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(54) Call authorization and billing message routing
Leitweglenkung von Wahlberechtigung und Vergebührungsnotizen
Routage de messages pour la facturation et l’autorisation d’un appel téléphonique

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(73) Proprietor:
LUCENT TECHNOLOGIES INC.
Murray Hill, New Jersey 07974-0636 (US)

(72) Inventors:
• Xiang, Yang Li
  Beijing (CN)
• Min, Liu
  Beijing
  100089 (CN)
• Reid, John B.
  Naperville
  Illinois 60563 (US)
• Starner, Guy H.
  Sugar Grove
  Illinois 60554 (US)
• Trivedi, Ashish
  Naperville
  Illinois 60563 (US)
• Peng, Wang
  Beijing
  100080 (CN)
• Yile Enoch, Wang
  Freehold
  New Jersey 07728 (US)
• Jun Zheng, Yang
  Beijing
  100086 (CN)
• Lei, Zhang
  Beijing
  100021 (CN)

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• Zhao, Jay Z.
  Villa 159
  Beijing
  100103 (CN)

(74) Representative:
Sarup, David Alexander
Lucent Technologies EUR-IP UK Ltd
Unit 18, Core 3
Workzone
Innova Business Park
Electric Avenue
Enfield, EN3 7XU (GB)

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Description

Related Application

[0001] This application is related to an application of Yigang Cai, Qing Hong He, Min Liu, John B. Reid, Ashish Trevidi, Yile Enoch Wang, and Jay Z. Zhao entitled "Pre-Biller Capability In Enhanced Charging Collection Function (CCF) Applications", which application is assigned to the assignee of the present application and is being filed concurrently herewith.

Technical Field

[0002] This invention relates to methods and apparatus for routing telecommunications authorization, billing, and charging inquiries and responses in a telecommunications network.

Background of the Invention

[0003] After many years of experience in postpaid charging of telecommunications calls, telecommunications service providers and their customers are becoming increasingly interested in real time charging which offers cost control and immediate balance update.

[0004] In response to these demands, the new generation of telecommunications systems such as those specified by 3GPP (3rd Generation Partnership Project) and 3GPP2 (3rd Generation Partnership Project 2) have introduced new and highly flexible billing arrangements. These billing arrangements are described in a standards document as Diameter billing arrangements.

[0005] In accordance with these Diameter billing arrangements, call authorization and billing services are provided by a group of Diameter servers, which store a customer profile and maintain billing records and account data for their served customers. These servers are accessed (optionally via a Diameter agent), and respond to billing inquiries from calls originated in a network by providing information to the Diameter client process controlling the billing aspects of a call. Because of a need to have a high degree of flexibility in the assignment of identifications of customers and because of the very large volume of billing inquiries and responses, it is necessary to provide a large number of Diameter servers in a network and to provide essentially complete flexibility in the assignment of subscribers to individual Diameter servers.

[0006] In accordance with one Diameter billing arrangement, the Diameter client comprises a database for storing the identity of the Diameter Server for serving each subscriber of the network. This arrangement creates problems for keeping all Diameter client databases up to date and in synchronism, and requires a large database in each Diameter client. For both of these reasons, if the number of subscribers served by a Diameter system is large, this arrangement is undesirable.

Summary of the Invention

[0007] Accordingly, a problem of the prior art is that there is no efficient system for determining the identity of the Diameter server of a particular customer without incurring a penalty in call setup time of a telecommunications call.


Brief Description of the Drawing(s)

[0010] A method and apparatus according to the present invention are set out in the independent claims, to which the reader is now referred. Preferred features are laid out in the dependent claims.

[0011] The above problem is alleviated and an advance is made over the teachings of the prior art in accordance with this invention wherein a billing agent for routing billing inquiry messages to the appropriate Diameter server further contains a database for determining the identity of the billing server given only the identity of the subscriber making a call for which a billing inquiry message has been received. Advantageously, such a billing agent which may serve a plurality of billing clients, and can directly process and forward messages without requiring that the messages contain the identity of the Diameter server serving the customer who has originated a call for which a billing inquiry message has been received. The identity of the Diameter server is returned with a billing request response message, so that the billing agent need not determine the identity of the Diameter server in subsequent billing inquiry messaging or action messages.

[0012] Advantageously, compared with storing a database for identifying the Diameter server for serving each subscriber in each Diameter client, the database is maintained only in the Diameter server, thus sharply reducing the multiple copies of this database in the many Diameter clients of a network.

FIG. 1 is a block diagram of the prior art Diameter
Detailed Description

[0014] FIG. 1 is a block diagram illustrating the operation of an authorization, charging and billing system, the Diameter system in accordance with the prior art. Billing and charging functions are initiated from a Diameter client, a software process including data storage for generating Diameter billing request messages and receiving Diameter responses. These responses can influence the action of a telecommunications switch (not shown) associated with the Diameter client, to request establishment of calls and to request disconnect of calls. When the Diameter client receives the identification of the Diameter server from the database 12, the Diameter client sends a message including the identity of the Diameter server for the subscriber and call to an intermediate Diameter agent 15 which includes a message switch 17 for transmitting the request message to the proper Diameter server. This may be one of the Diameter servers 21, 23, 25, etc., which can serve the subscriber originating the telecommunications call. When the Diameter client receives the identification of the Diameter server from the database 12, the Diameter client sends a message including the identity of the Diameter server for the subscriber and call to an intermediate Diameter agent 15 which includes a message switch 17 for transmitting the request message to the proper Diameter server. This may be one of the Diameter servers 21, 23, 25, etc., which can serve the subscriber originating the telecommunications call. The important point to remember is that the Diameter client receives the identification of the Diameter server for this call from the local subscriber database 12. The Diameter server comprises a database 22 for storing subscriber profiles and billing and account data.

[0015] FIG. 2 is a block diagram illustrating the operation of the Diameter system in accordance with Applicants’ invention. A change within the Diameter client is noted by having a different designation number (211) for this client. In accordance with Applicants’ invention, the Diameter client sends an initial message which does not contain the identity of the Diameter server for this call to an enhanced Diameter agent 215. The enhanced Diameter agent still includes a message router 217 but in addition contains a database 219 to identify the Diameter server for a subscriber given the subscriber identification received in the original Diameter request message. The Diameter agent database 219 contains the required information, and the message, including this information is sent to the selected Diameter server, one of the group 241, 243. For subsequent Diameter messages, the identity of the Diameter server serving this call is included in the message so that the database 219 need not be repeatedly accessed for this call. Each Diameter server comprises a subscriber profile database such as database 242.

[0016] The connection between the Diameter client and the Diameter agent and between the Diameter agent and the Diameter server is shown as a direct connection but it can also be a connection established through a data network such as the Internet.

[0017] In the Diameter system, messages include a header comprising a command code to identify the purpose of the message, an Attribute/Value pair (AVP) to identify a subscriber, and, if known, a Destination-Host indicator to identify the Diameter server. An original message from the Diameter client would not contain the Destination-Host attribute value pair; the Diameter agent uses the database of the Diameter agent to determine this value from the value of the subscriber number, and routes the message to the Diameter server identified by the Destination-Host indicator.

[0018] The response to the original billing request message includes an authorization to establish the call, or a denial of that authorization. Subsequent exchanges between the Diameter client and Diameter server include further authorization or denial indicators.

[0019] FIG. 3 is a flow diagram illustrating the operation of Applicants’ invention. The Diameter client generates billing request data when a call originates (action block 301). The Diameter client sends a Diameter request message which does not include the Diameter server identification to the Diameter agent (action block 303). The Diameter agent determines the identity of the Diameter server serving the calling party and routes the calling party to a Diameter server (action block 305). The Diameter agent sends the Diameter request message now including the Diameter server identity to the Diameter server (action block 307). The Diameter server responds to the Diameter client with a message providing the billing request response data and the Diameter server identity (action block 309).

[0020] For subsequent messages between the Diameter client and the Diameter server, the Diameter server identity is included in the Destination-Host AVP (action block 311); this identity was reported to the Diameter client in action block 309.

[0021] The arrangement described in accordance with Applicants’ invention is especially useful for calls requiring real time billing such as calls billed against a prepaid account. However, the arrangement can also be used for billing calls which do not require real time billing in which case the Diameter server performs the conventional postpaid billing function.

[0022] While the above preferred embodiment is for 3rd generation telecommunications systems it can also be retrofitted to earlier telecommunications systems; in that case the Diameter server would be a process in a control processor of a switching system.

[0023] In accordance with Applicants’ invention, the Diameter agent can be further enhanced by a translator.
221 to translate between messages of the Diameter system in a first dialect and messages of, for example, the Radius system, in a second dialect. With this arrangement, the Diameter agent and the Diameter servers can also serve subscribers served by the prior art Radius billing and charging system. The Diameter agent 215 receives messages from and to Radius client 251, and translates these messages into Diameter messages using translator 221. Thus, a system in accordance with Applicants’ invention can also handle legacy equipment using, for example, the Radius system, and not arranged to query a Diameter server.

[0024] In this description, it is assumed that the identity of the Diameter server, received in an initial response message, is retained by the Diameter client. This arrangement has the disadvantage that if the identity of the Diameter server changes during a call, the message will be incorrectly routed. It appears that this condition is unlikely, but to protect against it, in an alternate embodiment, the Diameter client does not specify the identity of the Diameter server in subsequent messages to the Diameter agent. If the Diameter agent database includes a cache memory, then subsequent requests to identify the Diameter server can be handled expeditiously.

[0025] The above description is of one preferred embodiment of Applicants’ invention. Other embodiments will be apparent to those of ordinary skill in the art without departing from the scope of the invention. The invention is limited only by the attached claims.

Claims

1. A method in a telecommunications network for controlling the billing of calls comprising the steps of:

   receiving an originating request for establishment of a telecommunications call in a billing client (301);
   transmitting (303) a message, including an identification of a caller of said call, in a first protocol, from said billing client to an agent server;
   responsive to receiving a billing request message, generating (309) a response message in said first protocol in a billing server; and
   transmitting said response message to said billing client;

   Characterized in that said method further comprises the steps of:

   in said agent server, determining (305) an identity of the billing server for authorizing and billing said call; and
   responsive to said determining, transmitting (307) the billing request message, including an identity of said billing server, to said billing server.

2. The method of claim 1 further comprising the step of: transmitting subsequent billing request messages for said call to said billing server without requiring a repetition of said determining step.

3. The method of claim 1 further comprising the steps of:

   transmitting another message in a second protocol from said billing client to said billing agent; and
   in said billing agent, translating (221) said another message in said second protocol into a corresponding message in said first protocol for transmission to said billing server; and
   translating another response message in said first protocol from said billing server to a corresponding response message in said second protocol for transmission to a source of said another message.

4. Apparatus in a telecommunications network for controlling the billing of calls comprising:

   means (211, 301) in a billing client for receiving an originating request for establishment of a telecommunications call;
   means for transmitting (303) a message, including an identification of a caller of said call, in a first protocol from said billing client to an agent server (215);
   means, responsive to receiving a billing request message, for generating a response message in said first protocol in a billing server; and
   means for transmitting said response message to said billing client;

   Characterized in that said apparatus further comprises:

   means (219) for determining an identity of said billing server (241) for authorizing and billing said call; and
   means, responsive to said determining, for transmitting said billing request message (307), including an identity of said billing client, to said billing server (241).

5. The apparatus of claim 4 further comprising:

   means for transmitting subsequent billing request messages for said call to said billing server without requiring a repetition of said determining step.

6. The apparatus of claim 4 further comprising:

   means for transmitting another message in a
second protocol to said billing agent; and
in said billing agent, means for translating said
another message in said second protocol into a
corresponding message in said first protocol for
transmission to said billing server; and
means for translating another response mes-
sage in said first protocol from said billing server
to a corresponding response message in said
second protocol for transmission to a source of
said another message.

Patentansprüche

1. Verfahren in einem Telekommunikationsnetz zum
Steuerung der Gebührenberechnung für Verbindun-
gen, mit den folgenden Schritten:
Empfangen einer Ursprungsanforderung zur
Herstellung einer Telekommunikationsverbin-
dung in einem Gebührenberechnungs-Client
(301);
Senden (303) einer Nachricht, einschließlich ei-
er Identifikation eines Anrufers der Verbin-
dung, in einem ersten Protokoll von dem Ge-
bührenberechnungs-Client zu einem Agent-
Server; als Reaktion auf den Empfang einer Gebühren-
berechnungs-Anforderungsnachricht, Erzeu-
gen (309) einer Antwortnachricht in dem ersten
Protokoll in einem Gebührenberechnungs-Ser-
ver; und
Senden der Antwortnachricht zu dem Gebüh-
renberechnungs-Client (309);
**dadurch gekennzeichnet, daß das Verfahren**
**ferner die folgenden Schritte umfaßt:**
in dem Agent-Server, Bestimmen (305) ei-
er Identität des Gebührenberechnungs-
Servers zur Autorisation und Gebührenbe-
rechnung für die Verbindung; und
als Reaktion auf das Bestimmen, Senden
(307) der Gebührenberechnungs-Anforder-
ungsnachricht, einschließlich einer Identität
tä des Gebührenberechnungs-Servers, zu
dem Gebührenberechnungs-Server.

2. Verfahren nach Anspruch 1, ferner mit dem folgen-
den Schritt:
Senden nachfolgender Gebührenberechnungs-
Anforderungsnachrichten für die Verbindung zu
dem Gebührenberechnungs-Server, ohne eine
Wiederholung des Schritts des Bestimmens zu
erfordern.

3. Verfahren nach Anspruch 1, ferner mit den folgen-
den Schritten:

Senden einer weiteren Nachricht in einem zwei-
ten Protokoll von dem Gebührenberechnungs-
Client zu dem Gebührenberechnungs-Agenten;
und
in dem Gebührenberechnungs-Agenten, Überset-
zen (221) der weiteren Nachricht in dem
zweiten Protokoll in eine entsprechende Nach-
richt in dem ersten Protokoll zur Übertragung zu
dem Gebührenberechnungs-Server; und
Übersetzen einer weiteren Antwortnachricht in
dem ersten Protokoll aus dem Gebührenbe-
rechnungs-Server in eine entsprechende Ant-
wortnachricht in dem zweiten Protokoll zur
Übertragung zu einer Quelle der weiteren Nach-
richt.

4. Vorrichtung in einem Telekommunikationsnetz zum
Steuerung der Gebührenberechnung für Verbindun-
gen, umfassend:
Mittel (211, 301) in einem Gebührenberech-
nungs-Client zum Empfangen einer Ursprungs-
anforderung zur Herstellung einer Telekommu-
kationsverbindung;
Mitteln zum Senden (303) einer Nachricht, ein-
schließlich einer Identifikation eines Anrufers
der Verbindung, in einem ersten Protokoll von
dem Gebührenberechnungs-Client zu einem
Agent-Server (215);
Mitteln zum Erzeugen einer Antwortnachricht in
dem ersten Protokoll in einem Gebührenberech-
nungs-Server als Reaktion auf den Empfang ei-
er Gebührenberechnungs-Anforderungsnach-
richt; und
Mitteln zum Senden der Antwortnachricht zu dem
Gebührenberechnungs-Client;
**dadurch gekennzeichnet, daß die Vorrichtung**
**ferner folgendes umfaßt:**
in dem Agent-Server, Mittel (219) zum Be-
stimmen einer Identität des Gebührenbe-
rechnungs-Servers (241) zur Autorisation
und Gebührenberechnung für die Verbin-
dung; und
Mitteln zum Senden der Gebührenberech-
nungs-Anforderungsnachricht (307), ein-
schließlich einer Identität des Gebührenbe-
rechnungs-Servers, zu dem Gebührenbe-
rechnungs-Server (241), als Reaktion auf
das Bestimmen.

5. Vorrichtung nach Anspruch 4, ferner umfassend:
Mitteln zum Senden nachfolgender Gebührenbe-
rechnungs-Anforderungsnachrichten für die
Verbindung zu dem Gebührenberechnungs-
Server, ohne eine Wiederholung des Schritts
des Bestimmens zu erfordern.
Revendications

1. Procédé de commande de la facturation des appels dans un réseau de télécommunications comprenant les étapes de :

- réception d’une requête initiale d’établissement d’un appel de télécommunications dans un client de facturation (301) ;
- transmission (303) d’un message, comportant une identification d’un appelant dudit appel, dans un premier protocole, par ledit client de facturation à un serveur d’agent ;
- en réponse à la réception d’un message de requête de facturation, génération (309) d’un message de réponse dans ledit premier protocole dans un serveur de facturation ;
- transmission dudit message de réponse audit client de facturation (309) ;

caractérisé en ce que ledit procédé comprend en outre les étapes de :

- dans ledit serveur d’agent, détermination (305) de l’identité du serveur de facturation pour autoriser et facturer ledit appel ;
- en réponse à ladite détermination, transmission (307) du message de requête de facturation, comportant une identité dudit serveur de facturation, audit serveur de facturation.

2. Procédé selon la revendication 1, comprenant en outre l’étape de :

transmission de messages de requêtes de facturation ultérieurs dudit appel audit serveur de facturation sans nécessiter de répétition de ladite étape de détermination.

3. Procédé selon la revendication 1, comprenant en outre les étapes de :

transmission d’un autre message dans un second protocole par ledit client de facturation audit agent de facturation ;
- dans ledit agent de facturation, traduction (221) dudit autre message dans ledit second protocole en un message correspondant dans ledit premier protocole en vue de sa transmission audit serveur de facturation ;
- traduction d’un autre message de réponse dans ledit premier protocole provenant dudit serveur de facturation en un message de réponse correspondant dans ledit second protocole en vue de sa transmission à une source dudit autre message.

4. Appareil dans un réseau de télécommunications pour commander la facturation des appels comprenant :

- un moyen (211, 301) dans un client de facturation pour recevoir une requête initiale d’établissement d’un appel de télécommunications ;
- un moyen pour transmettre (303) un message, comportant une identification d’un appelant dudit appel, dans un premier protocole, par ledit client de facturation à un serveur d’agent (215) ;
- un moyen, en réponse à la réception d’un message de requête de facturation, pour générer un message de réponse dans ledit premier protocole dans un serveur de facturation ;
- un moyen pour transmettre ledit message de réponse audit client de facturation ;

caractérisé en ce que ledit appareil comprend en outre :

- dans ledit serveur d’agent, un moyen (219) pour déterminer l’identité du serveur de facturation (241) pour autoriser et facturer ledit appel ;
- un moyen, en réponse à ladite détermination, pour transmettre ledit message de requête de facturation (307), comportant une identité dudit serveur de facturation, audit serveur de facturation (241).

5. Appareil selon la revendication 4, comprenant en outre :

- un moyen pour transmettre des messages de requêtes de facturation ultérieurs dudit appel audit serveur de facturation sans nécessiter de répétition de ladite étape de détermination.

6. Appareil selon la revendication 4, comprenant en outre :


un moyen pour transmettre un autre message dans un second protocole audit client de facturation ; et dans ledit agent de facturation, un moyen pour traduire ledit autre message dans ledit second protocole en un message correspondant dans ledit premier protocole en vue de sa transmission audit serveur de facturation ; et un moyen pour traduire un autre message de réponse dans ledit premier protocole provenant dudit serveur de facturation en un message de réponse correspondant dans ledit second protocole en vue de sa transmission à une source dudit autre message.
FIG. 2

- DIAMETER SERVER 241
  - DATABASE 242
- DIAMETER SERVER 243
- DIAMETER AGENT 215
  - MESSAGE ROUTER 217
  - SUBSCRIBER DATABASE 219
  - TRANSLATOR 221
- DIAMETER CLIENT 211
- RADIUS CLIENT 251
FIG. 3

DIAMETER CLIENT GENERATES BILLING REQUEST DATA

DIAMETER CLIENT SENDS DIAMETER REQUEST MESSAGE WITHOUT DIAMETER SERVER IDENTIFICATION INFORMATION TO DIAMETER AGENT

DIAMETER AGENT DETERMINES DIAMETER SERVER IDENTITY FOR SERVING DIAMETER MESSAGES FOR THE CALLING SUBSCRIBER

DIAMETER AGENT SENDS DIAMETER REQUEST MESSAGE, NOW INCLUDING DIAMETER SERVER IDENTITY, TO DIAMETER SERVER

DIAMETER SERVERResponds TO DIAMETER CLIENT WITH BILLING REQUEST RESPONSE DATA AND DIAMETER SERVER IDENTITY

IN SUBSEQUENT MESSAGES FROM DIAMETER CLIENT, THE DIAMETER SERVER IDENTITY IS INCLUDED