

SYSTEM AND METHOD FOR INDICATING CIRCUIT SWITCHED ACCESS AT IMS REGISTRATION

5 TECHNICAL FIELD

The present invention relates to IP Multimedia Subsystem (IMS). More particularly, and not by way of limitation, the present invention is directed to a system and method for assisting in the IMS user registration process.

10 BACKGROUND

The following is a list of acronyms used in the body of the specification and their definitions, which shall apply throughout the specification unless otherwise noted.

ACRONYMS

	3GPP:	3rd Generation Partnership Project
15	ADS:	Access Domain Selection
	AS:	Application Server
	CAMEL:	Customized Application for Mobile network Enhanced Logic
	CDR:	Call Data Record
	CS:	Circuit Switch
20	CSCF:	Call Session Control Function
	CSI:	Combination of CS and IMS service
	IA:	IMS Adapter
	ICCF:	IMS Circuit Switch Control Function
	ICCP:	IMS Circuit Switch Control Protocol
25	ICS:	IMS Centralized Services
	IMPI:	IP Multimedia Private Identity
	IMS:	IP Multimedia Subsystem
	IMSI:	International Mobile Subscriber Identity
	IP-CAN:	IP Connectivity Access Network
30	ISC:	IP multimedia Subsystem Control
	ISUP:	ISDN User Part
	MAP:	Mobile Application Part

	MGCF:	Media Gateway Control Function
	PS:	Packet Switched
	P-CSCF	Proxy Call Session Control Function
	S-CSCF	Serving Call Session Control Function
5	SIP	Session Initiation Protocol
	TAS:	Telephony Application Server
	UE:	User Equipment
	URL:	Uniform Resource Locator
	USSD:	Unstructured Supplementary Service Data
10	VCC:	Voice Call Continuity
	WCDMA:	Wideband Code Division Multiple Access

Figure 1 depicts a high-level block diagram of ICS architecture 100. IMS Centralized Services (ICS) is a proposed work item in Third Generation Partnership Project (3GPP) to make possible IMS services over many types of access networks, such as Circuit Switched (CS) network 102. Service implementation resides in IMS 110 and CS network 102 is used as an access to the services in IMS 110.

As compared to 3GPP Release 7, Voice Call Continuity (VCC) architecture, IMS CS Control Function (ICCF) 106 is introduced to allow signaling not supported over CS signaling (e.g., ISUP) such as IMS registration, mid-call signaling, additional information for call set-up signaling (e.g., SIP URL), to emulate an IMS terminal towards the IMS. Unstructured Supplementary Service Data (USSD) can be used to transport this additional signaling called ICCP (IMS CS Control) 104 in CS network.

In 3GPP Release 7 VCC, the VCC user is not IMS registered at CS access and Telephony Application Server (TAS) 108 has to implement additional mechanisms to provide IMS services to a user. A possible solution, in 3GPP Release 8, it is proposed to support IMS registration from UE 101 using ICCP so that TAS 108 can be informed from S-CSCF by a third party registration procedure that a user is IMS registered. The Serving CSCF is a call session control function for handling user equipment registration and routing for an IP

multimedia subsystem. Another CSCF, the Proxy-CSCF, is the first point of contact for user equipment and handles security, verification and policy decisions. Currently there is no procedure that informs the IMS whether a user is registered at CS access or at PS access (this is because there was previously no IMS registration for a CS access). IMS can only know that the user is registered at one or more radio accesses, where it is assumed that all accesses are packet-accesses. Packet Switched (PS) access has always been assumed in IMS.

Because of the assumption that the access is always PS access, there are situations that cannot be addressed by the IMS third party registration mechanism up to 3GPP Release 7. For instance, an operator may want to implement local policy in S-CSCF contact address selection to prefer CS access rather than PS access; or vice versa. An operator may want to differentiate charging for CS access and PS access and indicate that difference in IMS CDRs. Also, an operator may want to differentiate the TAS behavior if a user is registered at CS access or PS access (e.g. Call forwarding Video to Video mail box if a user is registered at CS access where video cannot be supported).

It would be advantageous to have a system and method for identifying whether a user is registered at CS or PS access that overcomes the disadvantages of the prior art. The present invention provides such a system and method.

SUMMARY OF THE INVENTION

The present invention provides a change in SIP interface, e.g., among ICCF, CSCF and AS, to support indication of CS access in P-Access-Network-Information header. Impacted nodes are ICCF, S-CSCF and AS. The indication can be used by S-CSCF or AS for different purposes such as routing decision, charging, and presence info.

Thus, in one aspect, the present invention is directed to a method for registering user equipment (UE) in an IP multimedia subsystem (IMS), by sending a registration request to a Serving Call Session Control Function (S-CSCF), wherein the registration request includes a header containing information about access type of the user and contacts related to the access type. The registration

request is forwarded to an IMS associated application server which responds to the ICCF. The S-CSCF utilizes the inserted registration request header to implement access rules according to operator or user preference, wherein the header included in the registration request is a P-Access Network-Information
5 header which includes contacts related to Circuit Switched access.

Contact addresses related to Circuit Switched access in the header are arranged in order of use before a normal, Packet Switched access contact and ordering rules regarding contact handling, related to the access type, are based on local policy in the S-CSCF. The local policy in the S-CSCF may be dependent
10 on time of day or according to a subscriber profile.

In another aspect, the present invention is directed to a system for registering user equipment (UE) in an IP multimedia subsystem (IMS), wherein the system comprises means for sending a registration request to a Serving Call Session Control Function (S-CSCF) and the registration request includes a
15 header containing information about access type of the user and contacts related to the access type. The system includes means for forwarding the registration request to an IMS associated application server and means for sending a registration response to the ICCF.

There are means included in the S-CSCF for utilizing the registration
20 request header to implement access rules according to operator or user preference and the header that is included in the registration request is a P-Access Network-Information header that includes contacts related to Circuit Switched access.

Contacts related to Circuit Switched access in the header can be arranged
25 in order before a normal, Packet Switched access contact and the ordering rules, regarding contact handling related to the access type on local policy in the S-CSCF, the local policy in the S-CSCF being dependent on time of day or according to a subscriber profile.

30 BRIEF DESCRIPTION OF THE DRAWINGS

In the following section, the invention will be described with reference to exemplary embodiments illustrated in the figures, in which:

Figure 1 depicts a high-level block diagram of ICS architecture;

Figure 2 illustrates a high-level signaling diagram of Circuit Switched Access at registration in accordance with an embodiment of the present invention; and

5 Figures 3a, 3b and 3c depict three situations in which a registered device is identified in a S-CSCF according to embodiments of the present invention;

Figures 4a-4d illustrate situations in which ordering in the S-CSCF is changed in accordance with an embodiment of the present invention;

10 Figures 5a-5d depict situations wherein different forking actions may be taken according to an embodiment of the present invention;

Figures 6a-6f illustrate situations regarding different sequential ringing actions according to an embodiment of the present invention; and

Figure 7 depicts Circuit Switched access indication to a presence server according to an embodiment of the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those skilled in the art that the present invention may be practiced
20 without these specific details. In other instances, well-known methods, procedures, components and circuits have not been described in detail so as not to obscure the present invention.

A parameter associated with IMS, "P-Access-Network-Information" already exists to deliver access specific network information, but no additional information
25 indicating access type (CS or PS) is currently included in this parameter. Prior to the introduction of ICS, PS access was the default case. The P-Access-Network-Information header is described below for reference:

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30   access-type = "IEEE-802.11" / "IEEE-802.11a" / "IEEE-802.11b" / "IEEE-802.11g" / "3GPP-
      GERAN" / "3GPP-UTRAN-FDD" / "3GPP-UTRAN-TDD" / "ADSL" / "ADSL2" / "ADSL2+" / "RADSL" /
      "SDSL" / "HDSL" / "HDSL2" / "G.SHDSL" / "VDSL" / "IDSL" / "3GPP2-1X" / "3GPP2-1X-HRPD" /
      "DOCSIS" / token
      access-info = cgi-3gpp / utran-cell-id-3gpp / dsl-location / i-wlan-node-id / ci-3gpp2 / extension-
      access-info
      extension-access-info = gen-value
35   cgi-3gpp = "cgi-3gpp" EQUAL (token / quoted-string)
      utran-cell-id-3gpp = "utran-cell-id-3gpp" EQUAL (token / quoted-string)
      i-wlan-node-id = "i-wlan-node-id" EQUAL (token / quoted-string)

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dsl-location = "dsl-location" EQUAL (token / quoted-string)
ci-3gpp2 = "ci-3gpp2" EQUAL (token / quoted-string)

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Figure 2 illustrates a high-level signaling diagram of Circuit Switched Access at registration in accordance with an embodiment of the present invention. P-Access-Network-Information header is extended in the present invention to indicate access type as CS and is inserted by ICCF into an ICCP registration request and delivered to S-CSCF and an Application Server (AS). The Application Server can be Telephony Application Server or Voice Call Continuity AS or any other AS (e.g., Presence Server) which uses registration status to execute its application on top of IP Multimedia Subsystem Control (ISC) interface. The S-CSCF can also use P-Access-Network Information to implement rules following operator or user preference to put contacts related to CS access in different order than PS access.

Figures 3a, 3b and 3c depict three situations in which a registered device is identified in a S-CSCF according to embodiments of the present invention. Differentiation between CS and PS UE devices is accomplished utilizing information included in the registration message provided by ICCF using ICCP. Figure 3a depicts utilizing a "Device ID" from UE during registration both in CS and in PS. This is a new parameter in ICCP registration request and in a SIP REGISTER message and S-CSCF needs to store the "Device ID" information with contact IP address. For example, if two devices are registered, one UE with CS and PS access, and another UE being a PC with only PS access, the information stored in S-CSCF appears as:

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Public User ID ----- Contact IP1 ----- CS access --- Device ID1
                        +-- Contact IP2 ----- PS access --- Device ID1
                        +-- Contact IP3 ----- PS access --- Device ID2

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Note 1 – IP1 is ICCF IP address in CS access case.

Figure 3b illustrates including at least one "alternative contact" from UE during CS registration. In an ICCP registration request and REGISTER message, S-CSCF needs to store the "alternative contact" information with contact IP address for CS access. S-CSCF can identify that two registrations belong to the same device matching contact address and alternative contact address. For

example, if case 2 devices are registered, one UE with CS and PS access, and another UE being a PC with only PS access, the information stored in S-CSCF appears as:

Public User ID ---- Contact IP1 ----- CS access --- Alt contact IP2
 5 +--- Contact IP2 ----- PS access
 +--- Contact IP3 ----- PS access

Note – IP1 is ICCF IP address in CS access case.

Figure 3c depicts using IP Multimedia Private Identity (IMPI) to identify the
 10 device. IMPI can be derived from IMSI delivered in ICCP registration request (MAP USSD message), and can be populated in an existing Authorization header in a REGISTER message. S-CSCF needs to store the IMPI information with contact IP address to be used for routing decision. For example, if two devices are registered, one UE with CS and PS access, and another UE as being a PC with
 15 only PS access, the information stored in S-CSCF looks as follows:

Public User ID ---- Contact IP1 ----- CS access --- IMPI1
 +--- Contact IP2 ----- PS access --- IMPI1
 +--- Contact IP3 ----- PS access --- IMPI2

Note 1 – IP1 is ICCF IP address in CS access case. Note 2 – IMPI1 is
 20 derived from IMSI and IMPI2 is stored in IMSI attached to PC.

Figures 4a-4d illustrate situations in which ordering in the S-CSCF is changed in accordance with an embodiment of the present invention. The S-CSCF can also use P-Access-Network Information to implement rules following
 25 operator or user preference to put contacts related to CS access in different order than a typical PS access.

Currently, contact handling is only based on q-value from the user. The q parameter is used to indicate priority value of the contacts for routing from a user. The present invention provides for an ordering rule that can be based on local
 30 policy in S-CSCF and may be different, e.g., dependent on time of day or per subscriber. Possible orderings in the S-CSCF may include:

- Try CS access contact first and then try PS access if no reply (Figure 4a);

- Try PS access contact first and then try CS access if no reply (Figure 4b);
- Try CS access contact only if both CS and PS access contacts are registered (if only one contact is registered, try the registered contact)(Figure 4c); and alternatively,
- 5 • Try PS access contact only if both CS and PS access contacts are registered (if only one contact is registered, try the registered contact)(Figure 4d). These options would expand contact handling in the S-CSCF which is only based on q-value from the user today.

10 Figures 5a-5d depict situations wherein different forking actions may be taken according to an embodiment of the present invention. The S-CSCF can also use the P-Access-Network-Information to implement rules to suppress forking to contacts for the same device registered over multiple accesses. The forking rule may be based on local policy in S-CSCF and may be different, e.g., dependent on time of day. Possible forking rules include:

- 15 • Fork to only PS access contact if a user is registered at both CS and PS access (Figure 5a);
- Fork to only CS access contact if a user is registered at both CS and PS access (Figure 5b).

20 Fork to PS access contact first, then to CS contact (Figure 5c) and Fork to CS access contact first, then fork to PS contact (Figure 5d).

The rule can be also combined with sequential ringing so that:

- Fork to only PS access contact if a user is registered at both CS and PS access. If none of the forked devices reply, try CS access contact and
- 25 • Fork to only CS access contact if a user is registered at both CS and PS access. If none of the forked devices reply, try PS access contact.

The forking rule can be based on local policy in S-CSCF and may be different e.g. dependent on time of day.

30 Figures 6a-6f illustrate situations regarding different sequential ringing actions according to an embodiment of the present invention. The S-CSCF can use the P-Access-Network-Information to sequentially ring the contacts in a way that contacts related to the same device but to different accesses are tried in

sequence before (or after) trying to ring contacts pointing to other devices. In other words, possible sequential ringing rules include:

- 1) While sequentially ringing different devices, try PS access contact first if a user is registered at both CS and PS access. If no reply:
 - 5 - Try CS access before trying another device (Figure 6a);
 - Try CS access contact after all sequential ringing to other devices are not responded to (Figure 6b); and
 - do not include CS access contact (Figure 6c);
- 2) While sequentially ringing different devices, try CS access contact first if
 - 10 a user is registered at both CS and PS access. If no reply:
 - Try PS access before trying another device (Figure 6d);
 - Try PS access contact after no response to all sequential ringing to other devices (Figure 6e); and
 - do not include P access contact (Figure 6f).

15 The sequential ringing rule can be based on local policy in S-CSCF and may be different, e.g., depending on time of day.

These parameters can be included in P-Access-Network-Information or can be included as a new SIP header parameter. The AS can use the contact information to differentiate between CS access and PS access for Access Domain
20 Selection (ADS).

In VCC 3GPP Release 7, the VCC application server implements ADS. When ADS selects PS access, the call is routed to the registered contact in PS access. When ADS selects CS access, since S-CSCF does not have any registered contact at CS access, ADS re-targets a call using a suitable routing
25 number to be able to route to CS access (called CS routing number), to bypass the contact handling in the S-CSCF. VCC AS may know the PS registration status using 3rd party registration mechanism when user is registered at PS access but needs to implement specific non-IMS mechanism to know that a user is registered at CS access. IMS 3rd party registration may also be used to determine the
30 registration status at CS access, which would simplify the ADS implementation.

The AS and S-CSCF can issue a CDR including P-Access network-Information so that an operator can differentiate the charging scheme for a

communication over PS access and a communication over CS access. P-Access-network-Information can be also included in the INVITE request when the session is established from ICCF (not only REGISTER message when user registers at CS access) in order to indicate that the communication is over CS access.

5 Figure 7 depicts Circuit Switched access indication to a presence server according to an embodiment of the present invention. A presence server, being an SIP AS can also receive P-Access-Network-Information during third party registration procedures to determine whether the user is in PS access or in CS access and can provide better information to watchers. A "watcher" in this context
10 is a user subscribed to presence information of an ICS user and "watches" the presence status of an ICS user. A watcher uses the presence status to decide which access should be used to initiate multimedia communication s that if the user is registered at PS access, the watcher can initiated multimedia call over PS access (e.g., voice and video over PS access). Such a watcher may reside in a
15 UE or in a network node.

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a wide range of applications. Accordingly, the scope of patented subject matter should not be limited to any of the specific exemplary teachings discussed above, but is instead
20 defined by the following claims.

WHAT IS CLAIMED:

1. A method for registering a user equipment, UE, in an IP multimedia subsystem, IMS, the method comprising the steps of:
 - 5 sending a UE registration request to the IMS;
 - determining whether the registration request originates from a circuit switched access network;
 - responsive to a determination that the registration request originates from a circuit switched network, inserting a header containing information regarding the circuit switch access network into the registration request ; and
 - 10 forwarding the registration request to the IMS and an IMS associated application server.
2. The method of claim 1, further comprising a Serving Call Session Control
15 Function, S-CSCF, utilizing the information in the inserted header to implement access dependent rules according to IMS operator or user preference.
3. The method of claim 1, wherein the header is inserted in the registration request by IMS CS control function and the header is a P-Access Network-
20 Information header that includes contacts related to Circuit Switched access.
4. The method of claim 3, wherein addresses of the contacts related to Circuit Switched access in the header are arranged in order before or after a normal, Packet Switched access contact based on local policy, time of day or according to
25 a subscriber profile.
5. The method of claim 1, wherein identification of the User Equipment is achieved by utilizing information included in a ICCP registration request the information including a Device ID, an alternative contact or an IP Multimedia
30 Private Identity.

6. The method of claim 5, wherein the Device ID is ICCF IP address, the alternative contact being information stored by the S-CSCF with the contact IP address, and the IP Multimedia Private Identity is derived from the IMSI of the UE.

5 7. A system for registering a user equipment, UE, in an IP multimedia subsystem, IMS, the system comprising:

a UE for sending an IMS CS Control Protocol, ICCP, registration request to the IMS;

means associated with the IMS for determining whether the registration request originates from a circuit switched access network;

10 a function for inserting a header containing information regarding the circuit switch access type into the registration request if the registration request is determined to originate from a circuit switched network; and

logic means for forwarding the registration request to the IMS and an IMS associated application server.

8. The system of claim 7, further comprising a Serving Call Session Control Function, S-CSCF, for utilizing the information in the inserted header to implement access rules according to IMS operator or user preference.

20 9. The system of claim 7, wherein the header is inserted in the registration request by IMS CS Control Function, ICCF, and the header is a P-Access Network-Information header that includes contacts related to Circuit Switched access.

25 10. The system of claim 9, wherein addresses of the contacts related to Circuit Switched access in the header are arranged in order before or after a normal, Packet Switched access contact based on ordering rules regarding contact handling according to local policy, time of day or according to a subscriber profile.

30 11. The system of claim 7, wherein identification of the User Equipment is achieved by utilizing information included in a ICCP registration request, the

information including a Device ID, an alternative contact or an IP Multimedia Private Identity.

12. The system of claim 11, wherein the Device ID is ICCF IP address, the alternative contact being information stored by the S-CSCF with the contact IP address, and the IP Multimedia Private Identity is derived from the IMSI of the UE.

13. A control function for registering a user equipment, UE, in an IP multimedia subsystem, IMS, the control function comprising:

- means for receiving an IMS CS Control Protocol, ICCP, registration request to the IMS from the UE;

- means associated with the IMS for determining whether the registration request originates from a circuit switched access network;

- a function for inserting a header containing information regarding the circuit switch access type into the registration request if the registration request is determined to originate from a circuit switched network; and

- logic means for forwarding the registration request to the IMS and an IMS associated application server.

14. A Serving Call Session Control Function, S-CSCF, in a system for registering a user equipment, UE, in an IP multimedia subsystem, IMS, the system comprising:

- means for receiving an IMS CS Control Protocol, ICCP, registration request to the IMS from the UE,

- means associated with the IMS for determining whether the registration request originates from a circuit switched access network;

- a function for inserting a header containing information regarding the circuit switch access type into the registration request if the registration request is determined to originate from a circuit switched network; and

- logic means for forwarding the registration request to the IMS and an IMS associated application server,

- wherein the S-CSCF comprises means for utilizing the information in the inserted header to implement access rules according to IMS operator or user preference.