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Suzuki et al.

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(54) **SYSTEM AND METHOD FOR MANAGING ACCESS TO A PUSH-TO-TALK-OVER-CELLULAR COMMUNICATION NETWORK**

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H04W 4/08	(2009.01)
H04W 8/20	(2009.01)

(52) **U.S. Cl.**

CPC ***H04W 4/10*** (2013.01); ***H04W 4/08*** (2013.01); ***H04W 8/20*** (2013.01)

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CPC H04W 4/10; H04W 4/08; H04W 8/20

(Continued)

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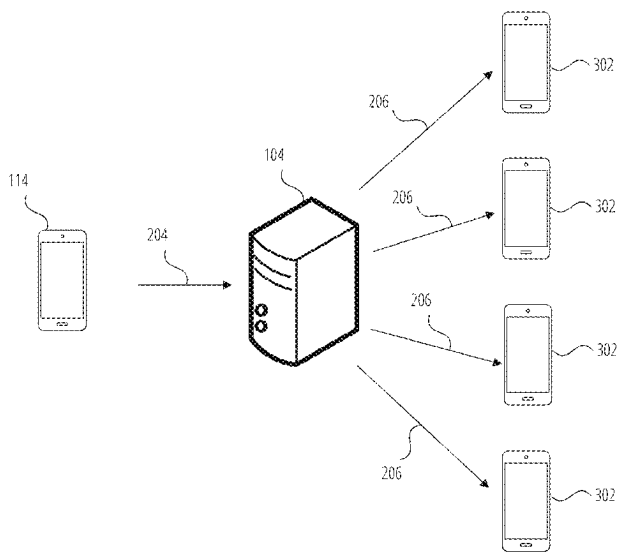
(57) **ABSTRACT**

A method of managing access to a push-to-talk-over-cellular (POC) talkgroup may include providing a control device configured to manage a first talkgroup, granting a first non-subscriber device access to the first talkgroup, and transmitting, from the control device to the first non-subscriber device, a first communication including a link to download a POC software application configured to access the first talkgroup. A method of managing access to a push-to-talk-over-cellular (POC) talkgroup may alternatively include providing a control device configured to manage a first talkgroup, providing a first subscriber device, transmitting, from the first subscriber device to the control device, first non-subscriber contact information associated with a first non-subscriber device, and granting the first non-subscriber device access to the first talkgroup.

21 Claims, 8 Drawing Sheets



(58) **Field of Classification Search**
USPC 370/329, 328, 338, 341, 345, 350
See application file for complete search history.

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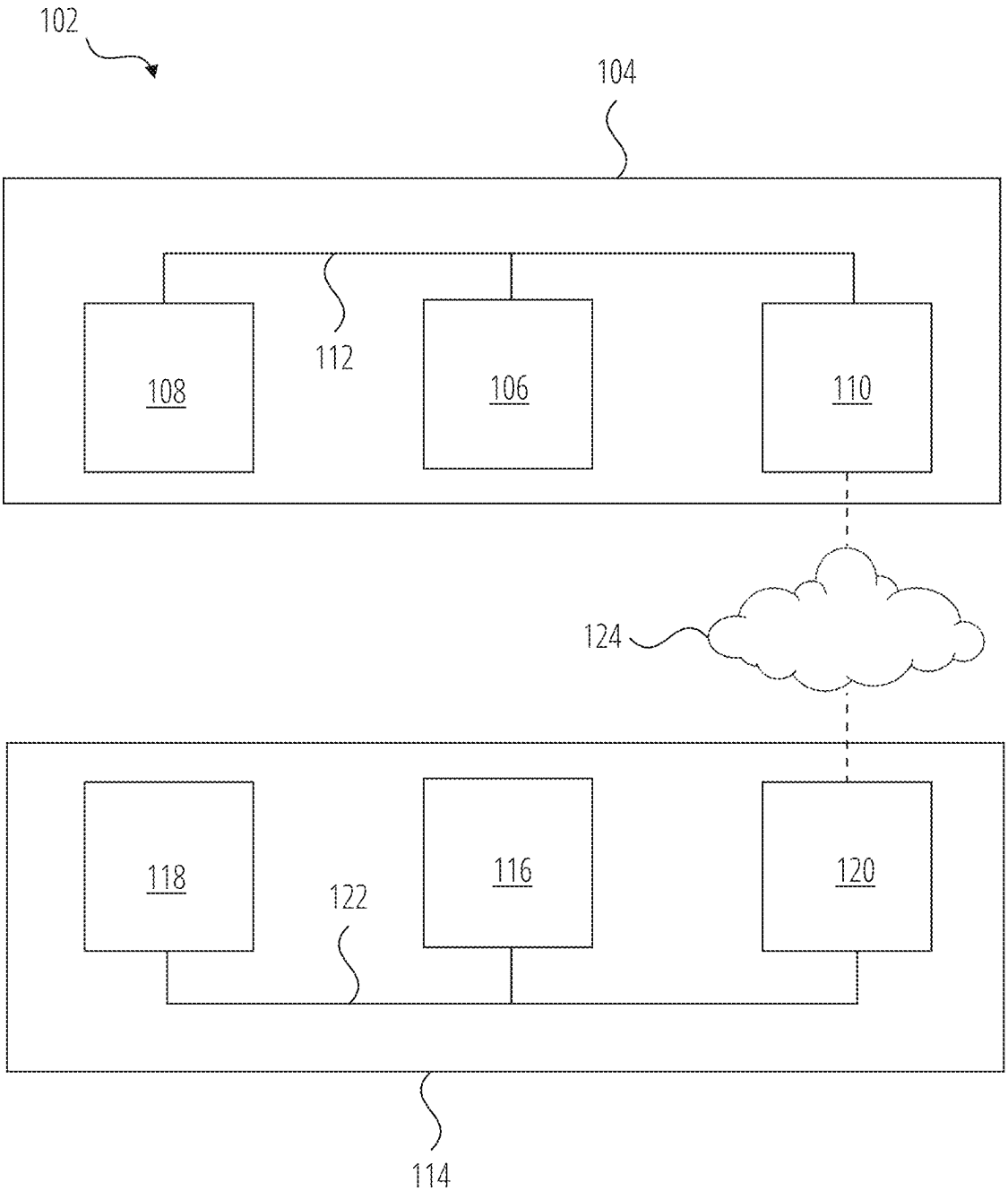


FIG. 1

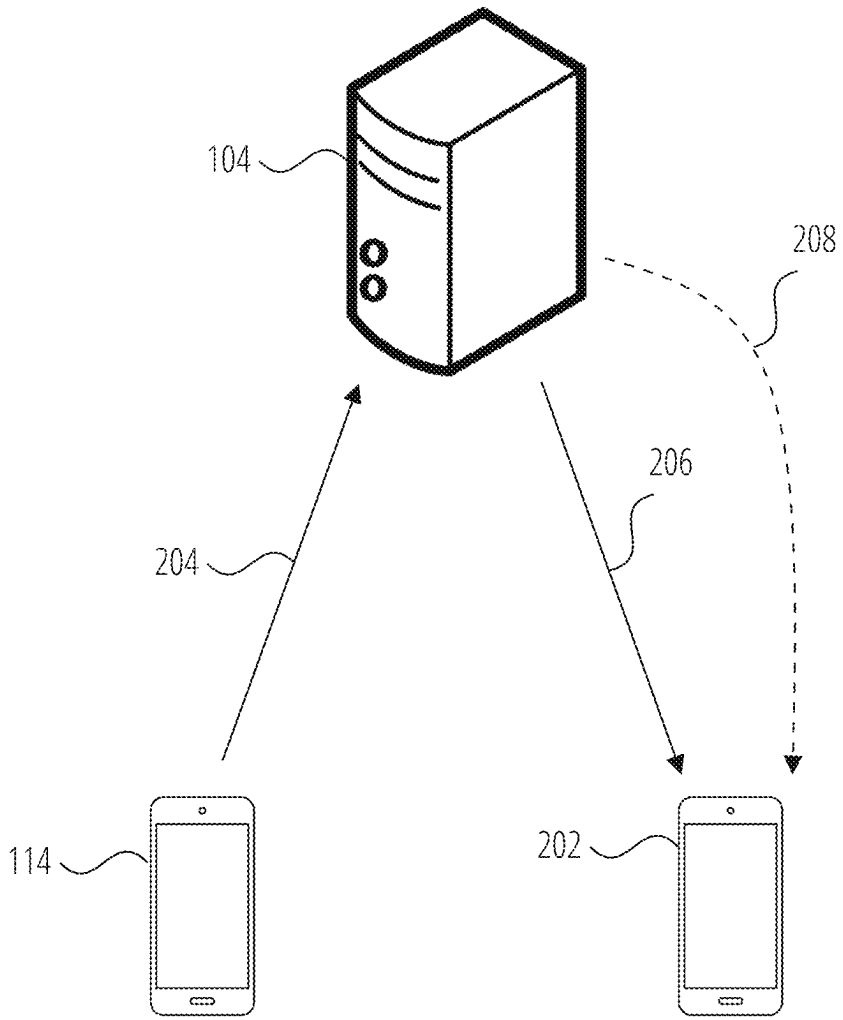


FIG. 2

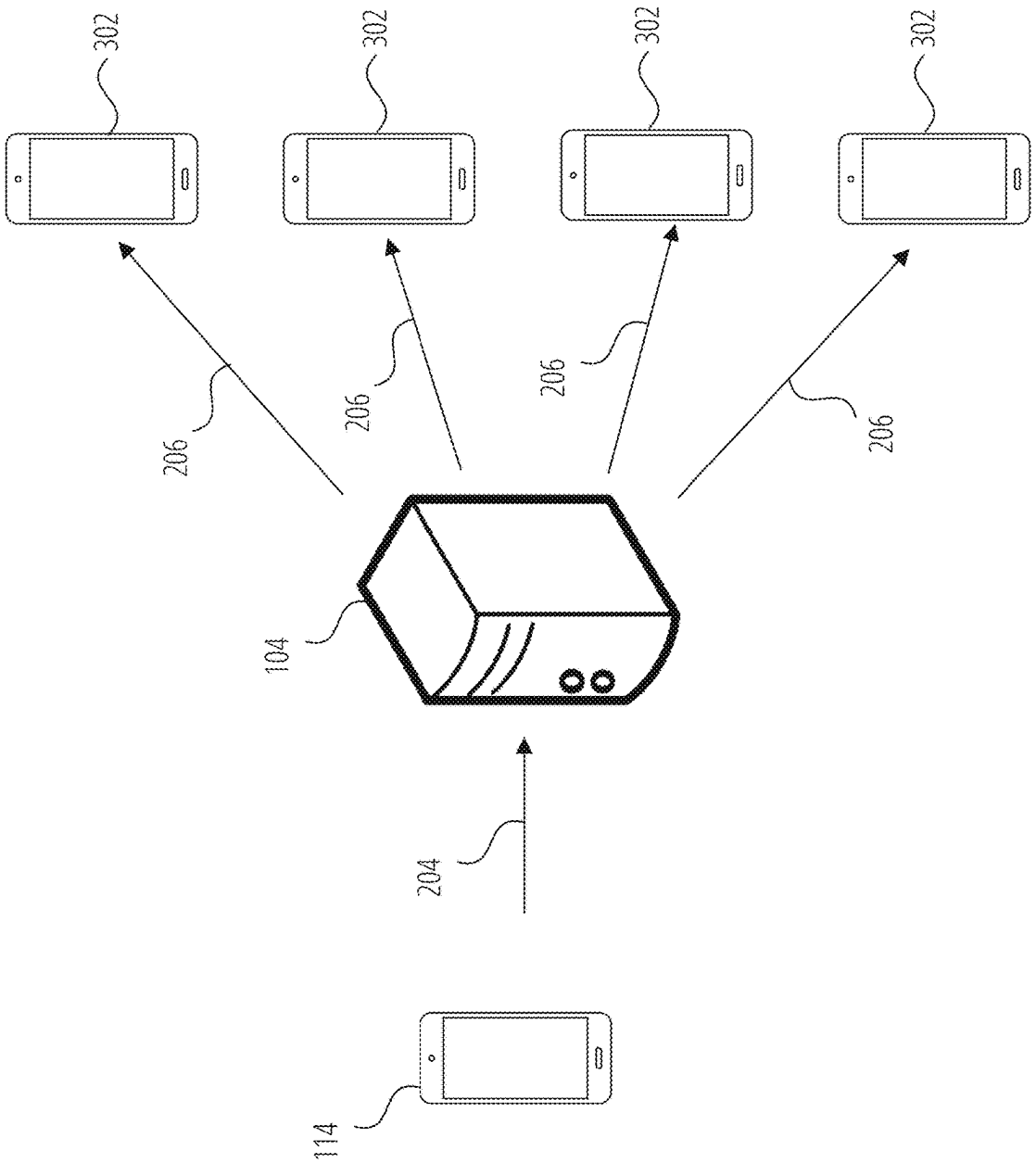


FIG. 3

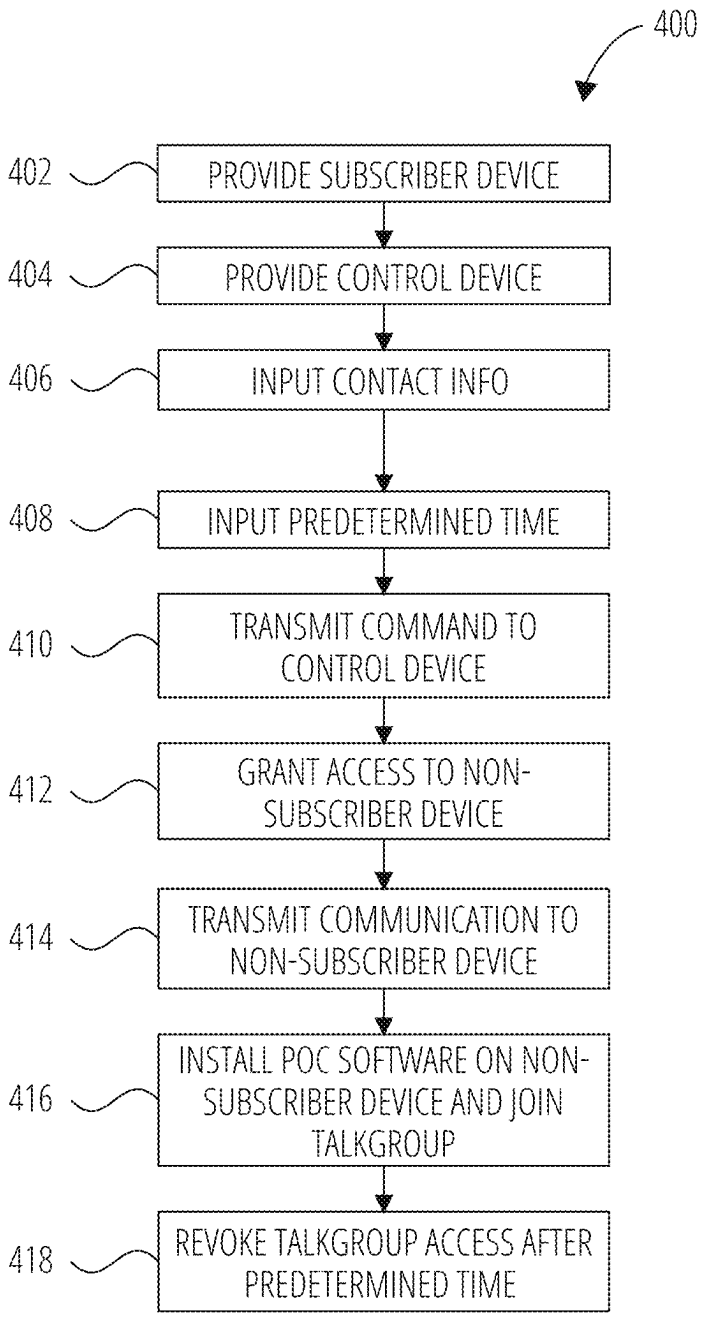
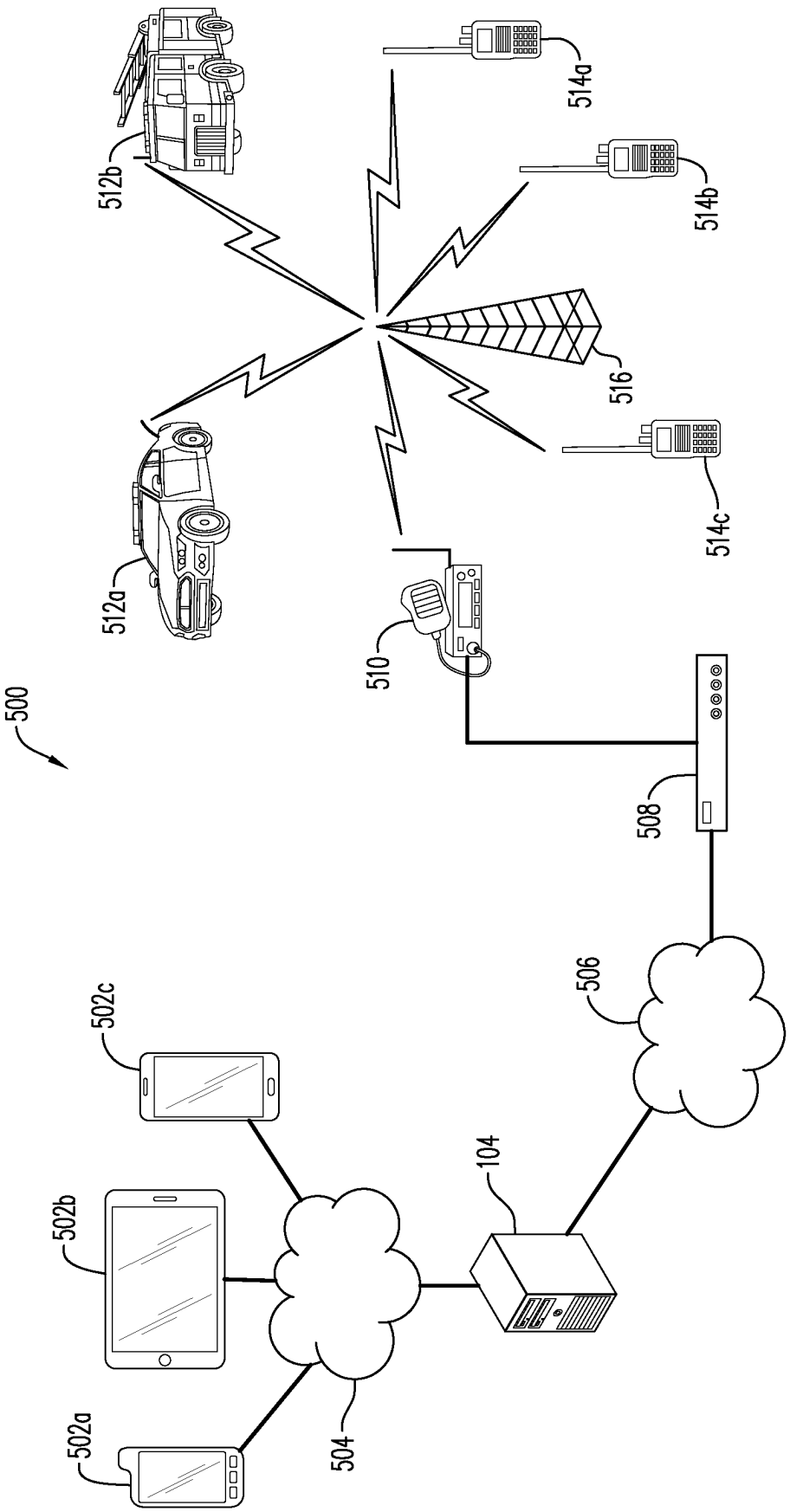

400
402
PROVIDE SUBSCRIBER DEVICE
404
PROVIDE CONTROL DEVICE
406
INPUT CONTACT INFO
408
INPUT PREDETERMINED TIME
410
TRANSMIT COMMAND TO CONTROL DEVICE
412
GRANT ACCESS TO NON-SUBSCRIBER DEVICE
414
TRANSMIT COMMUNICATION TO NON-SUBSCRIBER DEVICE
416
INSTALL POC SOFTWARE ON NON-SUBSCRIBER DEVICE AND JOIN TALKGROUP
418
REVOKE TALKGROUP ACCESS AFTER PREDETERMINED TIME

FIG. 4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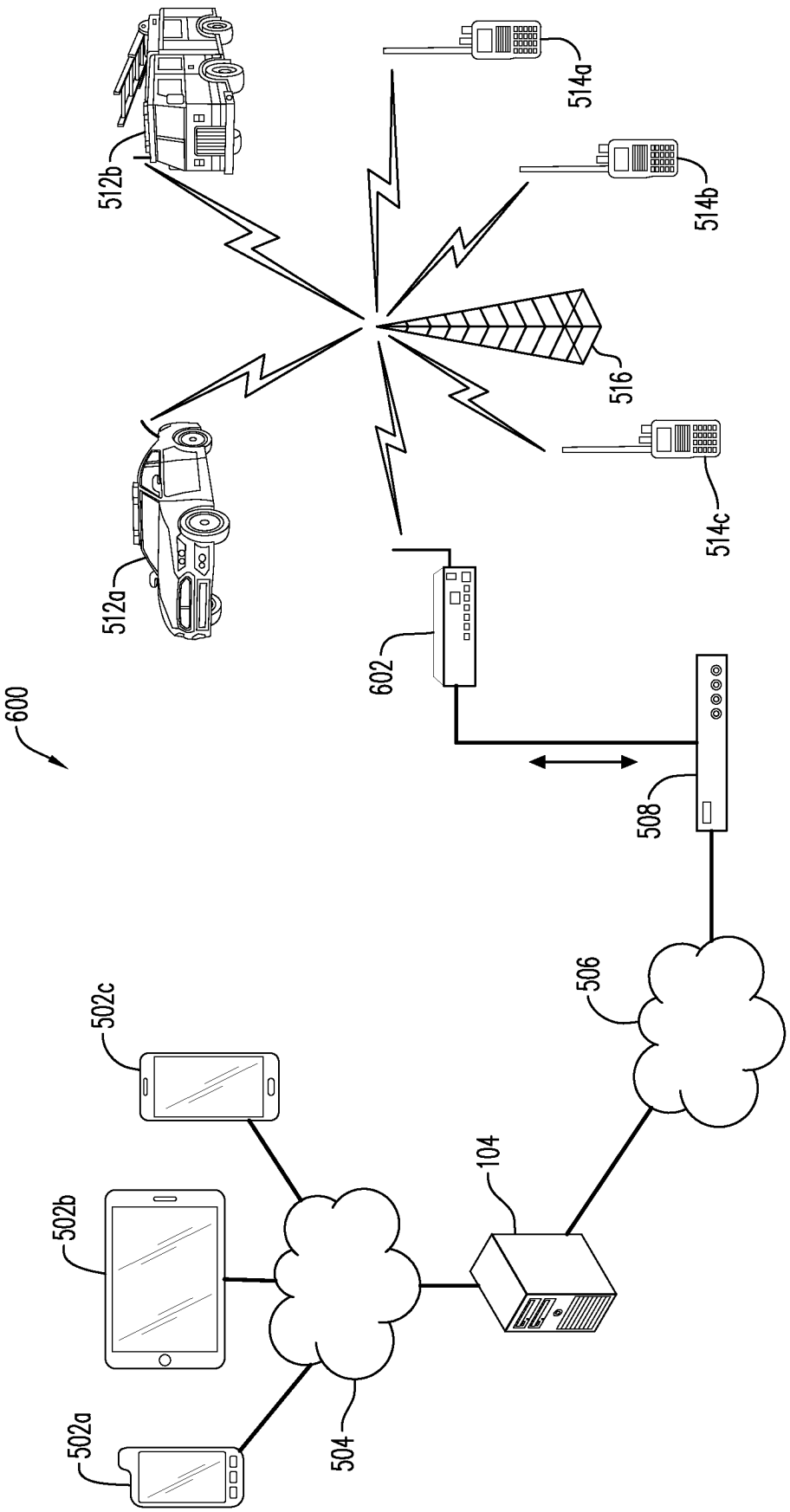
512a
512b
514a
514b
514c
516
510
508
506
502a
502b
502c
504
104

FIG. 5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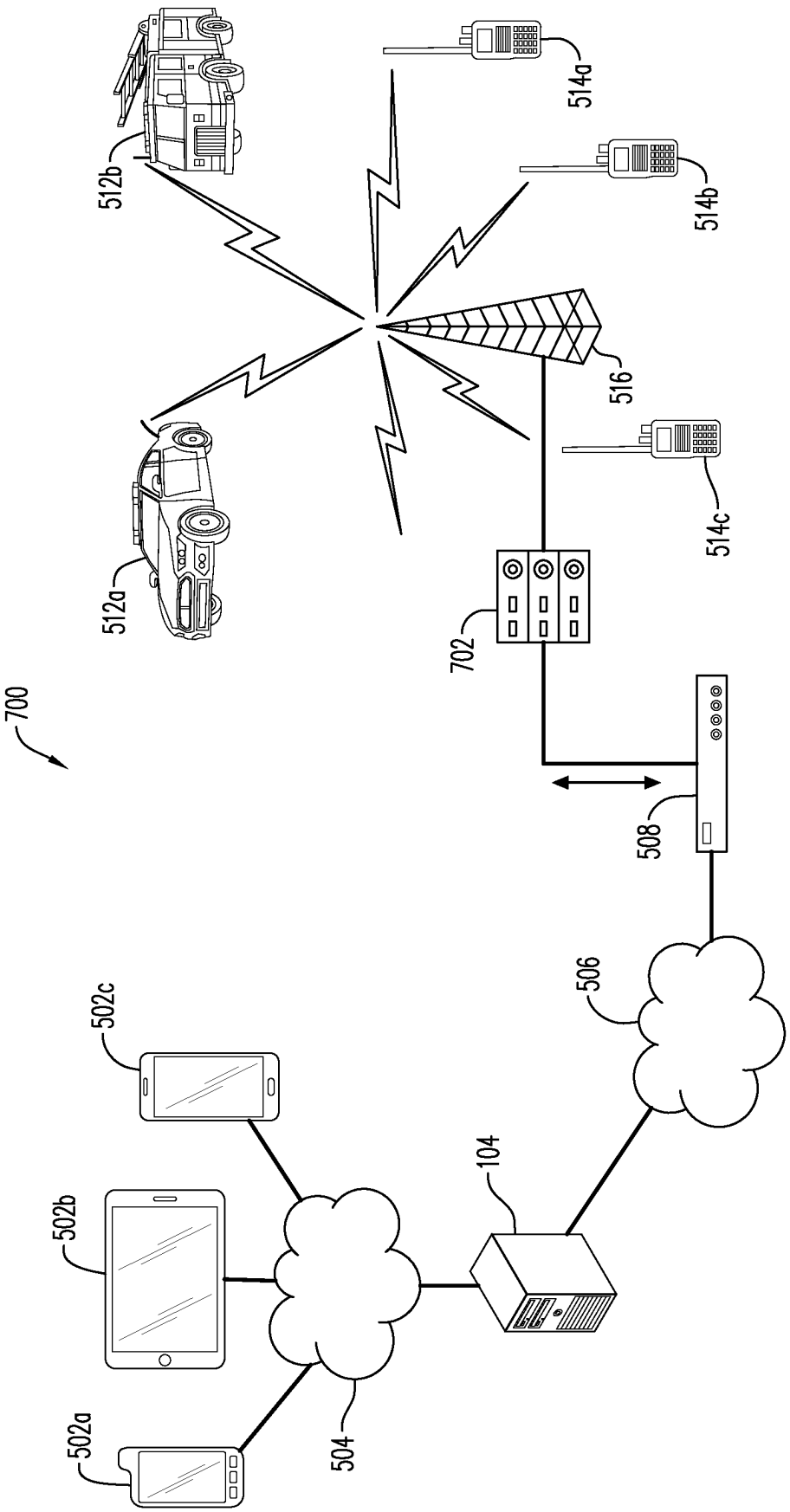
512a
512b
514a
514b
514c
516
602
508
506
502a
502b
502c
504
104

FIG. 6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512b
514a
514b
514c
516
702
508
506
502a
502b
502c
504
104

FIG. 7

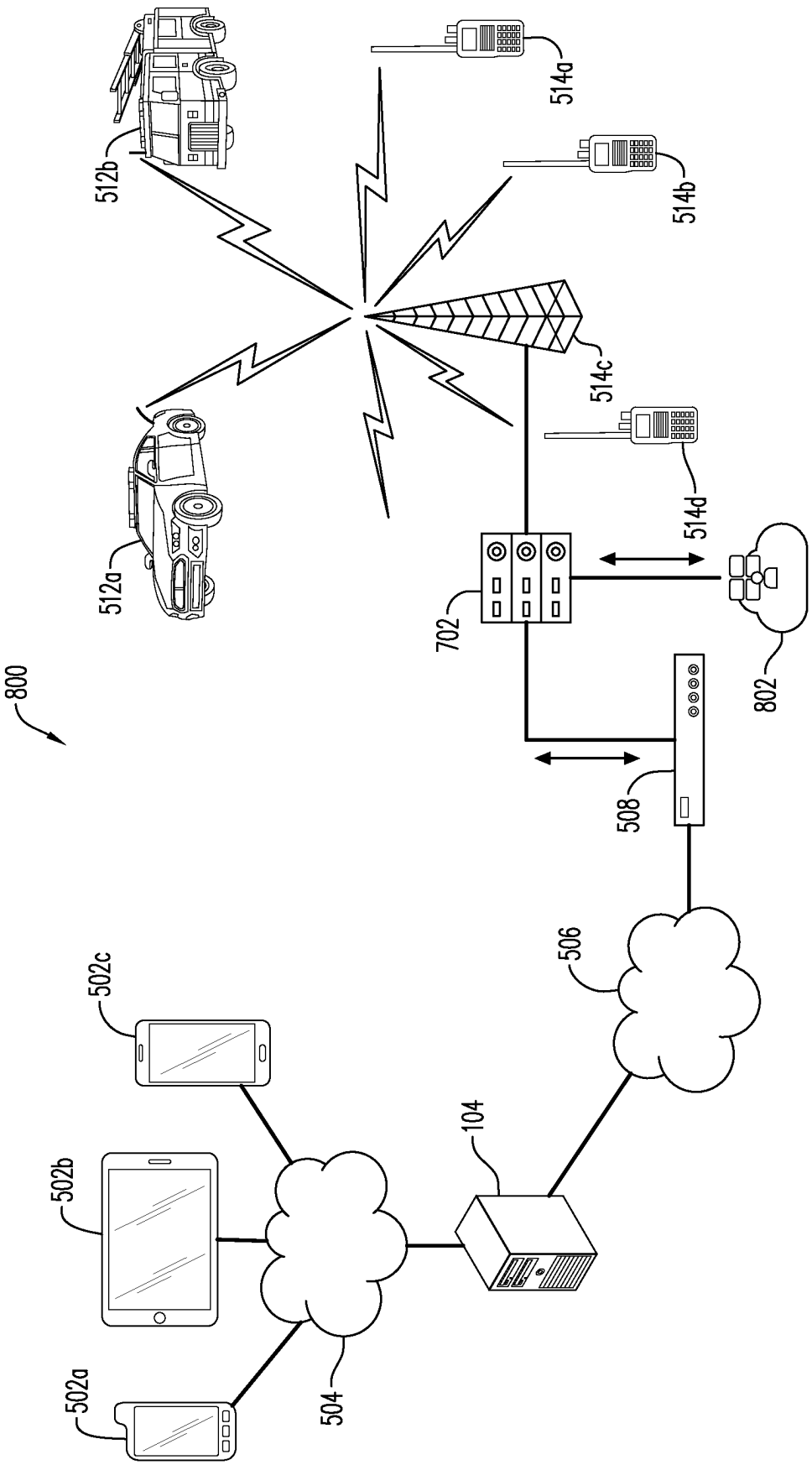
800
512a
512b
514a
514b
514c
514d
702
802
508
506
104
502a
502b
502c
504

FIG. 8

SYSTEM AND METHOD FOR MANAGING ACCESS TO A PUSH-TO-TALK-OVER-CELLULAR COMMUNICATION NETWORK

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 63/300,899 filed Jan. 19, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND

Modern society relies on a number of different public safety agencies, such as fire departments, police departments, ambulance services, etc., to respond to emergency situations. In many situations, inter-agency coordination is critical to effectively responding and protecting the public. However, coordination may be hampered by the lack of communication interoperability between agencies. For example, different agencies may use different communication devices, or may operate on different channels and/or talkgroups. While steps have been made to standardize radio channels and talkgroups for public safety agencies, many times the lack of a common communications network and the unpredictable nature of public safety emergencies may still result in communication difficulties despite the efforts at standardization.

While it may be possible to set up customizable talkgroups for communication, such efforts may be prohibitively complex and time-consuming in an emergency situation. Additionally, such talkgroups would require management after the conclusion of the event to remove access to the talkgroup from devices where it is no longer needed, which may result in tedious and time-consuming management and record-keeping.

Recent years have seen the development of push-to-talk-over-cellular (POC) networks that may rival or surpass the coverage of traditional land mobile radio networks. Additionally, smartphones are widely owned and carried by many people, including public safety agency employees.

Accordingly, there may be a need for methods and systems to quickly and efficiently manage access to push-to-talk talkgroups, especially those that leverage the widespread availability of personal smartphones.

BRIEF SUMMARY

At least an exemplary embodiment of a method of managing access to a push-to-talk-over-cellular (POC) talkgroup may include providing a control device configured to manage a first talkgroup, granting a first non-subscriber device access to the first talkgroup, and transmitting, from the control device to the first non-subscriber device, a first communication including a link to download a POC software application configured to access the first talkgroup.

At least an exemplary method of managing access to a push-to-talk-over-cellular (POC) talkgroup may include providing a control device configured to manage a first talkgroup, providing a first subscriber device, transmitting, from the first subscriber device to the control device, first non-subscriber contact information associated with a first non-subscriber device, and granting the first non-subscriber device access to the first talkgroup.

At least an exemplary embodiment of a non-transitory computer-readable storage medium may include computer-

executable instructions that, when executed by a computer, cause the computer to perform creating a first talkgroup for push-to-talk-over-cellular (POC) communication, receiving, from a first subscriber device, first non-subscriber contact information associated with a first non-subscriber device, and granting the first non-subscriber device access to the first talkgroup.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

A more particular description will be rendered by reference to exemplary embodiments that are illustrated in the accompanying figures. Understanding that these drawings depict exemplary embodiments and do not limit the scope of this disclosure, the exemplary embodiments will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. **1** is a schematic block diagram of a system according to an exemplary embodiment;

FIG. **2** is a schematic diagram of a system according to an exemplary embodiment;

FIG. **3** is a schematic diagram of a system according to an exemplary embodiment;

FIG. **4** is a flowchart illustrating a method according to an exemplary embodiment;

FIG. **5** is a schematic diagram of a system according to an exemplary embodiment;

FIG. **6** is a schematic diagram of a system according to an exemplary embodiment;

FIG. **7** is a schematic diagram of a system according to an exemplary embodiment; and

FIG. **8** is a schematic diagram of a system according to an exemplary embodiment;

Various features, aspects, and advantages of the exemplary embodiments will become more apparent from the following detailed description, along with the accompanying drawings in which like numerals represent like components throughout the figures and detailed description. The various described features are not necessarily drawn to scale in the drawings but are drawn to aid in understanding the features of the exemplary embodiments.

The headings used herein are for organizational purposes only and are not meant to limit the scope of the disclosure or the claims. To facilitate understanding, reference numerals have been used, where possible, to designate like elements common to the figures.

DETAILED DESCRIPTION

Reference will now be made in detail to various exemplary embodiments. Each example is provided by way of explanation and is not meant as a limitation and does not constitute a definition of all possible embodiments. It is understood that reference to a particular "exemplary embodiment" of, e.g., a structure, assembly, component, configuration, method, etc. includes exemplary embodiments of, e.g., the associated features, subcomponents, method steps, etc. forming a part of the "exemplary embodiment."

FIG. **1** shows a schematic block drawings of an exemplary embodiment of a system **102** for managing access to a push-to-talk-over-cellular (POC) talkgroup. The system **102** may include a control device **104** and a first subscriber device **114** in communication with the control device **104**. The control device **104** may be configured to perform

administrative duties with respect to one or a plurality of POC talkgroups, including a first talkgroup. For example, the control device **104** may control which non-subscriber devices have access to the talkgroups managed by the control device **104**.

In an exemplary embodiment, the phrase "subscriber device" may refer to a device that subscribes to a service provided by an operator of the control device **104**. For example, the operator of the control device **104** may provide a POC service for facilitating POC communication between various devices. In contrast, the phrase "non-subscriber device" may refer to a device that does not subscribe to the service provided by the operator of the control device **104**. The non-subscriber device may subscribe to a different POC service than the service provided by the operator of the control device **104**, or the non-subscriber device may not subscribe to any POC service at all and may not even have any POC software installed on the device. As explained further hereinbelow, at least an exemplary embodiment includes providing a link to download POC software compatible with the talkgroup(s) managed by the control device **104**.

In an exemplary embodiment, the control device **104** may be a server that is accessible via communication over internet **124**. The control device **104** may further include a control device processor **106**, a control device memory **108**, and a control device communication module **110**, which may be mutually operably coupled to each other via a control device bus **112**. The control device communication module **110** may include hardware components that allow the control device **104** to communicate with other devices, either locally or via a network such as the internet **124**. For example, the control device communication module **110** may include an ethernet connection, wireless LAN connection, and/or other hardware configured for communication over the internet **124**. The control device processor **106**, the control device memory **108**, and the control device communication module **110** may be mutually operably coupled via a control device bus **112**. The control device memory **108** may be a non-transitory computer-readable medium or media that stores computer-executable instructions thereon. The computer-executable instructions stored in the control device memory **108** may be executed by the control device **104**; in an exemplary embodiment, the computer-executable instructions may be executed by the control device processor **106**. Once executed, the computer-executable instructions may cause the control device **104** to perform steps consistent with the processes and methods described herein below.

The first subscriber device **114** may be configured to communicate with the control device **104** via the internet **124**. In various exemplary embodiments, the first subscriber device **114** may be a cellular telephone (e.g. a smart phone), a tablet computer, a laptop computer, or a desktop computer. Generally, the first subscriber device **114** may be used by a person with administrative rights with respect to the first talkgroup. The first subscriber device **114** may include a subscriber device processor **116**, a subscriber device memory **118**, and a subscriber device communication module **120**. Similar to the control device communication module **110** described above, the subscriber device communication module **120** may include hardware components that allow the first subscriber device **114** to communicate with the control device **104** via the internet **124**. For example, the subscriber device communication module **120** may include an ethernet connection, wireless LAN connection, broadband cellular antenna and related hardware, and/or other hardware configured for communication over the internet **124**. The subscriber device processor **116**, the subscriber device memory **118**, and the subscriber device communication module **120** may be mutually operably coupled via a subscriber device bus **122**.

It will be understood that FIG. **1** is not intended to demonstrate a specific physical arrangement of the hardware of the control device **104** or the first subscriber device **114**, but is instead intended as a conceptual representation to show what structures may be present in exemplary embodiments of the control device **104** and the first subscriber device **114**. It will be further understood that the control device **104** and the first subscriber device **114** are not limited to the specifically illustrated connections between the components. For example, in exemplary embodiments, certain components may be operably coupled to the control device processor **106** or the subscriber device processor **116** without direct connection to other components.

FIG. **2** is a schematic diagram showing an exemplary embodiment of how the system **102** may be used to manage a POC talkgroup. For example, in an emergency incident, a first responder (hereinafter referred to as an administrator) such as a senior police officer or senior firefighter may have control of the first subscriber device **114**. In the context of FIG. **2**, the first subscriber device **114** is illustrated as a smartphone, but it will be understood that the disclosure is not limited to this. For example, in another exemplary embodiment, the first subscriber device **114** may be a tablet, laptop computer, desktop computer, or other device, and may be operated by a dispatcher or senior officer at a command post. The administrator may have administrative privileges with respect to a preexisting first talkgroup or may create a new first talkgroup on an ad hoc basis.

Another first responder (hereinafter referred to as a client), owning a first non-subscriber device **202**, may arrive on the scene and may need to communicate with other first responders. The first non-subscriber device **202** may be a device configured to communicate via a broadband cellular network, such as a cellular telephone (e.g. a smartphone) or a tablet computer. The administrator may send a command **204** to the control device **104** including first non-subscriber contact information associated with the first non-subscriber device **202**. The command may be entered via a software application running on the first subscriber device **114** and configured for interfacing with the control device **104**. For example, the software application may have a user interface where the administrator can enter the first non-subscriber contact information. In some embodiments, entering the first non-subscriber contact information may be by manual entry of the first non-subscriber contact information. In some embodiments, entering non-subscriber contact information may be by selection of specific non-subscriber contact information (e.g. associated with a specific non-subscriber device, such as the first non-subscriber device **202**) from pre-entered non-subscriber contact information (e.g. by selection from a menu of pre-entered contact information). In some embodiments, the pre-entered contact information may include information (such as telephone numbers) from the administrator/subscriber's general contact list (e.g. on their cellphone and/or first subscriber device **114**) and/or information from a non-subscriber list (for example, in a database or spreadsheet or otherwise on or available through the first subscriber device **114**), which may include information built over time, such as non-subscribers that were previously invited to participate. The first non-subscriber contact information may be a cellular telephone number, email address, or other identifying information linked to the first non-subscriber device **202** and/or the client using the

first non-subscriber device **202**. The command **204** may further include instructions to grant the first non-subscriber device **202** access to the first talkgroup, and the command **204** may further indicate a predetermined period of time for access to the first talkgroup. The predetermined period of time may have a default value, or the predetermined period of time may be settable via first subscriber device **114**.

In response to the command **204**, the control device **104** may grant the first non-subscriber device **202** access to the first talkgroup. Further, the control device **104** may send a first communication **206** to the first non-subscriber device **202** notifying it that access has been granted to first talkgroup. The first communication **206** may be a text message, email message, or message sent via another suitable communication protocol. The first communication **206** may include first configuration information associated with the first talkgroup. The first configuration information may include any information and/or parameters necessary for communicating via the first talkgroup. For example, the first configuration information may be a file for use by a software application on first non-subscriber device **202**, such that the file may instruct the software application to display and/or communicate via the first talkgroup. Additionally, the first communication **206** may include a link for downloading a POC software application for POC communication. Thus, even if the first non-subscriber device **202** was not previously configured for POC communications, the first communication **206** will provide the first non-subscriber device **202** with the means for accessing the first talkgroup to which it has been granted access.

After the predetermined period of time has expired, the control device **104** may revoke access of the first non-subscriber device **202** to the first talkgroup. In an exemplary embodiment, the control device **104** may be configured and/or programmed to revoke the access to the first talkgroup automatically with no human interaction required. In an exemplary embodiment, the control device **104** may send a second communication **208** to the first non-subscriber device **202** instructing the first non-subscriber device **202** to remove the first talkgroup from the POC software on the first non-subscriber device **202**. In an alternative exemplary embodiment, control device **104** may be configured such that the administrator can terminate the first talkgroup via an affirmative command entered into the first subscriber device **114**. In another alternative exemplary embodiment, the control device **104** may be configured to terminate the first talkgroup after a predetermined period of no activity within the first talkgroup.

FIG. **3** is a schematic diagram showing another exemplary embodiment of how the system **102** may be used to manage a POC talkgroup. Similar to the embodiment shown in FIG. **2**, in FIG. **3** the first subscriber device **114** may send the command **204** to the control device **104**. The main difference between FIG. **2** and FIG. **3** is that in FIG. **3**, there are a plurality of non-subscriber devices **302**. Each of the plurality of non-subscriber devices **302** may have its own non-subscriber contact information, such as a cellular telephone number. Accordingly, the administrator may enter multiple telephone numbers into the software application on the first subscriber device **114**, each telephone number corresponding to one of the plurality of non-subscriber devices **302**. In some embodiments, entering the non-subscriber contact information may be by manual entry of the first non-subscriber contact information. In some embodiments, entering non-subscriber contact information (e.g. telephone numbers) may be by selection of specific non-subscriber contact information (e.g. associated with a specific non-subscribe device) from pre-entered non-subscriber contact information (e.g. by selection from a menu of pre-entered contact information, for example on the software application, such as subscribers previously invited to participate via the system or software application, and/or from the administrator's contact list on their first subscriber device **114**, such as a cellphone). The control device **104** may then grant access to the first talkgroup to each of the plurality of non-subscriber devices **302** for the predetermined period of time, and the control device **104** may further send the first communication **206** to each of the plurality of non-subscriber devices **302**. After the predetermined amount of time has expired, the control device **104** may revoke the access to the first talkgroup for each of the plurality of non-subscriber devices **302**. Alternatively, the first talkgroup may be terminated via an affirmative command or by lack of activity for a predetermined period of time.

The description above describes the control device **104** in terms of managing the first talkgroup. However, it will be understood that the disclosure is not limited to just a single talkgroup. For example, in an exemplary embodiment, the first talkgroup may be one of a plurality of talkgroups. In this situation, the first communication **206** from the control device **104** to the first non-subscriber device **202** or the plurality of non-subscriber devices **302** may include configuration information for each talkgroup of the plurality of talkgroups. Further, the control device **104** may grant access to one, several, or all of the talkgroups in the plurality of talkgroups to each of the first non-subscriber device **202** or the plurality of non-subscriber devices **302**. Additionally, in an exemplary embodiment, multiple talkgroups may be linked together as part of a single virtual incident. Each individual talkgroup may be configured to facilitate communication between particular groups during an incident. For example, the multiple talkgroups may correspond to different types of responders at an incident, such as a talk group for fire personnel, a talkgroup for law enforcement personnel, a talkgroup for medical personnel, etc. Alternatively, the multiple talkgroups may be geographically based, such as all emergency personnel in a first geographic area, all emergency personnel in a second geographic area, etc. Similarly, once the predetermined time has expired, access to the plurality of talkgroups may be automatically revoked by the control device **104**.

FIG. **4** is a flowchart illustrating an exemplary embodiment of a method for managing access to a POC talkgroup. In block **402**, a subscriber device is provided. The subscriber device may be the first subscriber device **114** as described above. In block **404**, a control device is provided. The control device may be the control device **104** as described above. The subscriber device and the control device may be configured to communicate via the internet.

In block **406**, non-subscriber contact information is input into the subscriber device. In an exemplary embodiment, the non-subscriber contact information may be a cellular telephone number, email address, or other information that can identify a user. In some embodiments, inputting the first non-subscriber contact information may be by manual entry of the first non-subscriber contact information. In some embodiments, inputting non-subscriber contact information may be by selection of specific non-subscriber contact information (e.g. associated with a specific non-subscriber) from pre-entered non-subscriber contact information (e.g. by selection from a menu of pre-entered contact information and/or from the administrator's contact list on their first subscriber device **114**, such as a cellphone). Additional methods of inputting non-subscriber contact information

into the subscriber device are included within the scope herein. In block **408**, a predetermined time for access to a talkgroup may be entered into the subscriber device.

In block **410**, the subscriber device may transmit a command to the control device. The command may include the non-subscriber contact information, a list of one or more talkgroups to which access is to be granted, and/or the predetermined time. In block **412**, the control device may then manage the desired talkgroup(s) to grant access to the device associated with the non-subscriber contact information.

In block **414**, the control device may transmit a communication to the non-subscriber device. The communication may include a link to download a software application that can communicate with the POC talkgroup if the non-subscriber device does not already include the software, as well as information sufficient to populate the software application with the talkgroup(s).

In block **416**, the non-subscriber device may install the POC software application, if necessary, and join the POC talkgroup. In block **418**, the control device may revoke talkgroup access for the non-subscriber device after the predetermined time has elapsed. The control device may also transmit a communication to the non-subscriber device removing the talkgroup from the software application on the non-subscriber device. Additionally, the control device may transmit a communication to the non-subscriber device that includes instructions to delete the POC software application from the non-subscriber device.

In certain situations, it may be advantageous to join a whole group of land mobile radio (LMR) users to the talkgroup(s) managed by the control device **104**. For example, a first jurisdiction may have an emergency situation that requires assistance from a fire department from a second jurisdiction. If the second jurisdiction fire department already has an LMR network and LMR devices configured for its members, it may be more efficient to simply join the entire LMR network to the talkgroups managed by the control device **104**, instead of joining individual non-subscriber devices. FIG. **5** shows an exemplary embodiment of a system **500** for POC communication in such a situation.

In the system **500**, there may be a predefined group of LMR users using devices such as mobile LMR devices **512***a*, **512***b* and handheld LMR devices **514***a*, **514***b*, **514***c*. Mobile LMR devices **512***a*, **512***b* and handheld LMR devices **514***a*, **514***b*, **514***c* may be in mutual communication via an LMR repeater system **516**. The LMR repeater system **516** may further be in communication with a donor radio **510** operably coupled to an LMR gateway such as a radio gateway **508**. The radio gateway **508** may communicate with the donor radio **510** via tone signaling or a proprietary signaling regime. The donor radio **510** may be an LMR device similar to the mobile LMR device **512***a* or the handheld LMR device **514***a* and be specifically configured as an access point between the radio gateway **508** and the LMR repeater system **516**. The radio gateway **508** may be configured to communicate with an IP network **506** (such as the Internet). The radio gateway **508** may be a purpose-built device specifically designed for communicating with LMR devices and IP networks, or, alternatively, the radio gateway **508** may be a general-use PC running software configured to serve as a gateway. The radio gateway **508** may be in communication with the control device **104** via the IP network **506**. As described above, the control device **104** may manage one or more POC talkgroups **504**, and POC devices **502***a*, **502***b*, **502***c* may be configured to communicate via the POC talkgroups **504**. Thus, the system **500** allows for LMC-POC communication between, on one side, a preexisting group comprising mobile LMR devices **512***a*, **512***b* and handheld LMR devices **514***a*, **514***b*, **514***c*, and, on the other side, POC devices **502***a*, **502***b*, **502***c*, via the control device **104**, the radio gateway **508**, and the donor radio **510**, thereby adding addition flexibility and utility to first responders' communications systems.

It will be understood that the systems and methods of the present disclosure are not limited to the system **500** shown in FIG. **5**, and instead are broadly applicable to any LMR system that can be linked to an IP network **506**. For example, FIG. **6** shows an embodiment of a system **600** in which the donor radio **510** of FIG. **5** is replaced by a P25 station **602** as the LMR gateway. The term P25 refers to the Project 25 suite of standards for interoperable digital two-way radio products. FIG. **7** shows an exemplary embodiment of a system **700** in which a P25 core **702** serves as the LMR gateway to the IP network **506**. FIG. **8** shows an exemplary embodiment of a system **800** using the P25 core **702** along with the addition of a P25 console subsystem **802** for additional connectivity and functionality.

A common feature among the system **500**, the system **600**, the system **700**, and the system **800** is that it allows for LMR device users to be invited to and join the POC talkgroups **504** managed by the control device **104**. In at least an embodiment described above, the administrator may enter non-subscriber contact information for inviting a non-subscriber device. In contrast, in an embodiment using one of the system **500**, the system **600**, the system **700**, and the system **800**, the administrator may enter identifying information of the LMR gateway, such as an IP address. Once the IP address of the LMR gateway is entered, any LMR devices on the corresponding LMR network will have access to the POC talkgroups **504**. Alternatively, depending on the capabilities of the specific LMR gateway being used, it may be possible to selectively limit access to the POC talkgroups **504** to individual devices of the LMR network. Access to the POC talkgroups **504** may be terminated in the same fashion as described hereinabove, i.e., after passage of a predetermined time, an affirmative command by an administrator, or lack of activity in the POC talkgroups **504**.

In the various embodiments described above, reference is made to non-subscriber devices. It will be understood that this is not meant to limit in any way the embodiments described above as only for use with non-subscriber devices. For example, it will be understood that other subscriber devices may also be invited to join talkgroups managed by the control device in addition to or as an alternative to the non-subscriber devices.

The exemplary embodiments of a method and system described above may provide significant advantages over conventional solutions. For example, certain emergency situations may require coordinated responses from several different agencies, possibly from multiple different jurisdictions. The agencies may each use different communication hardware, and/or may be configured to communicate on different talkgroups and channels, which could make coordination difficult. Embodiments of the system and method described above may allow users to quickly set up ad hoc talkgroups in the field for interagency communication, without required complicated administrative procedures. This would allow for more time and attention to be devoted to responding to the emergency situation. Additionally, automatically revoking access to the talkgroup after a predetermined period of time may help to reduce cluttered population of talkgroups and reduce the manpower required for

administering a talkgroup. Further, automatically revoking access to talkgroups may help to maintain the integrity and security of agency talkgroups by reducing the likelihood of unauthorized access after the emergency situation has passed.

This disclosure, in various embodiments, configurations and aspects, includes components, methods, processes, systems, and/or apparatuses as depicted and described herein, including various embodiments, sub-combinations, and subsets thereof. This disclosure contemplates, in various embodiments, configurations and aspects, the actual or optional use or inclusion of, e.g., components or processes as may be well-known or understood in the art and consistent with this disclosure though not depicted and/or described herein.

The phrases "at least one", "one or more", and "and/or" are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions "at least one of A, B and C", "at least one of A, B, or C", "one or more of A, B, and C", "one or more of A, B, or C" and "A, B, and/or C" means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.

In this specification and the claims that follow, reference will be made to a number of terms that have the following meanings. The terms "a" (or "an") and "the" refer to one or more of that entity, thereby including plural referents unless the context clearly dictates otherwise. As such, the terms "a" (or "an"), "one or more" and "at least one" can be used interchangeably herein. Furthermore, references to "one embodiment", "some embodiments", "an embodiment" and the like are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term such as "about" is not to be limited to the precise value specified. In some instances, the approximating language may correspond to the precision of an instrument for measuring the value. Terms such as "first," "second," "upper," "lower" etc. are used to identify one element from another, and unless otherwise specified are not meant to refer to a particular order or number of elements.

As used herein, the terms "may" and "may be" indicate a possibility of an occurrence within a set of circumstances; a possession of a specified property, characteristic or function; and/or qualify another verb by expressing one or more of an ability, capability, or possibility associated with the qualified verb. Accordingly, usage of "may" and "may be" indicates that a modified term is apparently appropriate, capable, or suitable for an indicated capacity, function, or usage, while considering that in some circumstances the modified term may sometimes not be appropriate, capable, or suitable. For example, in some circumstances an event or capacity can be expected, while in other circumstances the event or capacity cannot occur—this distinction is captured by the terms "may" and "may be."

As used in the claims, the word "comprises" and its grammatical variants logically also subtend and include phrases of varying and differing extent such as for example, but not limited thereto, "consisting essentially of" and "consisting of." Where necessary, ranges have been supplied, and those ranges are inclusive of all sub-ranges therebetween. It is to be expected that the appended claims should cover variations in the ranges except where this disclosure makes clear the use of a particular range in certain embodiments.

The terms "determine", "calculate" and "compute," and variations thereof, as used herein, are used interchangeably and include any type of methodology, process, mathematical operation or technique.

This disclosure is presented for purposes of illustration and description. This disclosure is not limited to the form or forms disclosed herein. In the Detailed Description of this disclosure, for example, various features of some exemplary embodiments are grouped together to representatively describe those and other contemplated embodiments, configurations, and aspects, to the extent that including in this disclosure a description of every potential embodiment, variant, and combination of features is not feasible. Thus, the features of the disclosed embodiments, configurations, and aspects may be combined in alternate embodiments, configurations, and aspects not expressly discussed above. For example, the features recited in the following claims lie in less than all features of a single disclosed embodiment, configuration, or aspect. Thus, the following claims are hereby incorporated into this Detailed Description, with each claim standing on its own as a separate embodiment of this disclosure.

Advances in science and technology may provide variations that are not necessarily expressed in the terminology of this disclosure although the claims would not necessarily exclude these variations.

What is claimed is:

1. A method of managing access to a push-to-talk-over-cellular (POC) talkgroup, the method comprising:

providing a control device configured to:

provide a POC service; and

manage a first POC talkgroup;

granting a first non-subscriber device access to the POC service and the first POC talkgroup such that the first non-subscriber is permitted to join the first POC talkgroup and communicate via the first POC talk group using the POC service; and

transmitting, from the control device to the first non-subscriber device, a first communication including a link to download a POC software application configured to join the first POC talkgroup and communicate via the first POC talkgroup using the POC service.

2. The method of claim **1**, further comprising automatically revoking access of the first non-subscriber device to the first POC talkgroup after a predetermined period of time has elapsed.

3. The method of claim **1**, further comprising:

providing a first subscriber device; and

transmitting, from the first subscriber device to the control device, first non-subscriber contact information associated with the first non-subscriber device.

4. The method of claim **3**, further comprising:

setting a predetermined period of time via the first subscriber device; and

automatically revoking access of the first non-subscriber device to the first POC talkgroup after the predetermined period of time has elapsed.

5. The method of claim **3**, wherein:

the first non-subscriber device is a cellular device; and

the first non-subscriber contact information is a first cellular telephone number.

6. The method of claim **1**, wherein:

the first non-subscriber device is one of a plurality of non-subscriber devices;

the granting the first non-subscriber device access to the first POC talkgroup comprises granting the plurality of non-subscriber devices access to the first POC talkgroup; and

the transmitting the first communication comprises transmitting the first communication to each non-subscriber device of the plurality of non-subscriber devices.

7. The method of claim **1**, wherein:

the first POC talkgroup is one of a plurality of POC talkgroups; and

each POC talkgroup of the plurality of POC talkgroups is linked as part of a single virtual incident.

8. A method of managing access to a push-to-talk-over-cellular (POC) talkgroup, the method comprising:

providing a control device configured to:

provide a POC service; and

manage a first POC talkgroup;

providing a first subscriber device;

transmitting, from the first subscriber device to the control device, first non-subscriber contact information associated with a first non-subscriber device;

granting the first non-subscriber device access to the POC service and the first POC talkgroup such that the first non-subscriber device is permitted to join the first POC talkgroup and communicate via the first POC talkgroup using the POC service; and

transmitting, from the control device to the first non-subscriber device, a first communication including a link to download a POC software application configured to join the first POC talkgroup and communicate via the first POC talkgroup using the POC service.

9. The method of claim **8**, further comprising automatically revoking access of the first non-subscriber device to the first POC talkgroup after a predetermined period of time has elapsed.

10. The method of claim **8**, further comprising:

setting a predetermined period of time via the first subscriber device; and

automatically revoking access of the first non-subscriber device to the first POC talkgroup after the predetermined period of time has elapsed.

11. The method of claim **8**, wherein:

the first non-subscriber device is a cellular device; and

the first non-subscriber contact information is a first cellular telephone number.

12. The method of claim **8**, wherein:

the first non-subscriber device is a land mobile radio (LMR) gateway; and

the first non-subscriber contact information is an internet protocol address of the LMR gateway.

13. The method of claim **8**, wherein:

the first non-subscriber device is one of a plurality of non-subscriber devices;

the transmitting, from the first subscriber device to the control device, first non-subscriber contact information associated with a first non-subscriber device comprises transmitting, from the first subscriber device to the control device, non-subscriber contact information associated with each non-subscriber device of the plurality of non-subscriber devices; and

the granting the first non-subscriber device access to the first POC talkgroup comprises granting the plurality of non-subscriber devices access to the first POC talkgroup.

14. The method of claim **8**, wherein:

the first POC talkgroup is one of a plurality of POC talkgroups; and

each POC talkgroup of the plurality of POC talkgroups is linked as part of a single virtual incident.

15. A non-transitory computer-readable storage medium comprising computer-executable instructions that, when executed by a computer, cause the computer to perform:

provide a push-to-talk-over cellular (POC) service;

creating a first POC talkgroup for POC communication;

receiving, from a first subscriber device, first non-subscriber contact information associated with a first non-subscriber device;

granting the first non-subscriber device access to the POC first talkgroup such that the first non-subscriber device is permitted to join the first POC talkgroup and communicate via the first POC talkgroup using the POC service; and

transmitting, to the first non-subscriber device, a first communication including a link to download a POC software application configured to join the first POC talkgroup and communicate via the first POC talkgroup using the POC service.

16. The non-transitory computer-readable storage medium of claim **15**, wherein the computer-executable instructions further cause the computer to perform:

automatically revoking access of the first non-subscriber device to the first POC talkgroup after a predetermined period of time has elapsed.

17. The non-transitory computer-readable storage medium of claim **15**, wherein the computer-executable instructions further cause the computer to perform:

receiving a predetermined period of time setting from the first subscriber device; and

automatically revoking access of the first non-subscriber device to the first POC talkgroup after the predetermined period of time has elapsed.

18. The non-transitory computer-readable storage medium of claim **15**, wherein:

the first non-subscriber device is a cellular device; and

the first non-subscriber contact information is a first cellular telephone number.

19. The non-transitory computer-readable storage medium of claim **15**, wherein:

the first non-subscriber device is a land mobile radio (LMR) gateway; and

the first non-subscriber contact information is an internet protocol address of the LMR gateway.

20. The non-transitory computer-readable storage medium of claim **15**, wherein:

the first non-subscriber device is one of a plurality of non-subscriber devices;

the receiving, from a first subscriber device, first non-subscriber contact information associated with a first non-subscriber device comprises receiving, from the first subscriber device, non-subscriber contact information associated with each non-subscriber device of the plurality of non-subscriber devices; and

the granting the first non-subscriber device access to the first POC talkgroup comprises granting the plurality of non-subscriber devices access to the first POC talkgroup.

21. The non-transitory computer-readable storage medium of claim **15**, wherein:

the first POC talkgroup is one of a plurality of POC talkgroups; and

each POC talkgroup of the plurality of POC talkgroups is linked as part of a single virtual incident.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 11,997,568 B2
APPLICATION NO. : 17/844488
DATED : May 28, 2024
INVENTOR(S) : John Marvin Suzuki, Lorenzo Cruger, Jr. and James Lowell Teel, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

At Column 10, Claim 1, Line number 38, please add the word --device-- after the word non-subscriber

Signed and Sealed this
Ninth Day of July, 2024

Katherine Kelly Vidal

Katherine Kelly Vidal
Director of the United States Patent and Trademark Office