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Sehn

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(54) **CONTENT DELIVERY NETWORK FOR EPHEMERAL OBJECTS**

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H04L 29/08 (2006.01)
H04L 12/58 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 67/26*** (2013.01); ***H04L 51/08*** (2013.01); ***H04L 67/2842*** (2013.01)

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CPC H04W 4/02; H04W 88/182; H04W 40/20; H04W 8/18; H04L 67/22; H04L 67/2847; H04L 67/26; H04L 67/101; H04L 67/1085; H04L 67/104; H04L 51/38; H04L 12/1825
See application file for complete search history.

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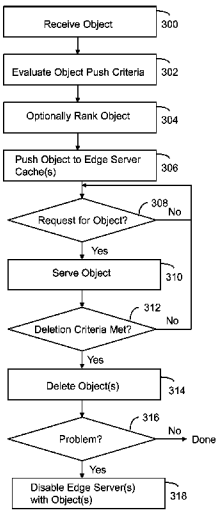
(57) **ABSTRACT**

A computer implemented method includes receiving an object scheduled for automatic deletion after a specified viewing period, a specified number of views or a specified period of time. Object push criteria are evaluated. The object is pushed to an edge server cache in response to evaluating. The object is served in response to a request for the object.

15 Claims, 3 Drawing Sheets



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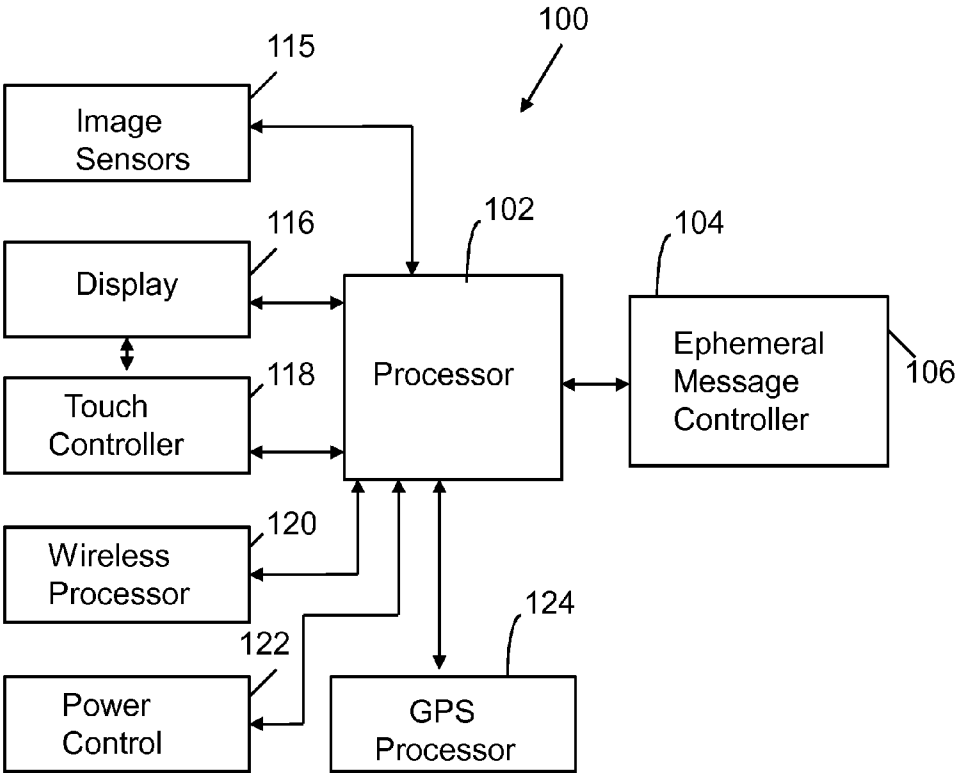
100
115
Image Sensors
116
Display
102
104
Processor
Ephemeral Message Controller
106
118
Touch Controller
120
Wireless Processor
122
Power Control
124
GPS Processor

FIG. 1

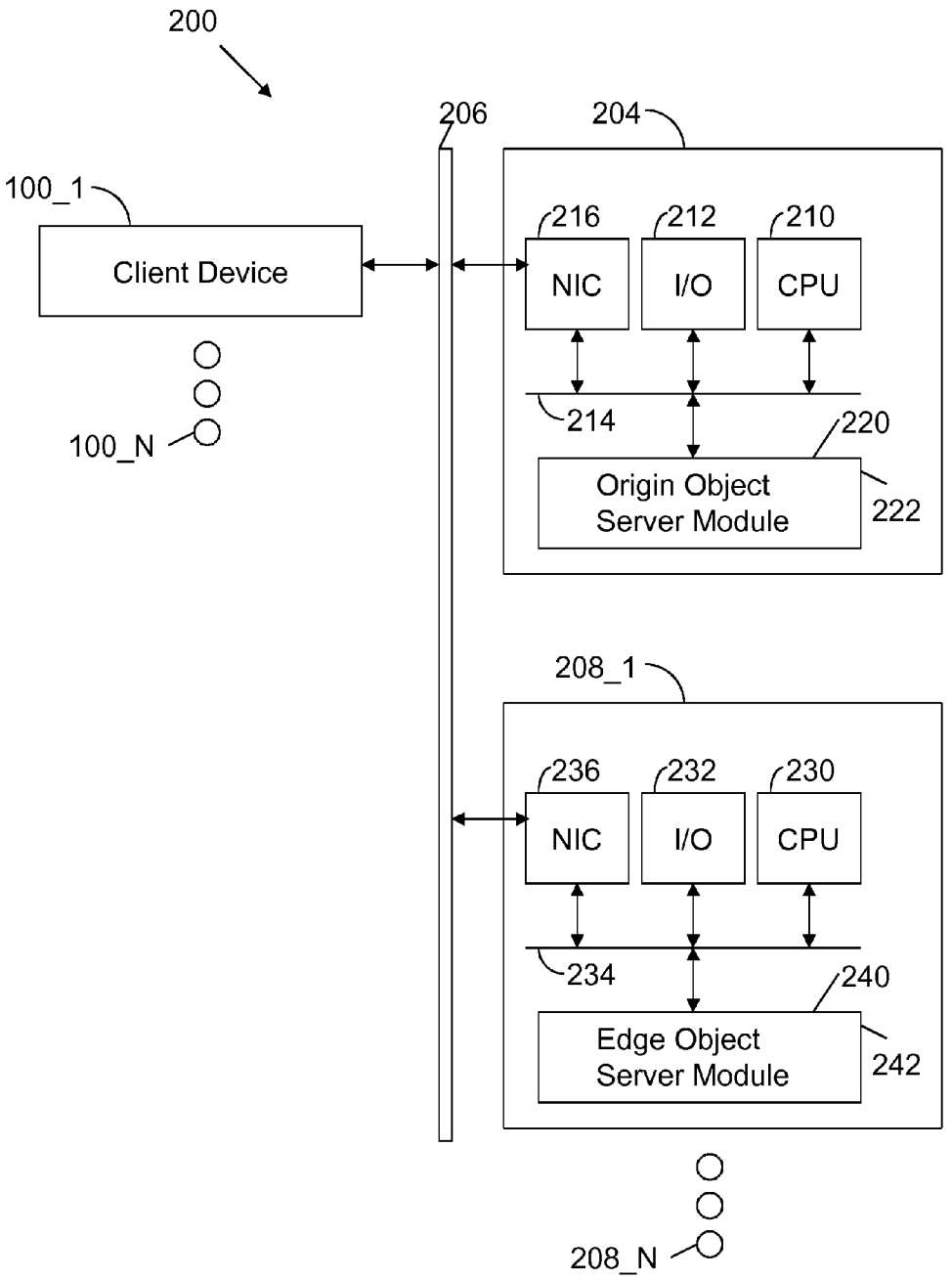
200
206
204
100_1
Client Device
100_N
216
212
210
NIC
I/O
CPU
214
220
Origin Object
Server Module
222
208_1
236
232
230
NIC
I/O
CPU
234
240
Edge Object
Server Module
242
208_N

FIG. 2

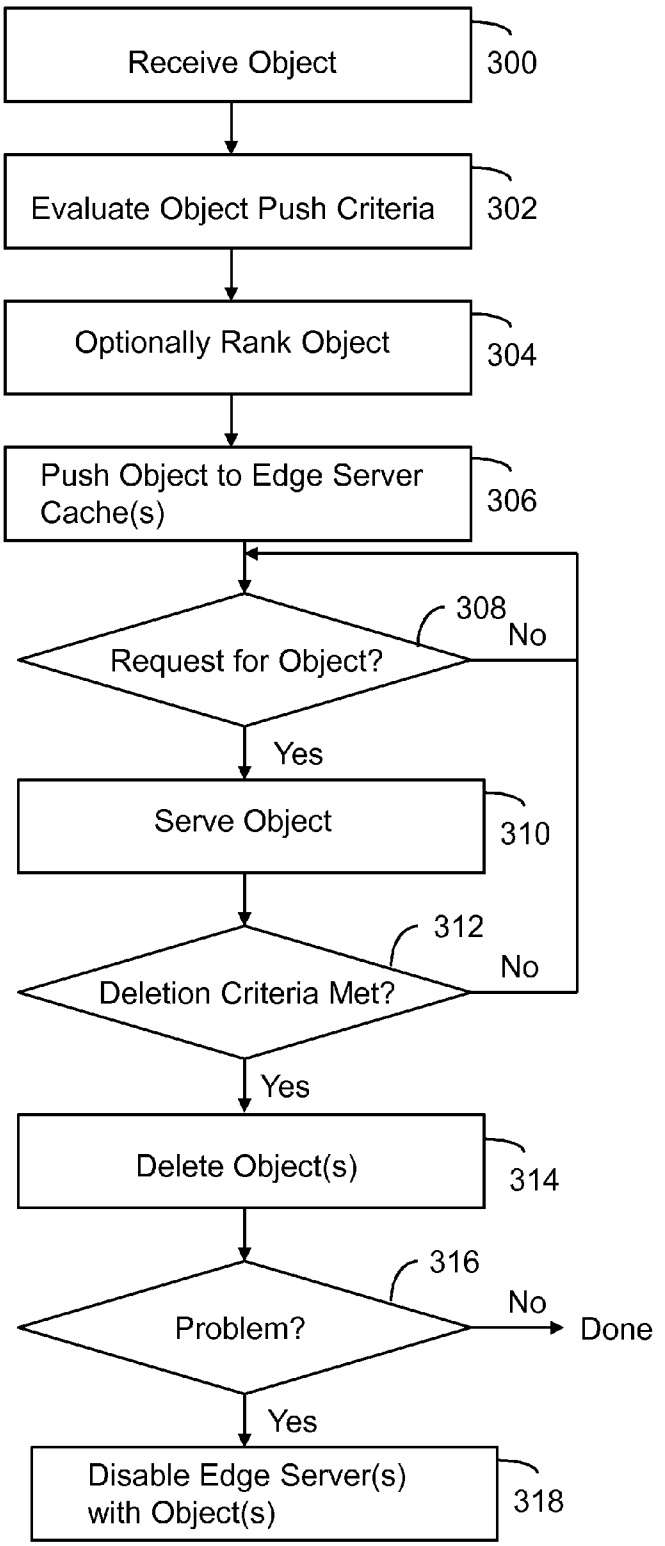
Receive Object
300
Evaluate Object Push Criteria
302
Optionally Rank Object
304
Push Object to Edge Server Cache(s)
306
Request for Object?
308
No
Yes
Serve Object
310
Deletion Criteria Met?
312
No
Yes
Delete Object(s)
314
Problem?
316
No
Done
Yes
Disable Edge Server(s) with Object(s)
318

FIG. 3

CONTENT DELIVERY NETWORK FOR EPHEMERAL OBJECTS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 14/201,707 filed Mar. 7, 2014, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to network communications. More particularly, this invention relates to a content delivery network for ephemeral objects.

BACKGROUND OF THE INVENTION

Traditional Content Delivery Networks (CDNs) work on a pull-based model. The CDN advertises a Hypertext Transport Protocol (HTTP) endpoint to the internet. Client requests are then routed to the closest (in internet terms) endpoint. If the target of the HTTP request is not in the cache of an endpoint, the CDN makes an origin (where the object is mastered) request, pulls the target of the HTTP request to the endpoint and caches the payload of the request. This adds additional latency. If the target of the HTTP request is in the cache, the request is served from the endpoint. These requests are served with lower latency because the object does not need to travel as far. Objects in the cache are evicted based on a predetermined model, such as a Least Recently Used model.

This approach is tailored for large objects that are read many times. This approach is not suitable for objects that are either read once or read very few times.

In view of the foregoing, it would be desirable to provide improved techniques for distributing ephemeral objects in a content delivery network.

SUMMARY OF THE INVENTION

A computer implemented method includes receiving an object scheduled for automatic deletion after a specified viewing period, a specified number of views or a specified period of time. Object push criteria are evaluated. The object is pushed to an edge server cache in response to evaluating. The object is served in response to a request for the object.

BRIEF DESCRIPTION OF THE FIGURES

The invention is more fully appreciated in connection with the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates a client device utilized in accordance with an embodiment of the invention.

FIG. **2** illustrates a system configured in accordance with an embodiment of the invention.

FIG. **3** illustrates processing operations associated with an embodiment of the invention.

Like reference numerals refer to corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** illustrates an electronic device **100** utilized in accordance with an embodiment of the invention. In one embodiment, the electronic device **100** is a smartphone with a processor **102** in communication with a memory **104**. The processor **102** may be a central processing unit and/or a graphics processing unit. The memory **104** is a combination of flash memory and random access memory. The memory **104** stores an ephemeral message controller **106**. The ephemeral message controller **106** includes executable instructions to display ephemeral messages. An ephemeral message may be a text, an image, a video and the like. The display time for the ephemeral message is typically set by the message sender. However, the display time may be a default setting or a setting specified by the recipient. Regardless of the setting technique, the message is transitory. That is, the message is automatically deleted after a specified viewing period, a specified number of views or a specified period of time (e.g., 24 hours). The ephemeral message controller **106** controls deletion of the object at the client device **100**, while other controllers delete network instances of the object, as discussed below.

The processor **102** is also coupled to image sensors **115**. The image sensors **115** may be known digital image sensors, such as charge coupled devices. The image sensors capture visual media, which is presented on display **116**.

A touch controller **118** is connected to the display **116** and the processor **102**. The touch controller **118** is responsive to haptic signals applied to the display **116**. In one embodiment, the ephemeral message controller **106** monitors signals from the touch controller **118**. If haptic contact is observed by the touch controller **118** then an ephemeral message is displayed until its automatic deletion time is reached. The electronic device **100** may also include other components commonly associated with a smartphone, such as a wireless signal processor **120** to support wireless communications, a power control circuit **122** and a global positioning system processor **124**.

FIG. **2** illustrates a system **200** configured in accordance with an embodiment of the invention. The system **200** includes a set of client devices **100_1** through **100_N**. The client devices **100** are connected to a network **206**, which is any combination of wireless and wired network communication devices. A server **204** is also connected to the network **206**. The server **204** includes standard components, such as a central processing unit **210** and input/output devices **212** connected via a bus **214**. The input/output devices **212** may include a keyboard, mouse, display and the like. A network interface circuit **216** is also connected to the bus **214** to provide connectivity to network **206**. A memory **220** is also connected to the bus **214**. The memory **220** includes modules with executable instructions, such as an origin object server module **222**. The origin object server module **222** implements content delivery network operations for ephemeral objects, as discussed below. The memory **220** may also include executable instructions to support the receipt, distribution and deletion of ephemeral objects.

FIG. **2** also includes a set of edge servers **208_1** through **208_N**. Each edge server **208** includes standard components, such as a central processing unit **230**, input/output devices **232**, a bus **234** and network interface circuit **236** to provide connectivity to network **206**. A memory **240** is also connected to the bus **234**. The memory **240** stores executable instructions, such as an edge object server module **242**. The edge object server module **242** includes executable instructions to communicate with the origin object server module **222**, receive ephemeral objects, serve ephemeral objects and automatically delete ephemeral objects after a specified viewing period, a specified number of views or a specified period of time.

The server **204** operates as an origin server in a content delivery network, while servers **208_1** operate as edge servers in the content delivery network. Client requests for ephemeral

objects from the client devices **100** are serviced by the origin server **204** and/or one of the edge servers **208**.

FIG. **3** illustrates processing operations associated with an embodiment of the invention. Initially, an object is received **300**. For example, a client device **100** generates an ephemeral photograph and associated text message, which is received by the server **204**. The object may be a text message with an accompanying video or simply a photograph or video without a text message.

The origin object server module **222** evaluates object push criteria **302**. In general, the push criteria specifies a set of policies for distributing the object to one or more edge servers **208** with the goal that a request for the object by a client device **100** is serviced by an edge server proximate to the client device **100**. The object push criteria may include content delivery network traffic patterns. In this case, an object may be pushed to a specified edge server **208** for load balancing purposes.

The object push criteria may include historical use patterns of a user. The historical use patterns may assess how frequently a user processes objects, when a user processes objects (e.g., only at night) and other behaviors observed through prior consumption of ephemeral objects. Simple historical use pattern rules may be relied upon, such as push an object to an edge server only if the user hit that edge server in the last twenty-four hours.

The object push criteria may include a social graph associated with a user. In particular, a social graph and past history of communication between two users may be used to probabilistically deliver an object to an edge server that is likely to be accessed by a message recipient.

The object push criteria may also include geolocation information. The GPS processor **124** of client device **100** may deliver geolocation information to the origin object server module **222**, which may be used to place an object at an edge server that is physically proximate to the geolocation of the user.

The next operation of FIG. **3** is to optionally rank the object **304**. The ranking is for cache eviction management purposes. Observe that a Least Recently Used cache eviction protocol does not make sense because the object is being speculatively populated to the edge server cache. A ranking may be based upon historical use patterns of a user. For example, an object intended for a frequent user would be ranked higher than an object intended for an episodic user. Alternately, an object may be ranked based upon geolocation information such that objects pushed to edge servers close to the user are ranked higher than objects pushed to edge servers far from the user. The rank may be based upon available space versus the probability an object would be served from that edge server.

The next operation of FIG. **3** is to push the object to an edge server, such as an edge server cache **306**. Observe here that the object is not sent to the edge server in response to a request, as is the typical case in a content delivery network. Rather, the object is speculatively pushed to the edge server based upon the object push criteria.

The next operation of FIG. **3** is to determine whether there is a request for the object **308**. This condition may be tested at any number of edge servers. If there is such a request (**308**—Yes), the object is served **310**. It is then determined whether deletion criteria is met **312**. For example, the deletion criteria may dictate that the object is deleted after a single viewing of 3 seconds. Alternately, the deletion criteria may specify that the object is deleted after a specified number of views (either by a single individual or different individuals). Alternately, the deletion criteria may specify that the object is deleted after a specified period of time, such as 24 hours. If the deletion criteria is not met (**312**—No), the edge server waits for additional requests for the object **308**. If the deletion criteria is met (**312**—Yes), the object or objects are deleted **314**. This operation may entail deletion of the object at a number of edge servers. Therefore, the system determines if there is problem in the deletion process **316**. For example, origin object server module **222** may supervise this deletion process. If there is no problem (**316**—No), then processing is complete. If there is a problem, (**316**—Yes), any number of remedial actions may be taken, including, if necessary, disabling any edge server containing the object **318**. Different deletion strategies may be deployed. For example, one may delete every instance of the object except one instance, sever the one instance and then delete the final (one) instance. Alternately, the object may be served and then all deletion operations may be performed.

An embodiment of the present invention relates to a computer storage product with a non-transitory computer readable storage medium having computer code thereon for performing various computer-implemented operations. The media and computer code may be those specially designed and constructed for the purposes of the present invention, or they may be of the kind well known and available to those having skill in the computer software arts. Examples of computer-readable media include, but are not limited to: magnetic media, optical media, magneto-optical media and hardware devices that are specially configured to store and execute program code, such as application-specific integrated circuits ("ASICs"), programmable logic devices ("PLDs") and ROM and RAM devices. Examples of computer code include machine code, such as produced by a compiler, and files containing higher-level code that are executed by a computer using an interpreter. For example, an embodiment of the invention may be implemented using JAVA®, C++, or other object-oriented programming language and development tools. Another embodiment of the invention may be implemented in hardwired circuitry in place of, or in combination with, machine-executable software instructions.

The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough understanding of the invention. However, it will be apparent to one skilled in the art that specific details are not required in order to practice the invention. Thus, the foregoing descriptions of specific embodiments of the invention are presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed; obviously, many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, they thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the following claims and their equivalents define the scope of the invention.

What is claimed is:

1. A computer implemented method, comprising:

receiving an ephemeral object scheduled for automatic deletion after a specified viewing period, a specified number of views or a specified period of time, wherein the ephemeral object has a designated recipient;

evaluating object push criteria including behaviors observed through prior consumption of ephemeral objects by the designated recipient;

pushing the object to an edge server cache in response to evaluating, wherein pushing is performed speculatively prior to the designated recipient requesting the ephemeral object; and

ascribing a cache management rank to the object based upon available space at an edge server versus the probability the ephemeral object will be served from the edge server.

2. The computer implemented method of claim **1** further comprising serving the object from the edge server in response to a request for the object by the designated recipient.

3. The computer implemented method of claim **1** wherein the object is a message.

4. The computer implemented method of claim **1** wherein the object is a message with an accompanying picture.

5. The computer implemented method of claim **1** wherein the object is a message with an accompanying video.

6. The computer implemented method of claim **1** wherein the object push criteria includes content delivery network traffic patterns.

7. The computer implemented method of claim **1** wherein the object push criteria includes historical use patterns of a user.

8. The computer implemented method of claim **1** wherein the object push criteria includes a social graph associated with a user.

9. The computer implemented method of claim **1** wherein the object push criteria includes geolocation information.

10. The computer implemented method of claim **1** further comprising ascribing a cache management rank to the object based upon historical use patterns of the designated recipient.

11. The computer implemented method of claim **1** further comprising ascribing a cache management rank to the object based upon geolocation information of the designated recipient.

12. The computer implemented method of claim **1** further comprising deleting every instance of the object.

13. The computer implemented method of claim **12** wherein deleting is performed after serving the ephemeral object.

14. The computer implemented method of claim **12** further comprising checking for an object deletion problem.

15. The computer implemented method of claim **14** further comprising disabling an edge server in response to an object deletion problem.

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