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(54) Title: ADVICE OF PROMOTION FOR USAGE BASED SUBSCRIBERS

(57) Abstract: Systems and method are described for providing advice of promotion to notify a subscriber about potential promotions that the subscriber would benefit from if he/she changed the context under which he/she plans to use a service. The process begins when a subscriber initiates a request to use the service, e.g. establish a call session. The operator identifies the subscriber by determining whether the subscriber is permitted to use the service, e.g. establish the session, and calculates a charge rate for the service usage, e.g. call session based on a usage plan associated with the subscriber. A rating engine is then invoked to identify a promotion that includes an additional rate that is different from the charge rate determined for the session. The promotion is identified based on parameters associated with the call session by determining which additional rate would apply if at least one of those parameters were modified.

FIGURE 1

Operator 100

Subscriber A’s Plan 101
Charging Engine 102
Runtime Rating Model Graph 103
Rating Engine 104

Subscription with Advice of Promotion

Subscriber A 105
Subscriber B 106

Subscriber B’s Plan 107

ADVICE OF PROMOTION FOR USAGE BASED SUBSCRIBERS

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Field of Invention:
[0002] The current invention generally relates to usage charging such as in wireless telecommunications and more particularly to billing systems and subscriber usage plans.

Background:
[0003] Cellular telephone plans and other usage based service plans often include promotions for the customers. For example, phone calls made after a certain hour, or during the weekend may be less expensive than phone calls made during regular business hours. Telecom operators and other service operators often define these promotions to encourage subscribers to use the services under the condition of promotions. For example, a telecom operator whose network is less loaded during the weekend may create weekend promotions to encourage their subscribers to make lower priority phone calls during the weekend, so as to offload the network during the week. The same example applies for an electricity provider or any other service provider.

[0004] Today, it is the responsibility of the subscribers to remember the conditions under which they can receive promotions. There exists an advice of charge mechanism to notify subscribers upfront regarding the cost of the usage of a service under the current condition (time of day, location, etc). With advice of charge, subscribers can be informed about the cost of the service usage before accessing that service. However, the advice of charge mechanism is generally not capable of advising the subscriber of potential promotions he could potentially benefit from.

Summary:
[0005] In accordance with various embodiments of the invention, systems and method are described for providing advice of promotion which can be used to notify a subscriber about potential promotions that the subscriber would benefit from if he/she changed the context under which he/she plan to use a service. For a wireless subscriber, the process begins when a subscriber first initiates a request to use a service (e.g., establish a call
session) by using a device such as a wireless device. The request is received by the telecom operator. The operator systems identify the subscriber by determining whether the subscriber is permitted to use the service. In addition, the systems determine a charge rate for the service usage based on a plan associated with the subscriber using a rating engine. As the rating engine is invoked to identify the rate for the usage, it can also calculate the rate for another set of parameters associated with the service usage and determining which additional rate would apply if at least one of those parameters were modified. If a different rate is identified, the operator can then transmit a response to the subscriber that includes information about the promotion identified by the rating engine. This information can be used to notify the subscriber of the additional promotions he/she could benefit if he/she changed its usage condition.

[0006] In accordance with some embodiments of the invention, there is provided a system for providing advice of promotion in a telecommunications environment comprising: means for receiving a request to render a service from a subscriber using a device; means for identifying the subscriber by determining whether the subscriber is permitted to access the service and using a rating engine to determine a charge rate for said service request based on a plan associated with said subscriber; means for invoking the rating engine to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service request, wherein the promotion is identified by analyzing a set of parameters associated with service request and determining which said additional rate would apply if at least one of said parameters were modified; and means for transmitting a response to the subscriber, said response including information about the promotion identified by the rating engine.

[0007] In accordance with some embodiments of the invention, the rating engine further includes a runtime rating model graph, said graph containing a set of conditions as nodes and a set of rates as leaves of said graph.

[0008] In accordance with some embodiments of the invention, the rating engine identifies said promotion by employing information from the plan associated with said subscriber.

[0009] In accordance with some embodiments of the invention, the plan associated with said subscriber is stored in a charging system.

[0010] In accordance with some embodiments of the invention, the system further comprise: means for notifying the subscriber of said promotion by using the device for said subscriber.

[0011] In accordance with some embodiments of the invention, the rating engine is capable of identifying the promotion before, during or after said service request has been terminated.

[0012] In accordance with some embodiments of the invention, the parameters further include one or more of the following type of request, quantity, tariffs, price plans, taxes, accumulated usage, contracts, time-of-day, and location of said device.
In accordance with some embodiments of the invention, the additional rate associated with said promotion is lower than the charge rate determined for the service request.

In accordance with some embodiments of the invention, the promotion is identified by the rating engine varying the parameters associated with said service request.

In accordance with some embodiments of the invention, there is provided a rating engine used for providing advice of promotion in a service delivery environment, wherein a request to render a service from a subscriber using a device is received and the subscriber is identified by determining whether the subscriber is permitted to access the service, the rating engine comprising: a charge rate determining unit, configured to determine a charge rate for the service usage based on a plan associated with said subscriber; and a promotion identifying unit, configured to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service usage, wherein the promotion identifying unit comprises an analyzing section configured to analyze a set of parameters associated with service request and a determining section configured to determine which said additional rate would apply if at least one of said parameters were modified.

In accordance with some embodiments of the invention, the rating engine further includes a storage unit storing a runtime rating model graph, said graph containing a set of conditions as nodes and a set of rates as leaves of said graph.

In accordance with some embodiments of the invention, the rating engine identifies said promotion by employing information from the plan associated with said subscriber.

In accordance with some embodiments of the invention, the rating engine is capable of identifying the promotion before, during or after said service has been rendered.

In accordance with some embodiments of the invention, the parameters further include one or more of the following: type of request, quantity, tariffs, price plans, taxes, accumulated usage, contracts, time-of-day, and location of said device.

In accordance with some embodiments of the invention, the additional rate associated with said promotion is lower than the charge rate determined for the service/call session.

In accordance with some embodiments of the invention, the promotion is identified by the rating engine varying the parameters associated with said service/call session.

In accordance with some embodiments of the invention, the rating engine functions in combination with an advice of charge rating engine.
Brief Description of the Figures:

[0023] FIGURE 1 is an illustration of a system that provides advice of promotion, in accordance with various embodiments of the invention.

[0024] FIGURE 2 is an illustration of the runtime rating model graph used by the rating engine, in accordance with various embodiments of the invention.

[0025] FIGURE 3 is a flow chart illustration of a process for providing advice of promotion, in accordance with various embodiments of the invention.

[0026] FIGURE 4 is an illustration of a functional block diagram in accordance with various embodiments of the invention.

[0027] FIGURE 5 is an illustration of data structure in accordance with various embodiments of the invention.

[0028] FIGURE 6 is an illustration of a rating engine used for providing advice of promotion in a service delivery environment, in accordance with various embodiments of the invention.

Detailed Description:

[0029] In accordance with various embodiments of the invention, techniques are described which can be used to analyze the current context under which a subscriber is planning to use a service (e.g. plans to make a telephone call) in order to not only notify that subscriber about charges, but to also notify of potential promotions that the subscriber would benefit from if he/she changed the context under which he/she plan to use the service.

[0030] By way of illustration, a subscriber may be signed up for a price plan where phone calls cost 5cents/minute before 6:00PM and 1cent/minute after 6:00PM. If the subscriber is planning to make a phone call at 5:55 PM, the system would notify the subscriber that the cost of making this call at the current moment is 5cts/min (advice of charge), and, additionally that in 5 minutes from now (at 6:00 PM) it would cost only 1cts/min (advice of promotion).

[0031] As another illustration, a subscriber may be signed up for a price plan where phone calls cost 5cents/minute except for calls made from non busy locations (e.g. where cell towers are under used). If a subscriber to this price plan is planning on making a phone call, the system would notify the subscriber that the cost of making this call at the current moment is 5cts/min (advice of charge), but in addition that if this call was made from another location near by, such as from an adjacent cell, then the call would cost only 2cts/min.

[0032] In this manner, the advice of promotion system provides an improved user experience and enables the subscriber to better control the charges and phone plan.

[0033] In accordance with an embodiment, the system can include a rating engine that can be instructed to calculate alternative rate(s) by varying the context of the usage. The
rating engine runtime rating model is a graph, whose nodes are conditions and leaves are the rates. The conditions and the rates are derived from the rate plan information and include reference to the context (subscriber data, usage data) that provides values for evaluating the conditions. When the rating engine processes a request, the rating graph is executed against the usage current context which efficiently leads to the determination of the rate for this context. The enhancement to the rating engine is to instruct it to evaluate alternative acceptable condition changes that will lead to different rate.

[0034] When the rating engine processes a service usage request, it executes the rules in the context of the current usage request. In accordance with an embodiment, the context includes but is not limited to (1) parameters of the request (type, quantity, etc.); (2) parameters of the customer/subscriber (tariffs, price plans, accumulated usage, contracts, etc.); and (3) other parameters (time-of-day, taxes, etc.).

[0035] The conditions that are under the control of the end user (time of the call, location, etc.) are tags and their acceptable variations are configured, so during the evaluation of the conditions, the rating engine detects the one that could lead to different rates and evaluate them. If any better alternative rate under the changed conditions is calculated, the new rate(s) and the service usage condition(s) would be used to advise the user of a promotion about the service to be rendered. It should be noted that this advice of promotion could be calculated and used before, during and after a service has been rendered.

[0036] FIGURE 1 is an illustration of a system that provides advice of promotion, in accordance with various embodiments of the invention. Although this diagram depicts components as logically separate, such depiction is merely for illustrative purposes. It will be apparent to those skilled in the art that the components portrayed in this figure and in other figures can be combined or divided into separate software, firmware and/or hardware. Furthermore, it will also be apparent to those skilled in the art that such components, regardless of how they are combined or divided, can execute on the same computing device or can be distributed among different computing devices connected by one or more networks or other suitable communication means.

[0037] As illustrated, a telecom operator 100 can provide telephone as well as other services to a number of subscribers (103, 104). Each subscriber typically has a usage plan (106, 107) or some charge rates associated with them. When one subscriber 103 initiates a telephone call to another subscriber, the operator will typically identify the subscriber by determining whether that particular subscriber is permitted to establish the call session. In addition, the operator will determine a charge rate for the call session based on the usage plan 106 associated with the subscriber 103.
In accordance with an embodiment, the operator can deploy a rating engine 102 that can be used to identify various additional promotions for the subscriber. The additional promotions may include different rates from the charge rate determined for the session being requested by the subscriber. The rating engine can employ a runtime rating model 108 to identify the promotion(s) by analyzing a set of parameters associated with the call session and determining which additional rate would apply if at least one of those parameters were modified. Once the promotion has been identified, it can be attached to the response transmitted to the subscriber that is requesting the call session. The response can include information about the promotion identified by the rating engine, which can be used to notify the subscriber using the device (e.g., a wireless device).

FIGURE 2 is an illustration of the runtime rating model graph used by the rating engine, in accordance with various embodiments of the invention. As illustrated, the runtime rating model can be a graph 208 whose nodes (200-204) are conditions and leaves (205-207) are the rates. The conditions and the rates are derived from the rate plan information and include reference to the context (subscriber data, usage data) that provides values for evaluating the conditions. When the rating engine processes a request, the rating graph is executed against the usage current context which efficiently leads to the determination of the rate for this context. The rating engine can be instructed to evaluate alternative acceptable condition changes that will lead to a different rate(s).

FIGURE 3 is a flow chart illustration of a process for providing advice of promotion, in accordance with various embodiments of the invention. Although this figure depicts functional steps in a particular sequence for purposes of illustration, the process is not necessarily limited to this particular order or steps. One skilled in the art will appreciate that the various steps portrayed in this figure can be changed, rearranged, performed in parallel or adapted in various ways. Furthermore, it is to be understood that certain steps or sequences of steps can be added to or omitted from this process, without departing from the spirit and scope of the invention.

As shown in step 300, a subscriber first initiates a request to establish a call session by using a device (e.g., a wireless device). The request is received by the telecom operator. In step 301, the operator identifies the subscriber by determining whether the subscriber is permitted to establish the call session. In addition, the operator determines a charge rate for the call session based on a plan associated with the subscriber. In step 302, a rating engine is invoked to identify a promotion that includes at least one additional rate that is different from the charge rate determined for the session. The rating engine identifies the promotion analyzing a set of parameters associated with the call session and determining which additional rate would apply if at least one of said parameters were modified. In step 303, the operator transmits a response to the subscriber that includes information about the
promotion identified by the rating engine. This information can be used to notify the subscriber of the additional promotions.

[0042] FIGURE 4 is an illustration of a functional block diagram in accordance with the various embodiments of the invention. A user device 400 is used by subscriber 103 or 104. User device 400 includes a transmitter 411 and a receiver 412. User device 400 is, for example, a communication terminal device such as a smart phone which includes at least a communication function. Service provider device 420 includes a receiver 421, an identification unit 422, a determination unit 423, a memory 424, and a transmitter 425. Service provider device 420 may preferably function as a charging system.

[0043] When transmitter 411 sends a request for a service to service provider device 420, the request is received by receiver 421. Identification unit 422 identifies a subscriber from the request. Determination unit 423 determines a charge rate using the subscriber identified by identification unit 422 and information stored in memory 424. Determination unit 423 determines a promotion relevant to the identified subscriber based on information stored in memory 424. Transmitter 425 sends to user device 410 a response including information about the promotion identified by determination unit 423. When user device receives the response, its user can know the promotion proposed by service provider device 420. Identification unit 422 and determination unit 423 may be implemented by a processor to execute processing steps shown in FIGURE 3.

[0044] With reference to FIGURE 5, data structure of service provider device 520 is described. FIGURE 5 illustrates data structure in memory 524. Memory 524 includes subscriber data 510, usage data 520 and conditions and rate plans 530. Subscriber data 510 includes each subscriber’s identification, such as subscriber 103 or 104 in FIGURE 1. Usage data 520 includes history data for each subscriber in terms of services provided by a service provider. Conditions and rate plans 530 include information about each service. Conditions and rate plans 530 also used for a promotion to be provided to an existing subscriber such as subscriber 103 or 104 in FIGURE 1.

[0045] FIGURE 6 is an illustration of a rating engine 600 used for providing advice of promotion in a service delivery environment, in accordance with various embodiments of the invention. In this service delivery environment, a request to render a service from a subscriber using a device is received and the subscriber is identified by determining whether the subscriber is permitted to access the service.

[0046] As illustrated in FIGURE 6, the rating engine 600 comprising: a charge rate determining unit 601, configured to determine a charge rate for the service usage based on a plan associated with said subscriber; and a promotion identifying unit 602, configured to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service usage, wherein the promotion
identifying unit 602 comprises an analyzing section 603 configured to analyze a set of parameters associated with service request and a determining section 604 configured to determine which said additional rate would apply if at least one of said parameters were modified.

According to one embodiment, the rating engine 600 may further include a storage unit 605 storing a runtime rating model graph 606, said graph containing a set of conditions as nodes and a set of rates as leaves of said graph.

According to one embodiment, the rating engine 600 identifies said promotion by employing information from the plan associated with said subscriber.

According to one embodiment, the rating engine 600 is capable of identifying the promotion before, during or after said service has been rendered.

According to one embodiment, the parameters further include one or more of the following: type of request, quantity, tariffs, price plans, taxes, accumulated usage, contracts, time-of-day, and location of said device.

According to one embodiment, the additional rate associated with said promotion is lower than the charge rate determined for the service/call session.

According to one embodiment, the promotion is identified by the rating engine varying the parameters associated with said service/call session.

According to one embodiment, the rating engine functions in combination with an advice of charge rating engine.

The functional blocks of the rating engine may be implemented by hardware, software, or a combination of hardware and software to carry out the principles of the invention. It is understood by persons of skill in the art that the functional blocks described in Figure 6 may be combined or separated into sub-blocks to implement the principles of the invention as described above. Therefore, the description herein may support any possible combination or separation or further definition of the functional blocks described herein.

Throughout the various contexts described in this disclosure, the embodiments of the invention further encompass computer apparatus, computing systems and machine-readable media configured to carry out the foregoing systems and methods. In addition to an embodiment consisting of specifically designed integrated circuits or other electronics, the present invention may be conveniently implemented using a conventional general purpose or a specialized digital computer or microprocessor programmed according to the teachings of the present disclosure, as will be apparent to those skilled in the computer art.

Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application
specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as will be readily apparent to those skilled in the art.

[0057] The various embodiments include a computer program product which is a storage medium (media) having instructions stored thereon/in which can be used to program a general purpose or specialized computing processor(s)/device(s) to perform any of the features presented herein. The storage medium can include, but is not limited to, one or more of the following: any type of physical media including floppy disks, optical discs, DVDs, CD-ROMs, microdrives, magneto-optical disks, holographic storage, ROMs, RAMs, PRAMS, EPROMs, EEPROMs, DRAMs, VRAMs, flash memory devices, magnetic or optical cards, nanosystems (including molecular memory ICs); paper or paper-based media; and any type of media or device suitable for storing instructions and/or information. The computer program product can be transmitted in whole or in parts and over one or more public and/or private networks wherein the transmission includes instructions which can be used by one or more processors to perform any of the features presented herein. The transmission may include a plurality of separate transmissions. In accordance with certain embodiments, however, the computer storage medium containing the instructions is non-transitory (i.e. not in the process of being transmitted) but rather is persisted on a physical device.

[0058] The foregoing description of the preferred embodiments of the present invention has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations can be apparent to the practitioner skilled in the art. The modification and variations may include any combination of the disclosed technical features. Embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the relevant art to understand the invention. It is intended that the scope of the invention be defined by the following claims and their equivalents.
Claims:

What is claimed is:

1. A method for providing advice of a promotion in a service delivery environment, said method comprising:
   - receiving a request to render a service from a subscriber using a device;
   - identifying the subscriber by determining whether the subscriber is permitted to access the service and using a rating engine to determine a charge rate for the service request based on a plan associated with said subscriber;
   - invoking the rating engine to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service request, wherein the promotion is identified by analyzing a set of parameters associated with the service request and determining which said additional rate would apply if at least one of said parameters were modified; and
   - transmitting a response to the subscriber, said response including information about the promotion identified by the rating engine.

2. The method of claim 1, wherein the rating engine further includes a runtime rating model graph, said graph containing a set of conditions as nodes and a set of rates as leaves of said graph.

3. The method of claim 1 or 2, wherein the rating engine identifies said promotion by employing information from the plan associated with said subscriber.

4. The method of any one of claims 1 to 3, wherein the plan associated with said subscriber is stored in a charging system.

5. The method of any one of claims 1 to 4, further comprising:
   - notifying the subscriber of said promotion by using the device for said subscriber.

6. The method of any one of claims 1 to 5, wherein the rating engine is capable of identifying the promotion before, during or after said the service has been rendered.

7. The method of any one of claims 1 to 6, wherein the parameters include one or more of the following type of request, quantity, tariffs, price plans, taxes, accumulated usage, contracts, time-of-day, and location of said device.
8. The method of any one of claims 1 to 7, wherein the additional rate associated with said promotion is lower than the charge rate determined for the service request.

9. The method of any one of claims 1 to 8, wherein the promotion is identified by the rating engine varying the parameters associated with said service request.

10. The method of any one of claims 1 to 9, wherein the rating engine functions in combination with an advice of charge rating engine.

11. A system for providing advice of a promotion in a telecommunications environment, said system comprising a physical storage memory and one or more hardware processors that execute instructions stored in said storage memory to perform a method comprising:

   receiving a request to render a service from a subscriber using a device;
   identifying the subscriber by determining whether the subscriber is permitted to access the service and using a rating engine to determine a charge rate for said service request based on a plan associated with said subscriber;
   invoking the rating engine to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service request, wherein the promotion is identified by analyzing a set of parameters associated with the service request and determining which said additional rate would apply if at least one of said parameters were modified; and
   transmitting a response to the subscriber, said response including information about the promotion identified by the rating engine.

12. The system of claim 11, wherein the rating engine further includes a runtime rating model graph, said graph containing a set of conditions as nodes and a set of rates as leaves of said graph.

13. The system of claim 11 or 12, wherein the rating engine identifies said promotion by employing information from the plan associated with said subscriber.

14. The system of any one of claims 11 to 13, wherein the plan associated with said subscriber is stored in a charging system.
15. The system of any one of claims 11 to 14, wherein the method to be performed further comprises:

notifying the subscriber of said promotion by using the device for said subscriber.

16. The system of any one of claims 11 to 15, wherein the rating engine is capable of identifying the promotion before, during or after said service request has been terminated.

17. The system of any one of claims 11 to 16, wherein the parameters include one or more of the following: type of request, quantity, tariffs, price plans, taxes, accumulated usage, contracts, time-of-day, and location of said device.

18. The system of any one of claims 11 to 17, wherein the additional rate associated with said promotion is lower than the charge rate determined for the service request.

19. The system of any one of claims 11 to 18, wherein the promotion is identified by the rating engine varying the parameters associated with said service request.

20. The system of any of claims 11 to 19, wherein the rating engine functions in combination with an advice of charge rating engine.

21. A non-transitory computer readable storage medium storing a set of instructions executable by one or more processors to carry out a set of steps comprising:

receiving a request to render a service from a subscriber using a device;

identifying the subscriber by determining whether the subscriber is permitted to access the service and using a rating engine to determine a charge rate for said service request based on a plan associated with said subscriber;

invoking the rating engine to identify a promotion that includes at least one additional rate, said additional rate being different from said charge rate determined for said service request, wherein the promotion is identified by analyzing a set of parameters associated with said service request and determining which said additional rate would apply if at least one of said parameters were modified; and

transmitting a response to the subscriber, said response including information about the promotion identified by the rating engine.
22. A computer program for causing a computer to implement the method recited in any one of claims 1 to 10.

23. A computer program comprising instructions for causing a machine including one or more processors to perform the method of any of claims 1 to 10.

24. A computer program product comprising the computer program of claim 23 on a computer-readable storage medium.
FIGURE 2

Rating Engine Runtime Model 208
A subscriber initiates a request to access a service and to establish a session by using a device. The request is received by the service provider.

The service provider systems identify the subscriber by determining whether the subscriber is permitted to establish the session and to access the service. In addition, a rating engine is used to determine a charge rate for the session based on a plan associated with the subscriber.

The rating engine is invoked to identify a promotion that includes at least one additional rate that is different from the charge rate determine for the session. The rating engine identifies the promotion analyzing a set of parameters associated with the session and determining which additional rate would apply if at least one of said parameters were modified.

The server provider system transmits a response to the subscriber that includes information about the promotion identified by the rating engine. This information can be used to notify the subscriber of the additional promotions.

FIGURE 3
FIGURE 5
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/068758

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04M 11/00 (2013.01)
USPC - 455/405

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) - H04M 11/00; 15/00; G06Q 20/00, 30/00 (2013.01)
USPC - 455/405, 455/406, 455/414.3, 379/114.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - H04M 3/51, 15/41; H04W 4/24; H04L 12/14 (2013.01)

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed
  - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  - "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  - "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
29 January 2013

Date of mailing of the international search report
15 FEB 2013

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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Facsimile No. 571-273-3201

Authorized officer:
Blaine R. Copenheaver
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)
This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ○ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. × Claims Nos.: 4-10, 14-20, 22-24
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4.  I No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest
- □ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- □ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- □ No protest accompanied the payment of additional search fees.