



- (51) International Patent Classification:
H04L 29/08 (2006.01) *H04B 7/185* (2006.01)
- (21) International Application Number:
PCT/US2018/044215
- (22) International Filing Date:
27 July 2018 (27.07.2018)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
62/538,318 28 July 2017 (28.07.2017) US
- (71) Applicant: **SYSTEMS AND SOFTWARE ENTERPRISES, LLC** [US/US]; 2929 East Imperial Highway, Suite 170, Brea, CA 92821 (US).
- (72) Inventors: **GIRARD, Larry**; 2929 East Imperial Highway, Suite 170, Brea, CA 92821 (US). **WINSTON, Joseph**; 2929 East Imperial Highway, Suite 170, Brea, CA 92821 (US).
- (74) Agent: **DEAN, Ryan**; Umberg Zipser LLP, 1920 Main Street, Suite 750, Irvine, CA 92614 (US).
- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,

DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— with international search report (Art. 21(3))

(54) Title: DISTRIBUTED CONTENT FOR AIRCRAFT

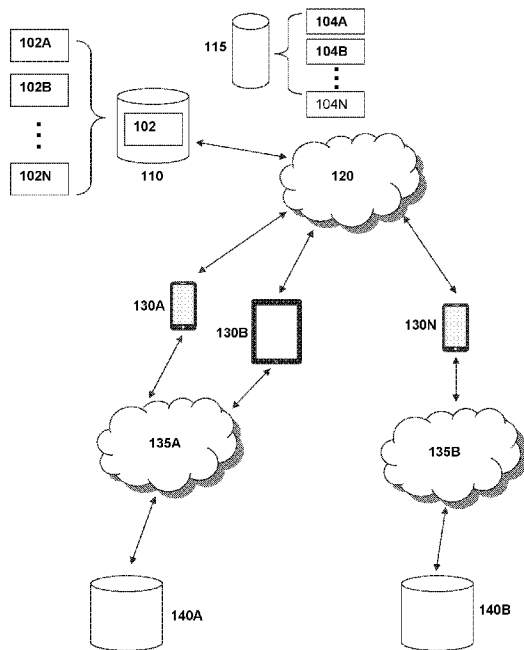


Figure 1

(57) Abstract: Systems and methods are described for transferring content to and from an aircraft. Content can be divided into one or more subsets that each contains some or all of the content. Each of the subsets can be transferred to one or more mobile computing devices via a wireless network, and then transferred from the mobile computing device one onboard or departed from the aircraft. In this manner, content can be updated more regularly and at a lesser expense than traditional avenues for updating content. Rewards can be used to incentivize participants to accept the temporary storage of a subset of the content on their mobile computing device.



DISTRIBUTED CONTENT FOR AIRCRAFT

[0001] This application claims priority to U.S. provisional application having serial number 62/538,318 filed on July 28, 2017. This and all other referenced extrinsic materials are incorporated herein by reference in their entirety. Where a definition or use of a term in a reference that is incorporated by reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein is deemed to be controlling.

Field of the Invention

[0002] The field of the invention is content distribution for aircraft and other vehicles.

Background

[0003] The background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0004] Airlines are requesting more and more content be added to and removed from aircraft as often as possible. Traditionally, content is added to an in-flight entertainment (IFE) system using secure digital (SD) cards or other portable storage solutions once a month (although it can be done more often as desired). Data is typically offloaded via a wireless network using a WIFI or cellular (e.g., 3G/4G/5G) data connection when the aircraft is in its own country or otherwise landed and if cellular roaming is permitted / used. News and other information can also be downloaded to the in-flight entertainment system over a wireless network when the aircraft is at a gate, for example.

[0005] However, such processes can be problematic as cellular networks and roaming on a network are not always accessible, or can be costly to utilize for transferring data to and from an aircraft. In addition, airlines may not want to spend the time and money to manually update content using ground personnel, for example.

[0006] All publications identified herein are incorporated by reference to the same extent as if each individual publication or patent application were specifically and individually indicated to

be incorporated by reference. Where a definition or use of a term in an incorporated reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein applies and the definition of that term in the reference does not apply.

[0007] Thus, there is still a need for systems and methods for more frequently transferring content to or from an aircraft, and preferably without the need for dedicated personnel.

Summary of the Invention

[0008] The inventive subject matter provides apparatus, systems and methods in which content can be transferred to or from an aircraft via one or more mobile computing devices. A set of content to be transferred can be identified. Based on the number of mobile computing devices available and their available storage space, the set of content can be divided into a plurality of subsets of content, each of which can be transferred to at least one of the mobile computing devices. Preferably the content is encrypted while being transferred.

[0009] The subset of content on the mobile computing device can then be downloaded to a server of an aircraft's in-flight entertainment system when the mobile computing device connects to a wireless access point on board the aircraft or connects to the server via a wired connection such as USB.

[0010] Users can be incentivized to allow the temporary storage of content on their devices via a reward system. Rewards may be offered once the user accepts the content on the user's device or after the content is downloaded from the user device. Rewards can include, for example, a monetary reward, a discount coupon, an in-flight offering, an upgraded seat, priority boarding, frequent flier points, or an entry into a drawing for a give-away.

[0011] Various objects, features, aspects and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

Brief Description of the Drawings

[0012] Fig. 1 illustrates a diagram of one embodiment of a system for transferring content to or from an aircraft.

[0013] Fig. 2 illustrates a flow chart of one embodiment of a method for transferring content to or from an aircraft.

Detailed Description

[0014] Throughout the following discussion, numerous references will be made regarding servers, services, interfaces, portals, platforms, or other systems formed from computing devices. It should be appreciated that the use of such terms is deemed to represent one or more computing devices having at least one processor configured to execute software instructions stored on a computer readable tangible, non-transitory medium. For example, a server can include one or more computers operating as a web server, database server, or other type of computer server in a manner to fulfill described roles, responsibilities, or functions.

[0015] The following discussion provides many example embodiments of the inventive subject matter. Although each embodiment represents a single combination of inventive elements, the inventive subject matter is considered to include all possible combinations of the disclosed elements. Thus if one embodiment comprises elements A, B, and C, and a second embodiment comprises elements B and D, then the inventive subject matter is also considered to include other remaining combinations of A, B, C, or D, even if not explicitly disclosed.

[0016] The following description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0017] The inventive subject matter describes systems and methods for transferring content to and from aircraft or other vehicles. Although the below discussion focuses on an aircraft, it is contemplated that the systems and methods discussed herein could likewise be used on ships, trains, busses, and other vehicles.

[0018] In one contemplated embodiment, an example of which is shown in **Figure 1**, a system 100 can be utilized to transfer content to or from an aircraft server 140A or 140B as often as necessary – for example, before every flight – using one or more mobile computing devices 130A-130N as carriers for the content. For example, the desired content that the airline would

like to transfer to or from the aircraft, or a portion thereof, could be stored in the memory of one or more of the mobile computing devices 130A-130N. It is contemplated that the mobile computing devices 130A-130N could be operated or owned by passengers or crew members or other personnel.

[0019] For example, system 100 can include a content server 110 having at least one set of content 102. System 100 can further include a device server 115 having a plurality of profiles 104A-104N. Each of the profiles 104A-104N is associated with a mobile computing device 130A-130N. Each of the profiles can comprise flight information associated with the user of the mobile computing device, a device type and an available storage of the device, among other information.

[0020] System 100 can further include a processor that is configured to select (i) a set of content 102 from the content server 110 and (ii) a set of mobile computing devices 130A-130N based at least in part on the profiles 104A-104N associated with each of the mobile computing devices 130A-130N. The processor is further configured to create a plurality of subsets 102A-102N of the set of content 102 based on the available space of each of the mobile computing devices 130A-130N, a total size of the content 102 to be transferred, and the number of mobile computing devices 130A-130N selected.

[0021] Preferably, the processor is further configured to encrypt the subsets of content 102A-102N before the content is transferred to the selected mobile computing devices 130A-130N.

[0022] Each of the subsets of content 102A-102N is transferred to at least one distinct mobile computing device 130A-130N.

[0023] As used herein, the term mobile computing device includes, for example, portable computers with dedicated storage including, for example, tablet PCs, smart phones, and smart watches. Preferred mobile computing devices are handheld and easily transported, and also can preferably upload and download data / content in the background (e.g., without disrupting a user from accessing the device). It is especially preferred that such devices can continue to upload or download content even where the device is locked or not in use (though powered on). Thus, for

example, while a laptop could be used, the typical size and weight of a laptop, and its typical inability to transfer data only when being used (e.g., in an open state) makes it less desirable.

[0024] Advantageously, the inventive concepts described herein can work in conjunction with the current solution using SD cards or other portable storage solutions and cellular or other wireless networks.

[0025] As a further example, while passengers and/or personnel are waiting at the gate or other location in the airport before boarding the aircraft, or while away from the airport, and are connected to a Wireless Access Point (WAP) 120 which could be a cellular network or a WIFI network, for example, content can be pushed (uploaded) to one or more mobile devices 130A-130N (preferably in the background) of the passengers and/or personnel. It is especially preferred that the content to be stored in the mobile computing devices 130A-130N is encrypted prior to being transferred to prevent unauthorized access to the content. Such access can also be prevented by dividing the content prior to transfer into sets where portions of files within the content are deliberately missing so that a portion of some or all of each file is not stored on a single device.

[0026] To entice passengers and/or crew members to allow a portion of their storage to be temporarily used for this purpose, it is contemplated that airlines could offer a reward or drawing entry to the individual via the system 100. Such awards could be for example, monetary gifts, discounts on a future flight, in-flight rewards such as a free or discounted meal, drink or movie, upgraded seating, priority boarding, free checked bag, frequent flier points, or an entry into a drawing for a give-away. Such rewards could be based, for example, on one or more of a passenger's status with the airline, a length of the flight associated with the passenger, a passenger's frequency of flying with the airline, a device type, an available storage of the device, and a size of the content permitted to be downloaded on the device. The reward offered or given could also be based on a reliability of the passenger to download and transfer the content to or from the aircraft, which may itself be based on past successes or failures by that passenger in transferring content to or from an aircraft.

[0027] It is further contemplated that the reward could be a point system where different amounts of points are redeemable for rewards having different tiers of points required for redemption.

[0028] This likely could be done with the airlines' frequent flyers, as their information is already in the airlines' system, and they are more likely to have downloaded the airlines' App for their mobile computing device. Download of the content could be coordinated with the software App installed on the mobile computing device and can be downloaded in the background and stored in the airline's App cache or any other dedicated space created by the App.

[0029] As discussed above, passengers could affirmatively accept transfer of data on to their mobile computing device for later transfer to or from an aircraft. It is contemplated that this selection could be done via a software App installed on the device or a website. With the selection, it is further contemplated that the user could select how much space the user would be willing to utilize for the transfer, and based on that selection, the reward offered to the user for completion of the transfer to or from an aircraft may vary.

[0030] It is contemplated that crew members or other personnel could carry dedicated mobile devices to move data to and from an aircraft.

[0031] Once on the aircraft, content from the one or more mobile computing devices 130A-130N can be downloaded to a server 140A or 140B of an in-flight entertainment system disposed on the aircraft, preferably over a wireless connection 135A or 135B without any action required from passengers or crew members once the device is connected to the network 135A or 135B. In a similar manner, the airline-selected content already on the server 140A or 140B of the in-flight entertainment system could be downloaded to the authorized mobile devices while passengers or personnel are on board or near the aircraft to either be uploaded to the ground server 110 via a WAP of the airport, a different wireless connection, or to other aircraft, for example. The content transferred to the server 140A or 140B of the IFE system can be made available to passengers on a passengers' Seat Display Unit (SDU) of the IFE, a passenger's mobile device, or other display, after the content is downloaded from the one or more mobile computing devices 130A-130N to the IFE's network and decrypted. Such decryption may occur directly at the SDU or passenger

device, for example, or could occur on the server prior to streaming content to the SDU or passenger device.

[0032] It is also contemplated that the content on the one or more mobile computing devices 130A-130N could be transferred to the server 140A or 140B of the in-flight entertainment systems via a wired connection. Such connection could include a USB port or other commercially suitable interface that may be disposed at a seat row, for example. This could permit powering of the device(s) via the port and transfer of the data without impacting the wireless network of the aircraft.

[0033] Thus, once passengers agree to share space on their devices, nothing else is required but the passengers to connect to the different wireless networks as everything else would occur in the background.

[0034] The inventive concept advantageously allows authorized data to be carried both on and off an aircraft without disturbing passengers or crew members. Such data could include, for example, movie or television shows to be loaded for passenger viewing on the aircraft, audio files, news or other information, and airline specific data (*e.g.*, information on passengers, specific light settings for a flight, etc.). Such data could also include data logs from the IFE Network that would generally be easier and less expensive to offload over mobile devices at any airport rather than wait for planes to return to their own countries. This is especially true where SIM card roaming is expensive.

[0035] It is contemplated that content stored on mobile devices would be encoded in a redundant manner using an Error-Correcting Code (ECC). The encoding could be based, for example, on the technique known as Forward Error Correction (FEC) in order to control errors in the data transmission over unreliable channels (here, the mobile computing devices).

[0036] To avoid situations where a full set of content is not unloaded or offloaded to or from an aircraft, it is preferred that the desired content is divided into parts, which are then duplicated and stored across several mobile computing devices. The data could be divided and copied into equal copies of the same parts or could be striped across the devices such that at least some of the data on two of the devices would overlap, as desired. This helps ensure that all of the desired

data is downloaded to or uploaded from an aircraft, as passengers may miss a flight, the device's battery could deplete prior to finishing downloading or uploading of the data, or there could be other issues that impact transfer of the data. By having a plurality of mobile computing devices each bringing a portion or all of the content to an aircraft, this reduces the risk of incomplete data sets.

[0037] Thus, for example, a set of content for transfer to an aircraft could be divided into ten equal or unequal portions depending on the device's available for temporary storage of the content. Those ten subsets of the content could then be transferred to thirty distinct devices, such that each subset of content is stored on three distinct devices. This increases the likelihood that each subset of content will be successfully transferred to the aircraft in this example. The individual subsets could be distinct from one another, or overlapping as discussed above.

[0038] It is further contemplated that a subset or set of content may be preferably transferred to a user or users who have multiple flights within a certain period of time, such that the data / content transferred to the user's portable computing device can be downloaded to two or more aircraft. This could occur where a user has a layover on the way to the user's final destination, and switches aircraft, but where both aircraft require the same content.

[0039] Figure 2 illustrates one embodiment of a method for transferring content to or from an aircraft using a plurality of mobile computing devices. In step 205, access is provided to a content server having at least one set of content, which may include movies, audio files, news, or other content / data. In step 210, access is also provided to device information regarding a plurality of mobile computing devices that have indicated willingness to temporarily store content for later transfer. Such device information can include, for example, flight information, a device type and an available storage of each device. Device information could further include, for example, a user profile associated with the device and/or a reliability score of a user associated with the device, wherein the reliability score is determined by the processor and based at least in part upon a number of previous successful transfers of content by that user.

[0040] In step 215, a set of content to be transferred to a first aircraft can be selected using a processor. The content is encrypted in step 220 and divided into two or more subsets of content, wherein each of the subsets comprises some or all of the content.

[0041] In step 225, a set of the plurality of mobile computing devices is selected by the processor based at least in part on the device information and the amount of content to be transferred. Thus, for example, a small amount of content to be transferred may require a lower total number of devices than a larger amount of content. The number of devices may also depend on the available storage space of each device, and the reliability or predicted reliability of the user associated with each device.

[0042] In step 230, each subset of content can be transferred to a distinct mobile computing device of the selected set of devices, for later transfer to the aircraft or a ground-based server, for example. It is contemplated that this transfer of data can occur via a wireless network, which could include a cellular network or WIFI network. Such transfer could occur at the airport or away from the airport such as at a user's home or hotel, for example.

[0043] As discussed above, transfer of data to an aircraft could occur via the aircraft's wireless network or a wired connection where the mobile computing device is plugged into a USB or other suitable port for transfer of data to or from the mobile computing device.

[0044] As used herein, and unless the context dictates otherwise, the term "coupled to" is intended to include both direct coupling (in which two elements that are coupled to each other contact each other) and indirect coupling (in which at least one additional element is located between the two elements). Therefore, the terms "coupled to" and "coupled with" are used synonymously.

[0045] Unless the context dictates the contrary, all ranges set forth herein should be interpreted as being inclusive of their endpoints and open-ended ranges should be interpreted to include only commercially practical values. Similarly, all lists of values should be considered as inclusive of intermediate values unless the context indicates the contrary.

[0046] As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

[0047] The recitation of ranges of values herein is merely intended to serve as a shorthand method of referring individually to each separate value falling within the range. Unless otherwise indicated herein, each individual value with a range is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g. “such as”) provided with respect to certain embodiments herein is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention otherwise claimed. No language in the specification should be construed as indicating any non-claimed element essential to the practice of the invention.

[0048] Groupings of alternative elements or embodiments of the invention disclosed herein are not to be construed as limitations. Each group member can be referred to and claimed individually or in any combination with other members of the group or other elements found herein. One or more members of a group can be included in, or deleted from, a group for reasons of convenience and/or patentability. When any such inclusion or deletion occurs, the specification is herein deemed to contain the group as modified thus fulfilling the written description of all Markush groups used in the appended claims.

[0049] It should be apparent to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms “comprises” and “comprising” should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refers to at least one of something selected from the group consisting of A, B, C ... and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

CLAIMS

What is claimed is:

1. A method for transferring content to or from an aircraft using a plurality of mobile computing devices, comprising:
 - providing access to a content server having at least one set of content;
 - providing access to device information concerning a plurality of mobile computing devices, wherein the device information comprises flight information, a device type and an available storage;
 - selecting a set of content to be transferred to a first aircraft using a processor;
 - the processor encrypting the content and dividing the selected set of content into two or more subsets of content, wherein each of the subsets comprises some or all of the content; and
 - selecting a set of the plurality of mobile computing devices based at least in part on the device information; and
 - transferring each subset of content to a distinct mobile computing device of the selected set of devices.
2. The method of claim 1, wherein the information further includes a user profile associated with the device.
3. The method of claim 1, wherein the information further includes a reliability score of a user associated with the device, wherein the reliability score is determined by the processor and based at least in part upon a number of previous successful transfers of content by that user.
4. The method of claim 1, wherein the step of transferring occurs via a terrestrial wireless connection.
5. The method of claim 1, wherein the step of transferring occurs on an aircraft via a wireless connection.
6. The method of claim 1, wherein the step of transferring occurs on an aircraft via a wired connection.

7. The method of claim 1, wherein data from a first subset of content at least partially overlaps with data from a second subset of content.
8. The method of claim 1, further comprising transferring each subset of content to at least two distinct mobile computing devices.
9. The method of claim 1, wherein the content is transferred to the distinct mobile computing device via a software App installed on the device.
10. The method of claim 1, further comprising:
 - determining an amount of storage available on each of the mobile computing devices;
 - and
 - dividing the selected set of content into the two or more subsets of content based on the available storage of each of the devices.
11. The method of claim 10, wherein a first subset of content is larger than a second subset of content.
12. The method of claim 2, further comprising presenting a reward to a user associated with the device based on the user profile.
13. The method of claim 12, wherein the reward is based at least in part on an amount of content transferred to or from the device or a number of successful transfers of content by that user.
14. The method of claim 12, wherein the reward comprises a monetary reward, a discount coupon, an in-flight offering, an upgraded seat, priority boarding, frequent flier points, or an entry into a drawing for a give-away.
15. A system for transferring content to or from an aircraft, comprising:
 - a content server having at least one set of content;
 - a device server having a plurality of profiles, each associated with a mobile computing device, and wherein each of the profile comprises a flight information associated with the user of the mobile computing device, a device type and an available storage of the device;

a processor configured to select (i) a set of content from the content server and (ii) a set of mobile computing devices based at least in part on the profiles associated with each device;

wherein the processor is further configured to create a plurality of subsets of the set of content based on the available space of each device, a total size of the content to be transferred, and the number of devices selected;

wherein the processor is further configured to encrypt the subsets of content; and

wherein the processor is further configured to transfer each of the plurality of subsets of content to distinct ones of the selected set of mobile computing devices.

16. The system of claim 15, wherein each of the profiles further includes information about a user associated with the mobile computing device for that profile.

17. The system of claim 15, wherein each of the subsets of content comprises some or all of the set of content.

18. The system of claim 15, wherein the plurality of subsets collectively comprises multiple copies of the set of content.

19. The system of claim 15, wherein the plurality of subsets of content comprises first and second subsets, and wherein a size of the first subset is different from a size of the second subset.

20. The system of claim 15, wherein the processor is further configured to present a reward to a user of the mobile computing device after the subset of content is transferred from the device.

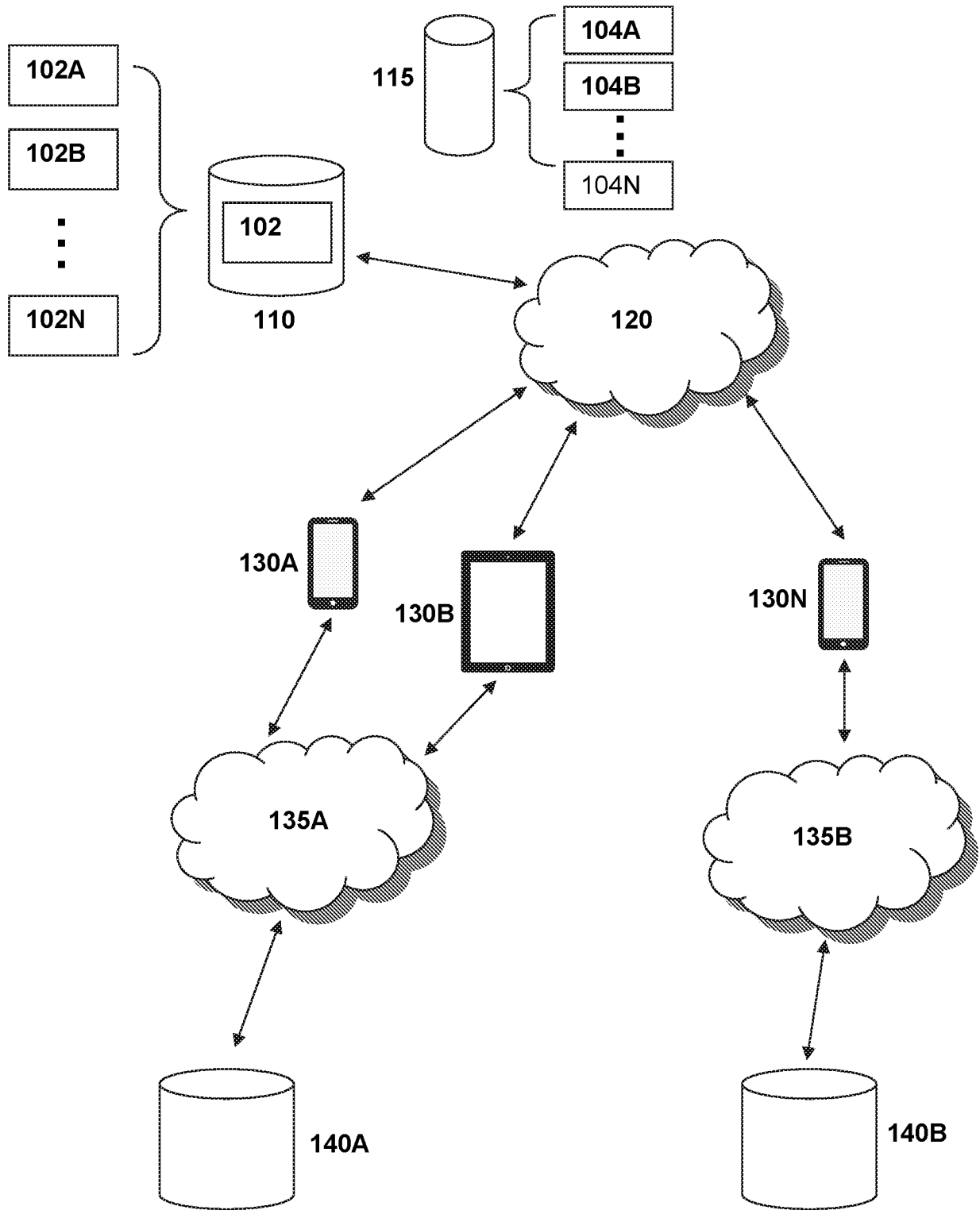


Figure 1

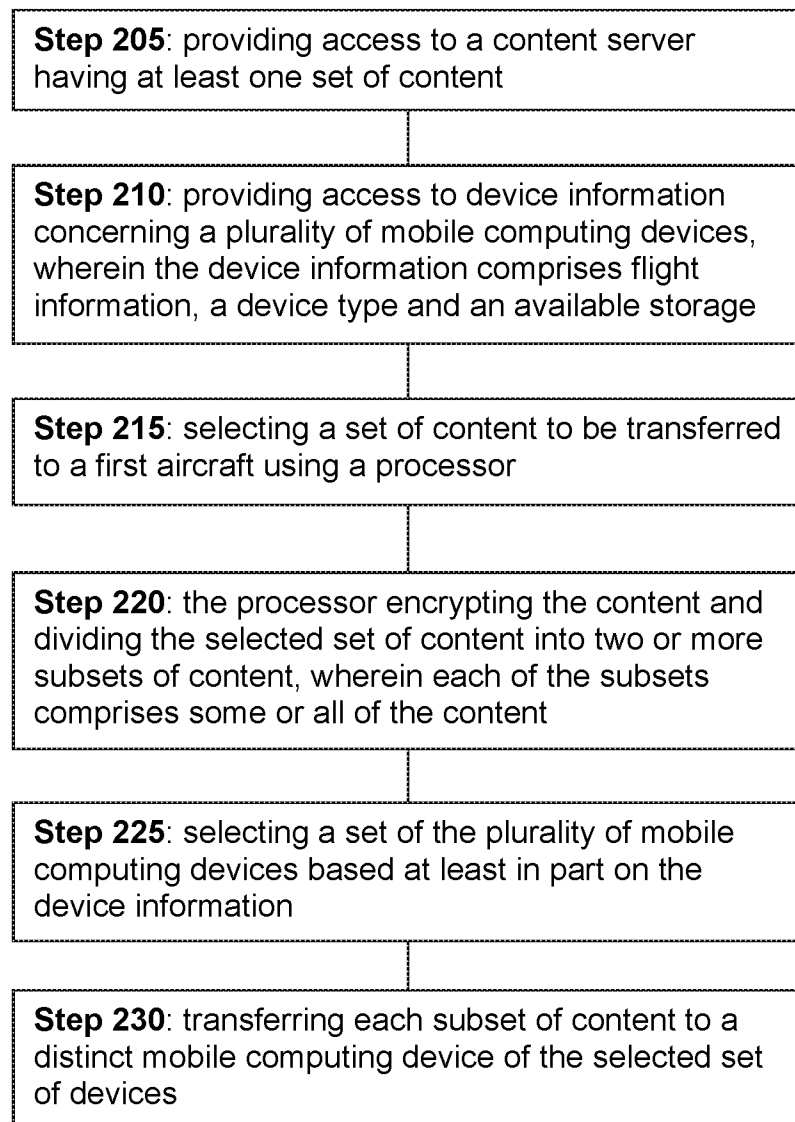


Figure 2

A. CLASSIFICATION OF SUBJECT MATTER**H04L 29/08(2006.01)i, H04B 7/185(2006.01)i**

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 29/08; G06F 17/00; G06Q 20/18; G06Q 50/14; H04L 12/751; H04N 7/18; H04W 4/00; H04W 72/00; H04B 7/185

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: aircraft, subsets of content, personal device, profile, content uploading

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 9634753 B2 (GOGO LLC) 25 April 2017 See column 4, lines 13-18, column 5, lines 49-52, column 9, lines 62-66, claim 1 and figure 1.	1-20
A	US 2012-0116615 A1 (RODNEY FARLEY et al.) 10 May 2012 See paragraphs [0062]-[0063], claim 1 and figure 7.	1-20
A	US 2015-0319073 A1 (GOGO LLC) 05 November 2015 See paragraphs [0020]-[0022] and figure 1.	1-20
A	US 2016-0063653 A1 (NCR CORPORATION) 03 March 2016 See claims 1-8 and figure 1.	1-20
A	US 9226000 B1 (KEITH R. KNIGHT) 29 December 2015 See column 3, line 41 - column 6, line 64 and figure 2.	1-20

 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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

01 November 2018 (01.11.2018)

Date of mailing of the international search report

02 November 2018 (02.11.2018)

Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

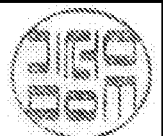
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-481-8578

Authorized officer

KIM, Seong Woo

Telephone No. +82-42-481-3348



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/044215

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 9634753 B2	25/04/2017	AU 2014-346521 B2	01/06/2017
		AU 2014-346524 A1	12/05/2016
		AU 2014-346524 B2	15/09/2016
		AU 2017-203203 A1	01/06/2017
		AU 2017-203203 B2	07/06/2018
		CN 105706378 A	22/06/2016
		CN 105765881 A	13/07/2016
		CN 105765881 B	14/08/2018
		CN 105830489 A	03/08/2016
		CN 105900352 A	24/08/2016
		CN 105900354 A	24/08/2016
		CN 105900354 B	12/09/2017
		CN 107508630 A	22/12/2017
		EP 3066764 A1	14/09/2016
		EP 3066764 B1	16/08/2017
		EP 3066765 A1	14/09/2016
		EP 3066765 B1	31/05/2017
		EP 3066767 A1	14/09/2016
		EP 3066767 B1	05/07/2017
		EP 3066768 A1	14/09/2016
		EP 3066768 B1	01/11/2017
		EP 3066769 A2	14/09/2016
		EP 3066769 B1	22/08/2018
		EP 3232584 A1	18/10/2017
		EP 3232586 A1	18/10/2017
		EP 3261271 A1	27/12/2017
		JP 2016-537885 A	01/12/2016
		JP 2016-537886 A	01/12/2016
		JP 2016-539570 A	15/12/2016
		JP 2017-041912 A	23/02/2017
		JP 2017-063478 A	30/03/2017
		JP 2017-501613 A	12/01/2017
		JP 2017-501614 A	12/01/2017
		JP 6050557 B1	02/12/2016
		JP 6050558 B1	02/12/2016
		JP 6271009 B2	31/01/2018
		JP 6359654 B2	18/07/2018
		JP 6377742 B2	22/08/2018
		US 2015-0131512 A1	14/05/2015
		US 2015-0131513 A1	14/05/2015
US 2015-0131514 A1	14/05/2015		
US 2015-0131519 A1	14/05/2015		
US 2015-0318913 A1	05/11/2015		
US 2016-0036517 A1	04/02/2016		
US 2016-0205610 A1	14/07/2016		
US 2016-0381519 A1	29/12/2016		
US 2017-0195039 A1	06/07/2017		
US 2018-0234165 A1	16/08/2018		
US 9197314 B1	24/11/2015		

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/044215

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 9326217 B2	26/04/2016
		US 9369991 B2	14/06/2016
		US 9577857 B2	21/02/2017
		US 9591462 B2	07/03/2017
		US 9900823 B2	20/02/2018
		US 9967020 B2	08/05/2018
		US 9973262 B2	15/05/2018
		WO 2015-070129 A1	14/05/2015
		WO 2015-070132 A1	14/05/2015
		WO 2015-070140 A1	14/05/2015
		WO 2015-070145 A1	14/05/2015
		WO 2015-070153 A2	14/05/2015
		WO 2015-070153 A3	24/09/2015
US 2012-0116615 A1	10/05/2012	US 2005-0129239 A1	16/06/2005
		US 2010-0008503 A1	14/01/2010
		US 7580528 B2	25/08/2009
		US 8126147 B2	28/02/2012
		US 8723692 B2	13/05/2014
US 2015-0319073 A1	05/11/2015	EP 2920941 A1	23/09/2015
		EP 3232644 A1	18/10/2017
		HK 1214692 A1	29/07/2016
		US 2014-0136730 A1	15/05/2014
		US 2018-0139120 A1	17/05/2018
		US 9088613 B2	21/07/2015
		US 9893976 B2	13/02/2018
		WO 2014-078254 A1	22/05/2014
US 2016-0063653 A1	03/03/2016	None	
US 9226000 B1	29/12/2015	None	