# DEVICES, METHODS, AND SYSTEMS FOR FREQUENCY CAPPING THE FORMAT IN WHICH CONTENT IS DELIVERED

## Technical Field

**[0001]** The disclosure relates generally to content delivery in on-line systems and, in particular, to the way in which ancillary content, such as an advertisement, is displayed when delivering it to a user of the on-line system.

## Background

**[0002]** On-line systems such as websites, mobile applications, and other on-line services frequently deliver ancillary content (e.g., advertising content) to users of the website, mobile application, or on-line service. Typically, the delivery of advertising content provides the on-line system with a revenue stream so that it may offer access to the main content of the on-line system to users for reduced pricing or for free. Such ancillary content may be delivered to a user in any number of ways, such as through blurbs embedded within the main content of the on-line system, pop-up windows to which the user must respond before being able to return to the main content, banners (e.g., fixed, scrolling, etc.) at the top, bottom, and/or sides of the main content, carousels, feed listings, etc. And although users have come to expect delivery of such ancillary content interposed amid the main content, the repetitive delivery of ancillary content may nevertheless diminish a user's enjoyment of the main content of the on-line system and/or may diminish a user's receptiveness to the ancillary content.

## Brief of the Drawings

**[0003]** In the following description, various exemplary aspects of the disclosure are described with reference to the following drawings, in which:

FIG. 1 shows an exemplary content delivery system for delivering ancillary content to a user; and

FIG. 2 illustrates an exemplary content-serving algorithm that may be utilized by a content delivery service to control the frequency of content delivery for a particular format.

## Description

**[0004]** The following detailed description refers to the accompanying drawings that show, by way of illustration, exemplary details and features.

**[0005]** Any aspect described herein as "exemplary" is not indented to mean preferred or advantageous over other aspects. Instead, the word "exemplary" is used herein to mean "serving as an example, instance, or illustration."

**[0006]** Throughout the drawings, it should be noted that like reference numbers are used to depict the same or similar elements, features, and structures, unless otherwise noted. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the exemplary principles of the disclosure.

**[0007]** The term "processor" as used herein may be understood to be any kind of technological entity (e.g., hardware, software, and/or a combination of both) that allows handling of data. The data may be handled according to one or more specific functions executed by the processor. Further, a processor may be understood as any kind of circuit, *e.g.*, any kind of analog or digital circuit and may include an analog circuit, digital circuit, mixed-signal circuit, software, firmware, logic circuit, processor, microprocessor, Central Processing Unit (CPU), Graphics Processing Unit (GPU), Digital Signal Processor (DSP), Field Programmable Gate Array (FPGA), integrated circuit, Application Specific Integrated Circuit (ASIC), etc., or any combination thereof. Any other kind of implementation of the respective functions, which will be described below in further detail, may also be understood as a processor. It is understood that any two (or more) processors may be realized as a single entity with equivalent

functionality or the like, and conversely that any single processor may be realized as two (or more) separate entities with equivalent functionality or the like.

**[0008]** As used herein, "memory" or "datastore" is understood as a computer-readable medium (*e.g.*, a non-transitory, computer-readable medium) in which data or information can be stored for retrieval. References to "memory" or "datastore" included herein may thus be understood as referring to volatile or non-volatile memory, including random access memory (RAM), read-only memory (ROM), flash memory, solid-state storage, magnetic tape, hard disk drive, optical drive, etc., or any combination thereof. Registers, shift registers, processor registers, data buffers, among others, are also embraced herein by the term memory. The term "software" refers to any type of executable instruction, including firmware.

**[0009]** The term "communicate" encompasses one or both of transmitting and receiving, i.e., unidirectional or bidirectional communication in one or both of the incoming and outgoing directions. The term "calculate" encompasses both "direct" calculations via a mathematical expression/formula/relationship and "indirect" calculations via lookup or hash tables and other array indexing or searching operations.

**[0010]** As used herein the term "content" is meant to refer generally to information that is published to a user in, for example, an application, on a website, in an on-line service, etc. The content may be the "main" content of the application or website, meaning it is the content the user seeks and why the user accesses the application, website, or service. Content may be "ancillary" content, in the sense that it is not necessarily the main content sought by the user when using the application, accessing the website, or using the service, but is nevertheless delivered to the user, such as advertising content, third-party content, or other content that is in addition to, supplemental to, or along side the main content, the most common example of which is advertising content. Thus, to the extent examples herein refer to "advertising content" or an "advertisement," this should be understood to broadly encompass any type of ancillary content and not limited to an advertisement. In addition, the term "on-line" is used herein to

refer generally to systems that are capable of communicating with other systems (e.g., a client-based application that communicates with a cloud-based service), typically via an internet communication protocol. "On-line" is not meant to require continuous connectivity, and instead, such connectivity with other systems (e.g., a remote server, a cloud- or edge-based service, etc.) may be continuous, regular, irregular, and/or intermittent.

**[0011]** As noted above, on-line systems such as websites, mobile applications, and other on-line services frequently deliver ancillary content (e.g., advertisements) to their users. As should be understood, the provider of such an on-line system is often referred to as a "publisher," who utilizes a client-side delivery mechanism such as an application, website, etc. to deliver its main content to a user of the system, alongside which, the client-side delivery mechanism may also deliver ancillary content such as advertising content to the user. The repetitive delivery of ancillary content, however, may diminish a user's enjoyment of the system and/or may diminish a user's receptiveness to the ancillary content. For example, if a user receives too many advertisements while using a given application/website, the user may grow weary of the application/website and stop using it or use it less frequently, e.g., in favor of other applications/websites. Similarly, if the user too often receives the same advertisement, the user may grow weary of the item of advertising content and become less receptive or even hostile to the item of advertising content or even to the main content alongside which the item of advertising content is delivered.

**[0012]** To combat this, content delivery systems may offer suppliers of ancillary content (e.g., an advertiser of advertising content) a way to limit the number of times a user is delivered a particular item of ancillary content. This limitation is often called "frequency capping," where, using advertising content as an example, the number of times a specific item of advertising content is delivered to a user is capped to a particular frequency so that the item of advertising content is delivered to a user a maximum number of times during a specified time period (e.g., deliver a particular ad to a user no more than three times per week). This frequency

capping is typically controlled from the perspective of the owner of the item of ancillary content (e.g., an advertiser), who wants to limit, irrespective of on which websites/application the item of ancillary content is delivered (e.g., on any publisher's application, website, or on-line service that the user may access), the number of times a given user has been delivered this item of ancillary content. While such frequency capping may help advertisers avoid a user's weariness with a particular item of ancillary content, it does not address the problem from the perspective of the publisher/provider of the application, website, or on-line service, where a user may grow weary of the application, website, or on-line service itself on account of the number and way in which ancillary content is delivered, irrespective of which item of ancillary content is delivered. With this type of frequency capping, a publisher/provider of the application, website, or on-line service may not be able to optimize its user experience.

**[0013]** In contrast to conventional content delivery systems, the disclosed content delivery system discussed in more detail below provides for format capping from the perspective of the publisher so that the number and way in which ancillary content is delivered may be frequency capped, irrespective of the content itself. Thus, while conventional frequency capping is from the perspective of the ancillary content provider (e.g., an advertiser) and specific to the item of ancillary content itself, the disclosed content delivery system provides capping of content delivery in terms of the format type (e.g., how an item of content is delivered/displayed to a user), without regard to the particular content (e.g., what item of content is delivered). By frequency capping at the format-type level, this may improve the user experience for the user of the application, website, or on-line service because it allows for controlling how frequently a certain type of content delivery mechanism is used for delivering ancillary content.

**[0014]** For example, different types of content delivery formats may include: a pop-up window that must be acknowledged by the user before the user may return to the main content of the on-line system/application; a scrolling or fixed banner that may be on the sides, top, bottom, or within the main content of the on-line system/application; a content delivery area

embedded within the main content of the on-line system/application; a carousel of ads, a feed listing of ads, etc. The distinction among the different types of delivery formats may be understood as the way the ancillary content is displayed to the user within the user interface and/or the way in which the user may engage with the ancillary content (e.g., a timed pop-pop with the content, a button to click to dismiss a pop-up with the content, a series of prompts that must be followed on a rewarded ad, scrolling passed ancillary content embedded within/alongside the main content, viewing a carousel of changing ancillary content, etc.).

**[0015]** Using pop-up windows as one example of a format type by which advertising content may be delivered, the disclosed content delivery system may be configurable to track and limit the frequency with which a pop-up window has been used to deliver advertising content to a user of the on-line system. Once the frequency limit (e.g., the pop-up window frequency cap) has been reached with respect to the user, the disclosed content delivery system may suspend delivery via pop-up windows of advertising content to the user until the cap resets (e.g., at the start of the next frequency cycle). As noted above, the pop-up window frequency cap may be agnostic to the item of content that is delivered through the pop-up window. In this manner, the total number of pop-ups encountered by a user of the application/website will be set by the publisher (e.g., at the application/website level), irrespective of the underlying item of advertising content delivered in the pop-ups and irrespective the overall number of times the item of advertising content may have been delivered to the user.

**[0016]** The disclosed content delivery system may have a number of components to facilitate frequency capping based on type of delivery format. The content delivery system may include a configuration service for defining types of delivery formats for which frequency capping may be set. For example, the configuration service may define different types of delivery formats with a format specification that maps a "format id" to a type of delivery format. For example, the format specification may be a set of tuples such as:

$$< 1, Pop\text{-}up >;$$

$< 2, Carousel >$;

$< 3, Feed\ listing >$; etc.

**[0017]** In the exemplary tuples above, a format id of 1 corresponds to a pop-up, a format id of 2 corresponds to a carousel, a format id of 3 corresponds to a feed-listing, etc. The configuration service may also provide a mechanism to define frequency capping rules/behavior for each type of delivery format (e.g., $\{< format, time\ duration > : frequency\}$). Thus, one example of the configuration service for a pop-up format type may be $\{< pop\text{-}up,\ 1\ day > : 1\}$, which means the content delivery system limits the number of pop-ups delivered to the user to no more than 1 pop-up per 1 day. Another example of the configuration service for a pop-up format type may be $\{< pop\text{-}up,\ 1\ week > : 15\}$, which means the content delivery system limits the number of pop-ups delivered to the user to no more than 15 pop-ups per 1 week. The configuration service may store the frequency caps for any number of different types and units in, for example, a database or datastore using the format specification defining the different types of delivery formats. Thus:

$\{< 1\ (pop\text{-}up), 1\ week > : 2,$

$< 2\ (carousel), 1\ day > : 1,$

$< 3\ (feed\ Listing), 1\ hour > : 2$

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**[0018]** As noted above, the format cap may be agnostic to the content of the pop-up, so that a displayed pop-up counts toward the format cap irrespective of which item of content is delivered. The content delivery system may also include a client-side (e.g., application-side) instrumentation that enables collecting/indicating what types of content formats have been delivered to each user (e.g., allowing tracking of "user views" of the advertising content displayed within the application, website, or other platform). For example, if the client-side application (e.g., the main content publisher) delivers an item of advertising content to a user, the client-side application may indicate a user view with a message indexed by

$< user\_id, format\_id, timestamp >$, where $format\_id$ indicates the type of format in which the item of content was delivered (e.g., whether a pop-up, a banner, a carousel, an in-line ad, a feed listing, etc.), $user\_id$ indicates to which user the content was delivered, and $timestamp$ indicates the date/time at which the content was delivered. Thus, one example of such an indication may be: $< 12345, 1, 2023\text{-}03\text{-}03\ 12{:}28{:}01 >$, where 12345 is the user_id, 1 indicates a pop-up was displayed (e.g., according the example format specification provided above), and the timestamp indicates the date/time for when the pop-up was displayed. The application-side instrumentation may provide the indication of the user view via a hypertext transfer protocol (HTTP) request to a backend event tracking service, as discussed in more detail below.

**[0019]** The indications of user views of the content that is received from the application (e.g., the mobile application or website that displays the content to the user) may be aggregated and/or stored at a backend event tracking service (e.g., using a memory/datastore) so that the content delivery system may determine the total user views within the time period associated with the given type of format cap, user, and frequency. As should be understood, the datastore may optimize the duration for which user views are stored by basing the storage time period on the format frequency capping time period(s). For example, if the longest time period of frequency capping for any type of format is one month, the lifespan of a stored user view may not need to be longer than one month (e.g., the time to live (TTL) may be set to the format frequency time period of the given format capping rule). As another example, if there are more than one capping rule, where, for example, one rule limits the number of pop-ups in a day while a second rule limits the number of carousels in a week, the storage time for user events may be set to one week, as one week is the maximum frequency time period of both capping rules. As should also be appreciated, the datastore may be partitioned for scalability purposes, where the datastore may be partitioned using primary keys of $< user\_id, format\_id >$.

**[0020]** The content delivery system may also include a content delivery service that uses a content-serving algorithm to determine, based on the given format frequency cap and its associated number of user views, whether advertising content may be delivered using a particular format or whether the cap for that particular format has been reached (and, for example, whether a different format may be used that is not capped or has not yet reached its cap). The content delivery service may control the frequency of content delivery in a particular format with the following flow. First, the client-side application (e.g., the mobile app or the website) sends an HTTP request(s) to a content delivery service to obtain the item of content for delivery. The request may include, for example, the user, the type of format in which the item of content is to be delivered, and a timestamp: $< user\_id, format\_id, timestamp >$. Next, the content delivery service may read the configuration rules associated with the format in which the content is to be delivered, for example, by reading in the $< format\_id, duration > : frequency$, to obtain the capping frequency for the associated format. This may be obtained by the content delivery service from the configuration service and/or from the datastore.

**[0021]** Next, the content delivery service may read from the datastore the user events associated with this format and count how many times this format of delivery has been used to show content to this particular user. If the number does not exceed the frequency cap, the item of content may be displayed to the user in the specified format. If the number exceeds the frequency cap read from the configuration rules, the item of content is not displayed to the user in the specified format. If the item of content is not displayed in the specified format, the content delivery system may also check other rules associated with other formats and may determine to deliver the item of content in an alternative format whose cap has not yet been reached (e.g., a "fallback" format). As should be appreciated, the fallback format, order of priority of fallback formats, etc., may be part of the configuration rules and/or may be associated with the item of content to be delivered.

**[0022]** FIG. 1 shows an example of a content delivery system 100 for delivering content (e.g., advertising content) to an app 110 running on a mobile device 101, depicting the components described above. As should be appreciated, mobile device 101 and app 110 are merely exemplary and not intended to be limiting, as content delivery system 100 may be applicable to any type of device or mechanism that publishes content to a user (e.g., a publisher's website, desktop application, etc.). The app 110 may exchange messages with various services (e.g., backend service(s) 160) that are external to the app 110 (e.g., via an application programming interface or "API"). The content delivery system 100 may exchange information among the components through messages that may utilize existing messaging protocols, such as HTTP, HTTPS, etc., via available communication connections (e.g., a wireless internet connection, a wired networking connection, etc.) on mobile device 101.

**[0023]** App 110 may make a request (e.g., via an HTTP request message) to a content delivery service 130 to obtain item of content to be delivered to a user of app 110. The content delivery service 130 may be part of backend service(s) 160. The content delivery service 130 may interact with a configuration service 120 that maintains and allows editing of rules and configuration parameters used by the content delivery service 130. For example, the configuration service 120 may define the different types of delivery formats and associates them with an identification number, such as "format id" discussed above. The configuration service 120 may also allow for configuring the frequency capping rules for each type of defined delivery format, where the configuration rule for a particular format type defines a limit to the number of times the particular format type is to be used to display content to a given user over a particular time period (e.g., the format frequency caps described above).

**[0024]** Importantly, the format frequency cap rule may be defined so as to be agnostic to the item of content to be delivered, meaning that the format frequency cap does not depend on the item of content and applies across any and all items of content delivered to the user using the particular type of format. As noted above, the different types of delivery formats may be

defined by the way in which the user receives the content and/or how the user interacts with the content, and examples of delivery format types may include a pop-up type, a banner type, a carousel type, an in-line ad type, a feed listing type, etc. Each format type, then, may be associated with one or more frequency capping rules for whether and how the delivery frequency is capped (e.g., a maximum number of times per hour, day, week, year, etc.), as discussed above. As should be appreciated, these examples of delivery format types and their frequencies are not limiting, and the configuration service 120 may provide for configuring the delivery format types and their frequencies in any manner.

**[0025]** The configuration service 120 may store the definitions and/or configuration rules in a datastore 150 (e.g., a database of a memory) so that they may be retrieved, modified, removed, etc. by the content delivery system 100. For example, the content delivery service 130 may request the configuration rules (e.g., by sending a request to the configuration service 120 or by querying the datastore 150) in response to a request from the app 110 to deliver an item of ancillary content to a user, as described above. The content delivery service 130 may request the configuration rules in order to obtain the frequency cap for the format type indicated in the request to deliver the item of ancillary content. The configuration service 120 may also request, by querying the datastore 150, the user events that have already been shown to the user in order to determine whether the applicable frequency cap for the user has already been reached or whether an alternative format may be used that is not capped or has not yet reached its cap for the user.

**[0026]** In order to populate the datastore 150 with records of user events (e.g., instances where ancillary content has already been delivered to users), the app 110 may provide an indication of an occurrence a user event to an event tracking service 140 that saves information about the occurrence of the user event in the datastore 150. As noted above, the saved information may include the type of format of how the content was delivered, an identifier for

the user to whom the content was delivered, and a timestamp for when the content was delivered.

**[0027]** If the content delivery service 130 determines that number of user events for the specified format type for the user does not exceed the associated frequency cap, the content delivery service 130 may inform app 110 that the item of content is allowed to be displayed to the user in the specified format. If the content delivery service 130 determines that the number of user events for the particular format type for the user exceeds the associated frequency cap, the content delivery service 130 may inform app 110 that the item of content is not to be displayed to the user in the specified format. If the item of content is not to be displayed in the specified format, the content delivery service 130 may check other rules associated with other formats and may determine that the item of content may be delivered in an alternative format whose cap has not yet been reached (e.g., a "fallback" format), and may inform app 110 that the item of content may be displayed to the user using the fallback format. As should be appreciated, the fallback format, order of priority of fallback formats, etc., may be part of the configuration rules and/or may be associated with the item of content to be delivered.

**[0028]** FIG. 2 shows an example of a content-serving algorithm that may be utilized by a content delivery service (e.g., content delivery service 130) to control the frequency of content delivery for particular format. Using content delivery system 100 of FIG. 1 as an example, app 110 may, in 210, request from content delivery service 130 the item of content to be delivered to a user. This may be, for example, an HTTP request(s). The request may include, for example, an identifier for the user, the type of format in which the content is to be delivered, and a timestamp for when the content is to be delivered. Next, content delivery service 130 may, in 220, obtain configuration rules for the given format in which the item of content is to be delivered (e.g., by requesting the configuration rules from the configuration service 120 and/or datastore 150) for a frequency cap for the given format.

**[0029]** Next, content delivery service 130 may, in 230, read from datastore 150 the user events associated with the given format and count how many times the given format has been used within the time period to deliver content to this particular user. Next, in 240, the content delivery system may control, based on the tallied user events and the format frequency cap, whether and how the item of ancillary content may be delivered to the user. If the number does not exceed the frequency cap for the time period, the item of content may be displayed to the user in the specified format. If the number exceeds the frequency cap read from the configuration rules, the item of content is not displayed to the user in the specified format. If the item of content is not displayed in the specified format, content delivery system 100 may determine to deliver the item of content in an alternative format whose cap has not yet been reached. As should be appreciated, the alternative format, order of priority of fallback to alternative formats, etc., may be part of the configuration rules and/or may be associated with the item of content to be delivered.

**[0030]** In the following, various examples are provided that may include one or more features of the content delivery systems described above. It may be intended that aspects described in relation to the devices may apply also to the described method(s), and vice versa.

**[0031]** Example 1 is a device for controlling content delivery, the device comprising a processor configured to determine a delivery format for delivering an item of ancillary content to a user. The processor is also configured to determine a configuration rule associated with the delivery format, wherein the configuration rule defines a criterion under which the delivery format may be used to deliver the ancillary content to the user. The processor is also configured to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using the delivery format.

**[0032]** Example 2 is the device of example 1, wherein the delivery format indicates a way in which the item of ancillary content is to be delivered to the user.

**[0033]** Example 3 is the device of either one of examples 1 or 2, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0034]** Example 4 is the device of any one of examples 1 to 3, wherein the configuration rule defines, irrespective of the item of ancillary content, a criterion for whether the delivery format may be used when delivering the ancillary content to the user.

**[0035]** Example 5 is the device of any one of examples 1 to 4, wherein the configuration rule includes a frequency cap defining a number of times within a time period the ancillary content may be delivered to the user using the delivery format.

**[0036]** Example 6 is the device of example 5, wherein the time period includes a number of seconds, minutes, hours, days, weeks, months, or years.

**[0037]** Example 7 is the device of any one of examples 1 to 6, wherein the processor is further configured to determine a total number of times within the time period the delivery format has been used to deliver the ancillary content to the user.

**[0038]** Example 8 is the device of example 7, wherein the processor configured to determine the total number of times includes the processor configured to query a datastore of previous deliveries to the user that are associated with delivery format.

**[0039]** Example 9 is the device of example 8, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0040]** Example 10 is the device of example 9, wherein each record of the database of records includes a user view of the ancillary content according to the delivery format.

**[0041]** Example 11 is the device of example 10, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the datastore is configured to remove each record of the database of records where the timestamp is older than a maximum time period of the predetermined time periods.

**[0042]** Example 12 is the device of any one of examples 1 to 11, wherein the delivery format includes one of a plurality of format types, wherein the processor is further configured to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0043]** Example 13 is the device of any one of examples 1 to 12, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0044]** Example 14 is the device of any one of examples 1 to 13, wherein the processor configured to control whether to deliver the item of ancillary content to the user using the delivery format includes the processor configured to send a message to a client-side application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0045]** Example 15 is the device of example 14, wherein the message includes a response from a content delivery service to a request from the client-side application for the ancillary content.

**[0046]** Example 16 is content delivery service including a processor configured to receive from an application a request to deliver, according to a delivery format, an item of ancillary content to a user of the application, wherein the delivery format indicates how the application is to deliver the item of ancillary content to the user. The processor is also configured to obtain a configuration rule that defines, irrespective of the item of ancillary content, a frequency cap associated with the delivery format. The processor is also configured to obtain a number of times the delivery format has been used to deliver ancillary content to the user. The processor is also configured to control, based on the frequency cap and the number of times, whether the application uses the delivery format to deliver the item of ancillary content to the user.

**[0047]** Example 17 is the content delivery service of example 16, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0048]** Example 18 is the content delivery service of either one of examples 16 or 17, wherein the frequency cap includes a predefined number of times the delivery format is permitted to be used within a time period for delivering ancillary content to the user.

**[0049]** Example 19 is the content delivery service of any one of examples 16 to 18, wherein the request includes a hypertext transfer protocol (HTTP) request from the application to deliver the item of ancillary content to the user.

**[0050]** Example 20 is the content delivery service of any one of examples 16 to 19, wherein the processor configured to obtain the number of times includes the processor configured to query a datastore of previous deliveries of ancillary content to the user that used the delivery format.

**[0051]** Example 21 is the content delivery service of example 20, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0052]** Example 22 is the content delivery service of example 21, wherein each record of the database of records includes a user view of ancillary content by the user according to the delivery format.

**[0053]** Example 23 is the content delivery service of any one of examples 21 or 22, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the datastore is configured to remove each record of the database of records where the timestamp is older than a maximum time period from among the predetermined time periods.

**[0054]** Example 24 is the content delivery service of any one of examples 16 to 23, wherein the delivery format includes one of a plurality of format types, wherein the processor is further

configured to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0055]** Example 25 is the content delivery service of any one of examples 16 to 24, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0056]** Example 26 is the content delivery service of any one of examples 16 to 25, wherein the processor configured to control whether the application uses the delivery format to deliver the item of ancillary content to the user includes the processor configured to send a message to the application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0057]** Example 27 is the content delivery service of example 26, wherein the message includes a response to a request from the application for the ancillary content.

**[0058]** Example 28 is a method for controlling content delivery, the method including determining a delivery format for delivering an item of ancillary content to a user. The method also includes determining a configuration rule associated with the delivery format, wherein the configuration rule defines a criterion under which the delivery format may be used to deliver the ancillary content to the user. The method also includes controlling, based on the configuration rule, whether to deliver the item of ancillary content to the user using the delivery format.

**[0059]** Example 29 is the method of example 28, wherein the delivery format indicates a way in which the item of ancillary content is to be delivered to the user.

**[0060]** Example 30 is the method of either one of examples 28 or 29, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0061]** Example 31 is the method of any one of examples 28 to 30, wherein the configuration rule defines, irrespective of the item of ancillary content, a criterion for whether the delivery format may be used when delivering the ancillary content to the user.

**[0062]** Example 32 is the method of any one of examples 28 to 31, wherein the configuration rule includes a frequency cap defining a number of times within a time period the ancillary content may be delivered to the user using the delivery format.

**[0063]** Example 33 is the method of example 32, wherein the time period includes a number of seconds, minutes, hours, days, weeks, months, or years.

**[0064]** Example 34 is the method of any one of examples 28 to 33, wherein the method further includes determining a total number of times within the time period the delivery format has been used to deliver the ancillary content to the user.

**[0065]** Example 35 is the method of example 34, wherein the determining the total number of times includes querying a datastore of previous deliveries to the user that are associated with delivery format.

**[0066]** Example 36 is the method of example 35, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0067]** Example 37 is the method of example 36, wherein each record of the database of records includes a user view of the ancillary content according to the delivery format.

**[0068]** Example 38 is the method of example 37, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the method further includes removing each record of the database of records from the datastore where the timestamp is older than a maximum time period of the predetermined time periods.

**[0069]** Example 39 is the method of any one of examples 28 to 38, wherein the delivery format includes one of a plurality of format types, wherein the method further includes controlling, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0070]** Example 40 is the method of any one of examples 28 to 39, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0071]** Example 41 is the method of any one of examples 28 to 40, wherein the controlling whether to deliver the item of ancillary content to the user using the delivery format includes sending a message to a client-side application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0072]** Example 42 is the method of example 41, wherein the message includes a response from a content delivery service to a request from the client-side application for the ancillary content.

**[0073]** Example 43 is a content delivery method including receiving from an application a request to deliver, according to a delivery format, an item of ancillary content to a user of the application, wherein the delivery format indicates how the application is to deliver the item of ancillary content to the user. The content delivery method also includes obtaining a configuration rule that defines, irrespective of the item of ancillary content, a frequency cap associated with the delivery format. The content delivery method also includes obtaining a number of times the delivery format has been used to deliver ancillary content to the user. The content delivery method also includes controlling, based on the frequency cap and the number of times, whether the application uses the delivery format to deliver the item of ancillary content to the user.

**[0074]** Example 44 is the content delivery method of example 43, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0075]** Example 45 is the content delivery method of either one of examples 43 or 44, wherein the frequency cap includes a predefined number of times the delivery format is permitted to be used within a time period for delivering ancillary content to the user.

**[0076]** Example 46 is the content delivery method of any one of examples 43 to 45, wherein the request includes a hypertext transfer protocol (HTTP) request from the application to deliver the item of ancillary content to the user.

**[0077]** Example 47 is the content delivery method of any one of examples 43 to 46, wherein the obtaining the number of times includes querying a datastore of previous deliveries of ancillary content to the user that used the delivery format.

**[0078]** Example 48 is the content delivery method of example 47, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0079]** Example 49 is the content delivery method of example 48, wherein each record of the database of records includes a user view of ancillary content by the user according to the delivery format.

**[0080]** Example 50 is the content delivery method of any one of examples 48 or 49, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the content delivery method further includes removing from the datastore each record of the database of records where the timestamp is older than a maximum time period from among the predetermined time periods.

**[0081]** Example 51 is the content delivery method of any one of examples 43 to 50, wherein the delivery format includes one of a plurality of format types, wherein the content delivery method further includes controlling, based on the configuration rule, whether to deliver the item

of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0082]** Example 52 is the content delivery method of any one of examples 43 to 51, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0083]** Example 53 is the content delivery method of any one of examples 43 to 52, wherein controlling whether the application uses the delivery format to deliver the item of ancillary content to the user includes sending a message to the application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0084]** Example 54 is the content delivery method of example 53, wherein the message includes a response to a request from the application for the ancillary content.

**[0085]** Example 55 is a non-transitory computer-readable medium including instructions that, when executed, cause one or more processors to determine a delivery format for delivering an item of ancillary content to a user. The instructions also cause the one or more processors to determine a configuration rule associated with the delivery format, wherein the configuration rule defines a criterion under which the delivery format may be used to deliver the ancillary content to the user. The instructions also cause the one or more processors to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using the delivery format.

**[0086]** Example 56 is the non-transitory computer-readable medium of example 55, wherein the delivery format indicates a way in which the item of ancillary content is to be delivered to the user.

**[0087]** Example 57 is the non-transitory computer-readable medium of either one of examples 55 or 56, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0088]** Example 58 is the non-transitory computer-readable medium of any one of examples 55 to 57, wherein the configuration rule defines, irrespective of the item of ancillary content, a criterion for whether the delivery format may be used when delivering the ancillary content to the user.

**[0089]** Example 59 is the non-transitory computer-readable medium of any one of examples 55 to 58, wherein the configuration rule includes a frequency cap defining a number of times within a time period the ancillary content may be delivered to the user using the delivery format.

**[0090]** Example 60 is the non-transitory computer-readable medium of example 59, wherein the time period includes a number of seconds, minutes, hours, days, weeks, months, or years.

**[0091]** Example 61 is the non-transitory computer-readable medium of any one of examples 55 to 60, wherein the instructions also cause the one or more processors to determine a total number of times within the time period the delivery format has been used to deliver the ancillary content to the user.

**[0092]** Example 62 is the non-transitory computer-readable medium of example 61, wherein the instructions that cause the one or more processors to determine the total number of times includes instructions that also cause the one or more processors to query a datastore of previous deliveries to the user that are associated with delivery format.

**[0093]** Example 63 is the non-transitory computer-readable medium of example 62, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0094]** Example 64 is the non-transitory computer-readable medium of example 63, wherein each record of the database of records includes a user view of the ancillary content according to the delivery format.

**[0095]** Example 65 is the non-transitory computer-readable medium of example 64, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the instructions also cause the one or more processors to remove from the datastore each record of the database of records where the timestamp is older than a maximum time period of the predetermined time periods.

**[0096]** Example 66 is the non-transitory computer-readable medium of any one of examples 55 to 65, wherein the delivery format includes one of a plurality of format types, wherein the instructions also cause the one or more processors to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0097]** Example 67 is the non-transitory computer-readable medium of any one of examples 55 to 66, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0098]** Example 68 is the non-transitory computer-readable medium of any one of examples 55 to 67, wherein the instructions that cause the one or more processors to control whether to deliver the item of ancillary content to the user using the delivery format includes instructions that also cause the one or more processors to send a message to a client-side application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0099]** Example 69 is the non-transitory computer-readable medium of example 68, wherein the message includes a response from a content delivery service to a request from the client-side application for the ancillary content.

**[0100]** Example 70 is a non-transitory computer-readable medium comprising instructions that, when executed, cause one or more processors to receive from an application a request to deliver, according to a delivery format, an item of ancillary content to a user of the application,

wherein the delivery format indicates how the application is to deliver the item of ancillary content to the user. The instructions also cause the one or more processors to obtain a configuration rule that defines, irrespective of the item of ancillary content, a frequency cap associated with the delivery format. The instructions also cause the one or more processors to obtain a number of times the delivery format has been used to deliver ancillary content to the user. The instructions also cause the one or more processors to control, based on the frequency cap and the number of times, whether the application uses the delivery format to deliver the item of ancillary content to the user.

**[0101]** Example 71 is the non-transitory computer-readable medium of example 70, wherein the delivery format includes a pop-up, a carousel, a banner, or a feed listing.

**[0102]** Example 72 is the non-transitory computer-readable medium of either one of examples 70 or 71, wherein the frequency cap includes a predefined number of times the delivery format is permitted to be used within a time period for delivering ancillary content to the user.

**[0103]** Example 73 is the non-transitory computer-readable medium of any one of examples 70 to 72, wherein the request includes a hypertext transfer protocol (HTTP) request from the application to deliver the item of ancillary content to the user.

**[0104]** Example 74 is the non-transitory computer-readable medium of any one of examples 70 to 73, wherein the instructions that cause the one or more processors to obtain the number of times includes instructions that also cause the one or more processors to query a datastore of previous deliveries of ancillary content to the user that used the delivery format.

**[0105]** Example 75 is the non-transitory computer-readable medium of example 74, wherein the datastore of previous deliveries includes a database of records, wherein each record of the database of records represents one of the previous deliveries and includes a user identification, a delivery format, and a timestamp.

**[0106]** Example 76 is the non-transitory computer-readable medium of example 75, wherein each record of the database of records includes a user view of ancillary content by the user according to the delivery format.

**[0107]** Example 77 is the non-transitory computer-readable medium of any one of examples 75 or 76, wherein the configuration rules includes one of a plurality of configuration rules, each associated with a predetermined time period, wherein the instructions also cause the one or more processors to remove from the datastore each record of the database of records where the timestamp is older than a maximum time period from among the predetermined time periods.

**[0108]** Example 78 is the non-transitory computer-readable medium of any one of examples 70 to 77, wherein the delivery format includes one of a plurality of format types, wherein the instructions also cause the one or more processors to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

**[0109]** Example 79 is the non-transitory computer-readable medium of any one of examples 70 to 78, wherein the ancillary content includes a plurality of advertising content items, wherein the item of ancillary content includes an advertisement from among the plurality of advertising content items.

**[0110]** Example 80 is the non-transitory computer-readable medium of any one of examples 70 to 79, wherein the instructions that cause the one or more processors to control whether the application uses the delivery format to deliver the item of ancillary content to the user includes instructions that also cause the one or more processors to send a message to the application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

**[0111]** Example 81 is the non-transitory computer-readable medium of example 80, wherein the message includes a response to a request from the application for the ancillary content.

**[0112]** While the disclosure has been particularly shown and described with reference to specific aspects, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the disclosure as defined by the appended claims. The scope of the disclosure is thus indicated by the appended claims and all changes, which come within the meaning and range of equivalency of the claims, are therefore intended to be embraced.

## CLAIMS

Claimed is:

1. A device for controlling content delivery, the device comprising a processor configured to:

determine a delivery format for delivering an item of ancillary content to a user;

determine a configuration rule associated with the delivery format, wherein the configuration rule defines a criterion under which the delivery format may be used to deliver the ancillary content to the user; and

control, based on the configuration rule, whether to deliver the item of ancillary content to the user using the delivery format.

2. The device of claim 1, wherein the delivery format indicates a way in which the item of ancillary content is to be delivered to the user.

3. The device of either one of claims 1 or 2, wherein the delivery format comprises a pop-up, a carousel, a banner, or a feed listing.

4. The device of any one of claims 1 to 3, wherein the configuration rule defines, irrespective of the item of ancillary content, a criterion for whether the delivery format may be used when delivering the ancillary content to the user.

5. The device of any one of claims 1 to 4, wherein the configuration rule comprises a frequency cap defining a number of times within a time period the ancillary content may be delivered to the user using the delivery format.

6. The device of claim 5, wherein the time period comprises a number of seconds, minutes, hours, days, weeks, months, or years.

7. The device of any one of claims 1 to 6, wherein the processor is further configured to determine a total number of times within the time period the delivery format has been used to deliver the ancillary content to the user.

8. The device of claim 7, wherein the processor configured to determine the total number of times comprises the processor configured to query a datastore of previous deliveries to the user that are associated with delivery format.

9. The device of claim 8, wherein the datastore of previous deliveries comprises a database of records, wherein each record of the database of records represents one of the previous deliveries and comprises a user identification, a delivery format, and a timestamp.

10. The device of claim 9, wherein each record of the database of records comprises a user view of the ancillary content according to the delivery format.

11. The device of claim 10, wherein the configuration rule comprises one of a plurality of configuration rules, each associated with a predetermined time period, wherein the datastore is configured to remove each record of the database of records where the timestamp is older than a maximum time period of the predetermined time periods.

12. The device of any one of claims 1 to 11, wherein the delivery format comprises one of a plurality of format types, wherein the processor is further configured to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

13. The device of any one of claims 1 to 12, wherein the ancillary content comprises a plurality of advertising content items, wherein the item of ancillary content comprises an advertisement from among the plurality of advertising content items.

14. The device of any one of claims 1 to 13, wherein the processor configured to control whether to deliver the item of ancillary content to the user using the delivery format comprises the processor configured to send a message to a client-side application indicating whether a delivery of the item of ancillary content to the user using the delivery format is permitted.

15. The device of claim 14, wherein the message comprises a response from a content delivery service to a request from the client-side application for the ancillary content.

16. A content delivery service comprising a processor configured to:

receive from an application a request to deliver, according to a delivery format, an item of ancillary content to a user of the application, wherein the delivery format indicates how the application is to deliver the item of ancillary content to the user;

obtain a configuration rule that defines, irrespective of the item of ancillary content, a frequency cap associated with the delivery format;

obtain a number of times the delivery format has been used to deliver ancillary content to the user; and

control, based on the frequency cap and the number of times, whether the application uses the delivery format to deliver the item of ancillary content to the user.

17. The content delivery service of claim 16, wherein the frequency cap comprises a predefined number of times the delivery format is permitted to be used within a time period for delivering ancillary content to the user.

18. The content delivery service of either one of claims 16 or 17, wherein the request comprises a hypertext transfer protocol (HTTP) request from the application to deliver the item of ancillary content to the user.

19. The content delivery service of any one of claims 16 to 18, wherein the delivery format comprises one of a plurality of format types, wherein the processor is further configured to control, based on the configuration rule, whether to deliver the item of ancillary content to the user using a fallback delivery format of the plurality of format types that is different from the delivery format.

20. The content delivery service of any one of claims 16 to 19, wherein the ancillary content comprises a plurality of advertising content items, wherein the item of ancillary content comprises an advertisement from among the plurality of advertising content items.