(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 August 2018 (23.08.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/152212 A1

(51) International Patent Classification:
H04L 29/06 (2006.01) *H04L 29/08* (2006.01)

(21) International Application Number:
PCT/US2018/018194

(22) International Filing Date:
14 February 2018 (14.02.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/458,942 14 February 2017 (14.02.2017) US

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(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,

(54) Title: DYNAMIC AND DISTRIBUTED MESHED NETWORK FOR IN-FLIGHT ENTERTAINMENT SYSTEMS

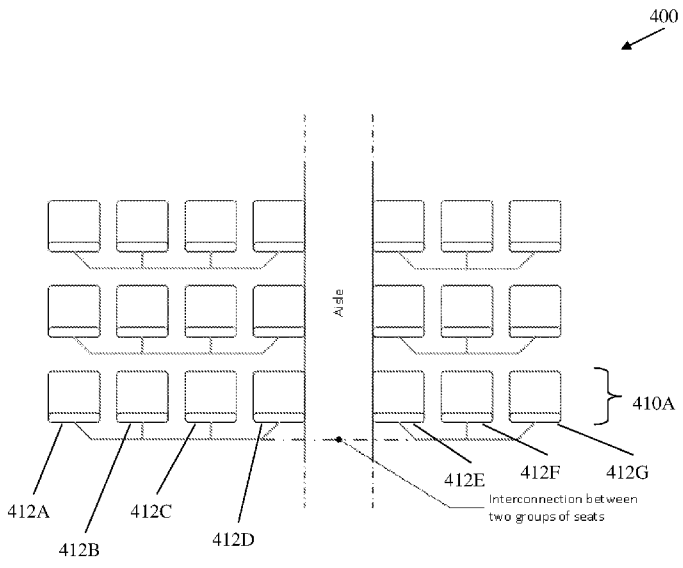


Figure 4

(57) Abstract: Systems and methods are described for distribution of content within a vehicle. A server having a first set of content stored within a memory can be communicatively coupled with one or more clients such as using a plurality of wireless access points. Each of the clients can have a processor, memory, and transceiver, such that it can communicate with the server and potentially its neighbors. Groups of the clients can be communicatively coupled, such as via a wired or wireless network, which permits the clients to communicate with one another to retrieve content, for example, rather than burden the server or the wireless access points.

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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))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

DYNAMIC AND DISTRIBUTED MESHED NETWORK FOR IN-FLIGHT ENTERTAINMENT SYSTEMS

[0001] This application claims priority to U.S. provisional application serial number 62/458,942 filed on February 14, 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 system for the control of and distribution of content to airline in-flight entertainment systems.

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] All publications 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.

[0005] Current in-flight entertainment (IFE) systems are generally either fully wired, e.g. using Ethernet, or fully wireless, e.g. using Wi-Fi. An IFE is composed of servers, used for hosting data and controlling clients, and a number of individual passenger's screens (clients, which are generally mounted on the seats). Two IFE architectures are generally used: (1) distributed architecture, and (2) client centric architecture. Distributed architectures store most of or all of the content on server(s) and distribute the content to multiple, individual clients via streaming. Client centric architectures utilize the internal memory of the clients to store content locally (e.g.

in client memory), which allows the clients to operate in an autonomous fashion, fore example playing content independently (to some extent) from the server(s). In both architectures the distribution of the content has to be performed by the server(s) to the clients either prior to flight and/or during the flight. The content is distributed using an IFE network in place in the aircraft.

[0006] Current fully wired (*e.g.* Ethernet) or fully wireless IFEs are limited necessarily by the capacity or performance of server resources that have to be shared by all clients that are being served at a given time (*e.g.* CPU, network, memory, mass storage, etc.). If there is one active server available the server has to serve hundreds of clients, which can lead to significant performance bottlenecks. One solution is to increase the number of servers so as to create sub-networks that have a relatively reduced number of clients sharing the server resources, thereby offering a higher achievable data rate per client. In fully wireless systems, however, at least several radio cells have to be deployed within the aircraft- primarily because a wireless LAN access point (WLAN AP) cannot serve a large number of active users at the same time. The medium has to be shared between the clients connected to the same WLAN AP. While a wired network inherently offers reliability it increases the number of cables and connectors, and therefore undesirably increases the weight of the aircraft. A wireless network, such as proposed in European Patent 1561308 (to Marston et al.), reduces the number of cables and connectors, transmission over a wireless medium is not as reliable as a wired network.

[0007] Systems that incorporate both wired and wireless communication have been proposed. For example, U.S. Patent No. 8,565,758 (to Owyang *et al.*) describes a complex wireless data distribution architecture for use in an aircraft that incorporates a wireless distribution system that is in wired or wireless contact with an information network, however it provides little insight regarding how such a system can be physically implemented. U.S. Patent No. 9,420,629 (to Krug) describes a system for providing broadband content within an aircraft by providing a central server that has a wired connection with a switch, where the switch can communicate with peripheral devices (which can be addressed as groups) via wireless protocols. Similarly, U.S. Patent Publication No. 2005/0021602 (to Noel *et al.*) describe a system in which a central server has wired connections to numerous wireless transmitters throughout the cabin of an aircraft, where each wireless transmitter provide information to wireless receivers associated with a group of seats. U.S. Patent Publication No. 2004/0139467 (to Rogerson and Mclelland) describes a

media distribution system for use on an aircraft in which distribution units are provided that have an Ethernet connection with a media server or a web server, and have wireless connections to display units associated with seats of the aircraft. The display units can include processors and memory, and can interact with the wired distribution units to act as a distributed server, however it is unclear how information is distributed and exchanged within the described network.

[0008] Thus, there is still a need for a system that provides a sufficiently high rate of content transfer to support a large number of active passenger screens in an in-flight entertainment system without adding a burdensome amount of weight to the aircraft.

Summary of the Invention

[0009] The inventive subject matter provides apparatus, systems and methods that provide an in-flight entertainment system in which both wireless and wired systems are mixed. Such an in-flight entertainment system can cope with specific airplane cabin environments, creating client group networks and inter-clients group networks using wired and/or wireless links. By avoiding the use of a fully wired network, such in-flight entertainment systems reduce the weight of the aircraft and facilitate maintenance. Such in-flight entertainment systems also provide a higher throughput per client that conventional systems, improving the speed at which data content is delivered.

[0010] Preferred systems and methods utilize a server and a plurality of in-flight entertainment units (also referred to herein as a "line replaceable unit" or "LRU") disposed with an aircraft. It should be noted that the description of the inventive subject matter contained herein references an aircraft. However, it is contemplated that the system and methods can be applied to other vehicles such as train cars, busses, or other multi-passenger vehicles or enclosed environments where wireless bandwidth is similarly limited.

[0011] Systems of the inventive concept include in-flight entertainment systems that include one or more server(s) hosting data and controlling the system, one or more wireless access points for distributing data wirelessly, and a plurality of clients (e.g. passengers' screens) equipped with internal memory and both Ethernet and wireless modules. The clients and the servers are interconnected using both wired and wireless networks. All clients are equipped with a wireless

module such that they are coupled to and in communication with an access point. Clients are also interconnected to each other using wires (*e.g.* Ethernet and/or optical fiber) and/or wireless links (e.g. Wi-Fi or WiGig). Therefore, clients can communicate with the server(s) and also with each other.

[0012] 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

[0001] Fig. 1 illustrates an embodiment of a prior art wireless in-flight entertainment system.

[0002] Fig. 2 illustrates one embodiment of a system where individual clients are connected to form a client group network.

[0003] Fig. 3 illustrates another embodiment of a system where individual clients are connected to form a client group network.

[0004] Fig. 4 illustrates yet another embodiment of a system where individual clients are connected to form a client group network.

Detailed Description

[0005] 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.

[0006] It should be noted that any language directed to a computer should be read to include any suitable combination of computing devices, including servers, interfaces, systems, databases, agents, peers, engines, controllers, or other types of computing devices operating individually or collectively. One should appreciate the computing devices comprise a processor configured to

execute software instructions stored on a tangible, non-transitory computer readable storage medium (e.g., hard drive, solid state drive, RAM, flash, ROM, etc.). The software instructions preferably configure the computing device to provide the roles, responsibilities, or other functionality as discussed below with respect to the disclosed apparatus. In especially preferred embodiments, the various servers, systems, databases, or interfaces exchange data using standardized protocols or algorithms, possibly based on HTTP, HTTPS, AES, public-private key exchanges, web service APIs, known financial transaction protocols, or other electronic information exchanging methods. Data exchanges preferably are conducted over a packet-switched network, the Internet, LAN, WAN, VPN, or other type of packet switched network.

[0007] 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.

[0008] 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.

[0009] Figure 1 depicts an embodiment of a prior art wireless in-flight entertainment system 100. As shown, a server 110 is in wired communication with a wireless router (AP) 120 that transmits content wirelessly to individual clients (e.g. passenger screens) that are generally mounted on passenger seats 130.

[0010] Figure 2 depicts one embodiment of a system 200 of the inventive concept in which groups of individual clients 212 (which include memory for content storage) are connected to form a number of client group networks. For example, as shown in the figure, there are nine distinct group networks. Groups 210A, 210B, and 210C each comprise three units disposed within individual rows of an aircraft or other vehicle. Although shown as disposed in seat rows,

it is contemplated that a group network could comprise clusters of clients from two or more seat rows of an aircraft or other vehicle. For example, in another embodiment, group 210A could comprise all of the clients of groups 210A, 210B, and 210C.

[0011] Members of a client group network can be connected using a wired (e.g. Ethernet) connection or other commercially suitable connection that provides a high rate of data transfer with no appreciable interference.

[0012] As used herein, a client 212 generally refers to a unit of an in-flight entertainment system. In some embodiments, the unit may be line-replaceable, meaning it can quickly and easily be swapped out for maintenance or other purposes. In some embodiments, the unit or LRU can comprise a memory, a processor, a wireless interface (e.g., Wi-Fi, cellular, etc.), and display screen for video playback. Contemplated LRUs can include entertainment units integrated into aircraft seats, such as in the seat-backs (this includes both self-contained seatback LRUs having all of the components within the seatback unit and also modular LRU systems where the display screen is integrated into the seatback but other components such as the storage, communication interfaces and/or processor(s) are located under the seat or in a separate part of the seat), and overhead display units ("ODUs"). In embodiments, the LRU can also include a short-rage wireless data communication interface capable of short-range data exchanges. Examples of short-range wireless interfaces include near-field communication interfaces, Bluetooth, and IR (infra-red). In embodiments, the LRU can include a wired connection interface (e.g., USB, HDMI, Thunderbolt, etc.) that can be connected to other computing devices for data exchange and/or power supply.

[0013] As shown, such client group networks 210A, 210B, and 210C can be conveniently grouped by location within a particular row and relative to a particular aisle. In the example shown the client group networks reflect the 3-4-3 seating typical of many aircraft designs.

[0014] When system 200 is initially set up, or when the content has to be updated (*e.g.* monthly content updates), a server 220 has to distribute data to all clients. Clients (*i.e.* screens) can store data locally, which is useful for example for highly popular content. Data can thus be accessed locally, because it is already stored and therefore available, or accessed remotely when it is not stored and therefore needs to be downloaded from server. It should be appreciated that the way

in which data is exchanged in the network improves the overall efficiency of data transfer and also the availability. Server 220 could be coupled via a wired or wireless connection to the client group networks 210A, 210B, 210C.

[0015] In an exemplary system, for installation ease of system 200, seats within the same row can be interconnected to each other, for example with an Ethernet switch. In an aircraft with a 3-4-3 seating organization, this means that each row could have three groups of seats that each act as a client group network: two columns of 3 seat client group networks and one column of 4 client group networks (see Figure 2).

[0016] Initial content can be distributed within the system 200 from server 220, for example, as fast as possible to clients 212 using wireless access points 230, especially where nothing is stored locally. Once the initial content is transferred, the clients 212 can verify the content received. The clients 212 can, for example, interrogate neighboring clients that are connected in the same client group network for content, avoiding loading the access points 230 with unnecessary requests. For example, it is possible for one seat to have properly received initial content whereas a neighboring seat did not. This verification permits rapid and local resolution of this problem without the need to address the access points 230.

[0017] On-Demand Content Distribution: Upon the request of a passenger, if the content of interest is not stored locally at a client 212, the client 212 necessarily has to retrieve it. In some embodiments, it is contemplated that the client 212 may first interrogate other clients 212 located in the same client group network. Thus, for example, a client 212 could interrogate the other two of the clients within group network 210A. If another client has the content and is able to deliver it (e.g., not busy with other operations), the content is transferred between the two clients. As before, this allows avoiding loading access points 230.

[0018] If for some reason the wireless link between the client 212 and the access point 230 does not operate properly (*e.g.* obstruction of the signal), the client 212 can be configured to interrogate neighboring clients 212 to retrieve the content. As previously, it is up to the neighboring client 212 to decide whether or not it can deliver the content.

[0019] Since clients 212 preferably have local storage (although generally with a capacity smaller than server 220), content can be distributed in a specific fashion such that neighboring clients 212 can access more easily and with higher probability access the desired content.

[0020] For example, assume server 220 has a storage capacity of 4 Terabytes, and a client 212 has a storage capacity of 512 GBytes. Client 212 can thus store 12.5% of the available content (assuming server 220 is full of content). Among the 512 GBs, 256 GBs (50%) could be reserved for commonly requested content. The remaining 256 GBs can be used for distributed content. As a result clients would have 256 GBs of common content and (virtually) N times 256 GBs of distributed content, where N represents the number of clients connected to the client group network. For instance, in the 3-4-3 configuration shown in Figure 2, clients between the window and the aisle (groups of 3 seats) would have a virtual storage of 1 Terabytes available. In this manner, each of the three clients of a group can have access to 25% of the total available content on the server 220 using their client group network and avoid requesting server resources needlessly.

[0021] Cooperative Networks: As noted above, within a aircraft there can be one or more client(s) 212 that are unable to communicate properly with a dedicated access point 230, for instance if the signal becomes obstructed (*e.g.* by passengers, crew, *etc.*). In such cases, a client 212 belonging to the same network group (e.g., 210A) can contribute and communicate with the access point 230in order to retrieve the data requested by its neighbor client. This can be seen as a cooperative network in which nodes / clients 212 can assist each other. Logic functions within the neighboring clients can be used to determine whether or not this cooperation is possible and useful. For example, a neighboring client may be busy (for example, in receiving content for itself) to provide assistance.

[0022] Another advantage of the cooperative network resides in the channel diversity that exists between the access point 230 and the clients 212. In a client group network composed of N seats all antennas can be used for retrieving content, improving the probability of good reception and therefore increasing the overall reliability. As before, logic functions within the clients can be used to determine whether or not this cooperation is possible and useful. In such an embodiment

the clients, at the completion of reception, can compare their content and contribute into rebuilding the original data, if necessary.

[0023] In other embodiments, inter-row group networks can be formed by providing a wired (e.g. Ethernet) connection between different client group networks. One example of this configuration is shown in **Figure 3**, which shows inter-row group network 310A formed by communicatively coupling between client group networks 312 and 314 associated with groups of seats in different seating rows of the aircraft. A separate group network 310B is also shown. Although shown as a wired connection, in some embodiments such an inter-client group network can be generated using a wireless connection between client group networks 312 and 314, for example.

[0024] Each the group networks 310A and 310B comprises a plurality of units 320 of an in-flight entertainment system 300, which may be located in an armrest or seat back, depending on the aircraft's configuration. It should be appreciated that in many aircraft, some seats may not have a screen (client) that is reachable by a wireless system and therefore be unable to receive content by such a route. Such seat screens are typically located in the armrest (for example, of the first seats after a panel, see FIG. 3), or seats located in areas without coverage (*e.g.* in a corner of a seating arrangement). Systems of the inventive concept also provide coverage of an entire flight cabin using a meshed network. This can be accomplished by providing inter-client group networks through interconnection between client group networks in different rows (see Figure 3). The interconnection can be either wired (*e.g.* Ethernet) or wireless (*e.g.* Wi-Fi. It should be appreciated that, in the case of a wireless link, the connection can made when needed and the network can be seen as changing dynamically.

[0025] Another example of an inter-client group network 410A of an in-flight entertainment system 400 is shown in **Figure 4**, which depicts inter-client group networks formed by communicatively coupling between client group networks associated with groups of seats within the same seating row of the aircraft (for example, separated by an aisle or walkway). Although shown as a wired connection, in some embodiments such an inter-client group network can be generated using a wireless connection between client group networks. Thus, it is possible to enable communication between seats located on either side of an aisle. As before the

communication can be done either using a wired connection or wirelessly. This permits a group of seats having poor conditions for wireless signal reception to be connected to another group of seats with good conditions.

[0026] For example, group network 410A can comprise units 412A-412G that are disposed within the same row, but are separated by an aisle. It should be appreciated that in-flight entertainment systems of the inventive concept can utilize a mixture of the architectures shown in Figure 2, Figure 3, and Figure 4.

[0027] The use of inter-client group networks (e.g., 410A), which can be set dynamically, allows expansion of the number of clients 412A-412G belonging to a common information network. In the example shown in Figure 4, and taking into account the storage capacities previously defined, a client group network of three seats is connected to another clients group network of 4 seats. In this case, each seat has a common content of 256 GBs and seven times 256 GBs of distributed content, leading to a virtual storage of 2 Terabytes. Dedicated algorithms can be put in place in order to distribute the content efficiently between the clients and avoid having duplicated content in seats, which may belong to the same network.

[0028] In some embodiments, the numbers expressing quantities of ingredients, properties such as concentration, reaction conditions, and so forth, used to describe and claim certain embodiments of the invention are to be understood as being modified in some instances by the term "about." Accordingly, in some embodiments, the numerical parameters set forth in the written description and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by a particular embodiment. In some embodiments, the numerical parameters should be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of some embodiments of the invention are approximations, the numerical values set forth in the specific examples are reported as precisely as practicable. The numerical values presented in some embodiments of the invention may contain certain errors necessarily resulting from the standard deviation found in their respective testing measurements.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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 system for distribution of content within a vehicle, comprising:
   a server comprising a first processor and a first memory, wherein the first memory comprises content for distribution within the vehicle;
   a distribution node that is communicatively coupled to the server; and
   a plurality of clients, wherein each of the plurality of clients comprises a client processor, a client memory, and a client transceiver, and wherein each of the plurality of clients is associated with a seat of the vehicle, and wherein a first client and a second client are communicatively coupled to form a first client group,
   wherein the distribution node is configured to transmit content to the client memories, and wherein the first client group is configured to permit exchange of content between the memories of the first and second clients.

2. The system of claim 1, further comprising a third client and a fourth client communicatively coupled to form a second client group, wherein the second client group is configured to permit exchange of content between the memories of the third and fourth clients.

3. The system of claim 2, wherein the first client group is communicatively coupled with the second client group to form an inter-client group network.

4. The system of claim 3, wherein the inter-client group network is configured to permit exchange of content between the first client group and the second client group.

5. The system of claim 3 or claim 4, wherein the first client group is associated with a first row of seats, and the second client group is associated with a second row of seats.

6. The system of one of claims 1 to 5, wherein the server is communicatively coupled with the distribution node by a wired connection.

7. The system of one of claims 1 to 5, wherein the server is communicatively coupled with the distribution node by a wireless connection.

8. The system of one of claims 1 to 7, wherein the distribution node is communicatively coupled to at least one of the plurality of clients by a wired connection.

9. The system of one of claims 1 to 8, wherein the distribution node is communicatively coupled to at least one of the plurality of clients by a wireless connection.

10. The system of one of claims 1 to 7, wherein the distribution node is communicatively coupled to the plurality of clients by a mixture of wired and wireless connections.

11. The system of one of claims 1 to 10, wherein the first client and the second client are communicatively coupled using a wired connection.

12. The system of one of claims 1 to 10, wherein the first client and the second client are communicatively coupled using a wireless connection.

13. The system of one of claims 3 to 6, wherein the first inter-client group is communicatively coupled to the second inter-client group using a wired connection.

14. The system of one of claims 3 to 6, wherein the first inter-client group is communicatively coupled to the second inter-client group using a wireless connection.

15. A method of distributing content within a vehicle, comprising:

providing a server comprising a first processor and a first memory, wherein the first memory comprises content for distribution within the vehicle; a distribution node that is communicatively coupled to the server; and a plurality of clients, wherein each of the plurality of clients comprises a client processor, a client memory, and a client transceiver, and wherein each of the plurality of client is associated with a seat of the vehicle, wherein at a first client and a second client are communicatively coupled to form a first client group, wherein the distribution node is configured to transmit content to the client memories, and wherein the first client group is configured to permit exchange of content between the memories of the first and second clients;

transmitting content from the server to the first client and the second client via the distribution node, wherein a first content is stored in the memory of the first client and a second content is stored in the memory of the second client; and

transferring at least a portion of the first content from the first client to the memory of the second client.

16. The method of claim 15, further comprising providing a third client and a fourth client communicatively coupled to form a second client group, wherein the second client group is configured to permit exchange of content between the memories of the third and fourth clients.

17. The system of claim 16, wherein the first client group is communicatively coupled with the second client group to form an inter-client group network.

18. The method of claim 17, wherein the inter-client group network is configured to permit exchange of content between the first client group and the second client group.

19. The method of claim 16 or claim 17, wherein the first client group is associated with a first row of seats, and the second client group is associated with a second row of seats.

20. The method of one of claims 15 to 19, wherein the server is communicatively coupled with the distribution node by a wired connection.

21. The method of one of claims 15 to 19, wherein the server is communicatively coupled with the distribution node by a wireless connection.

22. The method of one of claims 15 to 21, wherein the distribution node is communicatively coupled to at least one of the plurality of clients by a wired connection.

23. The method of one of claims 15 to 21, wherein the distribution node is communicatively coupled to at least one of the plurality of clients by a wireless connection.

24. The method of one of claims 15 to 21, wherein the distribution node is communicatively coupled to the plurality of clients by a mixture of wired and wireless connections.

25. The method of one of claims 15 to 24, wherein the first client and the second client are communicatively coupled using a wired connection.

26. The method of one of claims 15 to 24, wherein the first client and the second client are communicatively coupled using a wireless connection.

27. The method of one of claims 17 to 19, wherein the first inter-client group is communicatively coupled to the second inter-client group using a wired connection.

28. The method of one of claims 17 to 19, wherein the first inter-client group is communicatively coupled to the second inter-client group using a wireless connection.

29. The method of one of claims 15 to 28, wherein the at least a portion of the first content is determined by a comparison between the first content and the second content.

30. The method of one of claims 15 to 29, wherein the second client is in partial communication with the distribution node.

31. The method of one of claims 17 to 19, wherein the third client receives a third content from the distribution node, and wherein at least a portion of the first content is transferred from the first client to the memory of the third client.

32. The method of claim 31, wherein the at least a portion of the first content is determined by a comparison between the first content and the third content.

33. The method of claim 31 or 32, wherein the fourth client receives a fourth content from the distribution node, and wherein at least a portion of the third content is transferred from the third to the memory of the fourth client.

32. The method of claim 33, wherein the at least a portion of the third content is determined by a comparison between the third content and the fourth content.

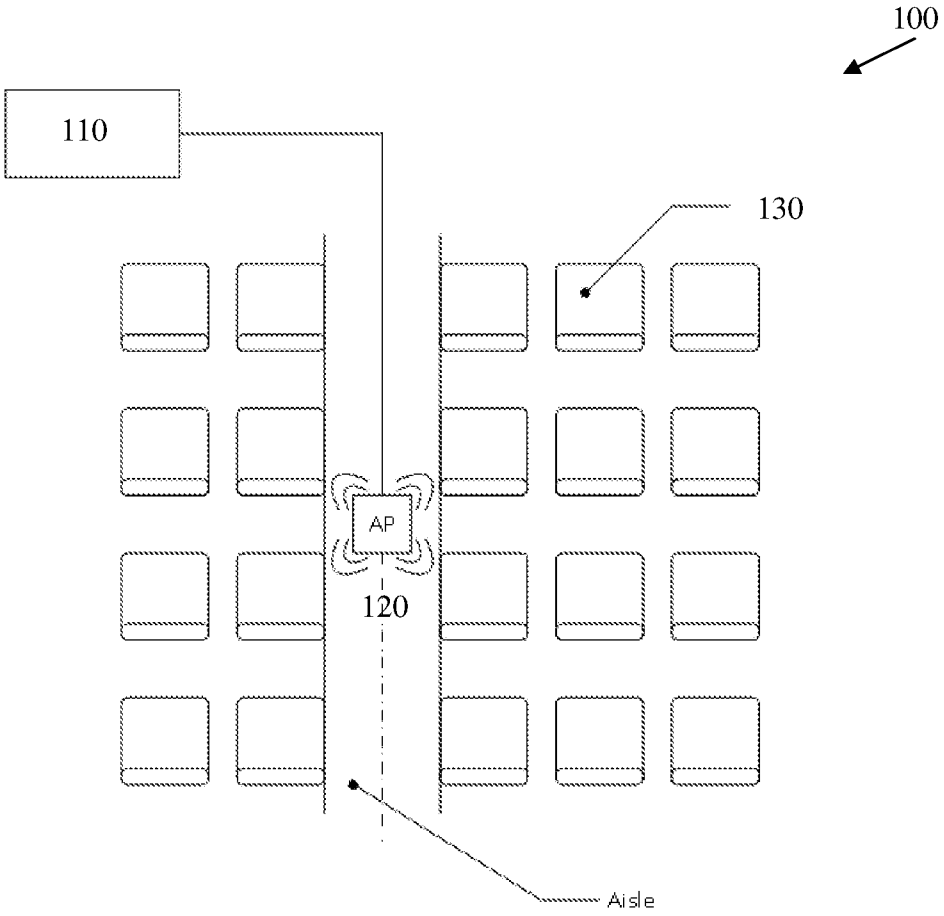


Figure 1

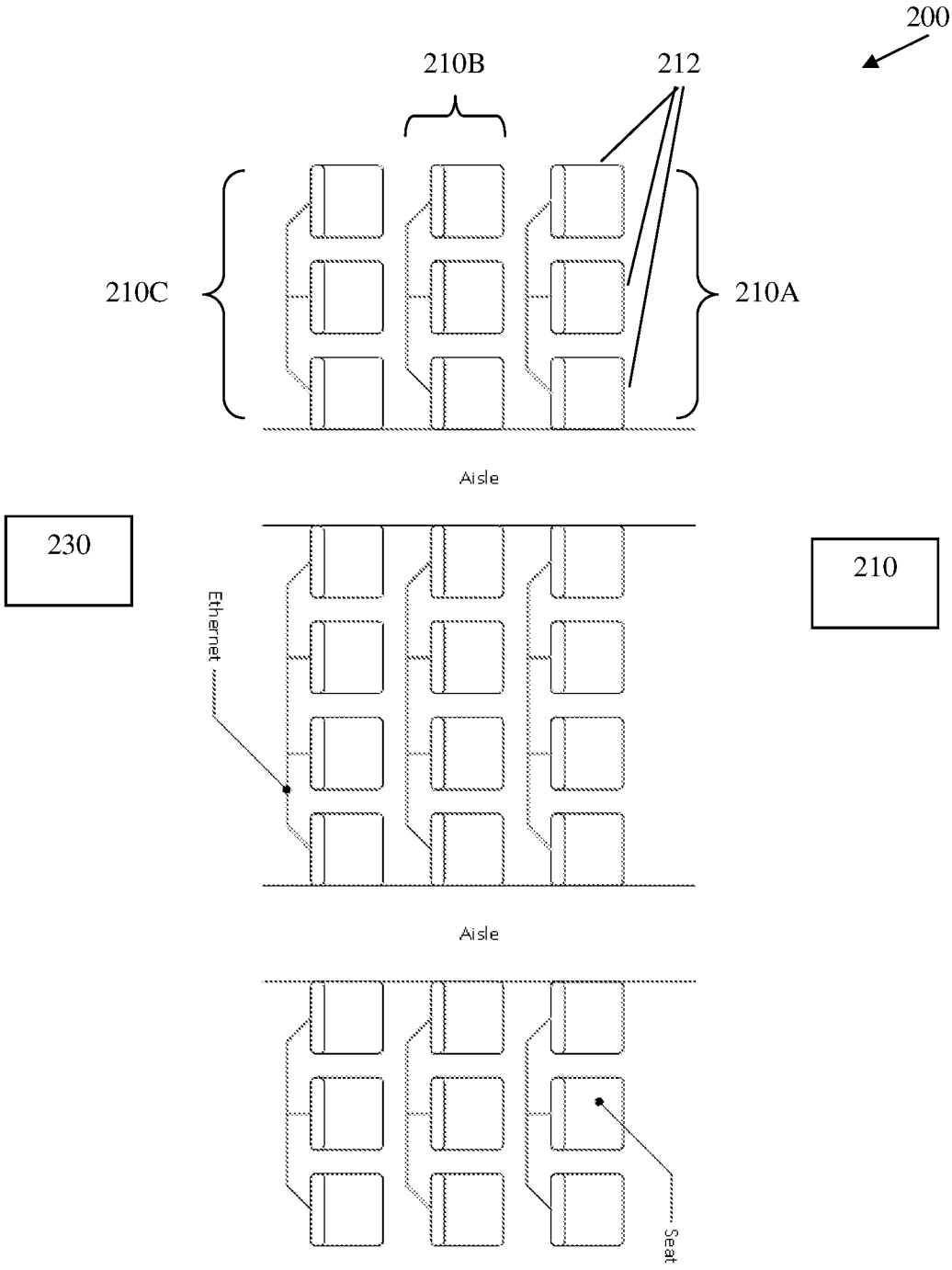


Figure 2

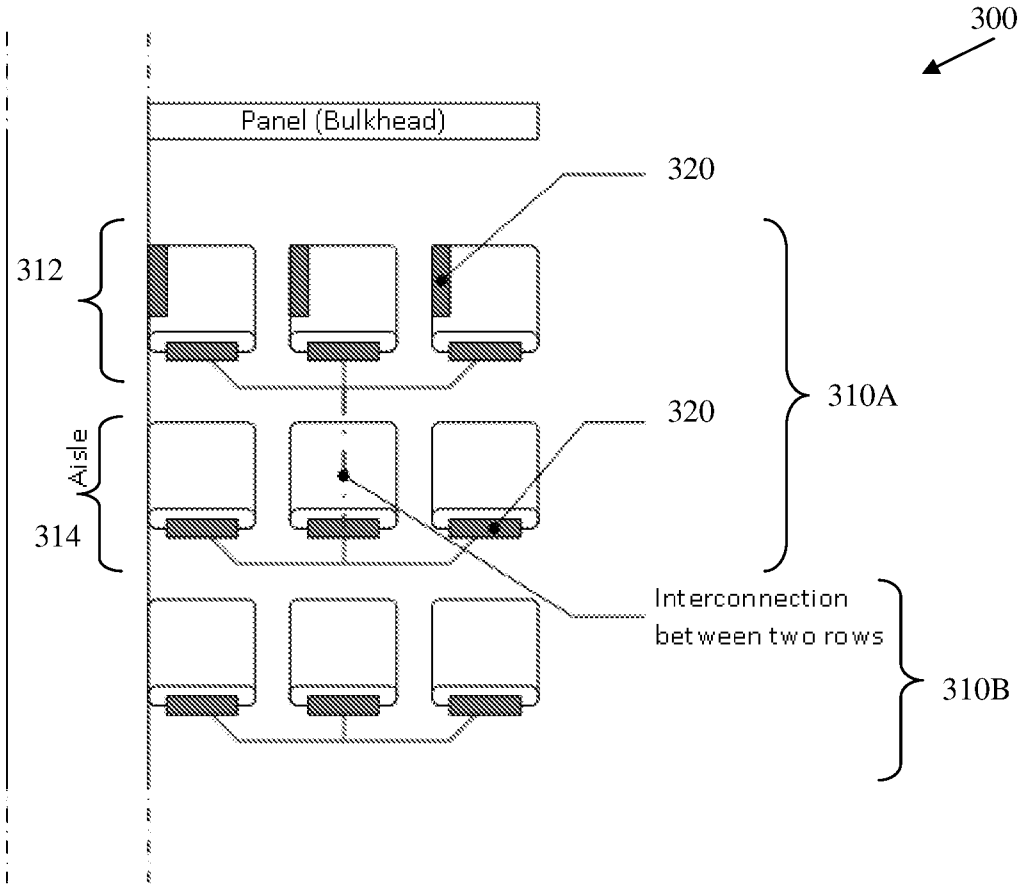

300
Panel (Bulkhead)
320
312
320
310A
Aisle
314
Interconnection
between two rows
310B

Figure 3

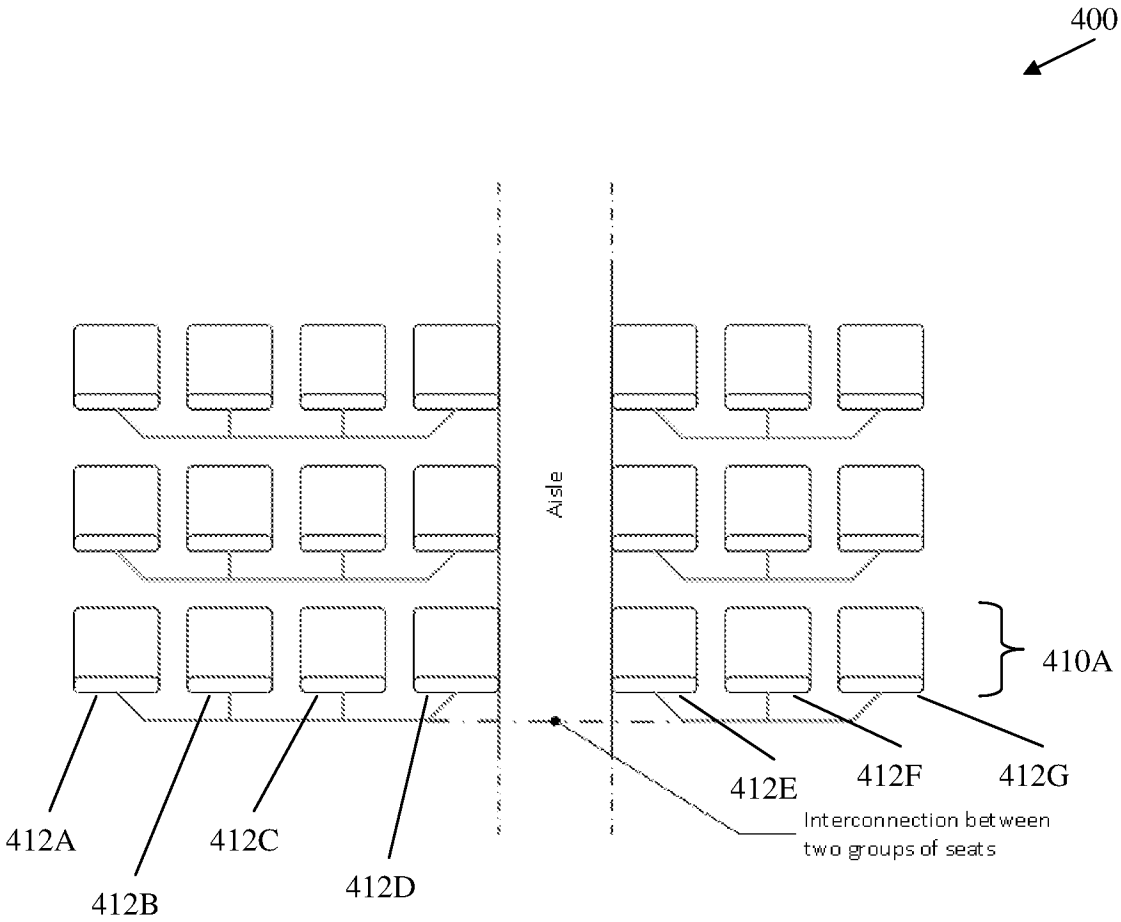

400
Aisle
410A
412A
412B
412C
412D
412E
412F
412G
Interconnection between two groups of seats

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/018194

A. CLASSIFICATION OF SUBJECT MATTER

H04L 29/06(2006.01)i, H04L 29/08(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 29/06; H04B 7/26; H04N 7/18; H04N 7/173; B64D 11/06; B60N 2/44; H04N 21/20; H04L 29/08

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: content distribution, server, distribution node, client groups, memories

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011-0219407 A1 (PAUL ANTHONY MARGIS et al.) 08 September 2011 See paragraphs [0049]-[0084], [0100]-[0122], [0162]-[0164]; and figures 7-8B.	1-4,15-18
Y		5,19
Y	US 2012-0167148 A1 (CHRIS HEALY et al.) 28 June 2012 See paragraphs [0006], [0022], [0039]; claims 1, 3, 6; and figure 1.	5,19
A	JP 2009-512581 A (SICMA AERO SEAT) 26 March 2009 See paragraphs [0026]-[0056]; and figure 2.	1-5,15-19
A	JP 2005-535170 A (ROGERSON AIRCRAFT CORP.) 17 November 2005 See paragraphs [0022]-[0044]; and figure 1.	1-5,15-19
A	US 2010-0162325 A1 (TERENCE BONAR) 24 June 2010 See paragraphs [0049]-[0061]; and figure 9.	1-5,15-19

☐ 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	Date of mailing of the international search report
06 August 2018 (06.08.2018)	**06 August 2018 (06.08.2018)**

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/018194

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

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

2. ☒ Claims Nos.: 32,34
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claims 32 and 34 do not comply with PCT Article (6) since they refer to unsearchable claims 31 and 33, respectively.
[Note: for the second claim 32, the claim was renumbered as claim 34 by this authority because claim 32 was found twice.]

3. ☒ Claims Nos.: 6-14,20-31,33
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

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

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

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

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

Remark on Protest

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2018/018194

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		WO 2004-008277 A3	25/03/2004

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/018194

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0162325 A1	24/06/2010	None	