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(54) Title: METHOD FOR CONTEXT AWARE SERVICE ADAPTATION FOR HETEROGENEOUS WIRELESS NETWORKS AND DEVICES

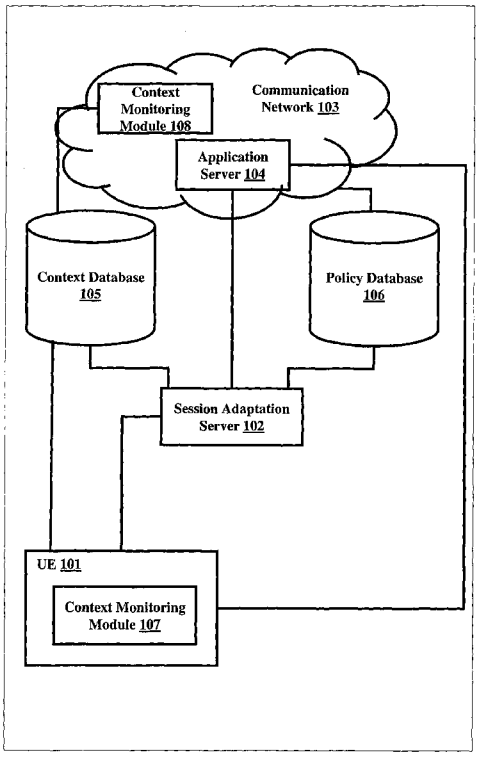

FIG. 1

(57) Abstract: A method for context aware service adaptation for heterogeneous wireless networks and devices is disclosed. This invention relates to wireless communication, and more particularly to context service in heterogeneous network. Present day communication network technologies are unable to present a uniform and consistent experience to the end user as the user accesses different services via heterogeneous access networks and devices. Method and system is proposed for adaptation of multimedia sessions as per the user and network context.

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Method for Context Aware Service Adaptation for Heterogeneous Wireless Networks and Devices

TECHNICAL FIELD

[001] The embodiments herein relate to heterogeneous wireless communication, and more particularly to context-aware service delivery in heterogeneous wireless networks.

BACKGROUND

[002] The modern-day communication paradigm is characterized by the availability of multiple access networks and different types of terminals. Examples of the former include Wi-Fi, EV-DO, GPRS, UMTS, HSPA, LTE and WiMAX and so on. Further, the plurality of wireless access networks may have different characteristics such as capacity, bandwidth, latency and so on. Terminals also come in various form factors with different capabilities in terms of processing power, screen resolution and size, operating systems and so on. Further, there is diversity among users present in the networks, with varying Quality of Service (QoS) requirements, Quality of Experience (QoE) expectations, geographical location, rate plans and so on.

[003] With such a large number of permutations and combinations possible, the user is not able to enjoy a uniform and consistent experience to the end user as he/she accesses different services via heterogeneous access networks and devices.

[004] QoE is generally considered as a subjective measure of a customer's perception of the performance a network and the services it offers (web browsing, phone call, TV broadcast etc.). While QoS refers to the performance in terms of

metrics such as packet loss, delay and jitter etc, QoE is relates to the overall user experience while accessing and using provided services. At any given point of time, the QoE is typically determined by the user and network context. For instance, a user with a low-bandwidth connection may be satisfied by a low/moderate quality video stream whereas someone who is paying a premium for a high-bandwidth connection will be satisfied only if the video is of a high quality. In other words, QoE is driven by the user and network context.

[005] Therefore, providing a consistent QoE requires multimedia services to be adapted according to the context. Consider a user with a subscription for 3G data connection, with volume-based charging. Assume that the user has multiple 3G-capable devices with different screen sizes and resolutions. When the user accesses YouTube videos over a low-resolution device, to push a high-resolution video wastes valuable billable bandwidth.

[006] Consider a user with a device that has a high-res display and that is capable of using both 3G and WiFi. Typically, while streaming a video, the user will choose the access technology that provides a higher data rate. However, if the residual battery power is low, the user may switch to a lower-bandwidth connection and opt for a low-res version of the video.

[007] Consider an example where a user has a 3G subscription that costs more while roaming. To reduce the cost of streaming a video, the user may choose a low-res stream even though sufficient bandwidth is available and the device is capable of displaying high-res videos.

[008] In all the three examples mentioned above, the choice of video quality was determined by multiple factors such as cost, screen resolution, available bandwidth and battery power. For the end user, the acceptable QoE also varies in

consonance with these factors.

SUMMARY

[009] In view of the foregoing, an embodiment herein provides a method for controlling delivery of a multimedia stream to a user equipment (UE) in a communication network, the method comprising of checking for at least one change in context by a session adaptation server (SAS), while the multimedia stream is being accessed from the UE; adapting the multimedia stream by a module, if there is at least one change in the context; and delivering the adapted stream to the UE by the module.

[0010] Also, disclosed herein is a system in a communication network, the device configured for controlling delivery of a multimedia stream to a user equipment (UE) in the communication network, the device comprising at least one means configured for checking for at least one change in context, while the multimedia stream is being accessed from the UE; adapting the multimedia stream, if there is at least one change in the context; and delivering the adapted stream to the UE.

[0011] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0012] The embodiments herein will be better understood from the following detailed description with reference to the drawings, in which:

[0013] FIG. 1 depicts a wireless communication network, according to embodiments as disclosed herein;

[0014] FIG. 2 depicts a service adaptation server, according to embodiments

as disclosed herein; and

[0015] FIG. 3 depicts a process of adapting a multimedia stream, according to embodiments as disclosed herein.

DETAILED DESCRIPTION OF EMBODIMENTS

[0016] The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments that are illustrated in the accompanying drawings and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[0017] The embodiments herein disclose a method and system for adaptation of multimedia sessions as per the user, user equipment (UE) and network contexts. Referring now to the drawings, and more particularly to FIGS. 1 through 3, where similar reference characters denote corresponding features consistently throughout the figures, there are shown embodiments.

[0018] The term context here refers to both user and network information. With respect to the user, the context may refer to device characteristics, user location (coordinates, home/office/travelling etc), roaming status, user profile/preferences and so on. The network context may include type of access, available bandwidth, QoS expected by the user, network load and so on. The user context may be gathered by the respective UE itself and in the communication network. The network context may be primarily collected in the communication network, but measurements may need to be done at the user terminal to determine available bandwidth.

[0019] FIG. 1 depicts a wireless communication network, according to embodiments as disclosed herein. The network, comprises of a plurality of UEs 101, a session adaptation server (SAS) 102, a communication network 103 (which further comprises of at least one application server (AS) 104), a context database (CDB) 105 and a policy database (PDB) 106.

[0020] The UE 101 may be any device which enables a user to access the communication network 103. Examples of the UE 101 may comprise but are not limited to mobile phones, phones, tablets, PDAs, laptops, computers, handheld devices and so on.

[0021] The communication network 103 is a wireless based communication network, which uses cellular (or similar) technologies to enable communication between various devices. The communication network 103 may use any suitable communication technology such as Wi-Fi, EV-DO, GPRS, UMTS, HSPA, LTE, WiMAX, 3G and so on.

[0022] The CDB 105 contains context information, relating to both users and the network. The CDB 105 may be implemented in a distributed fashion with difference pieces of information stored in different places. In an embodiment herein, the CDB 105 may act as a proxy between the SAS 102 and distributed databases located in the network and user devices which store different types of context.

[0023] The PDB 106 is a repository which stores network policies, SLAs and user preferences. The PDB 106 may be a distributed database with information stored in different places. For example, the user preferences may actually be in the UE 101. The user subscription information may be in the HLR/HSS, within the network 103.

[0024] The SAS 102 adapts the multimedia sessions running on the UE 101, wherein the multimedia session is being accessed by the UE 101 via the

communication network 103. The SAS 102 accesses the CDB 105 and PDB 106, and based on the information from the CDB 105 and the PDB 106, adapts the sessions and delivers the sessions to the UE 101. In an embodiment herein, the SAS 102 may be co-located with HTTP proxy on the data path between the network 103 and the UE 101.

[0025] In another embodiment herein, the SAS 102 may decide on whether to adapt the sessions and instructs the AS 104 to adapt the sessions, before delivering to the UE 101.

[0026] In another embodiment herein, the SAS 102 may decide on whether to adapt the sessions and trigger the UE 101 which then signals the AS 104 to adapt the sessions, before delivering to the UE 101.

[0027] The context monitoring modules 107, 108 track the relevant contexts and update the CDB 105 accordingly. The context monitoring module 107, 108 may track the contexts from both the UE 101 and the communication network 103. The context monitoring module 107, 108 may update the CDB 105 at periodic intervals, wherein the intervals may be defined at the UE 101 or at the network 103. In another embodiment herein, the updates to the CDB 105 from the context monitoring module 107, 108 may be event triggered, wherein the triggering events may be defined at the UE 101 or at the network 103.

[0028] FIG. 2 depicts a service adaptation server, according to embodiments as disclosed herein. The SAS 102, as depicted comprises of a session adaptation controller (SAC) 201 and a policy manager 202. The SAC 201 is responsible for performing the adaptation of multimedia sessions. The SAC 201 interfaces with the CDB 105.

[0029] The Policy Manager 202 acts as the Policy Decision Point. In another

embodiment herein, the Policy Manager 202 may be a module present external to the SAS 102.

[0030] The AS 104 may send the stream to the UE 102 directly or via the SAS 102.

[0031] In one embodiment, the media stream from the network 103 to the UE 101 may pass via the SAC 201. Based on the policies and the context available with respect to the user of the UE 101 and the network 103, the SAC 201 checks if the stream needs to be adapted. The SAC 201 may check at least one of the contexts against a corresponding condition and if the condition has been met, then the SAC 201 adapts the stream according to the corresponding policies and context. The SAC 201 then forwards the adapted stream to the UE 101.

[0032] In another embodiment herein, the media stream from the network 103 to the UE 101 does not pass through the SAC 201. The SAC 201 checks if the stream needs to be adapted based on the policies and the context available with respect to the user of the UE 101 and the network 103. The SAC 201 may check at least one of the contexts against a corresponding condition and if the condition has been met, then the SAC 201 informs the AS 104 to adapt the stream according to the corresponding policies and context. The AS 104 then adapts the stream and sends the adapted stream to the UE 101. The AS 104 may send the stream to the UE 102 directly or via the SAS 102.

[0033] In another embodiment herein, the media streams from the network 103 to the UE 101 do not pass through the SAC 201. The SAC 201 checks if the stream needs to be adapted based on the policies and the context available with respect to the user of the UE 101 and the network 103. The SAC 201 may check at least one of the contexts against a corresponding condition and if the condition has

been met, then the SAC 201 informs the UE 101 to request the AS 104 to adapt the stream according to the corresponding policies and context. The AS 104 then adapts the stream and sends the adapted stream to the UE 101.

[0034] FIG. 3 depicts a process of adapting a multimedia stream, according to embodiments as disclosed herein. When a UE 101 is accessing (301) a multimedia stream via the communication network, the SAS 102 maintains (302) a check for any change in the context. If there is no change in the context, the stream continues (304) to be sent to the UE 101. If there is a change in the context, the SAS 102 checks (305) if the change meets at least one condition (such as crossing a threshold or the change is greater than a specified range and so on). If the change in the context does not meet the condition, the stream continues (304) to be sent as it is to the UE 101. If the change in the context meets the condition, the SAS 102 determines (305) the type of adaptation to be applied to the stream (such a decrease/increase in quality/resolution and so on). The SAS 102 then checks (306) the policy to see if the adaptation meets (307) the policy. If the desired adaptation does not meet the policy, the stream continues (304) to be sent as it is to the UE 101. If the desired adaptation meets the policy, the SAS 102 or the AS 104 adapts (308) the stream and sends (309) the adapted stream to the UE 101. The various actions in method 300 may be performed in the order presented, in a different order or simultaneously. Further, in some embodiments, some actions listed in FIG. 3 may be omitted.

[0035] The embodiments disclosed herein can be implemented through at least one software program running on at least one hardware device and performing network management functions to control the network elements. The network elements shown in Figs. 1 and 2 include blocks which can be at least one of a hardware device, or a combination of hardware device and software module.

[0036] The embodiment disclosed herein describes a system and method to facilitate the adaptation of multimedia sessions as per the user and network context. Therefore, it is understood that the scope of the protection is extended to such a program and in addition to a computer readable means having a message therein, such computer readable storage means contain program code means for implementation of one or more steps of the method, when the program runs on a server or mobile device or any suitable programmable device. The method is implemented in a preferred embodiment through or together with a software program written in e.g. Very high speed integrated circuit Hardware Description Language (VHDL) another programming language, or implemented by one or more VHDL or several software modules being executed on at least one hardware device. The hardware device can be any kind of device which can be programmed including e.g. any kind of computer like a server or a personal computer, or the like, or any combination thereof, e.g. one processor and two FPGAs. The device may also include means which could be e.g. hardware means like e.g. an ASIC, or a combination of hardware and software means, e.g. an ASIC and an FPGA, or at least one microprocessor and at least one memory with software modules located therein. Thus, the means are at least one hardware means and/or at least one software means. The method embodiments described herein could be implemented in pure hardware or partly in hardware and partly in software. The device may also include only software means. Alternatively, the invention may be implemented on different hardware devices, e.g. using a plurality of CPUs.

[0037] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such

adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the claims as described herein.

CLAIMS

We Claim:

1. A method for controlling delivery of a multimedia stream to a user equipment (UE) in a communication network, said method comprising of

checking for at least one change in context by a session adaptation server (SAS), while said multimedia stream is being accessed from said UE;

adapting said multimedia stream by a module, if there is at least one change in said context; and

delivering said adapted stream to said UE by said module.

2. The method, as claimed in claim 1, wherein said module is at least one of said SAS; or an application server present in said communication network.

3. The method, as claimed in claim 1, wherein said context is updated by at least one of said UE; or said communication network.

4. The method, as claimed in claim 3, wherein said context is updated at periodic intervals.

5. The method, as claimed in claim 1, wherein said context is updated on being triggered by a pre-defined event.

6. The method, as claimed in claim 1, wherein said method further comprises of checking if said at least one change in said context satisfies at least one pre-defined condition.

7. The method, as claimed in claim 1, wherein said method further comprises of checking if said adapted stream meets policy corresponding to said UE, before delivering said adapted stream to said UE.

8. The method, as claimed in claim 1, wherein adaptation applied to said stream depends on said at least one change in said context.

9. A system in a communication network, said system configured for controlling delivery of a multimedia stream to a user equipment (UE) in said communication network, said system comprising at least one means configured for

checking for at least one change in context, while said multimedia stream is being accessed from said UE;

adapting said multimedia stream, if there is at least one change in said context; and

delivering said adapted stream to said UE.

10. The system, as claimed in claim 9, wherein said system is further configured for checking if said at least one change in said context satisfies at least one pre-defined condition.

11. The system, as claimed in claim 9, wherein said system is further configured for checking if said adapted stream meets policy corresponding to said UE, before delivering said adapted stream to said UE.

12. The system, as claimed in claim 9, wherein said system is further configured for applying adaptation to said stream depending on said at least one change in said context.

13. The system, as claimed in claim 9, wherein said system is further configured for signaling to the application server for applying adaptation to said stream depending on said at least one change in said context.

14. The system, as claimed in claim 9, wherein said system is further configured for signaling to the user device for triggering the application server to apply adaptation to said stream depending on said at least one change in said context.

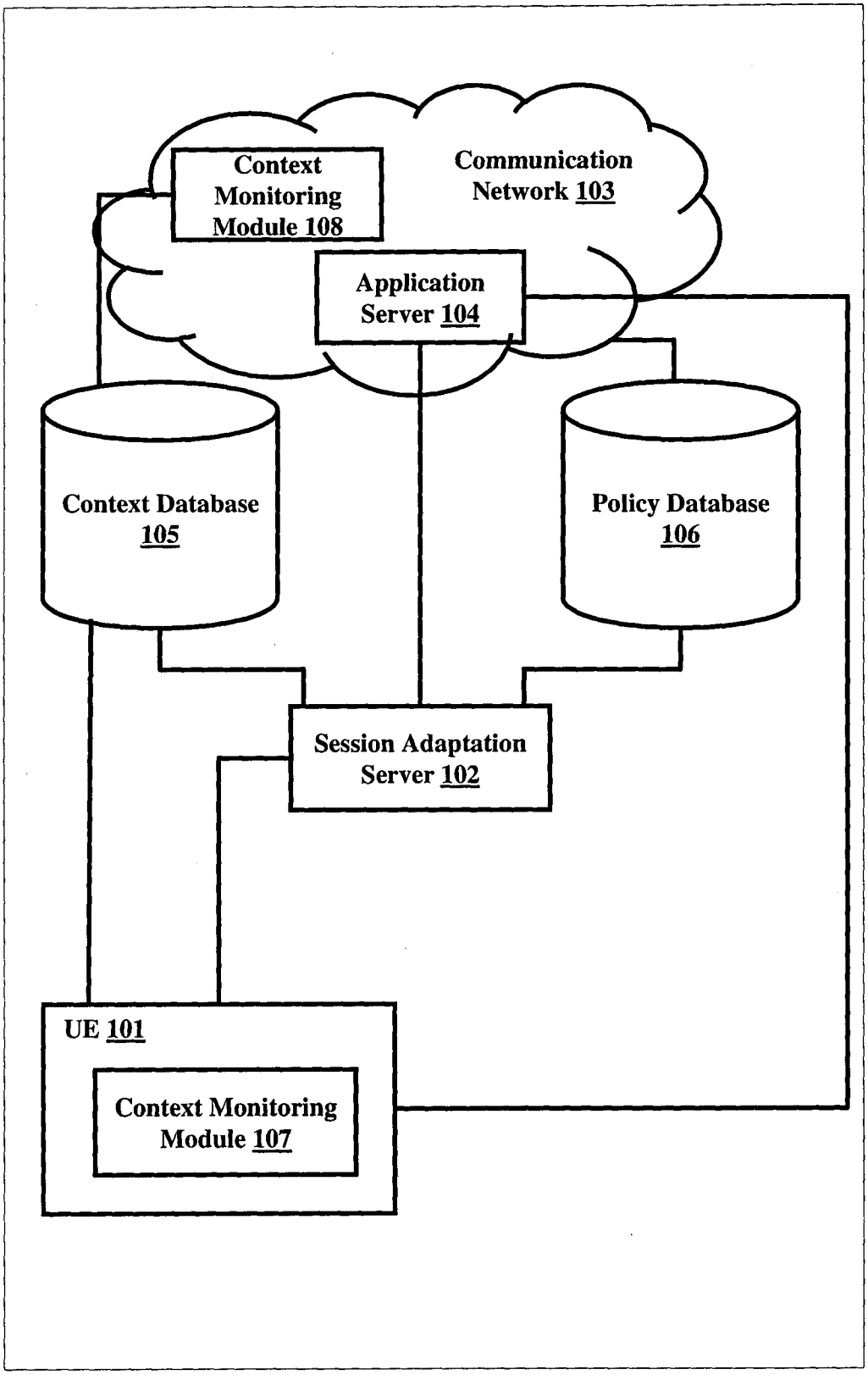
Context Monitoring Module 108
Communication Network 103
Application Server 104
Context Database 105
Policy Database 106
Session Adaptation Server 102
UE 101
Context Monitoring Module 107

FIG. 1

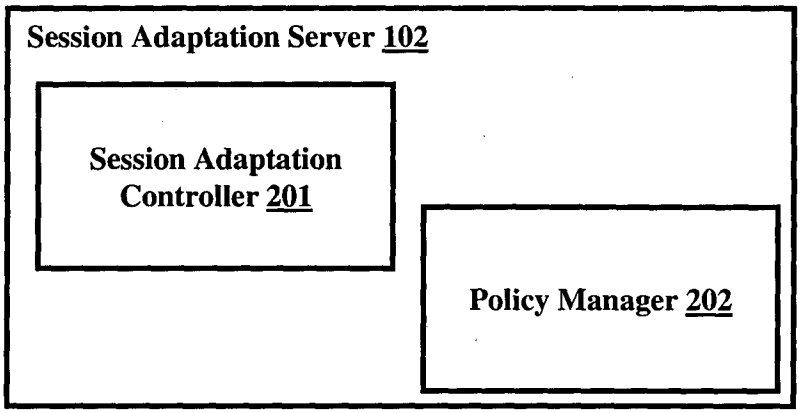
Session Adaptation Server 102
Session Adaptation Controller 201
Policy Manager 202

FIG. 2

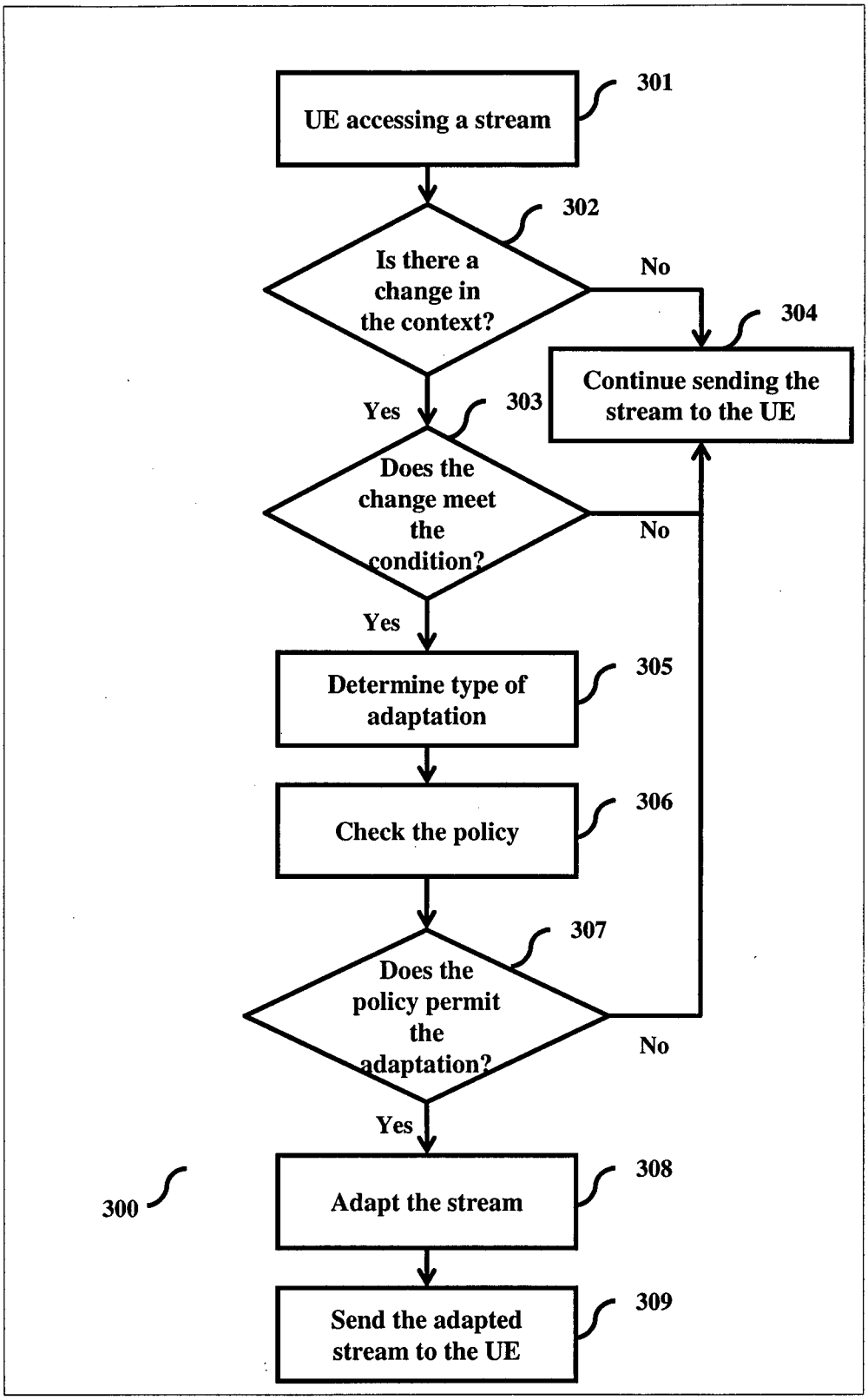
UE accessing a stream
301
Is there a change in the context?
302
No
304
Continue sending the stream to the UE
Yes
303
Does the change meet the condition?
No
Yes
Determine type of adaptation
305
Check the policy
306
Does the policy permit the adaptation?
307
No
Yes
300
Adapt the stream
308
Send the adapted stream to the UE
309

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2012/000459

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 17/00 (2012.01)
USPC - 709/228
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - G06F 17/00; H04B 7/005; H04W 8/00; H04H 20/00 (2012.01)
USPC - 709/228, 709/231, 709/229, 709/225

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, ProQuest

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0248643 A1 (AARON et al) 30 September 2010 (30.09.2010) entire document	1-6, 8-10, 12
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Y		7, 11, 13, 14
Y	US 2008/0195761 A1 (JABRI et al) 14 August 2008 (14.08.2008) entire document	7, 11
Y	US 2008/0222263 A1 (WU et al) 11 September 2008 (11.09.2008) entire document	13
Y	US 2010/0023624 A1 (LONG et al) 28 January 2010 (28.01.2010) entire document	14
A	US 2005/0060411 A1 (COULOMBE et al) 17 March 2005 (17.03.2005) entire document	1-14
A	US 2004/0181550 A1 (WARSTA et al) 16 September 2004 (16.09.2004) entire document	1-14

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 November 2012	20 NOV 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774