applications use web services as their interface and as such are based upon XML signalling. Providing an XML interface on the CSCF, which can directly communicate with IT applications, avoids the need to use an OSA/Parlay-X gateway to interface with such applications. This can considerably simplify the provision of applications provided by third parties.

[0011] The other entities that the CSCF interfaces with can be located outside the IMS network 20, such as servers supporting third party IT or web-based applications. The provision of an XML based interface on the CSCF also has advantages in communicating with other network entities which are located within the IMS network 20, such as other Application Servers, other CSCF entities, endpoints, network databases such as a Home Subscriber Server (HSS), or parts of the billing system such as a Charging Collection Function (CCF).

[0012] Preferably, the CSCF according to the present invention can direct XML based service requests by filtering XML messages received via the first interface. The IMS network can use inspection techniques at the XML level to provide the necessary complex service routing and logic handling. A further advantage of the present invention is that the IMS network can host a new entity—an XML application server. The CSCF acts as an anchor point for persistent session capability for the applications.

[0013] XML is a self-describing protocol and new network features can be defined via the XML format. Supporting XML at the Call Session Control Function, which is the primary entity within the IMS network for any session, allows extensive new features to be added to the network with greater ease than is currently possible.

[0014] Preferably, the transport layer of signalling between the CSCF and other entities (especially any external entity) is secured, such as by using the Transport Layer Security mechanism of IMS or the HTTPS protocol, and the content of the signalling messages can be encrypted using various standards based security components such as WS-Security or X.509.

[0015] The term Call Session Control Function (CSCF) is intended to refer to any of: a Proxy-CSCF (P-CSCF), an Interrogating-CSCF (I-CSCF) and a Serving-CSCF (S-CSCF). These will generally referred to as x-CSCF.

[0016] The functionality described here can be implemented in software, hardware or a combination of these. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably
programmed computer. Accordingly, another aspect of the invention provides software for implementing the method.

In accordance with this invention, the S-CSCF 22 also has an XML-based signalling interface 70 which allows the S-CSCF 22 to communicate directly with network entities which use XML-based signalling. The network entities can be other entities within the IMS network 20, such as Application Servers, other x-CSCF entities or endpoints. Alternatively, the other entities can be outside the IMS network 20, such as the Application Server supporting IT Application A 42, as shown in FIG. 2. The provision of interface 70 allows the S-CSCF 22 to directly control the provision of a service, without the need to use an OSA/Parlay gateway 30. It is preferred that the S-CSCF 22 has both the XML interface 70 and the ISC (SIP-based) interface 24 and selectively uses the interfaces as necessary. This allows the S-CSCF 22 to perform SIP and XML namespace based access from the same network point.

The XML signalling interface can be used to interface with applications, as shown in FIG. 2, or to interface with any other network entity that uses an XML format for signalling messages.

FIG. 3 shows the S-CSCF 22 in more detail. The XML interface 70 connects to an XML filtering unit 91. The XML filtering unit 91 inspects signalling data received via the interface and compares information elements within the XML signalling with stored data. The stored data can take the form of rules which indicate what action should be taken in response to receiving a particular information element, or combination of information elements, in the received signalling data. Rules can specify conditions, such as a limit or range that a received information element should take in order for an action to be followed. The S-CSCF accesses rules in a store 80 via a Rules API 84. The filtering process can use rules which include multiple inspection criteria. Alternatively, or additionally, the inspection process can use multiple rules. The filtering unit 91 can also use sets of rules which relate to different parties, such as the operator of the network 20, the subscriber (UE 12), and the provider of the external application 41, 42. The rules used by the XML filtering unit 91 can be stored at the S-CSCF 22, at a centralised database in the IMS network (80, FIG. 2) or at individual databases (81, 82, 83, FIG. 3). Where rules are stored at a database 80 externally of the S-CSCF 22, the S-CSCF 22 can perform a query to the database 80 in real-time. The set, or multiple sets, of stored rules that the XML filter unit 91 uses can be configured and updated as necessary.

The S-CSCF 22 has a network protocol interface 86 for communicating with other entities within the IMS network. This is typically SIP-based but, in accordance with the present invention, this interface 86 can also send and receive messages in the XML format and forward these to the XML filtering unit 91 for processing.

The XML filtering unit 91 can be used to perform various functions, such as routing, generating charging information and making operational measurements. One function which the control logic 32 can perform is a Charge Triggering Function (CTF). The control logic 32 compares information elements in the received data with stored data (billing triggers) which are indicative of charging events where charging information should be generated. The inspection process uses a set of rules. When received data matches one or more of the stored billing triggers (e.g. a condition specified in a rule) the control logic creates an information flow that captures any relevant information and creates an Accounting Request. The Charge Data Function (CDF) will act on this request to gen-
erate a charging record which is typically known as a Charging Data Record (CDR). An output function 33 of the Application Server 30 packages the charging information into the required output format. Preferably, the Accounting Request issued by the Application Server is compliant to the 3GPP RI interface standard as defined in 3GPP TS 32.260 (3rd Generation Partnership Project; Technical Specification Group Service and System Aspects; Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging). 3GPP TS 32.260 also defines how each Accounting Request is acknowledged by an Accounting Answer (ACA).

One example of a rule is a simple instruction for the control logic of the filtering unit 91 to look for a particular information element in the received data, such as a particular subscriber identity (e.g., john@nortel.com). A rule can instruct the control logic to look for a particular information element in the received data and to compare the value with a condition, such as a limit, or a range, which is specified in the rule. As an example, a rule can specify a number of messages that a user is allowed to send at a particular tariff and a tariff for the message (e.g., first ten messages per day free of charge, next ten messages per day at a price of $X per message).

The Accounting Requests 35 are sent to a Charging Data Function (CDF) 50 over an interface 36. The Charging Data Function 50 is a part of the IMS architecture which collates the accounting requests received from the AS, and the accounting requests received from other entities, such as accounting requests 25 received from the S-CSCF 22. The CDF 50 creates a Charging Data Record (CDR) and sends it to a Charging Gateway Function (CGF) 52. The CGF 52 subsequently issues billing information, via an interface 55, to a billing system 56. The billing system will add a charge to a subscriber’s account.

In cases where the comparison process compares the XML data with multiple rules, a separate Accounting Request can be generated on each occasion where a rule instructs the control logic to generate charging information. FIG. 4 schematically illustrates an alternative scheme performed by the filtering unit 91 at a S-CSCF in which the comparison process compares all of the XML data in a particular signalling flow against a set of rules, and issues a single Accounting Request which collates all of the charging information which results from the comparison. This can reduce network signalling overheads and the burden of subsequently processing the multiple Accounting Requests. Application XML data is received by the filtering unit 91. The filtering unit 91 checks the XML data against a set of rules (Rule 1, Rule 2, . . . Rule N) stored in rules database 80. On the first occasion when a comparison of a rule with the XML data results in a match, a create billing record function 61 is invoked. As an example, a rule may state:

```java
If (incomingData[@address='john@nortel.com'])
{
    billingRecord = new(billingRecord)
}
```

which creates a new Accounting Request based on match between a particular address stated in the rule with the same address appearing in the received XML data. The filtering unit 91 proceeds to compare other rules in the database 80 against the received XML data. On each subsequent occasion when a rule matches the XML data, further data is appended to the Accounting Request by an append data to Accounting Request function 62. A subsequent rule may state, for example:

```java
If (incomingData[@applicationRequested='EffectiveCallRoute'])
{
    append(billingRecord, EffectiveCallRoute)
}
```

At the end of the rule checking process, the Accounting Request is closed by a close Accounting Request function 63 and the Accounting Request is sent from the S-CSCF via an output interface (86, FIG. 3).

In an online charging scheme, a user has an account which defines an amount of credit and a check is made, in real-time, whether the user has sufficient credit before granting or denying access to a service. In an online charging implementation of the present invention, the S-CSCF 22 inspects incoming XML data and compares elements in the XML data with rules using the filtering unit 91, and then generates a Credit Control Request (CCR) to an Online Charging System (OCS) 54. The CCR is preferably sent via the Ro interface as defined in 3GPP 32.360. The OCS 54 will compare the request with the subscriber’s available credit and will reply with a Credit Control Authorisation (CCA) if sufficient credit exists. As the authorised credit is used up, or as stored rules are triggered at the filtering unit 91, further credit control requests may be sent from the filtering unit 91 to the OCS 54. At the end of the session, the filtering unit 91 will inform the OCS 54 to allow it to release any unused credit. The OCS 54 is responsible for keeping the Billing System informed of the usage of credit to allow billing records to be generated.

FIG. 5 schematically illustrates the inspection and comparison processes performed by XML filtering unit 91, using multiple rule sets. An Application 41 sends a signalling message 108, shown here as XML over SOAP. The message 108 includes instructions to play an audio message, and specifies the location (URL) of the audio server, the destination terminal, and charging information. Application 41 is provided by a party who is independent of the operator of the IMS network 20. The XML filter 91 is shown implementing rules for three separate parties: the IMS network operator; the subscriber and the provider of the external Application. In addition, a set of governance rules govern the compliance of the external application to limits imposed by the operator.

At stage 110, operational rules are checked. In this example, a count is maintained of audio messages and a check is made that the current count value is within a threshold limit. At stage 112 personal rules are checked. This may involve communicating with a Home Subscriber Server (HSS) 104 which maintains details of the subscriber. In this example, the personal rules implement a form of online charging. The signalling message 108 includes charging information for delivering the message. The Personal Rules at step 112 check that the user has sufficient credit in their account to deliver the message, and then debit the account. At stage 114 a set of IT Application Rules are checked. Finally, at stage 116 governance rules are checked. In this example, it checks that the IT Application making use of the IMS network is a valid application, and counts the number of messages that have been
delivered. The Governance Rules may impose a maximum number of messages that the IMS network will deliver from that IT Application.

[0041] At each of the stages 110, 112, 114, 116 data can be generated as a result of comparing the received XML data with the rules. The data can be sent after that stage has been completed, or the data can be collated as described above. If generated data is destined for different entities (e.g. charging information destined for a charging entity, operational measurements destined for a network management entity) then the generated data can be collated according to which network entity that data is destined.

[0042] FIG. 6 shows another example of an IMS network. This network includes a new entity—an XML Application Server 120. The provision of the XML interface on the S-CSCF allows this new entity to be provided within the network as XML signalling can now be carried through the IMS network and service requests can be directed to the XML Application Server 120 by the XML filtering action of the S-CSCF. FIG. 6 shows XML signalling between an endpoint terminal 12 and the XML Application Server 120. SIP signalling is also carried by the network, in a conventional manner.

[0043] FIGS. 7-10 show a sequence of events which illustrate call set up, and then putting a call on hold. Firstly, a call session is established between terminals 131, 132, resulting in a bearer path 135. This can be achieved using SIP-based signalling, in a known manner, but in FIG. 7 it is achieved using a signalling message 141 which includes XML data. The ‘callParty’ XML fragment is used to indicate that this message is the command and it is used to effect a new session and uses the address information contained within the fragment as the destination.

[0044] At some later point during the call session terminal 131 initiates a call hold event. Terminal 131 issues a message 142 instructing a music-on-hold server 133 to play music on hold to terminal 132. Message 142 includes XML data which carries an instruction to play an audio message, the address of the server which should play the music during the call hold event and charging information. As shown in FIG. 9, the XML signalling message is received by the S-CSCF. XML filtering unit 91 within the S-CSCF receives the message 142 and compiles the message with the rules in the database. After performing the rules check, the XML signalling message is forwarded to the music-on-hold server 133. As described in the examples previously, the rules check can result in charging information being generated by the S-CSCF. In this example, it is assumed that the rules allow the XML message to be forwarded to the music-on-hold server 133. The music-on-hold server 133 establishes a bearer path with terminal 132 and begins to play music-on-hold, as shown in FIG. 10.

[0045] The invention described above is not limited to providing services to wireless subscribers. Any form of access network (wireless, wireline or combination of these) can be used to connect a user equipment to the IMS network.

[0046] The invention is not limited to the embodiments described herein, which may be modified or varied without departing from the scope of the invention.

We claim:

1. A method of operating an IP Multimedia Subsystem (IMS) network, the method comprising:
   interfacing a Serving Call Session Control Function (S-CSCF) of a Call Session Control Function (CSCF) entity directly with at least one network entity internal to or external to the IMS network using markup language signalling to provision one or more services; and interfacing the S-CSCF to at least one other network entity using Session Initiation Protocol (SIP) signalling.

2. The method of claim 1, wherein interfacing the S-CSCF directly with the at least one network entity comprises interface to interfacing the S-CSCF with an application executing on the at least one network entity.

3. The method of claim 2, wherein the application is hosted externally of the IMS network.

4. The method of claim 2 comprising:
   sending markup language signalling information from the at least one network entity to the S-CSCF;
   receiving the markup language signalling information at the S-CSCF; and
   using the markup language signalling information to apply the application within the IMS network.

5. The method of claim 2 comprising:
   sending markup language signalling information from the S-CSCF to the at least one network entity; and
   using the markup language signalling information to control the application.

6. The method of claim 2, wherein the application is a web service.

7. The method of claim 2, comprising:
   sending markup language signalling information from the at least one network entity to the S-CSCF;
   receiving the markup language signalling information at the S-CSCF; and
   inspecting the received markup language signalling information;
   comparing the received markup signalling information with stored rule data which specifies a relationship between an element in the signalling information and an action that should be taken; and
   generating output data based on the basis of the comparison.

8. The method of claim 7, comprising sending the output data to at least one network entity.

9. The method of claim 7, wherein the rule data specifies when charging information should be generated and the method comprises generating charging information based on the comparison.

10. The method of claim 7, wherein the rule data comprises rules of the network operator.

11. The method of claim 7, wherein the rule data comprises rules for a subscriber.

12. The method of claim 7, wherein the rule data comprises rules for governance of an application.

13. The method of claim 1, wherein the S-CSCF comprises:
   a first interface configured to interface the S-CSCF directly with the at least one network entity using the markup language signalling; and
   a second interface configured to interface the S-CSCF to the at least one other network entity using the Session Initiation Protocol (SIP) signalling.

14. The method of claim 1, wherein the markup language signalling comprises signalling in an Extensible Markup Language (XML) format.

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