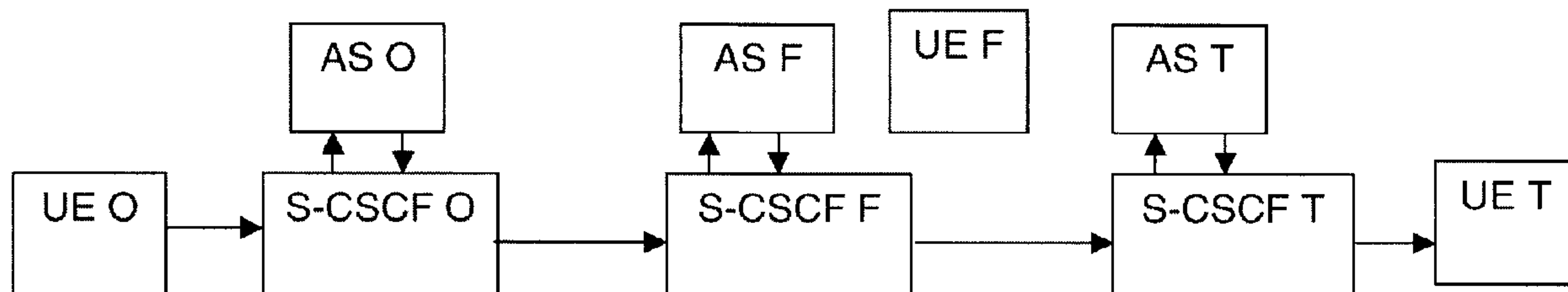




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 (54) Title: MESSAGE HANDLING IN AN IP MULTIMEDIA SUBSYSTEM



(57) Abrégé/Abstract:

A Session Initiation Protocol Application Server of an IP Multimedia Subsystem having processing means for handling a message received from a Serving Call/State Control Function, the means being arranged to handle the message based upon a header of the message containing the URI of the served user, this header having been introduced by the Serving Call/State Control Function and being other than the P-Asserted Identity and the R-URI.



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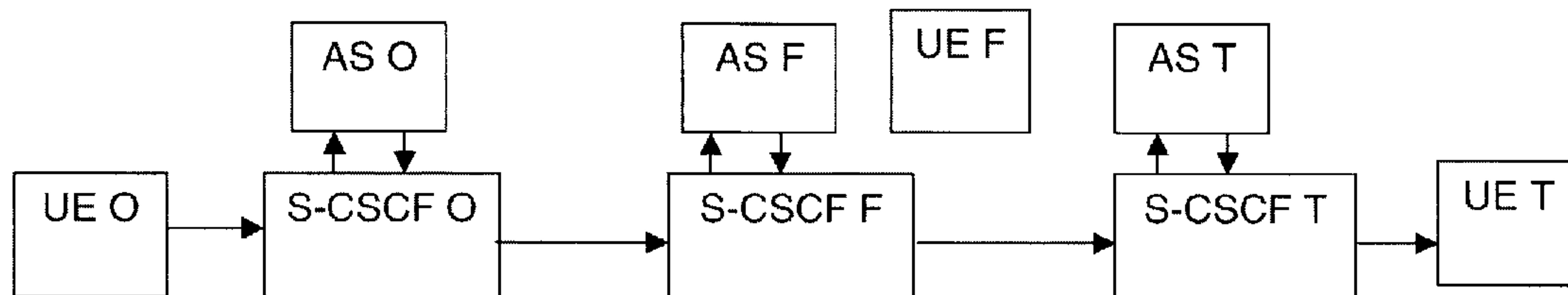
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(57) Abstract: A Session Initiation Protocol Application Server of an IP Multimedia Subsystem having processing means for handling a message received from a Serving Call/State Control Function, the means being arranged to handle the message based upon a header of the message containing the URI of the served user, this header having been introduced by the Serving Call/State Control Function and being other than the P-Asserted Identity and the R-URI.



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Message Handling in an IP Multimedia Subsystem

Field of the Invention

5 The present invention relates to Session Initiation Protocol message handling in an IP Multimedia Subsystem (IMS), and in particular, though not necessarily, to a method and apparatus for handling Session Initiation Protocol messages related to call forwarding at a Serving Call/Session Control Function within the IMS.

10

Background to the Invention

IP Multimedia services provide a dynamic combination of voice, video, messaging, data, etc. within the same session. By growing the number of basic applications and the media which it is possible to combine, the number of services offered to the end users will grow, and the inter-personal communication experience will be enriched. This will lead to a new generation of personalised, rich multimedia communication services, including so-called “combinational IP Multimedia” services which are considered in more detail below.

20

IP Multimedia Subsystem (IMS) is the technology defined by the Third Generation Partnership Project (3GPP) to provide IP Multimedia services over mobile communication networks (3GPP TS 22.228, TS 23.218, TS 23.228, TS 25 24.228, TS 24.229, TS 29.228, TS 29.229, TS 29.328 and TS 29.329 Releases 5 to 7. IMS provides key features to enrich the end-user person-to-person communication experience through the use of standardised IMS Service Enablers, which facilitate new rich person-to-person (client-to-client) communication services as well as person-to-content (client-to-server) services over IP-based networks. The IMS makes use of the Session Initiation Protocol (SIP) to set up and control calls or sessions between user terminals (or user

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terminals and application servers). The Session Description Protocol (SDP), carried by SIP signalling, is used to describe and negotiate the media components of the session. Whilst SIP was created as a user-to-user protocol, IMS allows operators and service providers to control user access to services and to charge users accordingly.

Figure 1 illustrates schematically how the IMS fits into the mobile network architecture in the case of a GPRS/PS access network. Call/Session Control Functions (CSCFs) operate as SIP proxies within the IMS. The 3GPP architecture defines three types of CSCFs: the Proxy CSCF (P-CSCF) which is the first point of contact within the IMS for a SIP terminal; the Serving CSCF (S-CSCF) which provides services to the user that the user is subscribed to; and the Interrogating CSCF (I-CSCF) whose role is to identify the correct S-CSCF and to forward to that S-CSCF a request received from a SIP terminal via a P-CSCF.

A user registers with the IMS using the specified SIP REGISTER method. This is a mechanism for attaching to the IMS and announcing to the IMS the address at which a SIP user identity can be reached. The user receives a unique URI from the S-CSCF that it shall use when it initiates a dialog. In 3GPP, when a SIP terminal performs a registration, the IMS authenticates the user, and allocates a S-CSCF to that user from the set of available S-CSCFs. Whilst the criteria for allocating S-CSCFs is not specified by 3GPP, these may include load sharing and service requirements. It is noted that the allocation of an S-CSCF is key to controlling (and charging for) user access to IMS-based services. Operators may provide a mechanism for preventing direct user-to-user SIP sessions which would otherwise bypass the S-CSCF.

During the registration process, it is the responsibility of the I-CSCF to select an S-CSCF if one is not already selected. The I-CSCF receives the required S-CSCF capabilities from the home network's Home Subscriber Server (HSS),

and selects an appropriate S-CSCF based on the received capabilities. [It is noted that S-CSCF allocation is also carried out for a user by the I-CSCF in the case where the user is called by another party, and the user is not currently allocated an S-CSCF.] When a registered user subsequently sends a session request (e.g. SIP INVITE) to the IMS, the request will include the P-CSCF and S-CSCF URIs so that the P-CSCF is able to forward the request to the selected S-CSCF. This applies both on the originating and terminating sides (of the IMS). [For the terminating call the request will include the P-CSCF address and the UE address.]

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Within the IMS service network, Application Servers (ASs) are provided for implementing IMS service functionality. Application Servers provide services to end-users in an IMS system, and may be connected either as end-points over the 3GPP defined Mr interface, or "linked in" by an S-CSCF over the 3GPP defined ISC interface. In the latter case, Initial Filter Criteria (IFC) are used by an S-CSCF to determine which Applications Servers should be "linked in" during a SIP Session establishment. Different IFCs may be applied to different call cases. The IFCs are received by the S-CSCF from an HSS during the IMS registration procedure as part of a user's User Profile. Certain Application Servers will perform actions dependent upon subscriber identities (either the called or calling subscriber, whichever is "owned" by the network controlling the Application Server). For example, in the case of call forwarding, the appropriate (terminating) application server will determine the new terminating party to which a call to a given subscriber will be forwarded.

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The working group known as ETSI TISPAN is developing the use of IMS for fixed broadband accesses. One of their tasks is to develop supplementary services based upon the IMS defined by 3GPP. These supplementary services will be defined in separate specifications although they will impact upon core specifications such as TS24.229. Figure 2 illustrates schematically the message flow within the IMS for a SIP INVITE, on the call originating side,

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according to TS24.229 (chapter 5.4.3.2). At step 1), the INVITE is sent from the originating User Equipment (UE) to the P-CSCF. This INVITE includes in its header a so-called P-Preferred identity, as well as including the URI of the P-CSCF at the topmost level of the SIP route header and the URI of the S-CSCF as the second entry. The UE also includes the identity of the communicating partner in the Request-URI. Upon receipt of the INVITE, the P-CSCF checks that the originating UE is allowed to use the identity included as the P-Preferred identity, and if so includes it as the P-Asserted Identity in the outgoing INVITE. The P-Asserted Identity is an identity that is used among trusted SIP entities, typically intermediaries, to carry the identity of the user sending a SIP message as it was verified by authentication. The P-CSCF identifies the S-CSCF allocated to the originating UE by looking in the Route Header, and at step 2) forwards the amended INVITE to that S-CSCF.

15 The S-CSCF handles the call according to an originating call case procedure. The S-CSCF uses the P-Asserted Identity to check whether any relevant restrictions have been placed on the originating UE, e.g. is the UE barred from using the requested service. The S-CSCF also uses the P-Asserted Identity and call case to determine the IFCs for the UE. In the example of Figure 2, it is assumed that the IFCs require that the S-CSCF forward (step 3)) the INVITE to a particular AS. The S-CSCF includes at the topmost level of the SIP route header the URI of the AS. It also includes in the subsequent level its own URI, together with an Original Dialog Identifier (ODI). The ODI is generated by the S-CSCF and uniquely identifies the call to the S-CSCF. The AS will itself perform authentication based upon the P-Asserted Identity contained in the message (the originating case). The appropriate case is identified to the AS by the S-CSCF (e.g. by sending the message to an appropriate port of the AS). When the AS returns the INVITE (step 4)) to the S-CSCF, the AS strips the URI of the AS from the route header, leaving the URI of the S-CSCF together with the ODI tag. The ODI tag allows the S-CSCF to determine that the INVITE relates to an earlier dialogue.

It is possible for the AS logic to require the setting up of a new session, in which case it would be necessary to provide a mechanism which allows the AS to replace the original R-URI with the URI of the new terminating User (the existing
5 TSs do not as yet provide for this re-routing scenario). In this case, the identity of the origin, i.e. the P-Asserted Identity of the INVITE at step 4), can be either the identity of the originating UE, the identity of the AS, or an identity of a third party on whose behalf the AS is setting up the new session. In this case, the S-CSCF will repeat the call restriction check and determine the IFCs based upon
10 the P-Asserted Identity contained in the "new" INVITE, assuming that the originating case is used. However, it is possible that the AS may signal to the S-CSCF that the terminating case is to be used, in which case the checks are carried out using the R-URI of the INVITE. Assuming that no further ASs are to be linked-in based upon the IFCs, the S-CSCF forwards the INVITE to the
15 Request URI (R-URI) contained in the INVITE. This may be the R-URI contained in the original INVITE, or a new R-URI contained in the new INVITE if that is different.

Figure 3 illustrates schematically the message flow within the IMS for a SIP
20 INVITE, on the call terminating side (TS24.229: chapter 5.4.3.3). At step 1), the INVITE arrives from the I-SCSF (not shown) including the R-URI indicating the called party. The S-CSCF uses this R-URI to check for restrictions placed on the called party, and to obtain the IFCs. In this case, the IFCs do not indicate that an AS needs to be contacted. The S-CSCF will acquire the preloaded
25 Route Headers for the called party, based on the R-URI, and send the INVITE forward to be UE based on these Route Header entries. The INVITE is received by the P-CSCF in accordance with the preloaded route in the S-CSCF, and the P-CSCF sends the INVITE to the UE in accordance with the contact header.

SUMMARY OF THE INVENTION

It is an object of the present invention to overcome the problems identified above, whilst avoiding the need to change the P-Asserted Identity contained within a SIP message. This and other objects are achieved by introducing a
5 new header into SIP messages at the S-CSCF prior to forwarding to an Application Server, the new header containing the URI of the User that is served by the S-CSCF and to which the message relates.

According to a first aspect of the present invention there is provided a method
10 of handling a Session Initiation Protocol communication within an IP Multimedia Subsystem, the method comprising:

receiving a Session Initiation Protocol message at a Serving Call/State Control Function serving a User identified by a R-URI of the message;
at the Serving Call/State Control Function, adding to the message a
15 further header, this header explicitly identifying the URI of the User served by the Serving Call/State Control Function;
forwarding the message to an Application Server; and
at the Application Server, handling the message on the basis of criteria defined for the User identified in said further header

20 Said step of handling the message at the Application Server may include changing the R-URI in the message to a URI of a User to which the message is to be re-routed, and returning the message to the Serving Call/State Control Function.

25 Said message may be forwarded directly to said Application Server by the S-CSCF, or subsequent to exchanges of the message between the S-CSCF and one or more other Application Servers. The earlier exchanges may introduce modifications to the message headers.

30 Said step of handling the message on the basis of criteria defined for the User identified in said further header may comprise obtaining re-routing criteria for the User identified in said further header.

Preferably, the method further comprises receiving the message at the S-CSCF and identifying the original R-URI on the basis of the Original Dialog Identifier contained in the returned message, and determining IFCs for the served User on the basis of that R-URI. Alternatively, in the event that the
5 returned message contains said further header, the S-CSCF may determine the IFCs based upon the User identified in the further header.

Whilst the invention is applicable to any process (i.e. Application Server) that handles re-routing of a message, a particular application is that of SIP call
10 forwarding.

Said further header is identified by a header identifier which is understood by both the S-CSCF and the AS. Typically, this header is a prefix, e.g. "P-Served-User-Identity".
15

Preferably, the P-Asserted Identity is the same in both the message initially received at the S-CSCF and the message returned from the Application server to the S-CSCF, this identity identifying the originating User.

20 Said step of handling the message received at the Application Server may comprise handling the message according to one of an originating or terminating case, the appropriate case being identified in the message received at the Application Server from the S-CSCF, for example in said further header.

25 Said step of authenticating the served User at the S-CSCF may comprise handling the message according to one of an originating or terminating case, the appropriate case being identified in the message received by the S-CSCF from the Application Server.

30 According to a second aspect of the present invention there is provided a Session Initiation Protocol Application Server of an IP Multimedia Subsystem having processing means for handling a message received from a Serving Call/State Control Function, the means being arranged to handle the message

based upon a header of the message containing the URI of the served user, this header having been introduced by the Serving Call/State Control Function and being other than the P-Asserted Identity and the R-URI.

- 5 According to a third aspect of the present invention there is provided a Serving Call/State Control Function node of an IP Multimedia Subsystem, the Serving Call/State Control Function node comprising means for receiving a SIP message and for applying Initial Filter Criteria to the message, and, in the event that the Initial Filter Criteria require forwarding of the message to an
10 Application Server, for adding a header to the forwarded message containing an identity of a served User to which the message relates.

- According to a further aspect of the present invention there is provided computer program code for carrying out the method of the first aspect of the
15 invention.

- The invention is applicable in particular to Session Initiation Protocol initial request messages, e.g. INVITE, and to standalone Session Initiation Protocol messages, e.g. messages relating to presence services.

20

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 illustrates schematically the integration of an IP Multimedia Subsystem into a 3G mobile communications system;
- FIG. 2 illustrates the flow of a SIP INVITE on the originating call side of the
25 IMS;
- FIG. 3 illustrates the flow of a SIP INVITE on the terminating call side of the IMS; and
- FIG. 4 illustrates the flow of a SIP INVITE in a call forwarding scenario within the IMS;
- 30 FIG. 5 shows the message header structure for a SIP INVITE message sent from an S-CSCF to an Application Server;
- FIG. 6 shows the message header structure for a SIP INVITE message sent from an Application Server to an S-CSCF;

FIG. 7 shows the message header structure for a SIP INVITE message sent from an S-CSCF to a second Application Server; and FIG. 8 illustrates a signalling exchange between IMS entities involving the message structure of FIG. 7.

5

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

FIG. 4 illustrates an alternative INVITE message flow scenario, where a call from an originating terminal (UE-O) to a peer terminal (UE-F) is forwarded to a terminating terminal (UE-T). The call forwarding action is performed by an Application Server (AS-F). The call flow is as follows:

10

1) The INVITE is sent from UE-O addressed to UE-F (R-URI). The S-CSCF O performs the originating side call procedure as described with reference to FIG. 2.

15

2) After interaction with the AS-O (no change is made to the R-URI at this stage) the S-CSCF O sends the INVITE to the I-CSCF (not shown) of UE-F's home network. The I-CSCF will acquire the address of the S-CSCF where the UE-F is registered from the HSS. The INVITE is sent to that S-CSCF, i.e. to S-CSCF F. The S-CSCF F will check the restriction requirement and obtain the IFCs as described above (for the terminating side case) with reference to FIG. 3, i.e. based on the R-URI contained in the INVITE. In the scenario illustrated in FIG. 4, the INVITE will be sent to the AS-F where the call forwarding is activated.

25

3) The AS-F will authorise the process based upon the R-URI (assuming the terminating case).

4) The AS-F will then change the R-URI in the INVITE header from that of UE-F to that of UE-T. The modified INVITE will be returned to the S-CSCF F.

30

5) The S-CSCF F will send the INVITE to the I-CSCF of the UE-T network, and the I-CSCF (not shown) will interrogate the HSS to get the address of the S-CSCF T of UE-T, and forward the INVITE to the S-CSCF T.

6) The S-CSCF T will perform the terminating procedure as described with reference to FIG. 3, on the basis of the R-URI contained in the INVITE (that is the R-URI of UE-T).

5

Referring again to FIG. 4, at step 5), it will additionally be necessary for the S-CSCF F to check whether there are any restrictions on the forwarding User, UE-F. To do this, the S-CSCF will typically use the originating side procedure of FIG. 2. However, in the absence of any special procedures implemented by the AS-F, the INVITE returned to the S-CSCF F by the AS-F will include in the P-Asserted Identity field the identity of the UE-O. If the S-CSCF F were to perform an originating side check on the INVITE using the P-Asserted Identity, the S-CSCF F will be unable to locate a record for this identity as it does not "belong" to the S-CSCF F (rather it belongs to the S-CSCF O).

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A solution to this problem might be for the AS-F to replace the P-Asserted Identity of UE-O with that of UE-F. However, this is unlikely to be accepted by operators who will prefer to leave the P-Asserted Identity unchanged from end-to-end. From the operators' point of view, the P-Asserted Identity field is akin to the traditional (PSTN) calling line identity. Other solutions to this problem must therefore be sought.

Whilst the forwarding user will typically be considered as an originating User in the call forwarding scenario, this need not be the case, and may be considered as a terminating User. In this case, when the S-CSCF F receives the INVITE from the AS-F, the S-CSCF will want to perform a terminating side check on the INVITE. (The message sent from the AS-F to the S-CSCF will contain a parameter to indicate to the S-CSCF whether the message is to be handled according to the terminating case or the originating case.) However, this check will also fail as the R-URI contained in the INVITE identifies the UE-T, and that R-URI belongs to the S-CSCF T rather than to the S-CSCF F. Changing the P-Asserted Identity will of course not address this problem.

These problems arise with messages other than INVITE, including, for

example, other initial request messages and standalone messages.

The problems involved in handling a "forwarding" scenario within the IP Multimedia Subsystem have been described above. It is desirable to be able
5 to provide a mechanism for handling call forwarding which allows both the Application Server (AS) and the S-CSCF to authorise, check restriction requirements, and/or determine IFCs for the appropriate user, i.e. that user which is served by the S-CSCF, and which deals both with the terminating case and the originating case to ensure appropriate flexibility.

10

Consider now an INVITE arriving at the S-CSCF F from some originating user (UE-O). The INVITE will include in its header a R-URI pointing to one of S-CSCF F's registered users (UE-F), namely userf_public1@home2.net. The INVITE also includes the P-Asserted Identity of the originating user, namely
15 "John Doe" <sip:user1_public1@home1.net>, <tel:+1-212-555-1111>. The S-CSCF handles this message using the terminating case (identified by the message being received at a particular port number in the absence of a specific indication within the message), and hence will obtain the appropriate IFCs based upon the R-URI of the message. One of these IFCs will indicate
20 that the message should be forwarded to an Application Server.

Upon determining that the message is to be forwarded to an Application Server, the S-CSCF will add an additional header to the INVITE. This header is referred to here as the “P-Served-User-Identity”, and contains the identity, SIP-
5 URI, or TEL URL of the user that is served by the S-CSCF and of which the S-CSCF has knowledge. The header also contains the call case which should be applied by the Application Server. Example headers are as follows:

P-Served-User-Identity: sip:alice@home1.net;orig

P-Served-User-Identity: sip:bob@home2.net;termunreg

10 *P-Served-User-Identity: sip:bob@home2.net;termreg*

Typically, in the case of call forwarding, the originating case will be applied. The P-Served-User-Identity header will always be added to the message, regardless of the Application Server to which the message is to be forwarded.

15 The S-CSCF will also perform the standard operations of adding the SIP URI of the AS as the topmost URI of the route header, i.e. sip:as1.home1.net;lr, and including its own SIP URI beneath the AS URI in the route header together with the “original dialog identifier” (ODI). The resulting exemplary INVITE message structure is shown in Figure 5, where the URI of the S-CSCF F added to the
20 route header is “scscf1.home1.net;lr” and the ODI is “cb03a0s09a2sdfglkj490333”. The message is then forwarded to the Application Server over the ISC interface. The S-CSCF F maintains state information for the session to which the INVITE relates. This information includes the ODI and the identity of the served User F.

25

Upon receipt of the INVITE message from the S-CSCF, the Application Server will always perform authorisation based upon the P-Served-User-Identity, according to the case (originating or terminating) identified in the message. In the case that call forwarding is to be performed, based upon the R-URI
30 contained in the INVITE, the Application Server will replace the original R-URI with the URI of the User to which the call is to be forwarded (UE-T). In addition,

the Application Server will add the “orig” parameter in the route header to indicate that the INVITE is to be dealt with using the originating call type procedure. The topmost routing header, i.e. the URI of the Application Server, is stripped from the message, and the message sent back to the S-CSCF. The
5 returned message retains the P-Served-User-Identity header.

The default operation of the S-CSCF when receiving a message containing a P-Served-User-Identity header is to perform the IFC check based upon the served User contained in the session state information corresponding to the ODI of the
10 received message. (Whilst the User identity contained in the P-Served-User-Identity header could be used for this purpose, it is preferable to avoid changing the existing procedures as much as possible). The S-CSCF will apply the terminating or originating case in dependence upon the case identified in the route header (or based upon the port number at which the INVITE is received
15 from the AS). Typically, a forwarded INVITE will be handled according to the originating call type. (In this example, the case contained in the P-Served-User-Identity header is not used by the S-CSCF, although this is possible.)

In the absence of an ODI in a message received over the ISC, the S-CSCF will
20 perform the necessary checks based upon either the P-Asserted Identity or the R-URI.

Following completion of the IFC check, the S-CSCF will process the INVITE according to the identified IFCs. This may involve forwarding the message
25 directly to the terminating User UE-T, or possibly forwarding it to a further Application Server.

In some cases, the IFC check carried out at the S-CSCF in response to receipt of a SIP message (INVITE) over the ISC interface may require that the
30 message be forwarded to a further Application Server. An example message forwarded to a second AS is illustrated in Figure 7. Again, the P-Served-User-

Identity header contains the URI of User F, namely userf_public1@home2.net, whilst the P-Asserted Identity is that of the originating User and the R-URI is that of the new terminating User. Figure 8 illustrates the message exchange between the S-CSCF F and two AS servers, AS-F 1 and AS-F 2.

5

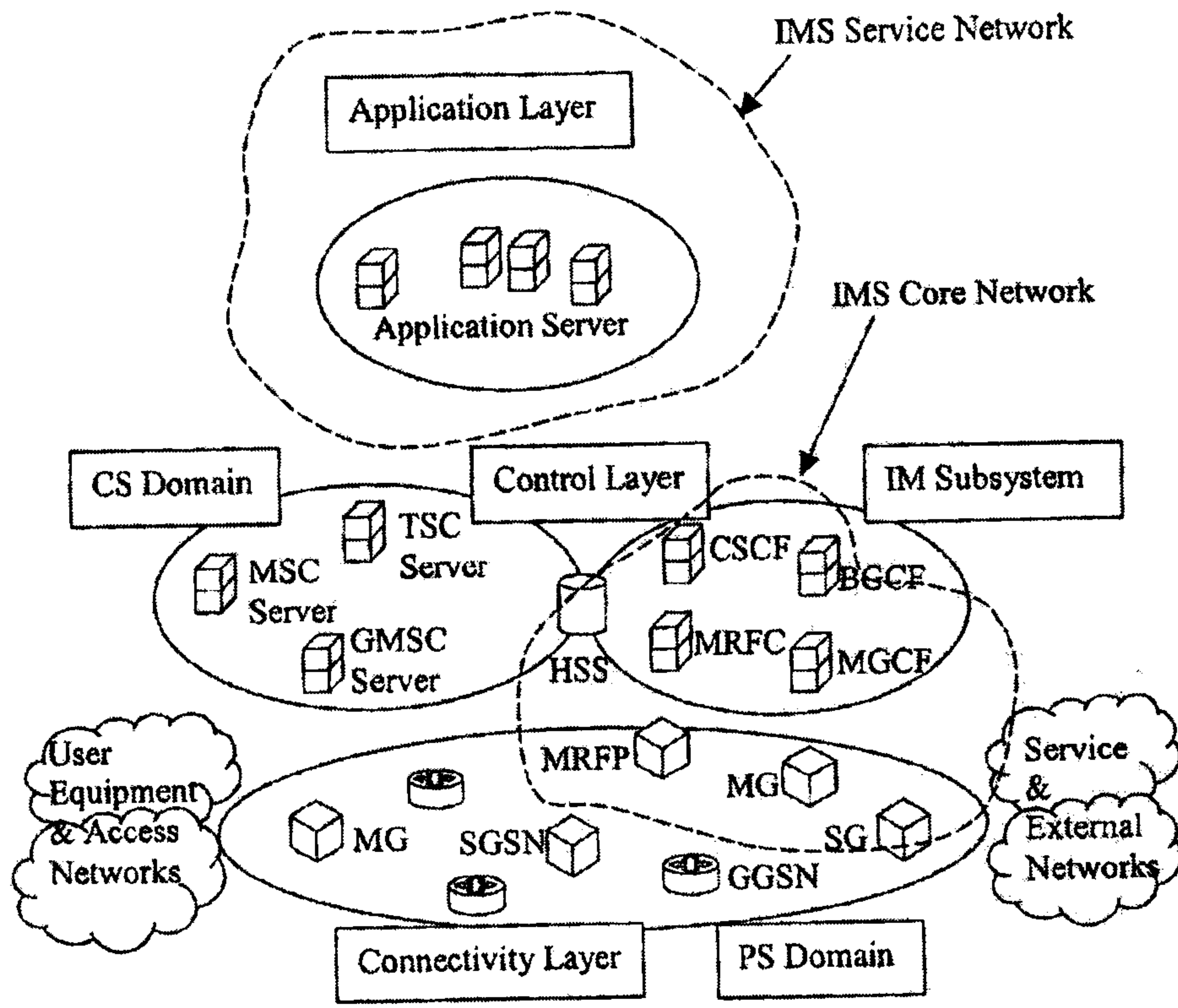
It will be appreciated by the person of skill in the art that various modifications may be made to the embodiments described above without departing from the scope of the present invention.

10

CLAIMS:

1. A method of handling a Session Initiation Protocol communication within an IP Multimedia Subsystem, the method comprising:
 - receiving a Session Initiation Protocol message at a Serving Call/State Control Function (S-CSCF) serving a User identified by a URI in a Request-URI (R-URI) header of the message;
 - at the Serving Call/State Control Function, adding to the message a further header, the further header explicitly identifying the URI of the served User served by the Serving Call/State Control Function; and
 - forwarding the message to an Application Server for handling the message on the basis of criteria defined for the User identified in said further header.
2. A method according to claim 1, wherein said handling the message at the Application Server includes changing the URI in the message to a URI of a User to which the message is to be re-routed, and receiving the changed message at the Serving Call/State Control Function.
3. A method according to claim 2, wherein the changed message is forwarded directly to said Application Server by the S-CSCF, or subsequent to exchanges of the message between the S-CSCF and one or more other Application Servers.
4. A method according to claim 1, 2 or 3, wherein said handling the message on the basis of criteria defined for the User identified in said further header comprises obtaining re-routing criteria for the User identified in said further header.
5. A method according to claim 1, 2, 3 or 4 and further comprising receiving the message at the S-CSCF from the Application Server and identifying the original R-URI on the basis of an Original Dialog Identifier contained in the returned message, and determining Initial Filter Criteria (IFC) for the served User on the basis of that R-URI.
6. A method according to claim 1, 2, 3, 4 or 5, wherein said handling of the message at the Application Server comprises implementing a call forwarding process.

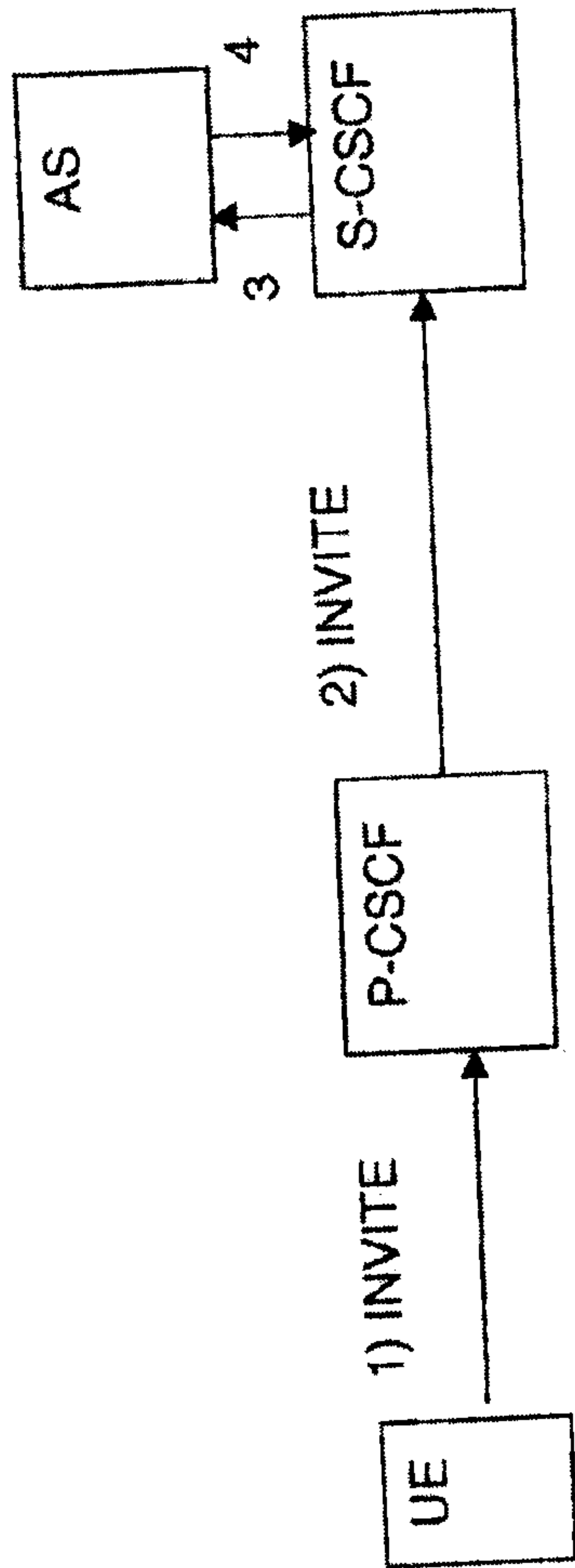
7. A method according to claim 1, 2, 3, 4, 5 or 6, wherein said further header is identified by a header identifier which is understood by both the S-CSCF and the AS.
8. A method according to claim 1, 2, 3, 4, 5, 6 or 7 and comprising returning the message from the Application Server to the S-CSCF, wherein the P-Asserted Identity is the same in both the message initially received at the S-CSCF and the message returned from the Application server to the S-CSCF, this identity identifying the originating User.
9. A method according to claim 1, 2, 3, 4, 5, 6, 7, or 8, wherein said handling the message at the Application Server comprises handling the message according to one of an originating or a terminating case as identified in said further header.
10. A Session Initiation Protocol Application Server of an IP Multimedia Subsystem having processing means for handling a message received from a Serving Call State Control Function, the means being arranged to handle the message based upon a header of the message containing a URI of a served user, this header having been introduced by a Serving Call/State Control Function and being other than a P-Asserted Identity and a R-URI in the message.
11. A Serving Call/State Control Function node of an IP Multimedia Subsystem, the Serving Call/State Control Function node comprising means for receiving a SIP message and for applying Initial Filter Criteria to the message, and, in the event that the Initial Filter Criteria require forwarding of the message to an Application Server, for adding a header to the forwarded message containing a URI of a served User to which the message relates.
12. A Serving Call/State Control Function node according to claim 11 wherein said means for applying Initial Filter Criteria to the message further comprises means for identifying the original R-URI on the basis of an Original Dialog Identifier contained in the SIP message, and determining Initial Filter Criteria (IFC) for the served User on the basis of that R-URI



PRIOR ART

Figure 1

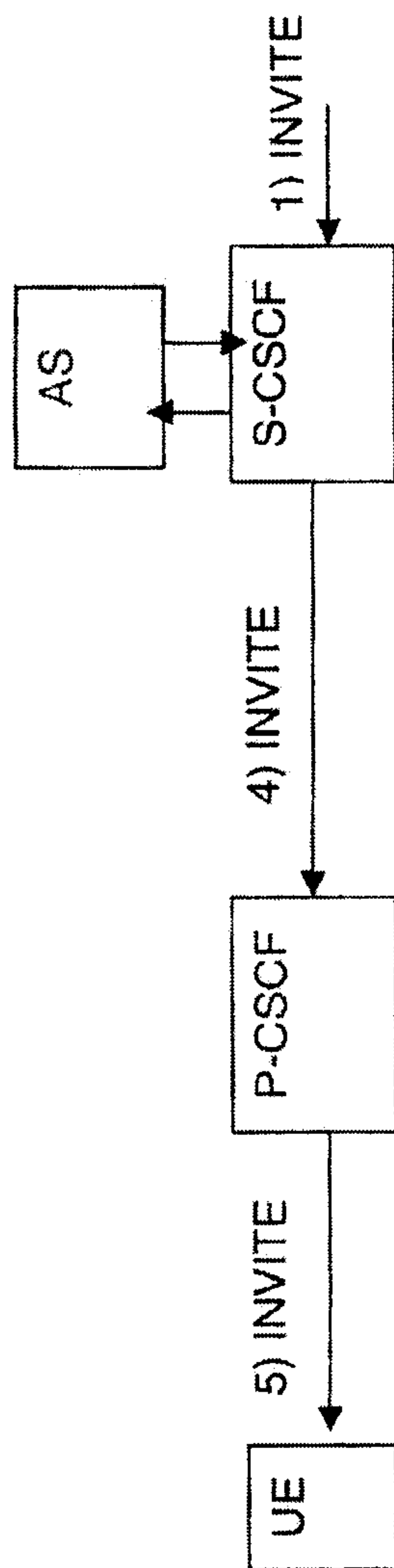
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PRIOR ART

Figure 2

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PRIOR ART

Figure 3

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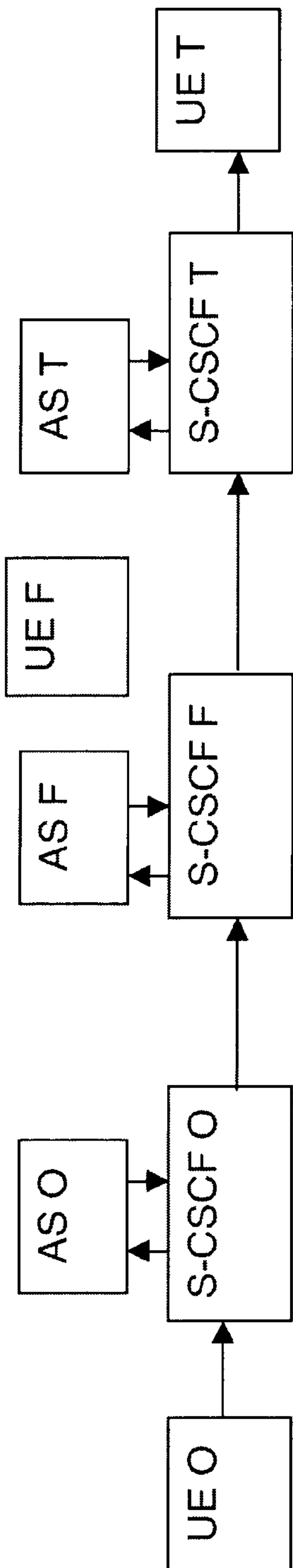


Figure 4

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```
INVITE sip:userf_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP
    scscf1.home1.net;branch=z9hG4bK344a65.1,
    SIP/2.0/UDP
    pcscf1.visited1.net;branch=z9hG4bK240f34.1,
    SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9
    hG4bKnashds7
Max-Forwards: 68
Route: <sip:as1.home1.net;lr>,
    <sip:cb03a0s09a2sdfglkj490333@scscf1.home1.net;lr>
Record-Route: <sip:orig@scscf1.home1.net;lr>,
    <sip:pcscf1.visited1.net;lr>
P-Asserted-Identity: "John Doe"
    <sip:user1_public1@home1.net>, <tel:+1-212-555-
    1111>
P-Access-Network-Info:
    userf_public1@home2.net;termreg
P-Charging-Vector: icid-
    value="AyretyU0dm+602Irt5tAFrbHLso=023551024";
    orig-ioi=home1.net
P-Charging-Function-Addresses:
    ccf=[5555::b99:c88:d77:e66];
    ccf=[5555::a55:b44:c33:d22];
    ecf=[5555::1ff:2ee:3dd:4ee];
    ecf=[5555::6aa:7bb:8cc:9dd]
Privacy:
From:
To:
Call-ID:
Cseq:
Contact:
Allow:
Content-Type:
Content-Length: (...)

v=
o=
s=
c=
t=
m=
a=
a=
```

Figure 5

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```
INVITE sip:usert_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP
  as1.home1.net;branch=z9hG4bK240f34.1
Max-Forwards: 70
Route:
  <sip:cb03a0s09a2sdfglkj490333@scscf1.home1.
  net;lr;orig >
P-Asserted-Identity: "John Doe"
  <sip:user1_public1@home1.net>, <tel:+1-212-
  555-1111>
P-Served-User-Identity:
  sip:userf_public@home2.net;orig
P-Charging-Vector: icid-
  value="AyretyU0dm+602IrT5tAFrbHLso=32355102
  4"
Privacy:
From: <sip:user1_public1@home1.net>;
  tag=234567
To: <sip:user2_public1@home2.net>
Call-ID: s09a233cbsdfglkj490303a0
Cseq: 278 INVITE
Contact: <sip:[7777::eee:ddd:ccc:aaa]>
Allow: INVITE, ACK, CANCEL, BYE, PRACK,
  UPDATE, REFER, MESSAGE
Content-Type: application/sdp
Content-Length: (...)

History-Info: <sip>Userf_public@home2.net>
index=1,

  <sip:Usert_public@home2.net;Reason=SIP%3B
  \cause%3D302> index=1.1
```

Figure 6

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```

INVITE sip:usert_public1@home2.net SIP/2.0
Via: SIP/2.0/UDP scscf1.home1.net;branch=z9hG4bK344a65.1,
    SIP/2.0/UDP pcscf1.visited1.net;branch=z9hG4bK240f34.1,
    SIP/2.0/UDP
    [5555::aaa:bbb:ccc:ddd]:1357;comp=sigcomp;branch=z9hG4b
    Knashds7
Max-Forwards: 68
Route: <sip:as2.home1.net;lr>,
    <sip:cb03a0s09a2sdfglkj490333@scscf1.home1.net;lr>
Record-Route: <sip:orig@scscf1.home1.net;lr>,
    <sip:pcscf1.visited1.net;lr>
P-Asserted-Identity: "John Doe"
    <sip:user1_public1@home1.net>, <tel:+1-212-555-1111>
P-Served-User-Identity: sip:userf_public@home2.net;orig
P-Access-Network-Info:
P-Charging-Vector: icid-
    value="AyretyU0dm+602IrT5tAFrbHLso=023551024"; orig-
    ioi=home1.net
P-Charging-Function-Addresses:
    ccf=[5555::b99:c88:d77:e66];
    ccf=[5555::a55:b44:c33:d22];
    ecf=[5555::1ff:2ee:3dd:4ee];
    ecf=[5555::6aa:7bb:8cc:9dd]
Privacy:
From:
To:
Call-ID:
Cseq:
Contact:
Allow:
Content-Type:
Content-Length: (...)

```

```

History-Info: <sip:Userf_public@home2.net> index=1,

```

```

    <sip:Usert_public@home2.net;Reason=SIP%3B\cause%3D302
  > index=1.1
v=
o=
s=
c=
t=
m=
a=
a=

```

Figure 7

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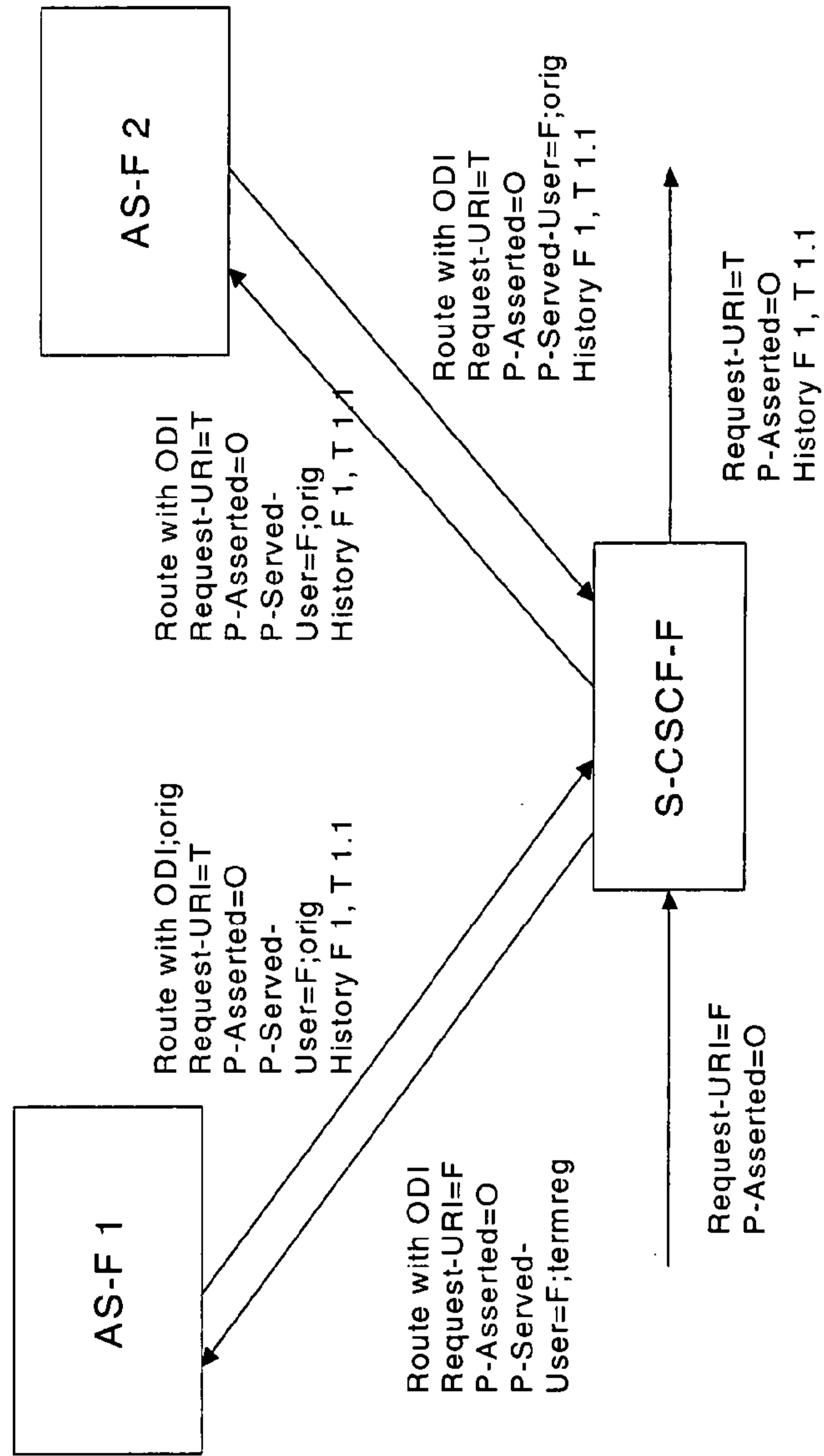


Figure 8

