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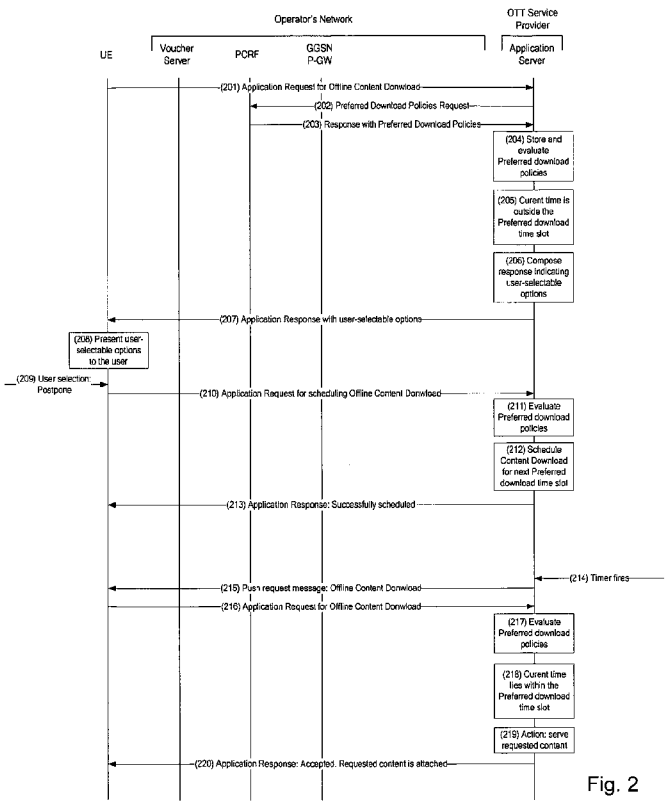

Fig. 2

(57) Abstract: A method for providing access to a content of a server (102) to a user equipment (108) in a communications network is proposed. The user equipment (108) requests access to the content of the server. The server (102) obtains (203) a set of parameters based on an access policy of said content and determines (206) a first and at least one further start time that the content is available for access by the user equipment (108). This determination is done based on the set of parameters that the server has obtained. The server then sends a response (207) to the user equipment indicating the first and the at least one further start time. The user equipment (108) then selects one of the first or the at least one further start time depending on when the user wants to access the content. Following that the server (102) provides access to said content to the user equipment (108) at the selected start time.

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Method for providing access to a content of a server in a communication network

Technical Field

The present invention disclosure pertains to the area of Packet Core in a mobile or fixed network. In particular, the invention is related to the scenario where users download content that is stored in third-party servers for later consumption. The technique proposed by the invention may be implemented as a method, a computer program product, a device or a network system.

Background

With the evolution of telecommunications, both over fixed and mobile networks, it has become a very common practise that users of fixed and mobile devices (also called user devices) want to access content which is stored in servers. This content has the form of videos, music, applications etc. It can be either accessed in real time or downloaded to a user device or user equipment (UE). The content which is downloaded is usually referred to as offline content because it is supposed to be consumed or viewed at a time different from the time the content is downloaded to the user equipment, as, for example, when the user is not connected to the network. Content is usually provided by so called Over the Top (OTT) service providers. These are providers of services that are different from the ones that network operators are providing. The OTT service providers may have a business relation with the network operators for the purpose of achieving a greater user experience.

A typical example of content download is media or application libraries. Users of these libraries may download content in the form of applications, music or films. Depending on the size of the content the download may take from some minutes to some hours. There are many platforms and libraries nowadays that offer content download. Also with the evolution of mobile devices and mobile networks, this

content is increasingly downloaded and consumed over mobile devices using mobile network infrastructure.

A problem that generally occurs is that this content to be downloaded might be large in size like, for example, a movie file, whose size may reach a few gigabytes. If a user decides to start the download of this movie during a time when the network is highly used (or even saturated), there can be a number of consequences. The users may experience very long download times. Other users of the network, not necessarily wanting to access and/or download content may also get a detriment in their communications. Further the third party servers might also get overloaded and not be able to handle all the requests for downloads resulting in a low quality of service and experience for their users.

The above problem is faced both in cases of mobile and fixed networks. It may be more prominent in the case of mobile networks though as usually the users faster download times for more immediate consumption of the content they are interested in.

Summary

In general, there is a need for an efficient way to access real time and offline content by users to be consumed on their user devices having minimum impact on the network or to existing applications in user devices. This object is achieved by the independent claims. Advantageous embodiments are described in the dependent claims.

According to one embodiment, a method for providing access to a content of a server to a user equipment in a communications network is proposed. The user equipment requests access to the content of the server. The server obtains a set of parameters based on an access policy of said content and determines a first and at least one further start time that the content is available for access by the user equipment. This determination is done based on the set of parameters that the server has obtained. The server then sends a response to the user equipment indicating the first and the at least one further start time. The user equipment then selects one of the first or the at least one further start time depending on when the user wants to access the content. Following that the server access to said content to the user equipment at the selected start time.

In another embodiment, a system comprising a server and a user equipment in a communication network for providing access to a content of the server to the user equipment is proposed. The user equipment requests access to the content of the server. The server is adapted to obtain a set of parameters based on an access policy of the content. The server is further adapted to determine a first and at least one further start time when the content is available for access by the user equipment based on the set of parameters. The server is yet further adapted to send to the user equipment a response indicating the first and the at least one further start time. The user equipment is adapted to select one of the first or the at least one further start time when the user wants to access the content of the server. Finally the server is adapted to provide access to the content to the user equipment at the selected start time.

In yet another embodiment, an access control device for providing access to a content of a server to a user equipment in a communications network is proposed. The user equipment requests access to the content of the server. The access control device comprises a first interface which is adapted to obtain a set of parameters based on an access policy of the content. The device also comprises a processor which is adapted to determine a first and at least one further start time when the content is available for access by the user equipment based on the set of parameters received by the interface. The processor is also adapted to send a response indicating the first and the at least one further start time to the user equipment. The device further comprises a second interface which is adapted to receive a response from the user equipment. This response comprises a selection of the first or the at least one further start time when the user wants to access the content. The second interface is also adapted to provide access to the content to the user equipment at the selected start time.

Brief Description of the Drawings

Further aspects, details and advantages of the invention presented herein will become apparent from the following description of exemplary embodiments in conjunction with the drawings, wherein:

Fig. 1 shows the general architecture of the invention in the form of a communication system

Fig. 2 shows a first embodiment of a method of implementing the invention.

Fig. 3 shows a first embodiment of a method of implementing the invention.

Fig. 4 shows a first embodiment of a method of implementing the invention.

Fig. 5 shows a device implementing the invention.

Detailed Description

In the following description of exemplary embodiments, for purposes of explanation and not limitation, specific details are set forth like specific flowcharts or architectural diagrams in order to provide a thorough understanding of the invention presented herein. It can be apparent to one skilled in the art that the invention may be practised in other embodiments that depart from these specific details.

Moreover, those skilled in the art will appreciate that the services, functions and steps explained herein may be implemented using software functioning in conjunction with a programmed microprocessor, an Application Specific Integrated Circuit (ASIC), a Digital Signal Processor (DSP) or a general purposes computer. It will also be appreciated that while the following embodiments will primarily be described in the context of methods and devices, the technique presented herein may also be embodied in a computer program product as well as in a system comprising a computer processor and a memory coupled to the processor, wherein the memory is encoded with one or more programs that may be adapted to perform the services, functions and steps disclosed herein.

Figure 1 illustrates the general architecture of the invention in the form of a communication system. As shown in the figure, there is an Application server 102, operated by an OTT Service Provider. An application server is a server, located in the OTT service provider network, which is able to receive requests from the UE or terminal 108. These requests indicate the content to be downloaded by the UE. The server is able to produce responses, to serve and offer the requested content to UE. This Application Server implements an application-specific communication protocol that allows the UE to select content to be downloaded over the name PMA-1 interface. The PMA-1 interface lies between the application client in the UE and the Application Server 102. This interface is application dependent.

The Application Server 102 also implements the code-named interface PMA-2 towards the Policy and Charging Rules Function (PCRF) 104 or similar node in the network, where utilization policies are stored and downloaded to a number of Application Servers in OTT Service Providers. The PCRF 104 is the node designated

in real-time to determine policy rules in the communication network. The Application Server 102 parses the preferred download policy that applies to the requested content and user, and enables an application-level dialog with the user over the PMA-1 interface. As preferred download policy we can consider a set of rules created by the operator, that determine the preferred download time slots for a given content (or type of content) and a given user. These rules can be also considered as parameters which are defined by the policy itself and these parameters can be the type of content, the size of content etc. Also the preferred download policy can be considered as an access policy as it determines the actual access options for the content. With the term preferred download time slots we can call a slot of time where the operator is favoring the download of non-critical real-time content (e.g., offline content). The opposite may also be true: operators may prohibit the download of offline content at a time outside the preferred download time slot.

This application-level dialog allows the user to postpone the downloading of the offline content or to buy a voucher from a Voucher Server 106 for immediate download. The voucher server is a server, located in the operator's network, which is responsible for monetizing vouchers for extra services, such as a download in a peek hour.

The Voucher Server 106 may implement an interface PMA-3 to the Application Server, so that the Voucher Server can authorize the Application Server to start the download of the requested content once the user buys a voucher. This interface is optional, and it is present if, for example, Security Assertion Markup Language (SAML) is the technology used to authorize the download of content. In other cases, the authorization may come in the format of new policies downloaded (or pushed) from the PMA-2 interface.

The UE or device implements a logical interface code-named PMA-4 to the Voucher server 106. This allows users to buy a voucher that, once presented to the Application Server, enables the download of the content at the current time.

The Voucher Server 106 also implements a logical interface code-named PMA-5 towards the PCRF. This interface is used to communicate to the PCRF that the user

has successfully bought a voucher for immediate download. The PCRF will use this information to modify its policy and charging control policies, push them to the Packet Data Network Gateway (P-GW)/ Gateway GPRS support node GGSN over the Gx interface. The Gx interface is the off-line policy interface between the GGSN and the PCRF. It is used for provisioning service data flow based on charging rules. Optionally, the PCRF can also create new utilization policies and push them to the Application Server 102 over the PMA-2 interface, in which case, the PMA-3 is not needed. Below an explanation is given on the different PMA interfaces and their implementation.

The PMA-2 interface lies between the Application Server 102 in the OTT Service Provider and the PCRF of the Operator.

This interface is realized following Representational State Transfer (REST) principles. REST is a style of software architecture for distributed systems such as the World Wide Web. The interface uses HTTP as transport and JavaScript Object Notation (JSON) as data format. JSON is a text-based open standard designed for human-readable data interchange. The communication is secured using Transport Layer Security (TLS). TLS is a cryptographic protocol that provides communication security over the Internet. TLS encrypts the segments of network connections at the Application Layer for the Transport Layer, using asymmetric cryptography for key exchange, symmetric encryption for confidentiality, and message authentication codes for message integrity. The aforementioned interface provides two operations: Download policy request and Batch download policies request.

The Download policy request operation is issued by the Application Server in order to request preferred download policies from the PCRF. These policies are applicable to the subscriber requesting to download a specific content.

The Application Server makes an HTTP POST request to the PCRF, with a Request-URI following this format:

/DPolicy/<subscriber_id>

where <subscriber_id> is a subscriber identifier that is known to both parties (such as the subscriber's MSISDN).

The body of the HTTP request contains an object encoded using JSON. This object provides details on the type of content that the user is requesting to download. These details include, but are not limited to size, media type, format, location and others and can be considered the parameters as mentioned above.

The object structure is shown below:

JSON structure. Download policy request

```
+- downloadItem (+)
   +- id
   +- url
   +- size
   +- type
   +- format
   +- serviceId
```

The (+) indicates a cardinality of one or more.

The PCRF answers the request with a Download policy response. The response comes in the HTTP response, and includes an object encoded using JSON. This object provides information of the authorized download windows for the different download items.

The object structure is shown below:

JSON structure. Download policy response

```
+- downloadItem (+)
   +- id
   +- preferredDownloadPolicy (*)
      +- preferredDownloadTimeslot (*)
         +- timeStart
```

```
        +- timeEnd
        +- periodicity
        +- priority
```

The (+) indicates a cardinality of one or more and the (*) indicates a cardinality of zero or more.

For illustration purposes, an example is provided. Assume the Application Server 102 asks the PCRF 104 for downloading preferred download policies for an application user (and also an operator subscriber) identified by the MSISDN +34600101010, wishing to download a video content located at the URL http://server.com/video.mpg, which has a size of 800 megabytes.

The Download policy request operation looks like the one below:

Table 1: Example of Download policy request operation

```
POST /DPolicy/+34600101010 HTTP/1.1
Host: operator.com
Content-Type: application/json;charset=UTF-8
Content-Length: 204
Date: Tue, 28 Aug 2012 22:51:57 GMT
Accept: application/json

{
"downloadItem":
   {
   "id": "6783246323478236473",
   "url": "http://server.com/video.mpg",
   "size": 800000000,
   "mediaType": "video/mpeg",
   "format": "mpeg",
   "serviceId": "videoOnDemand"
   }
}
```

Assuming the PCRF 104 offers a single preferred download policy that contains two preferred download time slots, both starting next day, the first one at 1:00 AM and lasting for 3 hours, and the second one at 7:00 AM and lasting for 2 hours. The download policy response operation may look like the one below:

Example of Download policy response operation

```
HTTP/1.1 201 Created
Content-Type: application/json
Location: http://server.com/downloadWindow/+34600101010
Content-Length: 376
Date: Tue, 28 Aug 2012 22:51:59 GMT

{
"downloadItem":
   {
   "id": "6783246323478236473",
   "preferredDownloadPolicy": [
   {
     "preferredDownloadTimeSlot": [
        {
        "timeStart": "Wed, 29 Aug 2012 01:00:00 GMT",
        "timeEnd": "Wed, 29 Aug 2012 03:59:59 GMT",
        "periodicity": "none",
        "priority": 1
        },
        {
        "timeStart": "Wed, 29 Aug 2012 07:00:00 GMT",
        "timeEnd": "Wed, 29 Aug 2012 08:59:59 GMT",
        "periodicity": "weekly",
        "priority": 2
        }
     ]
```

```
    }
    ]
    }
}
```

The Batch download policy request operation is issued by the Application Server in order to request a number of preferred download policies that are applicable to one or more users and one or more services controlled by the same OTT Service Provider. The Application Server fetches these policies prior to receiving user requests, so that user requests are not delayed for downloading the user-specific policy in real time. However, these policies may be large in nature, for example, if the policies are quite different from subscriber to subscriber. It is expected that service providers will evaluate whether they want to invoke the batch download policies operation or the download policy operation (user-specific) depending on their needs.

The Application Server 102 makes an HTTP POST request to the PCRF, with a Request-URI following this format:

/BDPolicy/

The body of the HTTP request contains an object encoded using JSON, according to the following structure:

JSON structure. Batch download policies request

```
+- downloadItem (+)
   +- id
   +- serviceId (+)
```

The (+) indicates a cardinality of one or more.

The PCRF 104 answers the request with a batch download policy response. The response comes in the HTTP response, and includes an object encoded using JSON. This object provides a number of policies that are applicable to one or more services and one or more users.

The object structure is shown below:

JSON structure. Batch download policy response

```
+- downloadItem (+)
   +- id
   +- subscriberId (+)
   +- minSize (*)
   +- maxSize (*)
   +- mediaType (*)
   +- format (*)
   +- serviceId (*)
   +- preferredDownloadPolicy (*)
      +- preferredDownloadTimeslot (*)
         +- timeStart
         +- timeEnd
         +- periodicity (*)
         +- priority
```

The (+) indicates a cardinality of one or more; the (*) indicates a cardinality of zero or more.

For illustration purposes, an example is provided. Assume the Application Server fetches Batch download policies for all the users who may access the video on demand service.

The Download policy request operation looks like the one below:

Example of Batch download policies request operation

```
POST /BDPolicy/OTTSP349 HTTP/1.1
Host: operator.com
Content-Type: application/json;charset=UTF-8
Content-Length: 204
Date: Tue, 28 Aug 2012 22:51:57 GMT
Accept: application/json
```

```
{
"downloadItem" :
   {
   "id": "6783246323478236473",
   "serviceId": "videoOnDemand"
   }
}
```

Assume the PCRF offers a single preferred download policy that applies to two subscribers when they try to download content identified with a given content type, format, a minimum size, and a maximum size. The policy contains the same two preferred download time slots that were shown in previous examples.

Example of Download policy response operation

```
HTTP/1.1 201 Created
Content-Type: application/json
Location: http://server.com/Batch/OTTSP349
Content-Length: 376
Date: Tue, 28 Aug 2012 22:51:59 GMT

{
"downloadItem":
   {
   "id": "6783246323478236473",
   "subscriberId": ["+34609101010, "+34609999999"],
   "minSize" : 10000,
   "maxSize" : 800000000,
   "mediaType" : "video/mpeg",
   "format" : "mpeg",
   "serviceId": "videoOnDemand",
   "preferredDownloadPolicy": [
   {
     "preferredDownloadTimeSlot": [
```

```
        {
        "timeStart": "Wed, 29 Aug 2012 01:00:00 GMT",
        "timeEnd": "Wed, 29 Aug 2012 03:59:59 GMT",
        "periodicity": "none",
        "priority": 1
        },
        {
        "timeStart": "Wed, 29 Aug 2012 07:00:00 GMT",
        "timeEnd": "Wed, 29 Aug 2012 08:59:59 GMT",
        "periodicity": "weekly",
        "priority": 2
        }
      ]
    }
    ]
    }
}
```


The PMA-3 interface lies between the Voucher Server and the Application Server. It is used when the Voucher Server has accepted a payment for a voucher. The Voucher Server then pushes a modification of the preferred download policies, so that the Application Server can authorize the requested download.

This interface is also implemented using HTTP, REST, JSON, with the addition of Security Assertion Markup Language (SAML) to handle the authorization and referral.

In this case, the HTTP POST request from the Voucher Server to the Application Server contains a JSON body that contains an identifier of the transaction that is now authorized.

The PMA-4 interface lies between the Application Server and the Application Client in the device. This interface allows users to buy a voucher that, once presented to the Application Server, enables the download of the content at the current time. The interface is based on HTTP, REST, and SAML.

The PMA-5 interface lies between the Voucher Server and the PCRF and is used to communicate to the PCRF that the user has successfully bought a voucher for immediate download. The interface is based on HTTP, REST, and SAML.

Figure 2 shows a first embodiment of a method of implementing the invention. The user requests to download 201 some content that is candidate to be downloaded at a later time. The Application Server first downloads preferred download policies from the PCRF that are applicable to this user and the requested service 202-203. The Application Server stores the received preferred download policies (for future usage) and evaluates them 204. Alternatively this evaluation may be performed by the PCRF. As a result of the time this request was received 205, the Application Server does not authorize the download to take place. Instead, the Application creates a response 206 that presents the user 207-208 with two options. Either to buy a voucher for enabling immediate download or to schedule the download at any time falling within one of the next preferred download time slots. These options can be considered as two different time options that the user can choose from. In that context a first time could be the time when the immediate download would be possible. At least one more time would be a time when the download would be possible during one of the next preferred download time slots.

It can be assumed that the user selects 209 to schedule the download at the beginning of the next preferred time slot. The response is sent from the UE to the Application Server 210. The Application Server uses the previously cached preferred download policies applicable to this user and service, and then verifies a second time 211 if the time selected by the user falls within a preferred time slot. In this case, the user selected to schedule the download of the content at the beginning of the next preferred download time slot. This makes the Application Server to set a timer at the beginning of the next Preferred download time slot 212 and to inform the UE of the success of the scheduling action.

When the timer fires 214, the Application Server contacts the UE 215 for the purpose of pushing the requested content. This is essentially a push message sent to the UE with a URL that the UE can invoke to download the content. The UE then invokes 216 this URL. This makes the Application Server to evaluate a third time the cached Preferred download policies that are applicable to this user and this service 217, in order to find out if the download is acceptable. In this case, the download is accepted 218-219 and the download of the requested content takes place 220.

Figure 3 shows a second embodiment of a method of implementing the invention. In this second embodiment, when the user is presented with the option of delaying the download of the content until the next preferred download time slot begins, he or she prefers to buy a voucher that grants the download of the content in real time. Therefore, steps 301 to 308 in this second embodiment are the same as steps 201 to 208 in the first embodiment. The difference lies in the user's selection. In this second embodiment the user chooses to download the requested content immediately for a price 30. This requires the user to buy a voucher from the operator network. The user communicates his or her selection to the Application Server 310. The Application Server then prepares the referral of the user toward the Voucher Server. This requires the Application Server to initialize the security and other parameters of the referral 311. Then the Application Server sends a response to the UE with a redirection to the Voucher Server 312, the redirection also including the parameters required by the Voucher Server for processing the payment. These parameters may include the URL of the Voucher Server, the type and size of the requested content, an identification of the Application Server, user identification, security parameters (e.g., a nonce, a transaction identifier), etc.

The UE then sends a request to buy an "immediate download voucher" to the Voucher Server 313. This request includes all the initialization parameters received from the Application Server. The Voucher Server requests the user to accept the payment of the voucher to download the content 314. When the user accepts the payment 315, the UE communicates the acceptance of the payment 316 to the Application Server. The Voucher server contacts the online charging system or offline charging system for authorizing and accruing the cost of the voucher into the users

account (this step is not show in the figure).The Application Server then contacts the PCRF 317-318 to request a modification in the existing PCC rules, so that the GGSN/P-GW will allow the download of the content to take place. This triggers the PCRF to install new PCC rules 319-320 in the GGSN/P-GW to allow the download when it will take place in the near feature. Last, the Voucher Server also contacts the Application Server in order to send updated Preferred Download Policies 321-323. This new set of policies includes at least a new Preferred Download Time Slot that starts at the current time. The Application Server updates the Preferred Download Policies for this user for future usage 322. Finally the Voucher Server creates a reply to the original request 313, including a referral to the Application Server, security parameters, the content to be downloaded, the user, the service, etc., and sends it 324 to the UE.

Upon reception of this response 324, the UE invokes the received URL in the referral in order to request the download of the content 325. The Application Server evaluates the Preferred Download Policies 326 once more, and in this case, the current time falls into the new Preferred Download Time Slot 327. Therefore, the Application Server decides to serve the requested content 328. This is communicated to the UE 329. The content download may be attached to this response or may be sent separately.

Figure 4 shows a third embodiment of a method of implementing the invention. The user requests the download of the content 401, and the Application Server downloads 402-403 Preferred Download Policies from the PCRF, which are evaluated 404. The time at which this request is received in the Application Server lies within one of the Preferred download time slots 405. Therefore, the Application Server authorizes the download 406 and serves the requested content in real time 407.

According to a fourth embodiment, the Application Server may fetch preferred download policies in a batch mode, applying to a plurality of users and a plurality of services.

According to a fifth embodiment of this invention, the preferred download policies are downloaded from a standalone node in the network, not necessarily co-located or being part of the PCRF.

Figure 5 shows a device 500 implementing the invention. The device is an access control device and is adapted to provide access to a content of a server to a user equipment or device in a communications network. Initially the device 500 requests access to the content which is stored in the server. This request can be received by the interface 502. Over the same interface the access control device obtains a set of parameters based on an access policy of said content. This policy can be generated from a PCRF node or another similar node in the network. These parameters and optionally the access policy are sent from the interface 502 to the processor 504. The processor 504, based on the set of parameters received by the interface, can determine a first and at least one further start time when said content is available for access by the user equipment. A response indicating the first and the at least one further start time is sent by the processor 504 to the user equipment over interface 506. This interface 506 is also adapted to receive a response from the user equipment. This response comprises the selection of the first or the at least one further start time when said user wants to access said content and to provide access to said content to the user equipment at the selected start time. The response can be sent back to the processor which can further forward it to the server for providing access to the content to the user equipment.

In an embodiment, the access control device of Figure 5 can also be implemented as part of a server or which can be in the form of an application server. In another embodiment, the access control device may additionally comprise a server or an application server. In yet another embodiment the access control device of Figure 5 may comprise a database for storing the content to be offered for download and consumption to users and also a memory for storing the times that this content may be available for access and download by the user equipment or device. These embodiments are not shown in Figure 5.

It is believed that many advantages of the invention described are fully understood from the provided description. It will be apparent though that various changes may be

made in the form, construction, and arrangement of the exemplary embodiments without departing from the scope of the invention, or without sacrificing all of its advantages. Because the invention presented can be varied in many ways, it will be recognized that the invention should be limited only by the scope of the claims that follow.

Claims

1. A method for providing access to a content of a server (102) to a user equipment (108) in a communications network, wherein the user equipment (108) requests access to said content of the server (102), the method comprising the steps of

- obtaining (203) a set of parameters by the server (102) based on an access policy of said content, said server determining a first and at least one further start time when said content is available for access by the user equipment (108) based on the set of parameters,
- sending (207) by the server (102) to the user equipment (108) a response indicating the first and the at least one further start time,
- selecting by the user equipment (108) one of the first or the at least one further start time when said user wants to access said content,
- providing (220) by the server (102) access to said content to the user equipment (108) at the selected start time.

2. The method of claim 1, wherein the access policy is based on network congestion information.

3. The method of claims 1 or 2, wherein the parameters indicate any of a type of the content, a size of the content or an application of the content.

4. The method of any of the preceding claims, wherein upon selection by the user equipment of the first time the server provides immediate access to the content of the server to the user equipment.

5. The method of claim 4, wherein the server providing immediate access to the content of the server to the user equipment comprises the server receiving an authorization to provide immediate access to its content to the user equipment.

6. The method of any of the preceding claims, wherein upon selection by the user equipment of one of the at least one further start times the server provides access to the content of the server to the user equipment at a pre-defined time.

7. The method of any of the preceding claims wherein the step of comprising access to said content to the user equipment at the selected start time further comprises the step of the server sending a URL to the user equipment for invoking to download the content.

8. A system comprising a server (102) and a user equipment (108) in a communication network for providing access to a content of the server (102) to the user equipment (108), wherein the user equipment (108) requests access to said content of the server (102) and wherein the server (102) is adapted to obtain a set of parameters based on an access policy of said content, said server (102) being further adapted to determine a first and at least one further start time when said content is available for access by the user equipment based on the set of parameters, to send to the user equipment (108) a response indicating the first and the at least one further start time, the user equipment (108) being adapted to select one of the first or the at least one further start time when said user wants to access said content, said server (102) being further adapted to provide access to said content to the user equipment (108) at the selected start time.

9. An access control device (500) for providing access to a content of a server to a user equipment in a communications network, wherein the user equipment requests access to said content of the server, the access control device (500) comprising a first interface (502) adapted to obtain a set of parameters based on an access policy of said content, a processor (504) adapted to determine a first and at least one further start time when said content is available for access by the user equipment based on the set of parameters received by the interface (502) and to send a response indicating the first and the at least one further start time to the user equipment, said access control device further comprising a second interface (506) adapted to receive a response from the user equipment said response comprising a selection of the first or the at least one further start time when said user wants to access said content and to provide access to said content to the user equipment at the selected start time.

10. The access control device of claim 9, adapted to perform any of the steps of the method of claims 1 – 7.

11. The system of claim 8, adapted to operate according to the method of claims 1 – 7.

12. A computer program product comprising program code to be executed by a processor of an access control device, thereby causing the access control device to operate according to a method as defined in any one of claims 1 – 7.

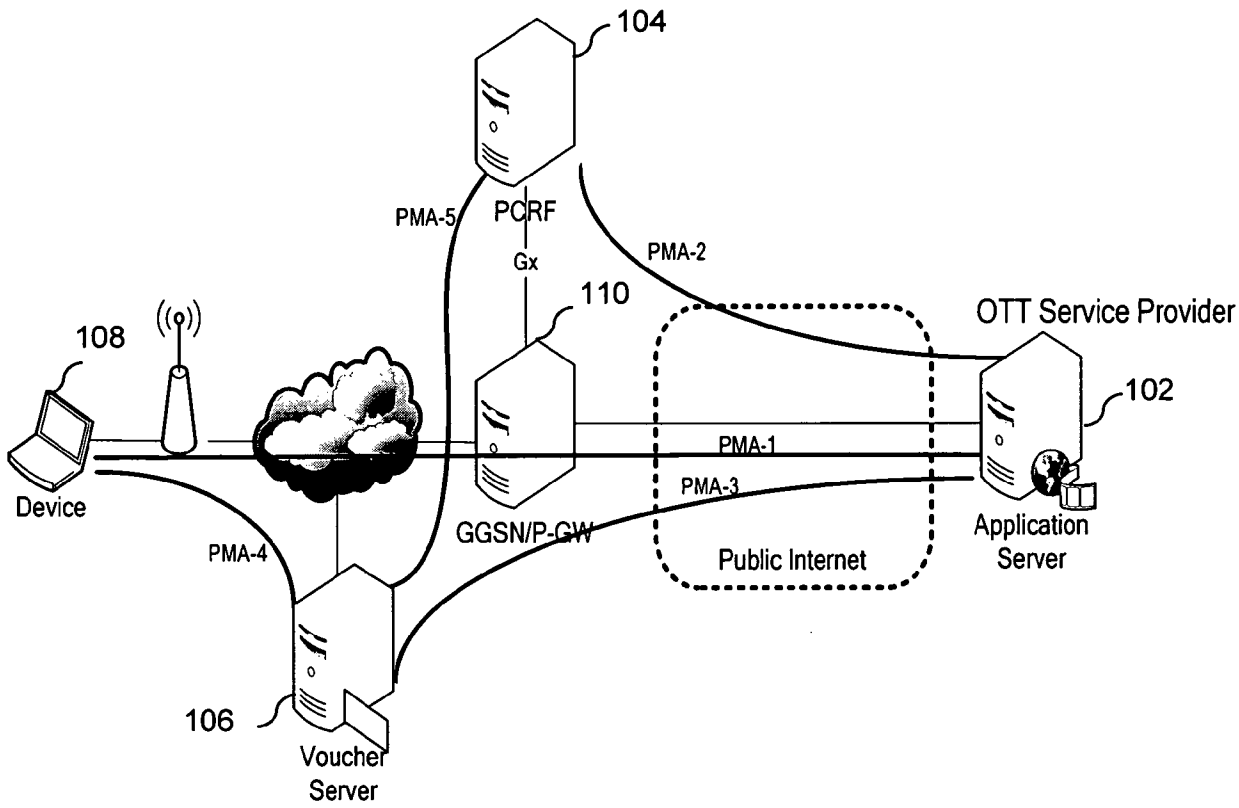
104
PMA-5
PCRF
Gx
PMA-2
110
OTT Service Provider
108
102
PMA-1
PMA-3
Device
GGSN/P-GW
Application
Server
Public Internet
PMA-4
106
Voucher
Server

Fig. 1

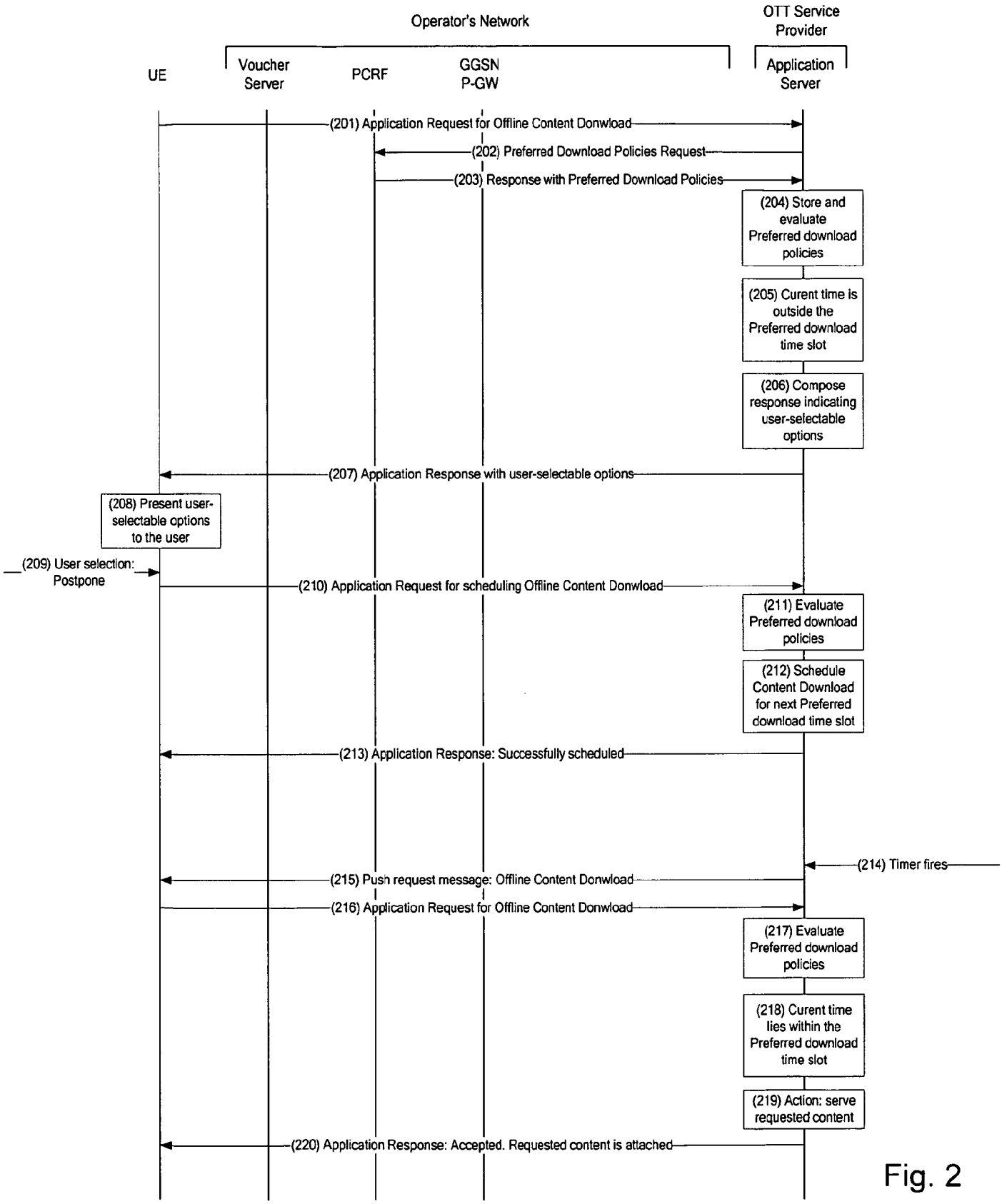
Operator's Network
OTT Service Provider
UE
Voucher Server
PCRF
GGSN P-GW
Application Server
(201) Application Request for Offline Content Donwload
(202) Preferred Download Policies Request
(203) Response with Preferred Download Policies
(204) Store and evaluate Preferred download policies
(205) Curent time is outside the Preferred download time slot
(206) Compose response indicating user-selectable options
(207) Application Response with user-selectable options
(208) Present user-selectable options to the user
(209) User selection: Postpone
(210) Application Request for scheduling Offline Content Donwload
(211) Evaluate Preferred download policies
(212) Schedule Content Download for next Preferred download time slot
(213) Application Response: Successfully scheduled
(214) Timer fires
(215) Push request message: Offline Content Donwload
(216) Application Request for Offline Content Donwload
(217) Evaluate Preferred download policies
(218) Curent time lies within the Preferred download time slot
(219) Action: serve requested content
(220) Application Response: Accepted. Requested content is attached

Fig. 2

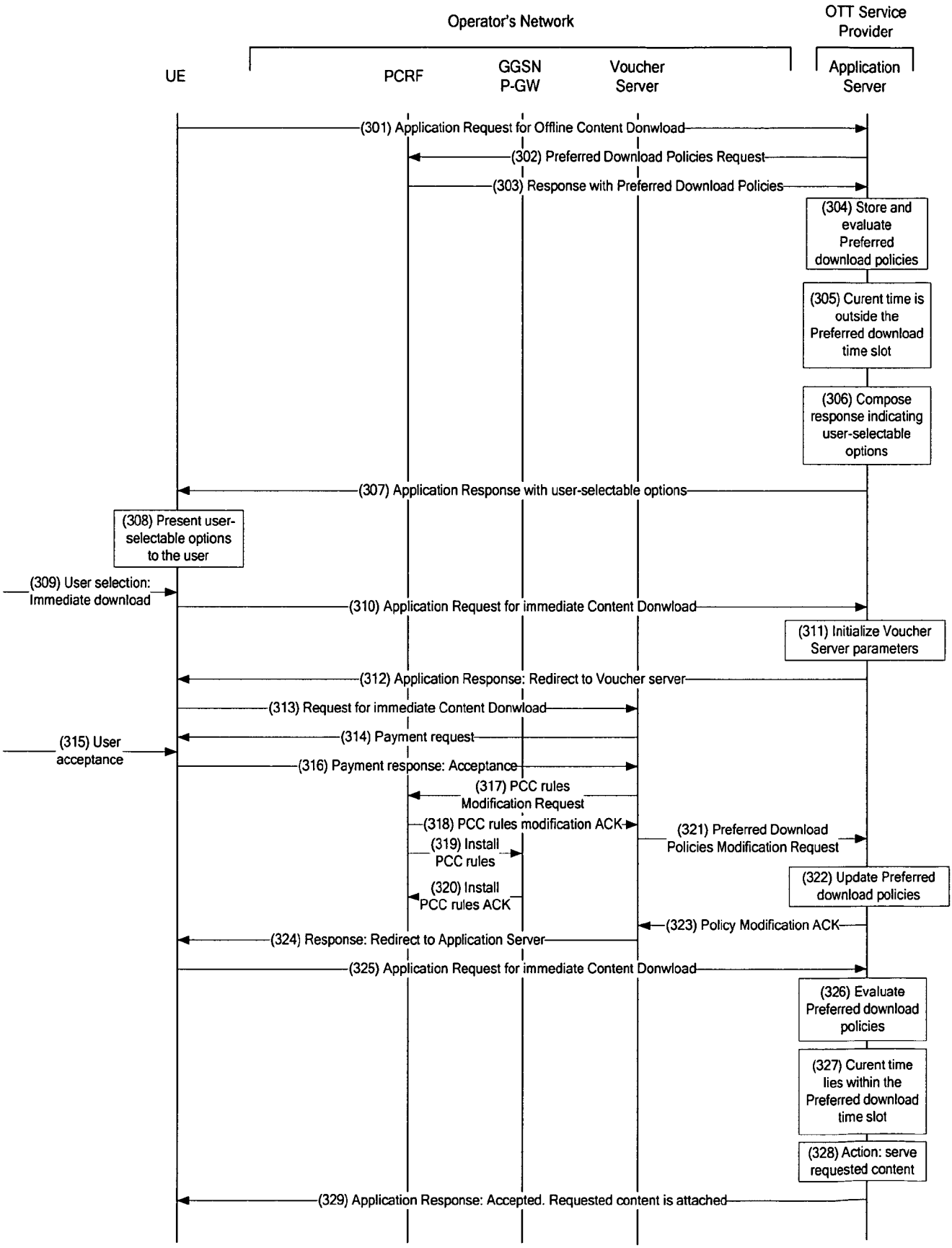
Operator's Network
OTT Service Provider
UE
PCRF
GGSN P-GW
Voucher Server
Application Server
(301) Application Request for Offline Content Donwload
(302) Preferred Download Policies Request
(303) Response with Preferred Download Policies
(304) Store and evaluate Preferred download policies
(305) Curent time is outside the Preferred download time slot
(306) Compose response indicating user-selectable options
(307) Application Response with user-selectable options
(308) Present user-selectable options to the user
(309) User selection: Immediate download
(310) Application Request for immediate Content Donwload
(311) Initialize Voucher Server parameters
(312) Application Response: Redirect to Voucher server
(313) Request for immediate Content Donwload
(314) Payment request
(315) User acceptance
(316) Payment response: Acceptance
(317) PCC rules Modification Request
(318) PCC rules modification ACK
(319) Install PCC rules
(320) Install PCC rules ACK
(321) Preferred Download Policies Modification Request
(322) Update Preferred download policies
(323) Policy Modification ACK
(324) Response: Redirect to Application Server
(325) Application Request for immediate Content Donwload
(326) Evaluate Preferred download policies
(327) Curent time lies within the Preferred download time slot
(328) Action: serve requested content
(329) Application Response: Accepted. Requested content is attached

Fig. 3

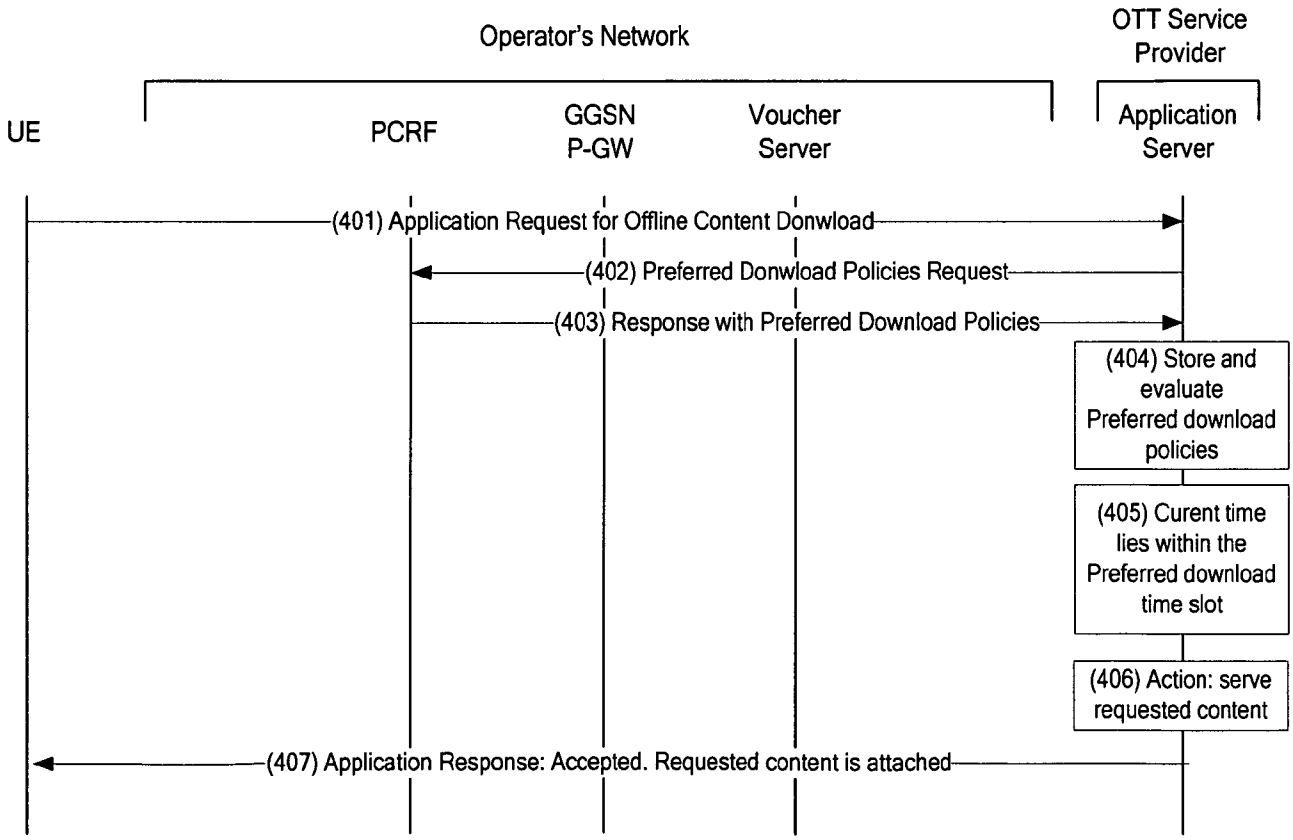
Operator's Network
OTT Service Provider
UE
PCRF
GGSN P-GW
Voucher Server
Application Server
(401) Application Request for Offline Content Donwload
(402) Preferred Donwload Policies Request
(403) Response with Preferred Download Policies
(404) Store and evaluate Preferred download policies
(405) Curent time lies within the Preferred download time slot
(406) Action: serve requested content
(407) Application Response: Accepted. Requested content is attached

Fig. 4

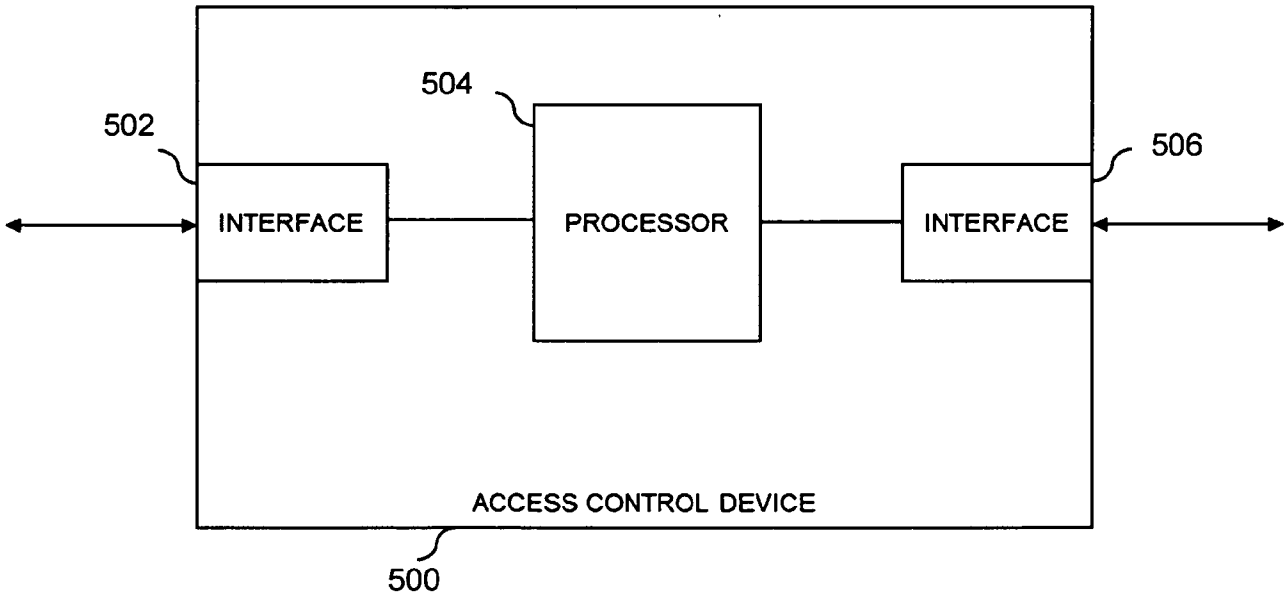
504
502
506
INTERFACE
PROCESSOR
INTERFACE
ACCESS CONTROL DEVICE
500

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/075640

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/08
ADD.

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)
H04L H04W

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001/037256 A1 (YAZAWA HIROYUKI [JP]) 1 November 2001 (2001-11-01) paragraphs [0001] - [0155]; figures 2-3,7-9	1-12
A	US 2012/257560 A1 (SRINIVASAN SUDHARSHAN [US] ET AL) 11 October 2012 (2012-10-11) paragraphs [0032] - [0049], [0205] - [0207]; figure 5	1-12
A	US 2003/045273 A1 (PYHALAMMI SEPPO [FI] ET AL PYHAELAMMI SEPPO [FI] ET AL) 6 March 2003 (2003-03-06) abstract; figure 7	1-12

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* 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

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"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	Date of mailing of the international search report
21 October 2013	29/10/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pandolfi, Alessandra

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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