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[Document Name] SPECIFICATION

[Name of Invention] INFORMATION PROCESSING SYSTEM AND INFORMATION PROCESSING METHOD

[Technical Field]

[0001]

The present technology relates to an information processing device. More specifically, the present technology relates to an information processing device, an information processing system, and an information processing method that exchange various types of information using wireless communication.

[Background Art]

[0002]

Conventionally, there exists wireless communication technology that uses wireless communication to exchange various types of data. For example, an information exchange device has been proposed that exchanges various types of information between two wireless communication devices via wireless communication (see, for example, Patent Document 1).

[Prior Art Documents]

[Patent Documents]

[0003]

[Patent Document 1] JP 2008-278388 A

[Summary of the Invention]

[Problem to be Solved by the Invention]

[0004]

According to the above-mentioned conventional technology, various types of information can be exchanged between two information processing devices using wireless communication without the need for a wired connection. For example, an image based on image data transmitted from a transmitting information processing device can be displayed on the display unit of a receiving information processing device.

[0005]

Here, for example, when various types of information are exchanged between two information processing devices using wireless communication, it is assumed that the two information processing devices may communicate directly with each other, or indirectly with each other. Further, indirect communication between two information processing devices refers to indirect communication between two information processing devices via another communication device (e.g., an access point or base station), for example.

[0006]

For example, when two information processing devices are communicating directly with each other, it is assumed that the two information processing devices will transition to communicating indirectly with each other. It is also possible that when two information processing devices are indirectly communicating with each other, the two information processing devices may transition to direct communication. Thus, when switching communications, it is important to exercise proper control.

[0007]

The present technology was developed in light of these circumstances, and aims to provide proper control when communicating between multiple information processing devices.

[Means for Solving the Problem]

[0008]

The present technology has been made to solve the above-mentioned problems, and a first aspect thereof comprises: an information processing device that performs real-time image transmission between another information processing device according to the Wi-Fi (Wireless Fidelity) CERTIFIED MICAST specification (Technical Specification Title: Wi-Fi Display), comprising a control unit that receives setting request information for making settings related to the real-time image transmission from another information processing device via an access point and transmits a setting request for making the settings based on the setting request information to another information processing device by direct

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communication; an information processing method thereof; and a program for causing a computer to execute the method. This provides the effect that setting request information is received from another information processing device via the access point, and the setting request is transmitted to another information processing device by direct communication.

[0009]

Further, in the first aspect, the control unit may exchange Capability information regarding the information processing device with another information processing device via the access point, and another information processing device may generate the setting request information based on the Capability information. This enables capability information regarding the information processing device to be exchanged with other information processing devices via the access point, and the other information processing devices generate setting request information based on the capability information.

[0010]

Further, in the first aspect, when switching between a connection status with another information processing device via the access point and a connection status with another information processing device by the direct communication, the control unit may perform control to perform a connection process using at least one of port information and IP information related to the connection before the switching. This provides an effect that, when switching between a connection status with another information processing device via an access point and a connection status with another information processing device by direct communication, a connection process is performed using at least one of the port information and the IP information related to the connection before switching.

[0011]

Further, in the first aspect, the control unit may be configured to control another information processing device to transmit an image according to the Wi-Fi CERTIFIED Miracast specification via the direct communication after transmitting the setting request to the other information processing device. This provides an effect that after a setting request is transmitted to another information processing device, image transmission is performed according to the Wi-Fi CERTIFIED Miracast specification through direct communication.

[0012]

Further, in the first aspect, the control unit may control transmission of an image to be displayed in a predetermined area on the display unit via a low-frequency band wireless transmission path, and transmission of an image to be displayed in an area on the display unit larger than the predetermined area via a high-frequency band wireless transmission path. This provides an effect that an image to be displayed in a predetermined area on the display unit is transmitted over a low-frequency band wireless transmission path, and an image to be displayed in an area larger than the predetermined area on the display unit is transmitted over a high-frequency band wireless transmission path.

[0013]

Further, in the first aspect, the control unit may be configured to perform control so as to transmit the setting request to another information processing device through the direct communication based on a user operation. This provides an effect that a setting request is transmitted to another information processing device through direct communication based on a user operation.

[0014]

Further, in the first aspect, when there is a plurality of information processing devices that transmit images through the direct communication, the control unit may control the information processing devices to transmit the setting request to the other information processing devices through the direct communication in a predetermined order. This provides an effect that, when there are a plurality of information processing devices performing image transmission through direct communication, a setting request is transmitted to the other information processing devices through direct communication based on a predetermined order.

[0015]

Further, in the first aspect, the control unit may perform, via the access point, exchange of permission information indicating whether or not to permit a connection with another information processing device

via an access point other than the aforementioned access point or a base station, and when the control unit receives the permission information indicating that the connection is permitted, performs control to perform an exchange with another information processing device via an access point other than the aforementioned access point or the base station. This provides the effect that permission information is exchanged via an access point, and when permission information to the effect that connection is permitted is received, communication with other information processing devices is performed via another access point or base station.

[0016]

Further, in the first aspect, when the control unit receives the permission information to permit the connection, the control unit may perform control to receive and output at least one of image data and audio data from another information processing device via an access point other than the aforementioned access point or the base station. This provides an effect that, when permission information to the effect that connection is permitted is received, at least one of image data and audio data is received from another information processing device via another access point or base station and output.

[0017]

Further, in the first aspect, the control unit may perform control to exchange information for performing the direct communication by utilizing short-range wireless communication. This provides an effect that information for performing direct communication is exchanged by utilizing short-range wireless communication.

[0018]

A second aspect of the present technology comprises: an information processing device that performs real-time image transmission with another information processing device according to the Wi-Fi CERTIFIED Miracast specification, comprising a control unit that transmits setting request information for setting the real-time image transmission to another information processing device via an access point, and controls the information processing device to receive a setting request for performing the setting based on the setting request information from another information processing device via direct communication; an information processing method thereof; and a program for causing a computer to execute the method. This provides an effect that the setting request information is transmitted to another information processing device via the access point, and the setting request is received from another information processing device by direct communication.

[0019]

Further, a third aspect of the present technology comprises: an information processing device comprising a control unit that performs control to set the communication mode of the source device to either a standby mode in which the sink device and the source device are connected via an access point or an image transmission mode in which the sink device and the source device are connected by direct communication when real-time image transmission is performed between a sink device and multiple source devices according to the Wi-Fi CERTIFIED Miracast specification; an information processing method thereof; and a program for causing a computer to execute the method. This provides an effect that the communication mode of the source device can be set to either the standby mode or the image transmission mode.

[0020]

Further, in the third aspect, the control unit may cause an input/output unit to display an image representing the plurality of source devices, and perform control to set the communication mode in the source devices based on an operation input in the input/output unit. This provides the effect that an image representing a plurality of source devices is displayed on the input/output unit, and the communication mode is set for the source devices based on an operational input on the input/output unit.

[0021]

Further, in the third aspect, the control unit may perform control to set the communication mode in the source device based on a predetermined order. This provides an effect of setting the communication mode in the source device based on a predetermined order.

[0022]

A fourth aspect of the present technology comprises: an information processing system comprising a sink device that performs real-time image transmission with a source device according to the Wi-Fi CERTIFIED Miracast specification, transmits setting request information for setting the source device regarding the real-time image transmission via an access point, and controls the source device to receive a setting request for performing the setting based on the setting request information from the source device through direct communication with the source device, and a control device that controls the source device to set a communication mode between the sink device and a plurality of source devices and a standby mode in which the sink device and the source device are connected via the access point and an image transmission mode in which the sink device and the source device are connected through the direct communication when the real-time image transmission is performed between the sink device and a plurality of source devices; an information processing method thereof; and a program for causing a computer to execute the method. There is provided the following effects: the sink device transmits setting request information to the source device via the access point and receives the setting request from the source device through direct communication; and the control device sets the communication mode of the source device to either the standby mode or the image transmission mode.

[Effect of the Invention]

[0023]

According to the present technology, it is possible to obtain an excellent effect of being able to perform proper control when communication is performed between a plurality of information processing devices. Moreover, the effects described here are not necessarily limited to those described herein, and may be any of the effects described in this disclosure.

[Brief Description of the Drawings]

[0024]

FIG. 1 is a block diagram showing an example system configuration of a communication system 100 in a first embodiment of the present technology.

FIG. 2 is block diagram showing an example of the functional configuration of an information processing device 200 in a first embodiment of the present technology.

FIG. 3 is a block diagram showing an example of the functional configuration of an information processing device 300 in the first embodiment of the present technology.

FIG. 4 is a diagram showing a schematic diagram of an example of the contents stored in the management information storage unit 390 in the first embodiment of the present technology.

FIG. 5 is diagram showing an example of transition of an image displayed on a display unit 351 of an information processing device 300 in the first embodiment of the present technology.

FIG. 6 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 7 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 8 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 9 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 10 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 11 is a sequence chart showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIG. 12 is a flowchart showing an example of the processing steps of data transmission processing by the information processing device 200 in the first embodiment of the present technology.

FIG. 13 is a flowchart showing an example of the processing steps of data transmission rate control processing by the information processing device 300 in the first embodiment of the present technology.

FIG. 14 is a sequence chart showing an example of communication processing between a source device and a sink device in the first embodiment of the present technology.

FIG. 15 is a sequence chart showing an example of communication processing between a source device and a sink device in the first embodiment of the present technology.

FIG. 16 is a sequence chart showing an example of communication processing between a source device and a sink device in the first embodiment of the present technology.

FIG. 17 is a diagram showing an example system configuration of a communication system 700 in a second embodiment of the present technology.

FIG. 18 is a diagram showing an installation example of a communication system 700 in the second embodiment of the present technology.

FIG. 19 is a block diagram showing an example of a functional configuration of a control device 740 in a second embodiment of the present technology.

FIG. 20 is a diagram showing a schematic diagram of an example of the contents stored in a group management information storage unit 750 in a second embodiment of the present technology.

FIG. 21 is a FIG. showing an example of a display screen displayed on the input/output unit 743 of the control device 740 in the second embodiment of the present technology.

FIG. 22 is a FIG. showing an example of transition of a display screen displayed on a display device 731 in the second embodiment of the present technology.

FIG. 23 is a diagram showing an example of switching communication modes between a source device and a sink device, which is the basis of the present technology.

FIG. 24 is a sequence chart showing an example of a connection process performed between a source device and a sink device in the second embodiment of the present technology.

FIG. 25 is a sequence chart showing an example of communication processing between each device constituting the communication system 700 in the second embodiment of the present technology.

FIG. 26 is a sequence chart showing an example of communication processing between each device constituting the communication system 700 in the second embodiment of the present technology.

FIG. 27 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the second embodiment of the present technology.

FIG. 28 is a diagram showing an example of use of an information processing device 710 according to a second embodiment of the present technology.

FIG. 29 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the second embodiment of the present technology.

FIG. 30 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the second embodiment of the present technology.

FIG. 31 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the third embodiment of the present technology.

FIG. 32 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the fourth embodiment of the present technology.

FIG. 33 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to the fourth embodiment of the present technology.

FIG. 34 is a block diagram showing an example of a general configuration of a smartphone.

FIG. 35 is a block diagram showing an example of a schematic configuration of a car navigation device.

[MODE FOR CARRYING OUT THE INVENTION]

[0025]

Hereinafter, modes for carrying out the present technology (hereinafter, referred to as embodiments) will be described. The explanation will be given in the following order.

- 1 First embodiment (example of controlling wireless communication based on user information and management information)
- 2 Second embodiment (example of switching between the connection between source device and sink device via access point and direct connection between source device and sink device)
- 3 Third embodiment (example of initiating group authentication between source and sink devices using short-range wireless communication)
- 4 Fourth embodiment (example in which a source device is automatically connected to an access point or a sink device)

5 Application Examples

[0026]

1. First embodiment

[Example of communication system configuration]

FIG. 1 is a block diagram showing an example of a system configuration of a communication system 100 according to a first embodiment of the present technology.

[0027]

The communication system 100 comprises an information processing device 200, an information processing device 300, and an information processing device 400. Further, the communication system 100 is a communication system in which the information processing device 300 receives data (e.g., image data or audio data) transmitted from at least one of the information processing devices 200 and the information processing device 400.

[0028]

Further, the information processing devices 200, 300, and 400 are transmitting/receiving devices equipped with wireless communication functions. For example, the information processing devices 200, 300, and 400 are display devices (e.g., personal computers) or portable information processing devices (e.g., smartphones and tablet terminals) equipped with wireless communication functions. Moreover, for example, the information processing devices 200, 300, and 400 are wireless communication devices conforming to IEEE (Institute of Electrical and Electronics Engineers) 802.11, IEEE 802.15, IEEE802.16, and 3GPP (3rd Generation Partnership Project) specifications (e.g., W-CDMA (Wideband Code Division Multiple Access), GSM (registered trademark) (Global System for Mobile Communications), WiMAX (Worldwide Interoperability for Microwave Access), WiMAX2, LTE (Long Term Evolution), and LTE-A (Advanced)). The information processing devices 200, 300, and 400 can exchange various types of information using wireless communication functions.

[0029]

Here, a case will be described in which wireless communication is performed using a wireless LAN (Local Area Network) between information processing device 200 and information processing device 300, or between information processing device 400 and information processing device 300, as an example.

[0030]

This wireless LAN can be, for example, Wi-Fi (Wireless Fidelity) Direct, TDLS (Tunneled Direct Link Setup), an ad-hoc network, or a mesh network. In addition, for example, Wi-Fi CERTIFIED Miracast (Technical Specification Title: Wi-Fi Display) can be used as the short-distance wireless AV (Audio Visual) transmission communication used in the communication system 100. Wi-Fi CERTIFIED Mirror is a mirroring technology that uses Wi-Fi Direct and TDLS technologies to transmit audio and images played on one device to another device, allowing the other device to output the same audio and image data in the same manner.

[0030]

Further, Wi-Fi CERTIFIED Microcast realizes UIBC (User Input Back Channel) on TCP/IP (Transmission Control Protocol 1/1 Internet Protocol). UIBC is a technology for transmitting operation information from input devices such as a mouse and keyboard from one terminal to another. Instead of Wi-Fi CERTIFIED Miracast, other remote desktop software (for example, VNC (Virtual Network Computing)) may be applied.

[0032]

Here, Wi-Fi CERTIFIED Miracast specifies that images (videos) are compressed and decompressed using H.264, for example. Moreover, with Wi-Fi CERTIFIED Miracast, H.264 can be adjusted on the sending side, for example. In addition to H.264, it can also support H.265 (e.g., HEVC (high efficiency video coding), SHVC (scalable video coding extensions of high efficiency video coding)), MPEG (Moving Picture Experts Group) 4, and JPEG (Joint Photographic Experts Group) 2000. It can also support line-based codecs (e.g., Wavelet, DCT (Discrete Cosine Transform)) that bundle and compress one or more lines, or divide two or more lines into 2 x 2 or more macroblocks for compression and decompression. In addition, by calculating the difference between a specific code amount area (such as a picture shape or a

bundle of multiple lines or a macroblock) and the previous code amount area, it is also possible to support codecs that reduce the transmission rate without performing compression such as DCT or Wavelet.

Also, images (video) may be transmitted and received in an uncompressed form.

[0033]

Further, in the first embodiment of the present technology, an example is shown in which the information processing device 200 transmits image data and audio data generated by an imaging operation. Further, in the first embodiment of the present technology, an example is shown in which the information processing device 400 transmits content (e.g., content consisting of image data and audio data) stored in a storage unit (e.g., a hard disk). Moreover, the information processing device 200 may be an electronic device equipped with a camera (for example, a personal computer, a game console, a smartphone, or a tablet terminal). Further, other electronic devices equipped with a display unit (e.g., an imaging device, a game machine, a smartphone, a tablet terminal) may be used as the information processing device 300. Further, if the information processing device 400 has a tethering function, it may be possible to transmit content stored in an Internet Services Provider (ISP) via a wireless or wired network.

[0034]

For example, image data generated by an imaging operation of the information processing device 200 is transmitted to the information processing device 300, and an image 11 based on the image data is displayed on the display unit 351 of the information processing device 300. In addition, content stored in a storage unit (e.g., a hard disk) of the information processing device 400 is transmitted to the information processing device 300, and an image 12 based on that content is displayed on the display unit 351 of the information processing device 300.

[0035]

In this manner, in the first embodiment of the present technology, an example is shown in which the source side information processing device (source device) is information processing device 200, 400, and the sink side information processing device (sink device) is information processing device 300.

[0036]

Further, in FIG. 1, the range in which the information processing device 300 can directly communicate using wireless communication via a P2P (Peer to Peer) direct connection is shown as an information transmission range 101. This information transmission range 101 is the information transmission range (service range) based on the information processing device 300.

[0037]

[Example of information processing device (source device) configuration]

FIG. 2 is a block diagram showing an example of a functional configuration of an information processing device 200 according to the first embodiment of the present technology. The functional configuration of the information processing device 400 regarding wireless communication is substantially the same as that of the information processing device 200. For this reason, in the first embodiment of the present technology, only the information processing device 200 will be described, and a description of the information processing device 400 will be omitted.

[0038]

The information processing device 200 comprises an antenna 210, a wireless communication unit 220, a control signal reception unit 230, a control unit 240, an image/audio signal generation unit 250, an image/audio compressing unit 260, and a stream transmission unit 270.

[0039]

The wireless communication unit 220, controlled by the control unit 240, utilizes wireless communication to transmit and receive information (e.g., image data and audio data) to and from other information processing devices (e.g., information processing device 300) via antenna 210. When image data transmission processing is performed, the image data generated by the image/audio signal generation unit 250 is compressed by the image/audio compression unit 260, and this compressed image data (image stream) is transmitted from the antenna 210 via the wireless communication unit 220, for example.

[0040]

Further, the wireless communication unit 220 is capable of transmitting and receiving various information to and from other information processing devices (e.g., the information processing device 300).

using multiple frequency channels. In the first embodiment of the present technology, an example is shown in which the wireless communication unit 220 has a function capable of transmitting and receiving signals on three types of frequency channels: 2.4 GHz, 5 GHz, and 60 GHz. In this manner, when a source device has the ability to transmit and receive multiple frequency channels, a sink device (e.g., information processing device 300) can control which frequency channel each source device is to use.

[0041]

The control signal reception unit 230 acquires a control signal (e.g., information exchanged with the information processing device 300) transmitted from another information processing device (e.g., the information processing device 300) from among the various information received by the wireless communication unit 220. Then, the control signal reception unit 230 outputs the acquired control signal to the control unit 240 .

[0042]

The control unit 240 controls each piece of information transmitted from the information processing device 200. For example, the control unit 240 controls the image/audio signal generation unit 250 and the image/audio compression unit 260 based on a control signal received by the control signal reception unit 230. The control unit 240 performs control to change the resolution of image data to be transmitted or the number of audio channels, and performs control to change the image area of image data to be transmitted, for example. That is, the control unit 240 performs transmission control (e.g., data transmission speed control, scalability transmission rate control) of the stream to be transmitted based on the control signal received by the control signal reception unit 230.

[0043]

In addition, the control unit 240 may have a function for measuring radio wave propagation conditions (link radio wave propagation conditions) when data is being sent and received between the sink device and the control unit 240 using wireless communication, and may transmit the measurement results (radio wave propagation measurement information) to the sink device.

[0044]

Here, the radio wave propagation measurement information is information used when determining whether the line quality with the sink device is sufficient to transmit and receive image data and audio data, for example. Further, the radio wave propagation measurement information is used when performing stream transmission control (for example, data transmission speed control, scalability transmission rate control), for example. The radio wave propagation measurement information will be explained in detail with reference to FIG.4. In addition, instead of using radio wave propagation measurement information, the control unit 240 may count the number of times the same packet is retransmitted, and the transmission of the stream may be controlled according to this count.

[0045]

Here, the data transmission rate mainly means the rate at which the communication path is occupied, and includes the definition of communication speed and communication capacity. Moreover, resolution is defined as an index of image quality that is composed of elements such as the image frame of the image data (number of pixels vertically and horizontally) and the bit rate (compression rate) of the image data. Further, the throughput of the stream can be used as an index of image quality. Further, the number of audio channels includes the audio recording and playback method, such as mono (1.0 ch) or stereo (2.0 ch). The number of audio channels is defined as an index of sound quality consisting of factors such as the bit rate (compression rate) of audio data and the number of channels. Moreover, the throughput of the stream can be used as an indicator of the sound quality.

[0046]

Further, the control unit 240 performs control to improve conditions that cannot be stabilized by data rate control. The control unit 240 acquires system performance information of a sink device (for example, the information processing device 300) by exchanging information with the sink device, for example. Here, the system performance information is performance information related to the system of the sink device, for example. System performance information is available frequency channels, resolution, TCP (Transmission Control Protocol) and UDP (User Datagram Protocol), for example. The system performance information is information indicating, encryption method support, SAM Standard

Definition)/HD (High Definition) support, and low power consumption mode support, for example. The control unit 240 controls the system of the communication system 100 depending on whether the sink device supports a low power consumption mode, for example. It is possible to select a method of stream transmission control (e.g., data transmission rate control, scalability transmission rate control) that further improves the stability of the entire system.

[0047]

The control unit 240 is assumed to include, in the information exchange with the information processing device 300, information as to whether the information processing device 200 is a mobile device or not, for example. The capability information regarding the information processing device 200 may include information as to whether the information processing device 200 is a mobile device, for example. Further, when the information processing device 300 recognizes that the information processing device 200 is a mobile device, it can determine that there is no need to operate the information processing device 200 based on the relationship with other connected information processing devices. In this manner, when it is determined that there is no need to operate the information processing device 200, the information processing device 200 receives a transmission stop command from the information processing device 300. Then, when the control unit 240 recognizes the transmission stop command, it can turn off the power to each of the functions of the image/audio signal generation unit 250, the image/audio compression unit 260, and the stream transmission unit 270 for a certain period of time. The control unit 240 can also transition the wireless communication unit 220 to intermittent reception (a mode in which the wireless communication unit 220 periodically wakes up to receive commands from the information processing device 300 and is otherwise powered down).

[0048]

The image/audio signal generation unit 250 generates data to be output (image data, audio data) based on the control of the control unit 240, and outputs the generated data to the image/audio compression unit 260. For example, the image/audio signal generation unit 250 includes an imaging unit (not shown) and an audio acquisition unit (not shown). This imaging unit (for example, a lens, an imaging element, and a signal processing circuit) captures an image of a subject and generates an image (image data). The audio acquisition unit (for example, a microphone) acquires ambient audio when the image data is generated. The data generated in this manner is to be transmitted to another information processing device (for example, information processing device 300).

[0049]

The image/audio compression unit 260 compresses (encodes) the data (image data and audio data) generated by the image/audio signal generation unit 250 as controlled by the control unit 240. The image/audio compression unit 260 then outputs the compressed data (image data and audio data) to the stream transmission unit 270. The image/audio compression unit 260 may be realized by executing encoding using software, or may be realized by executing encoding using hardware. Further, the image/audio compression unit 260 is assumed to function as a codec, but is also capable of handling uncompressed images and audio. Moreover, the image/audio compression unit 260 also functions as a scalable codec. Here, a scalable codec means a codec that can be freely adapted according to, for example, the resolution of the receiving information processing device (sink device) and the network environment.

[0050]

The stream transmission unit 270 performs a transmission process as controlled by the control unit 240 to transmit the data (image data and audio data) compressed by the image/audio compression unit 260 as a stream from the antenna 210 via the wireless communication unit 220.

[0051]

In addition to the above-mentioned components, the information processing device 200 may also include a display unit, an audio output unit, an operation reception unit, and the like, but these are not shown in FIG. 2. Further, although an example is shown in which the information processing device 200 generates image data and audio data to be transmitted, the information processing device 200 may obtain the image data and audio data to be transmitted from an external device. The information processing device 200 may acquire image data and audio data to be transmitted from a Web camera equipped with a microphone, for example. Further, the information processing device 200 may be configured to receive information from an external device.

content (e.g., content consisting of image data and audio data) stored in a storage device (e.g., a hard disk) regardless of whether the storage device is inside or outside the information processing device 200. In this case, it is also assumed that the content stored in the storage device is compressed content. If the compressed content has been compressed using an encoding method defined by the standard adopted by the communication system 100, the compressed content may be transmitted as is without being decoded.

[0052]

The display unit (not shown) of the information processing device 200 is a display unit that displays an image generated by the image/audio signal generation unit 250, for example. A display panel such as an organic EL (Electro Luminescence), a Crystal LED (Light Emitting Diode) Display, or an LCD (Liquid Crystal Display) may be used as the display unit, for example.

[0053]

The audio output unit (not shown) of the information processing device 200 is an audio output unit (for example, a speaker) that outputs the audio generated by the image/audio signal generation unit 250, for example. Although images can be output from both the transmitting device and the receiving device, it is preferable to output audio from only one of them.

[0054]

The operation reception unit (not shown) of the information processing device 200 is an operation reception unit that receives operation input performed by a user, and is, for example, a keyboard, a mouse, a game pad, a touch panel, a camera, or a microphone. The operation reception unit and the display unit may be integrally configured using a touch panel that allows the user to input operations by touching or approaching the display surface with the user's finger.

[0055]

[Example of configuration of information processing device (sink device)]

FIG. 3 is a block diagram showing an example of a functional configuration of an information processing device 300 according to the first embodiment of the present technology.

[0056]

The information processing device 300 comprises an antenna 310, a wireless communication unit 320, a stream reception unit 330, an image/audio expanding unit 340, an image/audio output unit 350, a user information acquisition unit 360, a control unit 370, a control signal transmission unit 380, and a management information storage unit 390.

[0057]

The wireless communication unit 320, as controlled by the control unit 370, uses wireless communication to transmit and receive various information (e.g., image data and audio data) to and from other information processing devices (e.g., the information processing device 200) via the antenna 310. When image data reception processing is performed, the image data received by the antenna 310 is expanded (decoded) by the image/audio expansion unit 340 via the wireless communication unit 320 and the stream reception unit 330, for example. The expanded image data is then supplied to the image/audio output unit 350, and an image corresponding to the expanded image data is output from the image/audio output unit 350. That is, an image corresponding to the expanded image data is displayed on the display unit 351.

[0058]

The wireless communication unit 320 is also capable of transmitting and receiving various information to and from other information processing devices (e.g., the information processing device 200) using multiple frequency channels. In the first embodiment of the present technology, an example will be shown in which the wireless communication unit 320 has a function capable of transmitting and receiving signals on three types of frequency channels: 2.4 GHz, 5 GHz, and 60 GHz. That is, the wireless communication unit 320 is capable of performing communication using a first frequency band and communication using a second frequency band having a faster data transmission speed than the first frequency band. The control unit 370 also controls which of the multiple frequency channels is to be used for wireless communication with each source device.

[0059]

Moreover, the link between the information processing device 200 and the information processing device 300 and the link between the information processing device 400 and the information processing device 300 may be on the same frequency channel, or may be on different frequency channels.

[0060]

Further, the first embodiment of the present technology shows an example in which the wireless communication unit 320 has a function capable of transmitting and receiving signals on three types of frequency channels, namely, 2.4 GHz, 5 GHz, and 60 GHz, but this is not limited to this. The wireless communication unit 320 may have the capability of transmitting and receiving other frequency channels, or two or more than three frequency channels, for example.

[0061]

The stream reception unit 330 receives information and streams (e.g., image streams and audio streams) exchanged with each source device from the various information received by the wireless communication unit 320 as controlled by the control unit 370. The stream reception unit 330 then outputs the received command information to the control unit 370, and outputs the received stream to the image/audio expansion unit 340 and the control unit 370.

[0062]

Here, the information exchanged with each source device is information sent from a source device (for example, the information processing device 200), and includes, for example, a request to acquire system performance information of the information processing device 300. This system performance information is information indicating, for example, available frequency channels, resolution, TCP, UDP, encryption method support, SD/HD support, and low power consumption mode support.

[0063]

Further, the stream reception unit 330 has a function of measuring radio wave propagation conditions (link radio wave propagation conditions) when data is being sent and received between the sink device and the stream reception unit 330 using wireless communication. The stream reception unit 330 then outputs the measurement results (radio wave propagation measurement information) to the control unit 370. The radio wave propagation measurement information will be explained in detail with reference to FIG. 4.

[0064]

The image/audio expansion unit 340 expands (decodes) a stream (image data and audio data) transmitted from another information processing device (e.g., information processing device 200) as controlled by the control unit 370. The image/audio expansion unit 340 then outputs the expanded data (image data and audio data) to the image/audio output unit 350. The image/audio expansion unit 340 may be realized by executing decoding by software, or may be realized by executing decoding by hardware. Further, the image/audio expansion unit 340 is assumed to function as a codec, but is capable of handling uncompressed images and audio. Further, the image/audio expansion unit 340 also functions as a scalable codec.

[0065]

The image/audio output unit 350 includes a display unit 351 and an audio output unit 352.

[0066]

The display unit 351 is a display unit that displays each image (e.g., images 11 and 12 shown in FIG. 1) based on the image data expanded by the image/audio expansion unit 340. The display unit 351 can be, for example, a display panel such as an organic EL panel, a crystal LED display, or an LCD panel. The display unit 351 may be a touch panel that allows the user to input operations by touching or approaching the display surface with the user's finger.

[0067]

The audio output unit 352 is an audio output unit (e.g., a speaker) that outputs various sounds (such as sounds related to the image displayed on the display unit 351) based on the audio data expanded by the image/audio expansion unit 340. Here, the audio output method can be, for example, a method in which only the audio from the source device assigned to the center channel (main image) is played from the

speaker, and the audio from the source device assigned to the peripheral channel (sub-image) is not played. Further, a method can be used in which the volume of the audio from the source device assigned to the center channel is made the main volume and the volume of the audio from the source device assigned to the peripheral channel is lowered as another audio output method, for example. Moreover, other sound output methods may be used.

[0068]

The user information acquisition unit 360 acquires information about the user (user information) and outputs the acquired user information to the control unit 370. For example, the user information acquisition unit 360 can acquire user information by accepting input from an operation reception unit (keyboard, mouse, remote control, game pad, touch panel) that allows the user to directly set the display method. The operation reception unit is, for example, an operational part for designating an arbitrary area in an image displayed on the display unit 351. In addition, for example, the user information acquisition unit 360 can acquire user information by accepting input from devices that can grasp the user's intentions, such as a camera, a microphone, various sensors (e.g., a gyro sensor, a sensor that detects the human body), and the like.

[0069]

The user information acquisition unit 360 acquires user information resulting from user actions while information based on a stream received from another information processing device (e.g., the information processing device 200) via wireless communication is being output from the image/audio output unit 350, for example. This user information is user information generated by a user's actions related to the image displayed on the display unit 351, for example. The user information is information generated based on a user operation related to an image displayed on the display unit 351, for example.

[0070]

The control unit 370 causes the management information storage unit 390 to store each piece of information acquired by the stream reception unit 330, and manages each source device based on the management information stored in the management information storage unit 390. Further, the control unit 370 performs transmission control of the streams (e.g., data transmission speed control, scalability transmission rate control) so as to improve stability throughout the system for the streams transmitted from multiple source devices.

[0071]

The control unit 370 performs stream transmission control (e.g., data transmission speed control, scalability transmission rate control) based on the user information acquired by the user information acquisition unit 360 and the management information stored in the management information storage unit 390, for example. Specifically, the control unit 370 generates a control signal for each source device to control the transmission of the stream (e.g., data transmission speed control, scalability transmission rate control) based on the management information stored in the management information storage unit 390, and outputs the generated control signal to the control signal transmission unit 380. The control unit 370 changes the resolution of the image displayed on the display unit 351 based on user information and management information, and generates a control signal to request each source device to have a transmission rate equivalent to this resolution, for example. Further, the control unit 370 generates a control signal for changing the display area of an image on the display unit 351 based on user information and management information, for example. Further, the control unit 370 generates a control signal for changing the size of an image on the display unit 351 based on user information and management information, for example.

[0072]

Further, the control unit 370 performs control to set the frequency channel and resolution to be used based on user information and management information. The control unit 370 sets the frequency channel to be used for each source device from among the multiple frequency channels provided in the wireless communication unit 320, for example. Further, if the power consumption mode differs for each frequency channel, the control unit 370 is able to grasp each mode and set a frequency channel that takes into consideration the power consumption of the mobile device. That is, the control unit 370 can separately set a first power consumption mode for a first frequency band and a second power consumption mode for a second frequency band.

second frequency band having a faster data transmission speed than the first frequency band.

[0073]

The control signal transmission unit 380 performs a transmission process to transmit the control signal output from the control unit 370 to another wireless communication device via the wireless communication unit 320 and the antenna 310.

[0074]

The management information storage unit 390 is a table that stores information (management information) for managing each source device connected to the information processing device 300 using wireless communication. The contents stored in the management information storage unit 390 will be explained in detail with reference to FIG. 4.

[0075]

[Example of contents stored in the management information storage unit]

FIG. 4 is a diagram showing an example of the contents stored in the management information storage unit 390 in the first embodiment of the present technology.

[0076]

The management information storage unit 390 is a table that stores information (management information) for managing each source device connected to the information processing device 300 using wireless communication. The management information storage unit 390 stores therein, in association with one another, terminal identification information 391, a frequency channel 392, radio wave propagation measurement information 393, device information 394, band usage level 395, a display format 396, standby/wakeup 397, and multi-reception diversity support 398, for example.

[0077]

The terminal identification information 391 stores identification information for identifying a source device connected to the information processing device 300 using wireless communication.

[0078]

The frequency channel 392 stores the frequency channel actually used by the source device connected to the information processing device 300 using wireless communication.

[0079]

The radio wave propagation measurement information 393 stores radio wave propagation measurement information regarding source device connected to the information processing device 300 using wireless communication. This radio wave propagation measurement information is measured by the stream reception unit 330 for each source device connected to the information processing device 300 using wireless communication.

[0080]

PER (Packet Error Rate), BER (Bit Error Rate), the number of packet retransmissions, and throughput are stored as the radio wave propagation general measurement information 393, for example. Further, radio wave propagation general measurement information 393 stores, for example, frame dropping, SIR (Signal to Interference Ratio), and RSSI (Received Signal Strength Indicator). Here, SINR (Signal to Interference plus Noise Ratio) may be used instead of SIR. Moreover, the radio wave propagation measurement information 393 shown in FIG. 4 is an example, and at least one of these may be stored, or other radio wave propagation measurement information may be measured and stored by the stream reception unit 330. Further, radio wave propagation measurement information measured by the source device may be acquired and stored. Further, the delay of packets received by the receiving side may be determined, and information regarding this packet delay may be used as radio wave propagation measurement information. This packet delay is an indicator of radio wave propagation because when an error occurs, retransmission processing at layer 2 causes a delay in transmission to the receiving side, for example. Further, in a wireless system where multiple devices share a wireless band packet delay can be an indicator of whether any link characteristics are degraded, for example.

[0081]

The device information 394 stores the type of source device (attributes of the source device) connected to the information processing device 300 using wireless communication. Either a mobile device or a

stationary device is stored as a type of source device, for example. Either a device that is used while being plugged in or other devices may be stored as a type of source device. Further, as the type of source device, either a battery-powered device or a non-battery-powered device may be stored.

[0082]

The bandwidth usage level 395 stores the bandwidth usage level of a source device connected to the information processing device 300 using wireless communication. The bandwidth usage level can be, for example, resolution or throughput. Further, the bandwidth usage level may be stored as the throughput being used, or a predetermined table may be prepared and a number indicating which range in the table it corresponds to may be stored and managed, for example.

[0083]

The display format 396 stores the display format (output format) of data based on a stream transmitted from a source device connected to the information processing device 300 using wireless communication. The display format (main image (center channel), sub-image (peripheral channel)) on the display unit 351 of image data based on the stream transmitted from the source device is stored, for example. Further, the output format (main audio, sub audio) from the audio output unit 352 of the audio data based on the stream transmitted from the source device is stored, for example. Further, depending on the display format, peripheral channel may not be displayed.

[0084]

The standby/wakeup 397 stores the mode (standby mode, wakeup mode) of the source device connected to the information processing device 300 using wireless communication. The standby mode and wakeup mode will be described in detail with reference to FIGS. 6 to 8.

[0085]

The multi-receive diversity support 398 stores information indicating whether or not the source device connected to the information processing device 300 via wireless communication supports multi-receive diversity.

[0086]

In this manner, the management information stored in the management information storage unit 390 is information that links and manages identification information (terminal identification information 391) for identifying other information processing devices and capability information related to the other information processing devices. The management information stored in the management information storage unit 390 comprises at least information on radio wave propagation measurement related to communication with other information processing devices (radio wave propagation measurement information 393) and information on power consumption (standby/wakeup 397) as cache-based information on other information processing devices. Further, the management information stored in the management information storage unit 390 includes at least information on the display format for displaying image information (display form 396) as capability information related to other information processing devices. The information on the display mode is information indicating whether the image information is to be displayed as a main display or a sub display, for example.

[0087]

[Image transition example]

FIG. 5 is a diagram showing an example of transition of an image displayed on the display unit 351 of the information processing device 300 in the first embodiment of the present technology.

[0088]

FIG. 5A shows an example of a display format in which the image 11 is set as a center channel and the image 12 is set as a peripheral channel, and the image 11 and the image 12 are displayed on the display unit 351 of the information processing device 300.

[0089]

FIG. 5B shows an example of a display format in which the image 11 is set as a peripheral channel and the image 12 is set as a center channel, and the image 11 and the image 12 are displayed on the display unit 351 of the information processing device 300.

[0090]

Assume that each of information processing device 200 and information processing device 400 transmits standard resolution streams (image data and audio data) to information processing device 300, for example. In this case, as shown in FIG. 1, image 11 based on image data from information processing device 200 and image 12 based on image data from information processing device 400 can be displayed on display unit 351 of information processing device 300 so that their respective sizes are the same. This example defines the given resolution and the display area as being the same, but a scaler function may be added to the display unit 351 so that the images 11 and 12 are rescaled and displayed on the display unit 351. However, in order to simplify the explanation, the embodiment of the present technology will be explained on the assumption that this function is not used.

[0091]

In addition, the display format of each of the images 11 and 12 may be retained from the time of the previous communication, and the images 11 and 12 may be displayed on the display unit 351 of the information processing device 300 according to this display format, for example.

[0092]

Further, the display format of each of images 11 and 12 may be determined based on the order in which they are connected to the information processing device 300. Assume that information processing device 200 is first connected to information processing device 300, and then information processing device 400 is connected to information processing device 300, for example. In this case, image 11 is set as the center channel and image 12 is set as the peripheral channel, and images 11 and 12 are displayed on the display unit 351 of the information processing device 300. That is, the center channel and peripheral channels may be displayed in that order based on the order of connection to the information processing device 300.

[0093]

Further, assume that image 11 is the center channel, image 12 is the peripheral channel, and images 11 and 12 are displayed on display unit 351, and user information with image 12 as the center channel is acquired by user information acquisition unit 360, as shown in FIG. 5A. When a viewer performs an operation to set image 12 as the center channel using a pointer such as a remote control or gestures, user information for setting image 12 as the center channel is acquired by user information acquisition unit 360, for example. In this case, as shown in FIG. 5B, image 11 and image 12 are displayed on display unit 351 with image 12 as the center channel and image 11 as the peripheral channel. Further, the display positions of the images 11 and 12 on the display surface of the display unit 351 are also determined based on user information (e.g., manual operation, line of sight) acquired by the user information acquisition unit 360.

[0094]

[Communication Example]

FIGS. 6 to 8 are sequence charts showing an example of communication processing between devices constituting the communication system 100 in the first embodiment of the present technology. FIGS. 6 to 8 show an example of communication processing between information processing device 200 and information processing device 300.

[0095]

Further, FIGS. 6 to 8, among the units constituting the information processing device 200, the image/audio signal generation unit 250, the image/audio compressing unit 260 and the stream transmission unit 270 are shown as a data transmitting system 201. Further, the antenna 210, the wireless communication unit 220, the control signal reception unit 230 and the control unit 240 are shown as a line control system 202.

[0096]

FIGS. 6 to 8 - among the components constituting the information processing device 300, the antenna 310, wireless communication unit 320, stream reception unit 330, control unit 370 and control signal transmission unit 380 - are shown as a line control system 301. The image/audio expansion unit 340, the image/audio output unit 350, and the user information acquisition unit 360 are shown as an input/output system 302.

[0097]

Further, FIGS. 6 to 8 show an example in which an image based on image data from **SAMSUNG** is

processing device 200 is first displayed on the display unit 351 of the information processing device 300 as a peripheral channel, and a low power consumption mode is set in the information processing device 200. Next, an example will be shown in which an image based on image data from the information processing device 200 is displayed on the display unit 351 as the center channel, and the normal power consumption mode is set in the information processing device 200. That is, FIGS. 6 to 8 show an example of a connection setup between the information processing device 200 and the information processing device 300, and an example of a transition of power consumption modes in the information processing device 200.

[0098]

When the information processing device 300 is first turned on, the output format (image display format, audio output format) of the information processing device 300 is set to the previous output format (the output format when the information processing device 300 was powered off) (501). Further, the control unit 370 of the information processing device 300 causes the management information storage unit 390 (shown in FIG. 4) to store management information of each source device connected to the information processing device 300 using wireless communication. Further, the control unit 370 of the information processing device 300 causes the display unit 351 to display images 11 and 12 corresponding to the two streams transmitted from the information processing device 200 and the information processing device 400, respectively, based on the previous output format, as shown in FIG. 5.

[0099]

Next, assume that the user performs a setting operation (changing operation) of the output format (502). In this case, a control signal related to the setting operation is acquired as user information by the user information acquisition unit 360, and the user information is output to the control unit 370. Then, the control unit 370 changes the contents stored in the management information storage unit 390 (shown in FIG. 4) based on the user information (503, 504). For example, as shown in FIG. 5B, assume that a setting operation (changing operation) has been performed to set an image 11 based on image data from the information processing device 200 as a peripheral channel. In this case, the control unit 370 changes the display mode 396 (shown in FIG. 4) of the information processing device 200 in the management information storage unit 390 to "Sub" (503, 504).

[0100]

Further, the information processing device 200 periodically or irregularly (including only at the start) transmits a mode table request (a request to inquire about resolution/sound quality, low power consumption mode, and the like) to the information processing device 300 (505, 506). This mode table request requests the transmission of various information managed in the information processing device 300 (management information related to the information processing device 300, and information used in communicating with the information processing device 200 (e.g., resolution information that the information processing device 200 can display, and the like)).

[0101]

When the information processing device 300 receives a mode table request (506), it transmits command information corresponding to the mode table request (507, 508). This command information is information regarding the information processing device 200 for which the information processing device 300 requests the information processing device 200 to set, taking into account the radio wave propagation environment and display format. For example, the command information includes information on the output mode of resolution/sound quality (for example, center channel, peripheral channel), whether or not a low power consumption mode is supported, the manufacturer's name, and whether or not a multi-reception diversity function is available. For example, command information includes information such as resolution/sound quality, type of image/audio codec, availability of 3D functionality, availability of content protection, display size of display device, topology information, available protocols, configuration information for these protocols (port information, and the like), connection interface information (connector type, and the like), horizontal/vertical synchronization positions, source device performance priority request information, mode control table response such as compatibility with low power consumption mode, maximum wireless transmission throughput or maximum receivable throughput, CPU (Central Processing Unit) performance, and the like.

Unit) power, remaining battery level, and power supply information. Further, each of these pieces of information is included as part of the capability information. Here, the resolution/sound quality output format information regarding the information processing device 200 is, for example, information indicating whether the display format of data from the information processing device 200 is main (center channel) or sub (peripheral channel). Further, the information processing device 300 transmits command information including, from the perspective of the information processing device 300, requests the setting of resolution/sound quality and low power consumption mode as parameters. Moreover, the information processing device 300 may transmit, as command information, information related to all of the source devices in addition to the information related to the information processing device 200 itself. In this case, the information processing device 200 selects and uses only the information intended for itself. In addition, Wi-Fi CERTIFIED Microcontroller compliant devices support wfd-audio-codecs, wfd-video-formats, wfd-content-protection, wfd-displayedid, wfd-coupled sink, wfd-client-rtpports, wfd-I2C, wfd-user-capability, wfd-connectortype, wfd-standby-resume-capability, and the like, which are defined as RTSP Messages. However, there are no limitations on the content of the message sent with this command.

[0102]

When command information is received (508), the control unit 240 of the information processing device 200 determines whether the output format of data from the information processing device 200 is main or sub, based on the command information. Further, the control unit 240 of the information processing device 200 determines whether or not the information processing device 300 has a function compatible with the power consumption operation mode, based on the command information. Next, the control unit 240 of the information processing device 200 transmits mode setting information indicating that the specified output format should be set to the information processing device 300 (509, 510). Here, it is assumed that the output format of data from information processing device 200 is identified as sub. Further, the information processing device 300 is assumed to have a function that supports a low power consumption mode. Then, the control unit 240 of the information processing device 200 transmits mode setting information to the information processing device 300 to notify it of the specified output format (sub) and of the setting of the low power consumption mode (509, 510).

[0103]

In this example, a low power mode is set by identifying whether the channel is the center channel or a peripheral channel based on the command information, but the low power mode may be set without using the criteria for determination of whether the channel is the center channel or a peripheral channel. For example, the low power consumption mode may be set by exchanging a permission flag that enables transition to the low power consumption mode between the source device and the sink device.

[0104]

Next, the control unit 240 of the information processing device 200 sets the image transmission mode (peripheral channel) as the transmission mode (511). As a result, the resolution for displaying the peripheral channels and the sound quality for outputting the sub-audio are set in the data transmission system 201 (512). Further, a low power consumption mode is set in the line control system 202 (513).

[0105]

Here, when setting the low power consumption mode in this manner, it is necessary for both the sink device and the source device to have this function. Further, for example, mobile devices (e.g., mobile phones, smartphones, tablet terminals) often perform operations using batteries. For this reason, when the data output format from the device itself is not the main form (when it is a sub form), it is preferable to reduce the battery consumption of the device itself as much as possible. Thus, it is preferable to set a low power consumption mode for a source device whose output format in the sink device is set to sub. Further, in the setting process (512), a setting may be made so that only the audio of the source device assigned to the center channel is played from the speaker, and the audio of the source devices assigned to the peripheral channels is not played. Moreover, a setting may be made so that the volume of the audio from the source device assigned to the center channel is the main volume, and the volume of the audio from the source devices assigned to the peripheral channels is lowered for playback.

[0106]

In this manner, the control unit 370 of the information processing device 300 performs a setting.

the information processing device 200 to a low power consumption mode when the output format is set as peripheral channel (sub-display). That is, the control unit 370 of the information processing device 300 performs control to set the power consumption mode of the information processing device 200 based on the output format of the display unit 351, which outputs image information based on the stream.

[0107]

In this manner, when the low power consumption mode is set (513), the control unit 240 of the information processing device 200 starts intermittent transmission (514 to 522).

[0108]

Specifically, the information processing device 200 stops transmission processing for a certain period of time and puts each component into sleep mode (514). Next, after a certain period of time has elapsed (514), the information processing device 200 wakes up each unit of the information processing device 200 in order to perform transmission processing, and performs transmission processing to the information processing device 300 (515 to 520).

[0109]

The control unit 240 of the information processing device 200 sends an inquiry message to the information processing device 300 to check whether any changes have been made in the information processing device 300 (e.g., a change in the output format) (515, 516), for example.

[0110]

Upon receiving the inquiry message (516), the control unit 370 of the information processing device 300 sends a response message to the information processing device 200 to notify whether there has been any change (for example, a change in the output format) (517, 518). Here, it is assumed that there has been no change (for example, a change in the output format) in the information processing device 300. For this reason, the control unit 370 of the information processing device 300 sends a response message to the information processing device 200 to notify that there has been no change (e.g., no change in the output format) (517, 518).

[0111]

In this manner, if a response message is received indicating that no changes (e.g., changes in output format) are to be made (518), there is no need to change the settings in the information processing device 200. For this reason, the control unit 240 of the information processing device 200 transmits streams for outputting the peripheral channels and the sub-audio to the information processing device 300 (519, 520). In this manner, upon receiving the stream (520), the information processing device 300 outputs images and sounds based on the received stream (521). As shown in FIG. 5B, an image 11 based on the stream from the information processing device 200 is displayed on the display unit 351 as a peripheral channel, for example.

[0112]

Further, when the transmission process is completed (519), the information processing device 200 stops the transmission process for a certain period of time and puts each component into sleep mode (522). Further, intermittent transmission continues until a change request is received from the information processing device 300.

[0113]

Here, with intermittent transmission, there are periods during which no stream is transmitted from the information processing device 200. For this reason, information processing device 300 performing display processing such as interpolating and displaying an image corresponding to the stream last received from the information processing device 200 is preferable. However, it is also possible that the information processing device 300 does not have an interpolation processing function. In this case, displaying an image from the information processing device 200 on the display unit 351 during the sleep period is not possible. For this reason, if the information processing device 300 does not have an interpolation processing function, the information processing device 200 may continue to transmit image data. Among the streams to be transmitted from the information processing device 200, the last image data at the time of transmission stop is held in the transmission buffer, for example. During the sleep period, image processing in the information processing device 200 is stopped, but transmission processing is continued on the

wireless link, and image data held in the transmission buffer is continuously transmitted.

[0114]

During the sleep period, only images corresponding to the stream transmitted from the information processing device 400 may be displayed on the display unit 351. An image corresponding to a stream transmitted from the information processing device 400 can be displayed on the entire surface of the display unit 351, for example.

[0115]

Next, an example will be shown in which the user performs a setting operation (changing operation) of the output mode.

[0116]

When the user performs a setting operation (change operation) of the output format (531), as described above, the control unit 370 changes the contents stored in the management information storage unit 390 (shown in FIG. 4) based on the user information related to the setting operation (532, 533). As shown in FIG. 5A, assume that a setting operation (changing operation) is performed to set image 11 based on image data from information processing device 200 as the center channel, for example. In this case, the control unit 370 changes the display mode 396 (shown in FIG. 4) of the information processing device 200 in the management information storage unit 390 to "Main" (532, 533).

[0117]

Here, as described above, when the low power consumption mode is set in the information processing device 200, it is assumed that the information processing device 200 is in a sleep state. In this manner, when the information processing device 200 is in sleep mode, it is not possible to notify the information processing device 200 that the user has performed a setting operation (changing operation) of the output mode.

[0118]

Thus, when the user performs an output format setting operation (change operation) (531) and the contents stored in the management information storage unit 390 (shown in FIG. 4) are changed (532, 533), the control unit 370 of the information processing device 300 sets a change trigger (534). This change trigger is a trigger for notifying the information processing device 200 that a user has performed a setting operation (change operation) of the output format when an inquiry message is received from the information processing device 200. This change trigger causes the information processing device 200 to be released from the standard mode, and notifies the information processing device 200 that the user has performed a setting operation (change operation) of the output format.

[0119]

Here, it is assumed that each component of the information processing device 200 is woken up and transmission processing to the information processing device 300 is started. In this case, the control unit 370 of the information processing device 300 transmits a Standby release message to the information processing device 200 (535, 536).

[0120]

When the Standby release message is received (536), the control unit 240 of the information processing device 200 transmits a response message to the information processing device 300 (537, 538).

[0121]

In this manner, when a request to cancel standard mode is received from the sink device (535 to 538), the information processing device 200 needs to inquire about the setting status. For this reason, the control unit 240 of the information processing device 200 transmits a mode table request to the information processing device 300 (539, 540). As described above, this mode table request requests the transmission of each piece of information managed in the information processing device 300 (management information related to the information processing device 200). Further, in each of the above-mentioned processes (535 to 538), an exchange may be made (for example, a response message to an inquiry message in each process (515 to 518)) to inform the user that there is a change (for example, a change in the output format).

[0122]

When the mode table request is received (540), the information processing device 300 transmits command information corresponding to the mode table request (541, 542). If the command information

has already been transmitted from the information processing device 300 to the information processing device 200, it means that the information processing device 200 has already acquired the information contained in the command information. For this reason, the information processing device 300 here may transmit only the difference information as command information in response to the mode table request (541, 542). This difference information is information related to the change output format information regarding the resolution/sound quality of the information processing device 200, for example.

[0123]

When command information is received (542), the control unit 240 of the information processing device 200 determines whether the output format of data from the information processing device 200 is main or sub, based on the command information. Next, the control unit 240 of the information processing device 200 transmits mode setting information indicating that the specified output format should be set to the information processing device 300 (543, 544). Here, it is assumed that the output format of data from the information processing device 200 has been specified to be main. Then, the control unit 240 of the information processing device 200 transmits to the information processing device 300 mode setting information for notifying the information processing device 300 of the setting of the specified output format (main) and the setting of the normal power consumption mode (543, 544). Further, each process (539 to 544) may be performed by Capability Re-negotiation in the case of a device that conforms to Wi-Fi CERTIFIED Microcast. In the case of Capability Re-negotiation, there is no need to renegotiate settings that do not change the output format in step (534). For example, wfd — displayedid, wfd — client — rtpports, wfd — I2C, wfd — connectortype, and the like.

[0124]

Next, the control unit 240 of the information processing device 200 sets the transmission mode to image transmission mode (center channel) (545). This causes the data transmission system 201 to set the resolution for displaying the center channel and the sound quality for outputting the main audio (546). Further, the line control system 202 is set to the normal power consumption mode (547).

[0125]

In this manner, when the normal power consumption mode is set (547), the control unit 240 of the information processing device 200 starts normal transmission processing (548, 549). That is, the information processing device 200 transmits streams for outputting the center channel and main audio to the information processing device 300 (548, 549). In this manner, upon receiving the stream (549), the information processing device 300 outputs images and audio based on the received stream (550). As shown in FIG. 5A, an image 11 based on the stream from the information processing device 200 is displayed on the display unit 351 as the center channel, for example.

[0126]

In this example, when the information processing device 300 is turned on, the display mode of the display unit 351 is set to the previous output mode (the output mode when the information processing device 300 is turned off). However, when the information processing device 300 is turned on, another output format may be set. When the information processing device 300 is turned on, the default output format may always be set, for example. Alternatively, the output format may be determined based on the order in which the information processing devices 300 are connected.

[0127]

Further, FIGS. 6 to 8 show an example in which the information processing device 200 inquires about the setting information of the information processing device 300 and sets the transmission parameters based on the received parameter information. However, the information processing device 200 may request the information processing device 300 to set the parameters it desires to set, and set the parameters when the information processing device 300 receives a response indicating that there is a problem. Examples of this are shown in FIGS. 9 and 10.

[0128]

[Communication Example]

FIGS. 9 to 11 are sequence charts showing an example of communication processing between each device constituting the communication system 100 in the first embodiment of the present technology.

FIGS. 9 and 10 are partial modifications of the communication processing example shown in FIGS. 6 to 8. For this reason, in FIGS. 9 and 10, parts that are common to the communication processing examples shown in FIGS. 6 to 8 are given the same reference numerals, and some of the explanations for these will be omitted. FIG. 11 shows a modification of the communication processing example shown in FIG. 9. For this reason, FIG. 11 gives the parts common to the communication processing example shown in FIG. 9 the same reference numerals, and some of the explanations for these will be omitted.

[0129]

The processes (561 to 564) shown in FIG. 9 correspond to the processes (501 to 504) shown in FIG. 6.

[0130]

Next, the control unit 370 of the information processing device 300 transmits a mode status notification to the information processing device 200 to notify the output format set by the user (565, 566). This mode status notification is information for notifying, along with the output format set by the user (for example, whether it is main or sub), the resolution/sound quality that can be set by the information processing device 200, the type of image/audio codec, the presence or absence of 3D functionality, the presence or absence of content protection, the display size of the display device, topology information, available protocols, configuration information for these protocols (port information, and the like), connection interface information (connector type, and the like), horizontal synchronization/vertical synchronization position, source device performance priority request information, mode control table response such as whether or not it supports low power consumption mode, the maximum wireless transmission throughput or the maximum receivable throughput, CPU power, remaining battery level, power supply information, and the like.

[0131]

In this manner, immediately after a user performs an output mode setting operation on the information processing device 300, a mode status notification can be sent to the information processing device 200 to notify the output mode related to the setting operation. This makes it possible to shorten the setup time (change time) between information processing device 200 and information processing device 300 that are connected using wireless communication.

[0132]

Upon receiving the mode status notification (566), the control unit 240 of the information processing device 200 compares the status parameters identified by the received mode status notification with the status parameters of its own device. Next, the control unit 240 of the information processing device 200 determines the settings (e.g., resolution/audio, power consumption mode) based on the results of the comparison. Next, the control unit 240 of the information processing device 200 sends a mode setting request to the information processing device 300 to notify it of the determined contents of the setting (e.g., resolution/audio, power consumption mode) (567, 568).

[0133]

When a mode setting request is received (568), the control unit 370 of the information processing device 300 determines whether or not to permit the contents of the setting (e.g., resolution/audio, power consumption mode) specified by the received mode setting request. Then, the control unit 370 of the information processing device 300 transmits a mode setting availability command to notify the information processing device 200 of the result of the determination (569, 570).

[0134]

When the mode setting possibility command is received (570), the control unit 240 of the information processing device 200 checks the contents of the mode setting possibility command. For example, when a mode setting permission command is received indicating that the contents of the setting related to the mode setting request sent by the information processing device 200 are permitted, the control unit 240 of the information processing device 200 sets the transmission mode to image transmission mode (peripheral channel) (571). Moreover, the processes (571 to 574) shown in FIG. 9 correspond to the processes (511 to 514) shown in FIG. 6. Also, the processes (575 to 578) shown in FIG. 10 correspond to the processes (519 to 522) shown in FIG. 7.

[0135]

Moreover, when a mode setting permission/prohibition command is received in **SAMSUNG**

contents of the setting related to the mode setting request sent by the information processing device 200 are denied, the control unit 240 of the information processing device 200 determines new contents of the setting (e.g., resolution/audio, power consumption mode). Then, the control unit 240 of the information processing device 200 sends a mode setting request to the information processing device 300 to notify it of the newly determined contents of the setting (e.g., resolution/audio, power consumption mode).

[0136]

The processes (581 to 583) shown in FIG. 10 correspond to the processes (531 to 533) shown in FIG. 7.

[0137]

Next, the control unit 370 of the information processing device 300 sends a mode status change notification to the information processing device 200 to notify the information processing device 200 of the output format changed by the user (584, 585). This mode status change notification is information for notifying the user of the output format changed by the user (e.g., whether it is main or sub), as well as the resolution/sound quality that the information processing device 200 can set, whether it supports low power consumption mode, and the like.

[0138]

When a mode status change notification is received (585), the control unit 240 of the information processing device 200 determines the contents of the setting (e.g., resolution/audio, power consumption mode). The process of determining the contents of the setting is the same as the process described above. Next, the control unit 240 of the information processing device 200 sends a mode change request to the information processing device 300 to notify it of the determined settings (e.g., resolution/audio, power consumption mode) (586, 587).

[0139]

When a mode change request is received (587), the control unit 370 of the information processing device 300 determines whether or not to permit the contents of the setting (e.g., resolution/audio, power consumption mode) specified by the received mode change request. Then, the control unit 370 of the information processing device 300 transmits a permitted/not-permitted command for the mode setting to notify the information processing device 200 of the result of the determination (588, 589).

[0140]

When the mode setting command is received (589), the control unit 240 of the information processing device 200 checks the contents of the mode setting command and sets the transmission mode (590). This confirmation process is similar to the confirmation process described above. Further, the processes (590 to 595) shown in FIG. 10 correspond to the processes (545 to 550) shown in FIG. 8

[0141]

Here, when the source device switches between the peripheral channels and the center channel, the source device may transmit information indicating the timing of the switch (for example, information indicating the beginning of a GOP (Group of Picture) or information indicating the beginning of a Picture) in the stream. That is, when switching between the main display and the sub-display, the source device may transmit information indicating the timing of the switching to the sink device. In this case, the sink device receiving the stream can switch between the peripheral channel and the center channel at the appropriate timing based on the information indicating the timing.

[0142]

Here, FIGS. 6 to 10 show an example of controlling standby wake-up of a source device connected to a sink device. However, the standby/wake-up of the sink device may be controlled based on the standby/wake-up of a source device connected to the sink device. For example, when all source devices connected to a sink device are in standby, the sink device can be controlled to be in standby. Further, when at least one of the source devices connected to the sink device is in a wakeup state, the sink device can be controlled to wake up.

[0143]

FIG. 11 shows a modified example of each process (565 to 570) shown in FIG. 9 in which the sink

device notifies the source device that the contents stored in process (564) have been changed, and the source device transmits a mode table request.

[0144]

As shown in FIG. 11, the information processing device 300 notifies the information processing device 200 that the output format has changed (564), and also transmits a mode status notification (565, 566) to prompt the information processing device 200 to send a mode setting request. If the information processing device 200 receives this mode status notification, it sends a mode status notification acknowledgment indicating that it acknowledges the mode status notification to the information processing device 300 (851, 852).

[0145]

In this manner, after the mode status notification acknowledgment is sent (851), the various processes (853 to 858) are performed. Moreover, these processes (853 to 858) correspond to the various processes (505 to 510) shown in FIG. 6. In this manner, after the mode status notification acknowledgment is sent (851), the various processes (853 to 858) are performed, whereby appropriate stream transmission control (e.g., data transmission speed control, scalability transmission rate control) can be performed in response to a state change (change in output format (564)).

[0146]

Here, for example, among the commands provided by Wi-Fi CERTIFIED Miracast, RTS PM5 Message including wfd-triggered-method is currently defined as a command that information processing device 200 transmits to information processing device 300. However, if the RTS PM5 Message including the wfd-triggered-method can be extended as a command to be sent by the information processing device 300 to the information processing device 200, the information processing device 200 will receive the RTS PM5 Message including the wfd-triggered-method, and will be able to start Capability Re-negotiation between the information processing device 200 and the information processing device 300. That is, management information can be exchanged using RTSPM 5 Messages that include the wfd-triggered-method. The control unit 370 of the information processing device 300 can perform control to transmit an RTS PM5 Message including the wfd-triggered-method defined in the Wi-Fi CERTIFIED Microcast specification to the information processing device 200 as a command for notifying the information processing device 200 of a change in management information when the change is made, for example. In addition to these commands, new commands may be defined to perform the same functions.

[0147]

[Example of operation of information processing device (source device)]

FIG. 12 is a flowchart showing an example of a processing steps of a data transmission process by the information processing device 200 in the first embodiment of the present technology. FIG. 12 shows an example in which the information processing device 200 transmits a standard resolution stream (image data and audio data) to the information processing device 300. In this case, it is assumed that the information processing device 300 is performing output based on that stream.

[0148]

First, the control unit 240 transmits a mode table request to the information processing device 300 (step S901). Next, the control unit 240 determines whether or not command information has been received from the information processing device 300 (step S902), and if command information has not been received, it continues monitoring. If no command information is received even after waiting for a certain period of time, a timeout may occur and the process may be terminated. For example, Wi-Fi CERTIFIED Miracast sets the timeout period to 5 to 9 seconds, depending on the situation.

[0149]

When command information is received from the information processing device 300 (step S902), the control unit 240 transmits mode setting information indicating that a mode should be set based on the received command information to the information processing device 300 (step S903).

[0150]

Next, the control unit 240 sets the mode based on the received command information (step S904). Further, if a change request to improve the resolution is included in the command information, the control unit 240

unit 240 sets the image and audio resolution according to the change request. Further, if a change request to reduce the resolution is included in the command information, the control unit 240 sets the image resolution and audio quality according to the change request.

[0151]

Next, the control unit 240 performs a transmission process to transmit the stream to the information processing device 300 according to the settings (step S905).

[0152]

Next, the control unit 240 determines whether or not the low power consumption mode is set (step S906), and if the low power consumption mode is not set (i.e., if the normal power consumption mode is set), the control unit 240 proceeds to step S911. On the other hand, if the low power consumption mode is set (step S906), the control unit 240 goes into sleep mode for a certain period of time (step S907).

[0153]

Next, the control unit 240 sends an inquiry message to the information processing device 300 (step S908). Next, the control unit 240 determines whether or not a response message has been received from the information processing device 300 (step S909), and if a response message has not been received, it continues monitoring. If no response message is received after a certain period of time, a timeout may occur and the process may be terminated. Wi-Fi CERTIFIED Miracast sets the timeout period to 5 to 9 seconds, depending on the situation, for example.

[0154]

When a response message is received from the information processing device 300 (step S909), the control unit 240 determines whether or not the response message includes a change request (step S910). If the response message contains a change request (step S910), the process returns to step S901.

[0155]

If the response message does not include a change request (step S910), the control unit 240 determines whether or not a change request has been received (step S911). If a change request is received (step S911), the process returns to step S901. On the other hand, if a change request has not been received (step S911), the control unit 240 determines whether a transmission stop operation has been performed (step S912). Then, if a transmission stop operation is performed (step S912), the data transmission process ends. First, if the transmission stop operation has not been performed (step S912), the process returns to step S905.

[0156]

[Example of operation of information processing device (sink device)]

FIG. 13 is a flowchart showing an example of a processing steps of a data transmission rate control process by the information processing device 300 in the first embodiment of the present technology. FIG. 13 shows an example in which the information processing device 300 determines the settings (e.g., resolution, power consumption mode) related to the source device when receiving a stream (image data and audio data).

[0157]

For example, the control unit 370 of the information processing device 300 can determine the resolution and frequency channel to be used depending on user information to be used as the center channel and the link radio wave propagation environment between the information processing device 300 and each source device.

[0158]

For example, assume that a user operation is performed to select image 12 in the state shown in FIG. 5A. In this case, it is preferable to increase the resolution for image 12 and decrease the resolution for image 11. It is also preferable to select the optimal resolution for images 11 and 12 based on the link radio wave propagation environment of each source device over time.

[0159]

For example, the information processing device 300 can grasp the radio wave propagation characteristics by transmitting data corresponding to the corresponding throughput on multiple frequency channels. Also, for example, the information processing device 300 stores a table that keeps track of the ideal throughput for each of multiple frequency channels. The information processing

then determine the available data transmission speed of the frequency channels to be used based on the number of simultaneously used source devices and the PER, and select the optimal frequency channel for each frequency channel.

[0160]

For example, the control unit 370 acquires management information from the management information storage unit 390 and acquires user information from the user information acquisition unit 360 (step S921). Next, the control unit 370 determines the output format based on the acquired management information and user information (step S922). Based on the determined output format, the control unit 370 outputs the output format of the content transmitted from each of the plurality of source devices. Images corresponding to the two streams are displayed on the display unit 351.

[0161]

Next, the control unit 370 determines whether there is a source device whose PER included in the management information is below a threshold value (step S923). If there is a source device whose PER contained in the management information is below the threshold value (step S923), the control unit 370 determines a change request to improve the resolution of that source device (step S924). Moreover, the control unit 370 controls the allocation of a high data transmission rate to the center channel depending on the output format based on user information. This change request is, for example, included in command information (for example, the command information shown in FIG. 6) and transmitted to the source device. Further, it may be possible to determine whether the throughput after improving the resolution of the source device is within a certain limit, and to control the stream rate based on the result of this determination.

[0162]

If there is no source device whose PER included in the management information is equal to or lower than the threshold (step S923), the control unit 370 determines whether the throughput of each source device is equal to or lower than the threshold based on the management information (step S925). That is, it is determined whether the throughput of each link is sufficient for the current frequency channel (step S925).

[0163]

If the throughput of each source device is not below the threshold value (step S925), the process returns to step S921. On the other hand, if the throughput of each source device is below the threshold value (step S925), the control unit 370 determines based on the management information whether or not there is a source device that supports a low power consumption mode (step S926).

[0164]

If a source device that supports the low power mode is present (step S926), the control unit 370 determines a change request to set the low power mode for the source device that supports the low power mode (step S928). This change request is, for example, included in command information (for example, the command information shown in FIG. 6) and transmitted to the source device.

[0165]

If there is no source device that supports the low power consumption mode (step S926), the control unit 370 determines a change request to reduce the resolution of that source device (a source device whose PER is below the threshold value) (step S927). This change request is, for example, included in command information (for example, the command information shown in FIG. 6) and transmitted to the source device.

[0166]

Further, it is determined whether or not a reception stop operation has been performed (step S929), and if a reception stop operation has been performed, the operation of controlling the data transmission rate is terminated, and if a reception stop operation has not been performed, the process returns to step S921. Moreover, if there is a source device that is in a sleep state due to its low power consumption mode setting, the number of source devices connected to the information processing device 300 is reduced. In this case, the throughput function value in step S925 may be changed. Further, after changing the throughput limit in this manner, a step equivalent to step S925 may be further executed.

[0167]

In this manner, a control protocol can be realized in which the sink device trains the line environment for a certain period of time and notifies the source device of the resolution at which stable video communication can be performed. Further, a control protocol may be used in which the source device trains the line environment for a certain period of time, requests a resolution that allows stable video communication, and the sink device responds.

[0168]

In this manner, the control unit 370 of the information processing device 300 can perform transmission control (e.g., data transmission speed control, scalability transmission rate control) of the two streams transmitted from each of the source devices based on the management information in the management information storage unit 390 and the user information acquired by the user information acquisition unit 360.

[0169]

Moreover, control may be performed so as to minimize the total data transmission rate of the two streams transmitted from each of information processing devices 200 and 400. The maximum allowable value of the total data transmission speed is set in the control unit 370 of the receiving information processing device 300, for example. Then, the control unit 370 transmits a change request to the information processing device 200 to reduce the bit rate, and then obtains the bit rates of the two streams transmitted from the information processing devices 200 and 400, respectively, from the stream reception unit 330. Next, the control unit 370 calculates the total data transmission rate of the two acquired streams. Next, the control unit 370 determines the bit rate of the stream to be transmitted from the information processing device 400 within a range not exceeding the set maximum allowable value, and transmits a change request to the information processing device 400 to increase the bit rate to this value. If the PER is too high to accommodate all data on the same frequency channel even when the minimum bit rate is set, a different frequency channel may be used. Further, if the image (center channel, peripheral channel) remains still for a certain period of time or more, the image data may be stopped unless an operation from the user (e.g., pointing) occurs.

[0170]

In this manner, according to the first embodiment of the present technology, even when multiple streams transmitted from multiple source devices are received by one sink device, appropriate stream transmission control (e.g., data transmission rate control) can be performed according to the user's operation, situation, and intention. Depending on the user's operation, situation, and intention, it is possible to reduce the data transmission speed of some of the multiple image and audio streams and increase the data transmission speed of the remaining streams, for example.

[0171]

Further, if a sink device is receiving and displaying multiple streams, the user can enjoy high quality images and sounds that are important to them, as configured by the user at each time, for example. Further, for other types of video and audio, the data transmission speed can be automatically adjusted to the optimal frequency channel, power consumption, and transmission rate.

[0172]

Here, with regard to the management information stored in the management information storage unit 390, commands provided in Wi-Fi CERTIFIED Miracast can be used for exchanging the management information, for example. In this case, capability negotiation or capability renegotiation can be used as defined in the Wi-Fi Device specification. Here, capability negotiation or capability re-negotiation refers to, for example, RF C5939 or Wi-Fi CERTIFIED Miracast specifications. However, capability negotiation or capability re-negotiation is not limited to these and is defined as the exchange of equipment performance information. Examples of communication using the Wi-Fi CERTIFIED Miracast specification command are shown in FIGS. 14 to 16.

[0173]

[Example of communication using Wi-Fi CERTIFIED Miracast specification commands]

FIGS. 14 to 16 are sequence charts showing an example of communication processing between a source device and a sink device in the first embodiment of the present technology. FIGS. 14 to 16 show examples of communication using the RTSP protocol. Moreover, the source device 820 corresponds to the information processing devices 200 and 400, and the sink device 830 corresponds to the information processing device 300.

[0174]

First, reference will be made to FIG. 14. For example, as shown in the dotted rectangle 840 in FIG. 14, an "RTSP M3 Request" (RTSP GET_PARAMETER Request) message sent from the source device to the sink device and an "RTSP M3 Response" (RTSP GET_PARAMETER Response) message sent in response from the sink device to the source device can be used. This exchange process corresponds to, for example, processes (505 to 508) shown in FIG. 6 and processes (539 to 542) shown in FIG. 8.

On the other hand, the data may be transmitted from the source device to the sink device as appropriate. For example, the exchange of the "RTSP M3 Request" (RTSP GET_PARAMETER Request) message and the "RTSP M3 Response" (RTSP GET_PARAMETER Response) message may be omitted, and management information may be included in a message transmitted from the source device to the sink device, and the management information may be transmitted from the source device to the sink device, and the sink device may select the information and store it in the management information storage unit 390. When configuring content protection, perform link protection setup after M3 Response, for example. For this reason, it may be desirable to be able to communicate using only messages of M4 or above while maintaining the privacy of the link once it has been established.

[0175]

Further, information regarding power consumption modes can be exchanged using specific messages that use the RTSP protocol. For example, the following three types of management information (1) to (3) can be exchanged.

(1) "Setting to Standby mode"

(2) "When the source device exits standby mode or when the source device exits standby mode of the sink device"

(3) "When the sink device cancels the standard mode or when the sink device cancels the standard mode of the source device"

[0176]

First, reference will be made to FIG. 15. For example, when using commands provided by Wi-Fi CERTIFIED Miracast, the above-mentioned (1) "Setting to Standby mode" exchange can use an "RTSP M12 Request" (RTSP SET_PARAMETER (with WFD-standby)) message sent from the source device 820 to the sink device 830 and an "RTSP M12 Response" (RTSP OK) message sent in response from the sink device 830 to the source device 820. On the other hand, the same process is used to set the source device 820 to standby mode from the sink device 830.

[0177]

Next, a description will be given with reference to FIG. 16. For example, in the above-mentioned (2) "When the source device releases the standby mode or when the source device releases the standby mode of the sink device," the source device 820 exchanges an "RTSP M5 Request" (RTSP SET_PARAMETER (Request (wfd -- trigger-method : PLAY))) message sent to the sink device 830 and an "RTSP M5 Response" (RTSP OK) message sent from the sink device 830 to the source device 820 in response. The sink device 830 can use an "RTSP M7 Request" (RTSP PLAY Request) message sent to the source device 820 and an "RTSP M7 Response" (RTSP OK) message sent from the source device 820 to the sink device 830 in response thereto.

[0178]

Further, for example, in the case of the above-mentioned (3) "when the sink device cancels the standard mode or when the sink device cancels the standard mode of the source device", the sink device 830 can use an "RTSP M7 Request" (RTSP PLAY Request) message sent to the source device 820 and an "RTSP M7 Response" (RTSP OK) message sent from the source device 820 to the sink device 830 in response thereto. These interactions correspond to processes (515 to 518) shown in FIG. 7 and processes (535 to

538) shown in FIG. 7, for example.

[0179]

Further, the exchange of the processes (565 to 570) shown in FIG. 9 can use an “RTSP M12 Request” (RTSP SET_PARAMETER (with WFD-standby)) message transmitted from the sink device 830 to the source device 820 and an “RTSP M12 Response (RTSP OK)” message transmitted in response from the source device 820 to the sink device 830, for example.

[0180]

Further, the exchange of the processes (584 to 589) shown in FIG. 10 may use an “RTSP M7 Request” (RTSP PLAY Request) message sent from the sink device 830 to the source device 820 and an “RTSP M7 Response” (RTSP OK) message sent in response from the source device 820 to the sink device 830, for example.

[0181]

In this manner, the wireless communication unit 320 can exchange capability information through capability negotiation or capability re-negotiation as defined in the Wi-Fi Display specification. Further, capability information is exchanged in RTSP M3 Messaging during capability negotiation or capability re-negotiation, for example.

[0182]

In this manner, for example, the wireless communication unit 320 of the information processing device 300 communicates with the source device to exchange capability information related to the information processing device 300 and capability information related to the information processing device 200. Further, the wireless communication unit 220 of the information processing device 200 performs communication with the information processing device 300 to exchange capability information regarding the information processing device 200 and capability information regarding the information processing device 300. In these cases, the wireless communication units 220, 320 can exchange capability information through capability negotiation or capability re-negotiation.

[0183]

Further, the control unit 370 of the information processing device 300 performs transmission control of the stream with the information processing device 200 (e.g., data transmission speed control, scalability transmission rate control) based on the capability information related to the information processing device 200, the radio wave propagation measurement information related to the communication with the information processing device 200, and the way the information processing device 300 is used. Further, although the method of stream transmission differs from the embodiment of the present technology, the control unit 240 of the information processing device 200 can also perform transmission control of the stream with the information processing device 300 (e.g., data transmission speed control, scalability transmission rate control) based on control from the information processing device 300 based on capacity information related to the information processing device 200 and radio wave propagation measurement information related to the stream communication with the information processing device 300.

[0184]

Further, the control unit 370 of the information processing device 300 performs control to set a power consumption mode in the information processing device 200 based on capability information related to the information processing device 200 (for example, information indicating whether it is a mobile device or not). In this case, the control unit 370 can perform control to set the information processing device 200 to a low power consumption mode based on the cache information related to the information processing device 200 and management information for managing the information processing device 200. Further, the control unit 240 of the information processing device 200 sets a power consumption mode based on control from the information processing device 300 based on Capability information related to the information processing device 200. Moreover, although an example of a topology with two source devices has been described in the embodiment of the present technology, the present technology is not limited to the embodiment of the present technology. If there are two or more devices, it is necessary to control the data transmission speed for each device, and since there are many state transitions, control becomes more difficult, but it is still beneficial, for example. It can also support topologies in which two source

devices are connected.

[0185]

2. Second embodiment

The second embodiment of the present technology shows an example in which a connection between a source device and a sink device via an access point and a direct connection between the source device and the sink device are switched.

[0186]

[Example of communication system configuration]

FIG. 17 is a diagram showing an example of a system configuration of a communication system 700 according to the second embodiment of the present technology.

[0187]

The communication system 700 includes an access point 701, a network 702, information processing devices 703, 704, 710, 720, 730, a display device 731, and a control device 740.

[0188]

The access point 701 is an access point for a wireless LAN (e.g., Wi-Fi). For example, the access point 701 has the functionality of the Infrastructure mode of the IEEE 802.11 standard. The access point 701 is connected to one or more information processing devices (for example, a transmitting information processing device (source device) and a receiving information processing device (sink device)).

[0189]

Further, the access point 701 can be connected to an information processing device 730 via a wired line (e.g., Ethernet (registered trademark)). For example, an access point 701 can be connected to an information processing device 730 via a network 702. The access point 701 may also be connected to the internal bus of the information processing device 730 to perform processing. The internal bus of the information processing device 730 is a Universal Serial Bus (USB), a Peripheral Components Interconnect (PCI), or a PCI Express, for example. Further, the connection between the access point 701 and the information processing device 730 may be a wireless connection (e.g., wireless LAN) rather than a wired connection. In the case of a wireless LAN, the network 702 is connected to the information processing device 730, and the information processing device 730 needs to determine whether to perform transmission/reception processing with the access point 701 or with the information processing device 710, for example.

[0190]

The second embodiment of the present technology shows an example in which the access point 701 and the information processing devices 703, 704, 710, and 720 are connected using a wireless LAN (e.g., a wireless LAN equivalent to IEEE 802.11a/b/g/n/ac/ad). Moreover, an example is shown in which the access point 701 and the information processing device 730 are connected via an Ethernet line.

[0191]

Further, an example is shown in which the information processing devices 703, 704, 710, and 720 are transmitting information processing devices (source devices), and the information processing device 730 is a receiving information processing device (sink device). Further, the information processing devices 703, 704, 710, and 720 correspond to the information processing device 200 shown in FIG. 2, and the information processing device 730 corresponds to the information processing device 300 shown in FIG. 3. In the following, the information processing device 710 will be mainly described as a source device, but the same applies to the information processing devices 703, 704, and 702.

[0192]

The information processing device 710 is a transmitting information processing device (source device) that transmits images. Further, the information processing device 710 is an information processing device that can connect to the access point 701 in Infrastructure mode.

[0193]

Here, a connection example in which an information processing device 710 connects to an access point 701 in Infrastructure mode will be described. The information processing device 710 transmits a connection request signal to the access point 701 in response to a beacon signal transmitted from the access

point 701. In this manner, the information processing device 710 starts an operation for establishing a connection with the access point 701 (a connection establishment operation) by transmitting a connection request signal.

[0194]

This connection establishment operation is an operation for connecting the layer 2 level. In addition to the password authentication using PID (Packet Identification) performed in wireless LAN, a connection authentication process is also required to determine whether or not the information processing device 710 should be connected as an application, for example.

[0195]

Further, the information processing device 710 can be connected to the information processing device 730 via P2P direct communication (e.g., WiFi Direct). The information processing device 710 is connected to the information processing device 730 via Wi-Fi Direct and has a protocol that enables image communication such as Wi-Fi CERTIFIED Miracast or DLNA (Digital Living Network Alliance), for example.

[0196]

Further, the information processing device 710 may be connected to the access point 701 and serve as a standby device that only exchanges various types of information with the information processing device 730 via the access point 701. Moreover, when the information processing device 710 is used only as a standby device, the information processing device 710 does not need to have a protocol that enables image communication.

[0197]

The information processing device 730 has a communication function for connecting to the access point 701, the information processing devices 703, 704, 710, 720, and the control device 740. The information processing device 730 is also connected to the access point 701, the information processing devices 703, 704, 710, 720, and the control device 740, and has the function of controlling the entire protocol. Further, the information processing device 730 has a communication function for connecting to an in-house LAN or a global LAN.

[0198]

Here, it is important to stabilize the connections between the information processing device 730 and the information processing devices 703, 704, 710, and 720. For this reason, using a wireless frequency different from that used by the access point 701 for connecting the information processing device 730 to the information processing devices 703, 704, 710, and 720 is preferable. The second embodiment of the present technology shows an example in which frequency bands such as 2.4 GHz band, 5 GHz band, and 60 GHz band of IEEE 802.11 a/b/g/n/ac/ad are used. However, other wireless standards and frequency bands may be used.

[0199]

In addition, the information processing device 730 has a display function for displaying images. This display function is a function for displaying images on a TV (television), projector, and the like. The information processing device 730 may display an image on a display unit provided in the information processing device 730, or may display an image on an external display device. In the second embodiment of the present technology, an example is shown in which a display device 731 is provided separately from an information processing device 730.

[0200]

In this manner, when the display device 731 is provided as a separate device from the information processing device 730, the information processing device 730 and the display device 731 can be connected by wire or wirelessly. For example, when connecting the information processing device 730 and the display device 731 via a wired connection, the connection can be made using a wired cable (e.g., HDMI (registered trademark) (High-Definition Multimedia Interface), MHL (Mobile High-definition Link), DisplayPort, or USB 3.0). Further, when wirelessly connecting the information processing device 730 and the display device 731, the connection can be made using a wireless LAN, for example. Further, multiple

display devices may be connected to the information processing device 730.

[0201]

The control device 740 is a connection control device that manages each information processing device (information processing devices 703, 704, 710, 720, 730) that constitutes the communication system 700 and controls the connection of each information processing device. The control device 740 manages and keeps track of information regarding each information processing device (e.g., terminal identification information, Capability information) and the operating status of each information processing device (e.g., communication mode, group participation status), for example. Further, the control device 740 is connected to the information processing device 730 using wireless communication. This wireless communication can use, for example, a communication method (e.g., wireless LAN) provided in the information processing device 730. Further, infrared rays, other wireless methods, or wired lines may be used. Moreover, the control device 740 may be provided with a protocol for connecting to the access point 701 and connected to the information processing device 730 via the access point 701.

[0202]

[Example of communication system installation]

FIG. 18 is a diagram showing an example of installation of a communication system 700 according to the second embodiment of the present technology.

[0203]

FIG. 18 shows an example in which a communication system 700 is installed in a university classroom 30. In FIG. 18, people are shown diagrammatically as circles, and the names of each person are given inside the circles corresponding to those people. Assume that a teacher 1 is present on the podium side of the classroom 30 (upper side in FIG. 18) and that the teacher 1 is using control device 740, for example. Further, it is assumed that student 1 is seated in seat 31 at the front of classroom 30 and is using information processing device 710. Similarly, students 2 to 20 are seated in seats 32 to 35 and are using information processing devices 703 to 705, 720. Further, an entrance/exit 36 is provided at the rear of classroom 30 (lower side of FIG. 18).

[0204]

In a classroom 30, a display device 731 is installed on the podium side so that the students 1 to 20 seated in seats 31 to 35 can easily see it, for example. Further, the access point 701, the network 702, and the information processing device 730 are appropriately installed inside or outside the classroom 30, taking into consideration the space of the classroom 30. In this case, it is preferable that the access point 701 is installed in a location where wireless communication is possible between the access point 701 and the information processing devices used by the students seated in the seats 31 to 35.

[0205]

For example, assume that students are giving presentations one by one in classroom 30. In this case, each student can make a presentation while displaying images related to the presentation on the display device 731 for other students to see.

[0206]

Further, by operating the control device 740, the teacher 1 can sequentially select the students' information processing devices on which images should be displayed on the display unit 732 of the display device 731. An example of this information processing device selection will be described in detail with reference to FIG.21

[0207]

Further, a reader/writer device 37 is installed near the entrance 36 of the classroom 30. The reader/writer device 37 exchanges various types of information with the information processing device using short-range wireless communication (e.g., NFC (Near Field Communication)). Further, the reader/writer device 37 transmits information exchanged with the information processing device to the information processing device 730 using a wireless or wired line. An example of using the reader/writer device 37 will be shown in the third embodiment of the present technology.

[0208]

[Control device configuration example]

FIG. 19 is a block diagram showing an example functional configuration of a control device 740 in the second embodiment of the present technology.

[0209]

The control device 740 comprises an antenna 741, a wireless communication unit 742, an input/output unit 743, an operation reception unit 746, a control unit 747, and a group management information storage unit 750.

[0210]

The wireless communication unit 742 transmits and receives various information to and from the information processing device 730 via the antenna 741 using wireless communication based on the control of the control unit 747.

[0211]

The operation reception unit 746 is an operation reception unit that receives operation input performed by a user, and outputs operation information corresponding to the received operation input to the control unit 747. The operation reception unit 746 is realized by, for example, a keyboard and a mouse.

[0212]

The input/output unit 743 displays various images on the display unit 744 based on the control of the control unit 747, and accepts operation input from the user via the input unit 745 based on the detection status of an object approaching or touching the display surface of the display unit 744. Further, the input unit 745 outputs control information corresponding to the received operation input to the control unit 747.

[0213]

In this manner, the input/output unit 743 is configured as an integrated unit of the display unit 744 and the input unit 745. The input/output unit 743 can be configured as an integrated unit using, for example, a touch panel that allows the user to input operations by touching or approaching the display surface with their finger. For example, the user can operate the control device 740 by performing a contact operation (or a proximity operation) on an image displayed on the display unit 744.

[0214]

The input unit 745 can be an electrostatic (capacitive) touch panel that detects contact or proximity of a conductive object (e.g., a person's finger) based on changes in capacitance, for example. Moreover, touch panels other than the electrostatic type (capacitive type) may be used. A pressure-sensitive (resistive film pressure) or optical touch panel can be used, for example.

[0215]

The control unit 747 controls each part of the control device 740 based on a control program. The control unit 747 performs control to set the communication mode to the source device when real-time image transmission is performed between a sink device and multiple source devices according to the Wi-Fi CERTIFIED Microcast specification, for example. In this case, the control unit 747 causes an image representing multiple source devices to be displayed on the input/output unit 743, and performs control to set the communication mode to the source device based on operational input at the input/output unit 743. Alternatively, the control unit 747 performs control to set the communication mode to the source device based on a predetermined order. Here, the specified order may be, for example, the order of images displayed side by side in the peripheral channel region 734 shown in FIG. 22. Further, when multiple display devices are used, the control unit 747 can control full-screen display, switching display, and the like on each display device.

[0216]

The group management information storage unit 750 is a table that stores information (group management information) for managing each source device connected to the information processing device 730 in groups using wireless communication. The contents stored in the group management information storage unit 750 will be explained in detail with reference to FIG. 20.

[0217]

[Example of contents stored in the group management information storage unit]

FIG. 20 is a diagram showing an example of the contents stored in the group management information storage unit 750 in the second embodiment of the present technology.

[0218]

The group management information storage unit 750 stores terminal identification information 751, user information 752, communication mode 753, group participation status 754, outdoor use 755, and group participation available time 756 in association with each other.

[0219]

The terminal identification information 751 stores identification information for identifying a source device connected to the information processing device 300 using wireless communication.

[0220]

The user information 752 stores information (user information) about the user who owns the source device connected to the information processing device 300 using wireless communication. The user's name, nickname, identification information (for example, student ID number, employee number, membership number), image (for example, a facial image of the user, a portrait of the user), and the like can be stored as user information, for example. Further, the user information stored in user information 752 is displayed on input/output unit 743. Moreover, the user information can be registered in advance in the control device 740 by the user who owns the source device, for example. Further, each time a connection is made to the information processing device 300, it may be registered in the control device 740.

[0221]

The communication mode 753 stores the communication mode set in the source device connected to the information processing device 300 using wireless communication. One of the following is stored as the communication mode: standby mode, image transmission mode (center channel), or image transmission mode (peripheral channel), for example. Each of these communication modes is described in more detail with reference to FIG.22

[0222]

The group participation status 754 stores information indicating whether or not a connection to the information processing device 300 is made using wireless communication. For example, it is possible that a source device that is pre-registered in the control device 740 is not connected to the information processing device 300. Thus, by referring to the group participation status 754, it is possible to identify source devices that are registered in the control device 740 but are not connected to the information processing device 300.

[0223]

The outdoor use 755 stores information indicating whether a source device connected to the information processing device 300 using wireless communication is capable of communicating using a base station other than a specific access point. That is, the outdoor use 755 stores information indicating whether or not a source device connected to the information processing device 300 via wireless communication can communicate using the source device even if the source device is moved to a location other than the specific location.

[0224]

The group participation available time 756 stores information indicating a time period during which a source device connected to the information processing device 300 via wireless communication can participate in a group. During times when highly confidential or important presentations or meetings are being held, or when meetings that should not be made public are being held, some users may be denied access, for example.

[0225]

[Example of control device display]

FIG. 21 is a diagram showing an example of a table screen displayed on the input/output unit 743 of the control device 740 in the second embodiment of the present technology.

[0226]

The input/output unit 743 displays images (teacher 1, students 1 to 20) representing one or more information processing devices managed by the control device 740. Further, the input/output section 743

is provided with a presentation area 748 and a waiting area 749.

[0227]

FIG. 21 shows an example in which a communication system 700 is installed in a university classroom 30 as shown in FIG.18 In this case, for example, images (e.g., icons) representing a teacher 1 and students 1 to 20 present in a classroom 30 are displayed. In FIG. 21, the rectangle corresponding to the image of the teacher is shown with the name of the teacher and a number to identify the teacher. Further, within the rectangles corresponding to the images of the students, numbers are added to identify the students along with the letters of the students. Further, an icon with other information for identifying the student (for example, student ID number, ID, face image, name, nickname) may be displayed.

[0228]

FIG. 21 shows an example in which images representing students 1 through 20 are arranged in a grid in the order of the numbers assigned to the students, but other arrangements may also be used. Students can be placed according to where they are located, for example. The location information (for example, latitude and longitude) of the information processing device owned by each student can be obtained, and the absolute location of each information processing device can be determined based on this location information, for example. Based on the position of each information processing device thus determined, the relative positions of each information processing device can be determined to arrange each student. Each information processing device can obtain location information, for example, using GPS (Global Positioning System).

[0229]

Further, the relative positions of each information processing device can be detected by using radio waves, for example. The information processing device 730 can acquire radio wave intensities from multiple information processing devices and, based on these radio wave intensities, use a triangulation surveying method to determine its relative position (the position of its own device) with respect to other information processing devices, for example. The relative positions thus determined can then be acquired by the control device 740 so that each student can be positioned.

[0230]

Here, each source device participating in the group performs processing such as sending commands to the access point 701 or the information processing device 730, without affecting power consumption. If this command is received directly or indirectly via the access point 701, the information processing device 730 notifies the control device 740 of information regarding the source device that received the command. This allows the control device 740 to check whether the source device has left the group.

[0231]

The control device 740 checks whether a source device participating in a group has left the group, and if it detects a source device that has left, it deletes the image (e.g., an icon) corresponding to the source device that has left from the input/output unit 743, for example. If the control device 740 determines that it has not received a command from the information processing device corresponding to student 17 shown in FIG. 21 for a predetermined period of time or longer, it determines that the information processing device corresponding to student 17 has left the group, for example. Then, the control device 740 deletes the image (student 17) corresponding to the removed information processing device from the input/output unit 743.

[0232]

The presentation area 748 is an area used when switching from standby mode to image transmission mode (center channel, peripheral channel).

[0233]

The standby area 749 is an area used when switching from the image transmission mode to the standby mode.

[0234]

The second embodiment of the present technology shows an example in which a control device 740 manages one or more information processing devices connected to an information processing device 730,

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and an image representing each information processing device is displayed on an input/output unit 743 of the control device 740. However, the information processing device 730 may manage one or more information processing devices connected to it, and display an image representing each information processing device on the display unit or display device 731 of the information processing device 730.

[0235]

[Example of displaying on a display device]

FIG. 22 is a diagram showing an example of transition of a display screen displayed on a display device 731 in the second embodiment of the present technology. FIG. 22 shows an example of the transition of the display screen that can be switched depending on the communication mode of the source device.

[0236]

As described above, when the source device is connected to the sink device (when participation in the group is permitted), the communication mode in the source device is set to either the standby mode or the image transmission mode.

[0237]

Here, the image transmission mode is a communication mode in which images are transmitted from a source device to a sink device, and the source device and sink device are directly connected via P2P. The image transmission modes include an image transmission mode (center channel) that transmits an image on a center channel, and an image transmission mode (peripheral channels) that transmits images on peripheral channels.

[0238]

The image transmission mode (center channel) is a communication mode in which image data is transmitted to display an image on the center channel (center channel area 733) of the display unit of the sink device. In the image transmission mode (center channel), for example, image data is transmitted via a high-frequency band wireless transmission path.

[0239]

The image transmission mode (peripheral channel) is a communication mode in which image data is transmitted to display an image on the center channel (peripheral channel, area 734) of the display unit of the sink device. In the image transmission mode (peripheral channel), image data is transmitted over a low-frequency band wireless transmission path, for example.

[0240]

The standby mode is a communication mode in which no image is transmitted from the source device to the sink device, and the connection between the source device and the sink device is maintained via an access point. That is, the standby mode is the mode set when the sink device and the control device 740 are recognized as a network participant.

[0241]

In this manner, in the image transmission mode, images can be transmitted from the source device to the sink device. However, in the standby mode, image transmission from the source device to the sink device is not possible. However, simple messaging and the like can be transmitted from the source device to the sink device even in standby mode.

[0242]

In addition, in the source device, the communication mode shall be switched sequentially, for example, from standby mode → image transmission mode (peripheral channel) → image transmission mode (center channel) > standby mode.

[0243]

FIG. 22A shows an example of a display when standby mode is set in the information processing device 710. In the example shown in FIG. 17, assume that the information processing device 710 is set to standby mode, for example. In this case, the information processing device 710 is connected to the information processing device 730 via the access point 701. In this case, no image is transmitted from the information processing device 710 to the information processing device 730. As a result, the image (running horse) displayed on the information processing device 710 is not displayed on the display unit 732 of the display device 731.

[0244]

FIG. 22b shows an example of a display when image transmission mode (peripheral channel) is set in the information processing device 710. In the example shown in FIG. 17, it is assumed that the image transmission mode (peripheral channel) is set in the information processing device 710, for example. In this case, the information processing device 710 is connected to the information processing device 730 without going through the access point 701. In this case, an image is transmitted from the information processing device 710 to the information processing device 730. The image (a running horse) displayed on the information processing device 710 is displayed in the peripheral channel area 734 in the display unit 732 of the display device 731.

[0245]

Here, images from each source device are displayed in the peripheral channel area 734 in the order in which the images are displayed in the center channel area 733. The source device transmitting the image to be displayed at the bottom of peripheral channel area 734 will then become the source device displaying the image in center channel area 733, for example. Further, the source device transmitting the image displayed second from the bottom in the peripheral channel area 734 will then be the source device that displays an image in the center channel area 733, for example. That is, images (sub-images) can be displayed side-by-side in the peripheral channel area 734 according to the presentation order.

[0246]

FIG. 22c shows an example of a display when image transmission mode (center channel) is set in the information processing device 710. For example, in the example shown in FIG. 17, it is assumed that the image transmission mode (center channel) is set in the information processing device 710. In this case, the information processing device 710 is connected to the information processing device 730 without going through the access point 701. In this case, image transmission is performed from the information processing device 710 to the information processing device 730. The image (a running horse) displayed on the information processing device 710 is displayed in the center channel region 733 of the display unit 732 of the display device 731.

[0247]

[Example of switching the communication mode of the source device]

Here, a method for switching the communication mode (standby mode, image transmission mode) of the source device will be described.

[0248]

The following (B1) to (B3) can be used as triggers for switching the communication mode of the source device, for example.

(B1) Switching using a source device (e.g., active switching by a user operating a source device)

(B2) Switching using a control device (e.g., switching by user operation using the control device 740 (remote control switching))

(B3) Switching using a sink device (e.g., switching by a user operation using a sink device)

[0249]

Further, the user operation (switching operation) in each device is a user operation using an operation reception unit (e.g., an operating member, a touch panel) provided in each device, or a user operation using a user information acquisition unit (e.g., a detection unit that detects gestures) provided in each device, for example.

[0250]

(B1) can use an application pre-installed in the source device or an operation input of an operating member as a switching trigger, for example. When a switching operation is performed on the source device, a command regarding switching of the communication mode is sent to the sink device (information processing device 730), for example. When this command is received, the sink device (information processing device 730) controls the bandwidth of the source device that sent the command while also controlling other bandwidths. Further, the sink device (information processing device 730) sends information to the control device 740 that it has switched the communication mode of the source device that sent the command. In this case, the control device 740 may output (display, audio output) notification

information that the communication mode has been switched.

[0251]

(B2) can use a user operation on the sink device (information processing device 730) as a switching trigger, for example. When a switching operation of a source device is performed in a sink device (information processing device 730), the bandwidth of the source device for which the switching operation was performed is increased or decreased while controlling other bandwidths as well, for example. Further, the sink device (information processing device 730) transmits information to the control device 740 indicating that the communication mode of the source device for which the switching operation was performed has been switched. In this case, as in the case of (B1), the control device 740 may be configured to output notification information indicating that the communication mode has been switched.

[0252]

(B3) can use a user operation on the control device 740 as a switching trigger, for example. When a source device is switched in the control device 740, the switching operation, for example. Information about the source device on which the operation was performed (e.g., terminal identification information) is transmitted to the sink device (information processing device 730). When this information is received, the sink device (information processing device 730) controls the bandwidth of the source device for which the switching operation was performed, while also controlling other bandwidths.

[0253]

Here, user operations on the control device 740 will be described. In the display screen shown in FIG. 21, assume that an information processing device (student 17) set to standby mode is switched to image transmission mode (peripheral channel), for example. In this case, an operation is performed to move the image corresponding to the information processing device (student 17) to the presentation area 748. A drag-and-drop operation is performed, for example. This allows the information processing device (student 17) set in standby mode to be switched to image transmission mode (peripheral channel).

[0254]

Further, assume that the information processing device (student 13) set to the image transmission mode (center channel, peripheral channel) on the display screen shown in FIG. 21 is switched to the standby mode, for example. In this case, an operation is performed to move the image corresponding to the information processing device (student 13) to the waiting area 749. A drag-and-drop operation is performed, for example. This allows the information processing device (student 13) set in image transmission mode (center channel, peripheral channel) to be switched to standby mode.

[0255]

As in the cases (B1) and (B2), the control device 740 may be configured to output notification information indicating that the communication mode has been switched, for example.

[0256]

Further, the control device 740 may display images representing each information processing device (for example, students 1 to 20 shown in FIG. 21) in different ways for each communication mode. The outline of an image representing an information processing device set to image transmission mode (center channel) is indicated by a thick line, and the outline of an image representing an information processing device set to image transmission mode (peripheral channel) is indicated by a thin line, for example. Further, the outline of an image representing an information processing device set in the standby mode may be made to be a dotted line. Further, the color of an image representing an information processing device set to an image transmission mode (center channel) is set to red, and the color of an image representing an information processing device set to an image transmission mode (peripheral channel) is set to blue, for example. Further, the color of the image representing the information processing device set to the standby mode can be set to white.

[0257]

[Example of switching communication modes]

FIG. 23 shows an example of switching the communication mode between a source device and a sink device, which serves as the basis of this technology.

[0258]

As described above, the second embodiment of the present technology adopts, in the standby mode, a connection method in which the source device 610 and the sink device 612 are indirectly connected via the access point 611. The image transmission mode adopts a connection method in which the source device 610 and the sink device 612 are directly connected without going through the access point 611.

[0259]

Assume a case where a connection in standby mode (613) is switched to a connection in image transmission mode (614), for example. That is, a case in which a standby mode (613) connected via an access point 611 is switched to an image transmission mode (614) connected without going through the access point 611 is assumed.

[0260]

When switching in this manner, it is necessary to carry out Wi-Fi Direct control (P2P Device Discovery, P2P Service Discovery, GO Negotiation) shown in FIG. 24, a 4-way handshake to perform wireless LAN security authentication, DHCP (Dynamic Host Configuration Protocol) access to obtain an IP (Internet Protocol) address, and RTSP (Real Time Streaming Protocol) port setting exchange. For this reason, when switching from a connection in the standby mode (613) to a connection in the image transmission mode (614), a connection time D1 of about several seconds occurs.

[0261]

Here, it is assumed that the access point 611 and the source device 610, and the source device 610 and the sink device 612 are in the same group authentication. In this case, security authentication is performed between the access point 611 and the source device 610. For this reason, it is assumed that there is no problem in terms of security even if the setting values between the access point 611 and the source device 610 are used for the connection processing between the source device 610 and the sink device 612.

[0262]

The second embodiment of the present technology shows an example in which security authentication between a source device and a sink device is omitted to perform more seamless connection switching. Processes such as obtaining the IP for HDCP (High-bandwidth Digital Content Protection system) and setting the port for RTP (Real-time Transport Protocol) can be reused, for example. This allows for rapid connection processing even when switching between communication modes with different connection methods (switching from standby mode to image transmission mode, or switching from image transmission mode to standby mode). This provides the user the feeling that the connection is continuous.

[0263]

Moreover, if the source device and sink device support the TDL S (Tunneled Direct Link Setup) function, the TDL S protocol may be used.

[0264]

[Connection processing example]

FIG. 24 is a sequence chart showing an example of a connection process performed between a source device and a sink device in the second embodiment of the present technology. In addition, FIG. 24 shows an example of connection processing between an information processing device (source device) 710 and an information processing device (sink device) 730.

[0265]

First, the information processing device 710 performs Device Discovery (615). When the information processing device 730 is detected by this Device Discovery, the information processing device 710 determines the parent-child relationship and performs authentication processing between the information processing device 730 and the information processing device 710 by Formation (620). When each of these processes is completed, a connection is established between the information processing device 710 and the information processing device 730. Then, the information processing device 710 performs direct communication (operation) with the information processing device 730 (616).

[0266]

Here, Formation (620) will be explained.

[0267]

First, GO_Negotiation is performed between the information processing device 710 and the information processing device 730. In this GO_Negotiation, the information processing device 710 and the information

processing device 730 exchange the priority for operating as the group owner (GO), and the information processing device with the higher priority determines to operate as the group owner (GO). FIG. 24 shows an example in which the information processing device 730 has a high priority and is determined to be the group owner (GO).

[0268]

More specifically, the information processing device 710 sends a GO_Negotiation_Request to the information processing device 730 (621). Upon receiving this GO_Negotiation_Request (621), the information processing device 730 sends a GO_Negotiation_Response to the information processing device 710 (622). Upon receiving this GO_Negotiation_Response (622), the information processing device 710 transmits a GO_Negotiation_Configuration to the information processing device 730 (623).

[0269]

Through these interactions (621 to 623), the information processing device 730 is determined as the group owner (GO) and the information processing device 710 is determined as the client.

[0270]

Next, the information processing device 710 and the information processing device 730 execute a Wi-Fi Protected Access (WPs) exchange (624). By executing this WPS exchange, the information processing device 710 and the information processing device 730 share credentials (e.g., SSID (Service Set Identifier), WPS2 (Wi-Fi Protected Access 2) - PSK (Pre-Shared Key)).

[0271]

Next, the information processing device 710 and the information processing device 730 execute 4-way_handshake (625).

[0272]

[Communication Example]

FIGS. 25 and 26 are sequence charts showing an example of communication processing between each device constituting the communication system 700 in the second embodiment of the present technology. Moreover, FIGS. 25 and 26 show an example of communication processing between an information processing device (source device) 710, an information processing device (sink device) 730, and an access point 701.

[0273]

Further, FIGS. 25 and 26 show an example in which the information processing device (sink device) 730 functions as a group authentication server. That is, the information processing device (sink device) 730 is equipped with a group authentication function.

[0274]

First, an application for communicating with the information processing device 730 (an application pre-installed in the information processing device 710) is launched in the information processing device 710 (631). The application is started, for example, by a user operation (for example, pressing an application button).

[0275]

Here, FIGS. 25 and 26 show an example in which the source device starts each process after directly connecting to the access point by default. That is, the information processing device 710 launches a pre-installed application and requests connection to a sink device (information processing device 730) via a specific access point (access point 701).

[0276]

More specifically, after an information processing device 710 connects to an access point 701, it performs device discovery (corresponding to Device Discovery (615) shown in FIG. 24) and displays connectable sink devices on a display unit 711.

[0277]

Here, as a method for device discovery, for example, a method can be used in which the WiFi Direct protocol is enabled via the access point 701, and messages such as ProbeRequest are received to discover devices. Further, a method of device discovery can be used in which a Device Service Type such as Universal Plug and Play (UPnP) is exchanged between States connected to the access point 701, for

example.

[0278]

It is also assumed that the device discovery process will result in the discovery of multiple sink devices that correspond to the launched application. In this case, a selection screen for selecting a desired sink device from among the multiple discovered sink devices can be displayed on the display unit of the source device, and the user can select the desired sink device through a user operation on this selection screen. Further, from among a plurality of discovered sink devices, the device closest to the source device may be automatically selected and connected. Moreover, when automatically selecting the nearest device, for example, location information acquired by each device can be used.

[0279]

In this manner, the application is launched in the information processing device 710 and the sink device is selected (631). FIGS. 25 and 26 show an example in which information processing device 730 is selected.

[0280]

When the sink device (information processing device 730) is selected in this manner (631), the control unit of the information processing device 710 (corresponding to the control unit 240 shown in FIG. 2) makes a connection request to the sink device (information processing device 730) via the access point 701 (632 to 635). This connection request includes identification information for identifying the information processing device 710 (for example, terminal identification information 391 shown in FIG. 4) and identification information for identifying the application to be launched (application information), for example.

[0281]

When a connection request is received from the information processing device 710 (635), the control unit of the information processing device 730 (corresponding to the control unit 370 shown in FIG. 3) performs group authentication processing (636). In this group authentication process, a determination is made as to whether or not the information processing device 710 should participate in a group operated by an application started on the information processing device 710 (636). That is, the control unit of the information processing device 730 performs group authentication processing (636) to determine whether or not to permit the information processing device 710 to connect to run an application launched in the information processing device 710.

[0282]

For example, in the group authentication process, it is determined whether a user operation to authorize the information processing device 710 has been performed on any of the source device, sink device, and control device 740 that belong to the same group and are already connected. Then, on the condition that a user operation to authorize the information processing device 710 is performed in any of these devices (source device, sink device, control device 740), a decision can be made to permit the information processing device 710 to join the group.

[0283]

A display screen (e.g., a pop-up) for allowing a user to perform an operation to authorize the information processing device 710 is displayed on the display unit of at least one of the devices (the source device, the sink device, and the control device 740), for example. Then, when a user operation to authorize the information processing device 710 is performed on the display screen, the control unit of the information processing device 730 makes a decision to authorize the information processing device 710 to join the group (636).

[0284]

Further, group authentication processing may be performed based on whether or not the group is registered in the control device 740, for example. For an information processing device whose terminal identification information is stored in the terminal identification information 751 (shown in FIG. 20) of the group management information storage unit 750, the control unit of the information processing device 730 makes a decision to permit the device to join the group (636), for example. In this case, however, the control unit of the information processing device 730 determines whether to permit the user to join the

group only if the time is within the group participation time 756 (shown in FIG. 20) in the group management information storage unit 750 (636).

[0285]

If the group authentication process determines that the information processing device 710 should be permitted to join the group (636), the control unit of the information processing device 730 transmits connection permission information to the information processing device 710 via the access point 701 (637 to 640). Here, the connection permission information is information indicating that the information processing device 710 is permitted to participate in a group created by an application started in the information processing device 710.

[0286]

Moreover, when it is determined in the group authentication process that the information processing device 710 should not participate in the group (when authentication is denied) (636), the control unit of the information processing device 730 transmits connection denial information to the information processing device 710 via the access point 701. Here, the connection denial information is information indicating that the information processing device 710 is denied to join a group operated by an application started in the information processing device 710. When the information processing device 710 receives this connection denial information, it terminates the data transmission process.

[0287]

When connection permission information is received from the information processing device 730 (640), the control unit of the information processing device 710 transmits Capability information regarding the information processing device 710 to the information processing device 730 via the access point 701 (641 to 644). This Capability information is Capability information for performing Wi-Fi CERTIFIED Miracast communication with the information processing device 730. Further, this Capability information includes information for making a P2P direct connection to the information processing device 730.

[0288]

When Capability information is received from the information processing device 710 (644), the control unit of the information processing device 730 transmits setting request information to the information processing device 710 via the access point 701 (645 to 648). This setting request information is information requesting settings for transmitting images according to the Wi-Fi CERTIFIED Miracast standard.

[0289]

Here, the information processing device 730 performs bandwidth control and display screen control of each source device connected to the information processing device 730. For this reason, it is necessary to request the newly connected information processing device 710 to set parameters that take into account group sharing, based on the relationship with other source devices. Thus, after the information processing device 710 is permitted to join the group, the information processing device 730 setting request information regarding the information processing device 710 is transmitted (645 to 648) based on each piece of information regarding each source device connected to the information processing device 730.

[0290]

As described above, the information processing device 710 is initially set to standby mode based on an instruction from the information processing device 730. That is, when setting request information is received from the information processing device 730 (648), the standby mode is set in the information processing device 710 as the initial state.

[0291]

Further, the communication mode in the information processing device 710 is switched sequentially in the following order: standby mode - image transmission mode (peripheral channel) - image transmission mode (center channel) - standby mode, and the like based on instructions from the information processing device 730.

[0292]

Here, it is assumed that the communication mode of the information processing device 710 is switched by any one of the switching methods (B1) to (B3) described above. Here, an example is shown in which

the communication mode of the information processing device 710 is switched from the standby mode to the image transmission mode (peripheral channel).

[0293]

In this manner, when the image transmission mode is set (649), the control unit of the information processing device 710 cuts off access to the information processing device 730 via the access point 701 (650, 651).

[0294]

Next, the control unit of the information processing device 710 performs P2P connection processing to directly connect to the information processing device 730 (652, 653). After this P2P connection process is completed (652, 653), the control unit of the information processing device 710 makes a connection request to the information processing device 730 based on the setting request information received from the information processing device 730 (654, 655). That is, the control unit of the information processing device 710 transmits a connection request to the information processing device 730 based on the setting request information received from the information processing device 730 (654, 655). This connection request is a connection request regarding connection settings up to layer 3.

[0295]

When a connection request is received (655), the control unit of the information processing device 730 transmits confirmation information indicating that reception of the image corresponding to the connection request is permitted to the information processing device 710 (656, 657). When this confirmation information is received (657), the control unit of the information processing device 710 initiates a P2P direct connection with the information processing device 730 (658, 659).

[0296]

That is, the control unit of the information processing device 710 negotiates image parameters and audio parameters with the information processing device 730 based on a connection request corresponding to the received confirmation information, and transmits image data (658, 659).

[0297]

Here, it is assumed that the communication mode of the information processing device 710 is switched by any one of the switching methods (B1) to (B3) described above. Here, an example is shown in which the communication mode of the information processing device 710 is switched from an image transmission mode (center channel) to a standby mode.

[0298]

In this manner, when standby mode is set (660), the control unit of the information processing device 710 disconnects the direct connection with the information processing device 730 (661, 662).

[0299]

Next, the control unit of the information processing device 710 performs connection processing to connect to the information processing device 730 via the access point 701 (663, 664).

[0300]

When switching between a direct connection and a connection via the access point 701, the connection time may be known in advance and the sink device (information processing device 730) may retain the image last displayed on the display device 731. Then, the sink device (information processing device 730) performs connection switching during the process of changing the display position on the display device 731. That is, the sink device performs compensation processing that makes it difficult for the user to notice that a disconnection has occurred. This allows switching to be performed without the user aware of the switching time that would normally occur physically.

[0301]

[Example of operation of information processing device (source device)]

FIG. 27 is a flowchart showing an example of a processing steps of a data transmission process by an information processing device 710 according to a second embodiment of the present technology. FIG. 27 shows an example in which, by default, the source device (information processing device 710) starts each process after directly connecting to the access point. That is, the information processing device 710 launches a pre-installed application and makes a connection request to the sink device via **SAMSUNG** access

point (access point 701). Further, FIG. 27 shows an example in which the sink device is connected to an information processing device 730 and the specific access point is connected to an access point 701.

[0302]

First, an application for communicating with a sink device (information processing device 730) is launched in the information processing device 710 (step S1031). After this startup, the sink device (information processing device 730) to be connected is selected (step S1031).

[0303]

Next, the control unit of the information processing device 710 makes a connection request to the information processing device 730 via the access point 701 (AP) (step S1032). Next, the control unit of the information processing device 710 determines whether or not connection permission information has been received from the information processing device 730 via the access point 701 (step S1033). If no connection permission information is received from the information processing device 730 (step S1033), the data transmission processing operation is terminated. In this case, the data transmission process may be terminated on the condition that the connection permission information is not received within a predetermined time.

[0304]

When connection permission information is received from the information processing device 730 (step S1033), the control unit of the information processing device 710 transmits capability information of the information processing device 710 to the information processing device 730 via the access point 701 (step S1034).

[0305]

Next, the control unit of the information processing device 710 determines whether or not setting request information has been received from the information processing device 730 via the access point 701 (step S1035). Moreover, step S1035 is an example of the second procedure described in the claims. If no setting request information is received (step S1035), monitoring continues.

[0306]

When setting request information is received (step S1035), the standby mode is set in the information processing device 710 as the initial state. Then, the control unit of the information processing device 710 determines whether or not the standby mode is set (step S1036). Then, if standby mode is set in the information processing device 710 (step S1036), monitoring continues.

[0307]

If the standby mode is not set (if the image transmission mode is set) (step S1036), the control unit of the information processing device 710 determines whether the information processing device 710 has left the group (step S1037). Here, cases in which the information processing device 710 leaves the group include when the information processing device 710 moves to a location where radio waves from neither the access point nor the sink device reach, or when a user operation is performed to leave the group, for example. This user operation can be, for example, pressing a release button (for example, pressing an operating member or a touch panel). Further, the user operation is assumed to be performed on the information processing device 710, another source device, a sink device, or the control device 740.

[0308]

Then, when the information processing device 710 leaves the group (step S1037), the data transmission process ends. Further, if the information processing device 710 has not left the group (step S1037), the control unit of the information processing device 710 disconnects the connection with the information processing device 730 via the access point 701 (step S1038).

[0309]

Next, the control unit of the information processing device 710 performs P2P connection processing to establish a direct connection with the information processing device 730 (step S1039). After the P2P connection process is completed (step S1039), the control unit of the information processing device 710 sends a connection request to the information processing device 730 based on the setting request information received from the information processing device 730 (step S1040). Moreover, step S1040 is an example of the third procedure described in the Claims.

[0310]

Next, the control unit of the information processing device 710 determines whether or not confirmation information indicating that reception of an image corresponding to the connection request is permitted has been transmitted from the information processing device 730 (step S1041). If confirmation information has not been transmitted from the information processing device 730 (step S1041), the control unit continues monitoring.

[0311]

When the confirmation information is transmitted from the information processing device 730 (step S1041), the control unit of the information processing device 710 starts a P2P direct connection with the information processing device 730 (step S1042). Then, the control unit of the information processing device 710 negotiates image parameters and audio parameters with the information processing device 730 based on a connection request corresponding to the received confirmation information, and transmits image data (step S1043). Moreover, step S1043 is an example of the first procedure described in the Claims.

[0312]

Next, the control unit of the information processing device 710 determines whether or not the image transmission mode is set (step S1044). Then, if the image transmission mode is set in the information processing device 710 (step S1044), the process returns to step S1043.

[0313]

If the image transmission mode is not set (if the standby mode is set) (step S1044), the control unit of the information processing device 710 determines whether the line has been disconnected (step S1045). When the information processing device 710 leaves the group, the line with the access point 701 or the information processing device 730 is disconnected, for example. If the line is disconnected (step S1045), the data transmission process is terminated.

[0314]

If the line is not disconnected (step S1045), the control unit of the information processing device 710 disconnects the direct connection with the information processing device 730 (step S1046). Next, the control unit of the information processing device 710 initiates a connection with the access point 701 (step S1047).

[0315]

In this manner, the information processing device 710 performs real-time image transmission between the information processing device 730 according to the Wi-Fi CERTIFIED Miracast specification. Further, the control unit of the information processing device 710 controls the information processing device 730 to receive setting request information for configuring the information processing device 710 for real-time image transmission via the access point 701. Further, the control unit of the information processing device 710 controls the information processing device 730 to send a setting request to perform settings based on the setting request information via direct communication with the information processing device 730. The setting request information is generated based on the Capability information (related to the information processing device 710) exchanged between the information processing device 710 and the information processing device 730 via the access point 701.

[0316]

Further, when switching the connection status, the control unit of the information processing device 710 can control the connection processing to be performed using at least one of the port information and IP information related to the connection before the switching. The switching of the connection status is a switching from a connection status with the information processing device 730 via the access point 701 to a connection status with the information processing device 730 by direct communication, or vice versa.

[0317]

Further, in the image transmission mode (peripheral channel), the control unit of the information processing device 710 controls the transmission of images to be displayed in the peripheral channel area 734 of the display device 731 via a low-frequency band wireless transmission path. Further, in the image transmission mode (peripheral channel), the control unit of the information processing device 710 controls the transmission of an image to be displayed in the center channel area 733 of the display device 731 via

a high-frequency band wireless transmission path.

[0318]

Further, the control unit of the information processing device 710 controls the information processing device 730 to transmit a setting request via direct communication based on a user operation on any of the devices. Alternatively, the control unit of the information processing device 710 controls the information processing device 730 to transmit a setting request via direct communication based on a predetermined order (e.g., the order of images displayed in a row in the peripheral channel area 734).

[0319]

Further, the control unit of the information processing device 730 controls the transmission of setting request information to the information processing device 710 via the access point 701, for setting the information processing device 710 regarding real-time image transmission. Further, the control unit of the information processing device 730 controls the information processing device 730 to receive a setting request from the information processing device 710 via direct communication with the information processing device 710 to perform settings based on the setting request information.

[0320]

In this manner, when switching between an access point and a direct connection, the switching time can be shortened. In an environment where multiple source devices are bandwidth controlled, it is possible to reduce switching time between an Infrastructure environment and a WiFi Direct (or Wi-Fi CERTIFIED Mirror) environment, for example. This makes it possible to provide seamless connection switching.

[0321]

In a multi-source environment, multiple source devices can be included in a group, a connection order can be set, and image information can be shared with higher image quality. It is possible to notify a sink device (or a control device) of source devices participating in the infrastructure environment, for example. Further, in a WiFi Direct (or Wi-Fi CERTIFIED Miracast) environment, images can be transmitted via direct communication on a frequency channel different from that in an Infrastructure environment. This enables stable image communication even when multiple source devices are connected to one display device (sink device). Further, even if all source devices cannot enter image transmission mode due to wireless bandwidth restrictions, all connections can be made stably.

[0322]

Further, the more devices connected in a group, the greater the overhead of connection control becomes, and the less efficient the bandwidth becomes, making it difficult to transmit images stably. In contrast, in the embodiment of the present technology, it is possible to provide a communication system capable of performing stable image transmission even in an environment with a large number of connected devices. That is, in the embodiment of the present technology, proper control can be performed when communication is performed between a plurality of information processing devices.

[0323]

[Example of connection to a public line other than the initially connected access point]

In the above, examples have been shown in which a source device connects to a sink device via an access point or directly to the sink device. Here, when the source device is a mobile-type information processing device (for example, a smartphone or a tablet terminal), it is assumed that the user of the source device moves around. In this case, for example, it is possible that a user of a source device may move to a location where connection to an access point is not possible. Even in such a case, it is assumed that some users will wish to continue connecting to the sink device. Accordingly, in the following, we will show an example that considers the case where a user using a source device moves to a location where connection to an access point is not possible.

[0324]

[Example of source device use]

FIG. 28 is a diagram showing an example of use of an information processing device 710 in the second embodiment of the present technology.

[0325]

FIG. 28 shows a schematic diagram of a case where a student 1 who is using an information processing device 710 in the classroom 30 shown in FIG. 18 moves outside the classroom 30 as indicated by an arrow 40. It is possible that student 1 moves from the classroom 30 where he or she gave the presentation to a research lab or a location outside the university, for example. Further, in a company, a salesperson may leave the conference room where he or she gave a presentation, for example.

[0326]

Further, in FIG. 28, the range in which direct communication with the access point 701 can be performed using wireless communication (the radio wave reachable range when the access point 701 is used as the base) is shown as radio wave reachable range 705. The range in which direct communication with base station 762 can be performed using wireless communication (the radio wave coverage area based on base station 762) is shown as radio wave coverage area 763.

[0327]

Public network 761 refers to public line networks such as telephone networks and the Internet. The network 702 and the base station 762 are connected via, for example, a public network 761.

[0328]

The base station 762 is a base station operated by a telecommunications carrier, and provides various wireless services by connecting the information processing device to the public network 761 using wireless communication. The wireless service is, for example, a hotspot service of IEEE 802.11, a line service conforming to IEEE 802.15, IEEE 802.16, and 3GPP specifications (e.g., W-CDMA, GSM, WiMAX, WiMAX 2, LTE, LTE-A).

[0329]

[Example of operation of information processing device (source device)]

FIGS. 29 and 30 are flowcharts showing an example of a processing steps of a data transmission process by the information processing device 710 in the second embodiment of the present technology. Moreover, FIGS. 29 and 30 show an example in which, by default, the source device (information processing device 710) starts each process after directly connecting to the access point, and also enables connection to public lines other than the access point. Further, since FIGS. 29 and 30 are modified examples of FIG. 27, some of the explanations of parts common to FIG. 27 will be omitted.

[0330]

First, the application is started (step S1051), and a connection request is made to the information processing device 730 via the access point 701 (AP) (step S1052). Next, the control unit of the information processing device 710 determines whether or not connection permission information has been received from the information processing device 730 via the access point 701 (step S1053). If connection permission information has not been received from the information processing device 730 (step S1033), the data transmission processing operation is terminated. Moreover, steps S1051 to S1053 correspond to steps S1031 to S1033 shown in FIG. 27.

[0331]

When connection permission information is received from the information processing device 730 (step S1053), the control unit of the information processing device 710 determines whether the connection permission information includes information permitting use outdoors (outdoor use information) (step S1054). This outdoor use information is permission information indicating whether or not connection to the information processing device 730 is permitted via an access point other than the access point 701 or a base station, and is stored in the outdoor use 755 (shown in FIG. 20) of the group management information storage unit 750. Further, when the information processing device 730 transmits connection permission information in response to a connection request received via the access point 701 (AP), the information processing device 730 obtains outdoor use information (permitted, denied) from the control device 740 and transmits the information together with the connection permission information. Moreover, even if "permitted" is stored in the outdoor use field 755, the information processing device 730 transmits outdoor use information indicating that the outdoor use is denied together with the connection permission information if the time period is other than the time period stored in the group participation available time field 756 (shown in FIG. 20). That is, the control device 740 can perform scheduling (schedule management) and manage the planned times of participants, allowing outdoor use only during specific times.

Moreover, the outdoor use information may be included in the capability information and transmitted from the sink device to the source device.

[0332]

Further, when the information processing device 730 transmits connection permission information including outdoor use permission information, the information processing device 730 includes setting information for using a public network in a location where the radio waves from the access point 701 cannot reach in the connection permission information.

[0333]

In this example, permission or denial of outdoor use is preset, but permission or denial may be set in each device each time a connection request is received from a source device. Operations for setting permission or denial can be performed using at least one of other source devices (e.g., information processing devices 703, 704, 720), a sink device (information processing device 730), and the control device 740, for example.

[0334]

The information sorting device 730 can display a display screen for selecting permission or denial on the input/output unit 743 of the control device 740, and accept the selection operation of permission or denial made on this display screen, for example.

[0335]

Further, the information processing device 730 can display a display screen for selecting permission or denial on the display unit 732 of the display device 731, and accept the selection operation of permission or denial using this display screen, for example. The selection operation of permission or denial can be accepted by operation input using an operational part or operation input by gesture, for example.

[0336]

Further, the information processing device 730 causes the display unit 721 of another source device (for example, the information processing device 720) to display a display screen (for example, a pop-up) for selecting permission or denial, for example. The information processing device 730 can then accept the selection operation of permission or denial performed on the display screen.

[0337]

In this manner, each time there is a connection request from a source device, it can be set to either permitted or denied. For this reason, even if confidentiality or importance differs depending on the time of day, permission or denial can be set appropriately.

[0338]

In this example, the sink device functions as a group authentication server, and performs management to determine whether outdoor use is permitted. However, a management device (e.g., a management server) may be newly provided to manage whether outdoor use is permitted and to link and manage the source device, and the management device may be used to determine whether outdoor use is permitted.

[0339]

If the connection permission information includes outdoor use information that permits outdoor use (step S1054), the control unit of the information processing device 710 causes the display unit 711 to display that outdoor use is permitted (step S1055). For example, a pop-up message can be displayed to inform the user that use on the same floor (within the range of the radio waves from access point 701) and outdoor use are permitted.

[0340]

Next, the control unit of the information processing device 710 transmits Capability information and public network service information related to the information processing device 710 to the information processing device 730 via the access point 701 (step S1056). Here, the public network service information is information for the information processing device 710 to use a public network service, such as a destination telephone number (the telephone number of the information processing device 710) and an authentication password.

[0341]

Next, the control unit of the information processing device 710 performs communication processing

(step S1057). In this communication process, the processes shown in FIG. 27 (steps S1035 to S1047) are performed.

[0342]

Next, the control unit of the information processing device 710 determines whether it has moved outside the radio wave transmission range of the access point 701 (step S1058). If the user has not moved outside the radio wave transmission range of the access point 701 (step S1058), the process returns to step S1057.

[0343]

When the information processing device 710 moves outside the radio wave transmission range of the access point 701 (step S1058), the control unit of the information processing device 710 checks whether the user wishes to continue using the device outdoors (step S1059). For example, it is assumed that the user may perform an operation to disconnect the device from the sink device (e.g., an operation to terminate communication). For this reason, the user is prompted to confirm whether or not to continue using the device outdoors.

[0344]

For example, the control unit of the information processing device 710 causes the display unit 711 to display a pop-up indicating that the device has moved outside the radio wave transmission range of the access point 701 and including a selection button for selecting whether or not the user wishes to continue using the device outdoors. Then, the control unit of the information processing device 710 determines whether or not the selection button for selecting continued use outdoors is pressed in the pop-up (step S1059). That is, the control unit of the information processing device 710 determines whether or not continued use at the location after movement has been selected (step S1059). If continued use at the new location is not selected (step S1059), the data transmission process ends.

[0345]

In this manner, when the control unit of the information processing device 710 receives outdoor use information (permission information) permitting use outdoors, it controls communication with the information processing device 730 via an access point other than the access point 701 or a base station. In this case, the control unit of the information processing device 710 can control the information processing device 730 to receive and output at least one of image data and audio data from the information processing device 730 via an access point or base station other than the access point 701.

[0346]

In this example, a check is performed to see whether or not the device can be used outdoors each time movement outside the radio wave transmission range of the access point 701 is detected. However, whether or not the device can be used outdoors may be set in advance. By making these advance settings, it is possible to automatically and seamlessly switch between same floor use and outdoor use.

[0347]

If continued use at the new location is selected (step S1059), the information processing device 730 performs connection processing via a base station at the new location (step S1060). For example, the control unit of the information processing device 730 determines whether the information processing device 710 has moved outside the radio wave transmission range of the access point 701. When the information processing device 710 moves outside the radio wave transmission range of the access point 701, the control unit of the information processing device 730 performs connection processing to connect to the information processing device 710 via a base station present in the location after the movement. For example, when a telephone number is included in the public line service information received from the information processing device 710, the control unit of the information processing device 730 makes a call to the information processing device 710 via the public network based on the telephone number. Then, the control unit of the information processing device 710 performs connection processing with the information processing device 730 via a public network.

[0348]

Here, if the user of the information processing device 710 moves outside the radio wave transmission

range of the access point 701, it is assumed that the user will not be able to see the display unit 732 of the display device 731, and will not be able to hear the audio output from the display device 731. Accordingly, when the information processing device 730 connects to the information processing device 710 via the public network, the information processing device 730 carries out an exchange to confirm whether the information processing device 710 is capable of receiving images and audio. Then, the information processing device 730 determines whether the information processing device 710 is capable of receiving both images and audio, is capable of receiving only images, or is capable of receiving only audio.

[0349]

Based on the result of this determination, the information processing device 730 performs data communication (image data, audio data) with the information processing device 710. That is, the control unit of the information processing device 710 performs data communication (image data, audio data) with the information processing device 730 via the public network. In this data communication, two-way communication is carried out between information processing device 710 and information processing device 730.

[0350]

For example, the control unit of the information processing device 730 transmits at least one of the display screens displayed on the display unit 732 of the display device 731 and the audio output from the display device 731. Further, when outdoors, it is assumed that the display screen displayed on the display unit 711 of the information processing device 710 cannot be seen. In this case, only audio may be transmitted. The data to be transmitted can be changeable by the user of the information processing device 710.

[0351]

Further, when bidirectional data exchange is performed between the information processing device 710 and the information processing device 730, the information processing device 730 checks the transmission path (e.g., bandwidth and communication conditions) to the information processing device 710 via the public network. The information processing device 730 may then switch the data to be transmitted based on the confirmation results. For example, when a large-capacity transmission path is secured, the information processing device 730 is configured to transmit both image data and audio data. Further, if a large-capacity transmission path is not secured, the information processing device 730 transcodes image data to reduce capacity or transmits only audio data, for example.

[0352]

Next, the control unit of the information processing device 710 determines whether or not to continue the connection with the information processing device 730 via the public network (step S1062). For example, the control unit of the information processing device 710 causes the display unit 711 to display (constantly or periodically) a display screen for selecting whether or not to continue the connection with the information processing device 730 via the public network. Then, based on the selection operation on the display screen, the control unit of the information processing device 710 can determine whether or not to continue the connection with the information processing device 730 via the public network.

[0353]

If the connection to the information processing device 730 via the public network is to be continued (step S1062), the process returns to step S1061. Further, if the connection with the information processing device 730 via the public network is not to be continued (step S1062), the control unit of the information processing device 710 disconnects the connection with the information processing device 730 via the public network (step S1063).

[0354]

If the connection permission information includes outdoor use information that denies outdoor use (step S1054), the control unit of the information processing device 710 causes the display unit 711 to display a message indicating that outdoor use is denied (step S1064).

[0355]

Next, the control unit of the information processing device 710 transmits Capability information regarding the information processing device 710 to the information processing device 730 via the access point 701 (step S1065).

[0356]

Next, the control unit of the information processing device 710 performs communication processing (step S1066). In this communication process, the processes shown in FIG. 27 (steps S1035 to S1047) are performed.

[0357]

Next, the control unit of the information processing device 710 determines whether it has moved outside the radio wave transmission range of the access point 701 (step S1067). If the user has not moved outside the radio wave transmission range of the access point 701 (step S1067), the process returns to step S1066. Further, if the user moves outside the radio wave transmission range of access point 701 (step S1067), the process proceeds to step S1063.

[0358]

In this manner, when information is shared between a sink device and a plurality of source devices, the information can be exchanged regardless of the location of the source devices. For example, even if student 1 who owns information processing device 710 moves outside the radio wave coverage area 705 of access point 701, the information processing device 710 can be connected to information processing device 730 via the base station. For example, it is possible that student 1 may move from the classroom 30 where the student made a presentation to a research lab or a location outside the university. Further, if the communication system 700 is installed in a company, it is conceivable that a salesperson may leave the conference room where the salesperson gave a presentation, for example. In this case, the salesperson can listen to the contents of the meeting outside (for example, on a train).

[0359]

<3. Third embodiment>

The second embodiment of the present technology showed an example in which group authentication between a source device and a sink device is started by first connecting the source device to an access point.

[0360]

The third embodiment of the present technology shows an example in which group authentication between a source device and a sink device is started using short-range wireless communication. For example, group authentication can be initiated using the Wi-Fi Direct over NFC protocol or the Wi-Fi direct using NFC protocol. Group authentication can be initiated by directly touching a source device with NFC capability to a sink device with NFC capability, for example.

[0361]

The Wi-Fi Direct over NFC protocol is a protocol for connecting a source device and a sink device by having them come in contact. This protocol is a protocol that exchanges information for connecting Wi-Fi Direct by touching (or bringing) a source device equipped with an NFC tag to (or close to) a sink device equipped with an NFC Reader/Writer function.

[0362]

In this manner, group authentication can be started by the user's action of directly touching the source device to the sink device. For this reason, if a user intends to join a group, the user can actively take action to join the group. After the source and sink devices are directly connected, the connection can be switched to an access point. This allows for a more user-friendly interface.

[0363]

Further, in the second embodiment of the present technology, when multiple sink devices are discovered by device discovery, an example is shown in which a selection screen is displayed to allow the user to select a desired sink device, and the user is allowed to select the desired sink device on this selection screen. In contrast, in the third embodiment of the present technology, a user can touch a source device to a desired sink device, thereby automatically connecting the source device to the desired sink device.

[0364]

Moreover, instead of touching the sink device directly, group authentication may be started by having the source device touch another device. For example, in the example shown in **SAMSUNG** group

authentication may be started by having the source device touch to a reader/writer device 37 installed near the entrance/exit 36 of a classroom 30. In this case, the reader/writer device 37 transmits information about the touched source device (e.g., terminal identification information, PIN (Personal Identification Number) code) to the sink device. It is preferable to use a unique ID that is generated for the PIN code.

[0365]

Further, a remote control (remote controller) for operating a sink device (e.g., information processing device 730) or a display device (e.g., display device 731) may be used in place of the sink device, for example. Group authentication may be started by having a source device touch a remote control equipped with an NFC Reader/Writer function, for example. In this case, the remote control transmits information about the touched source device (for example, terminal identification information, PIN code) to the sink device.

[0366]

[Example of operation of information processing device (source device)]

FIG. 31 is a flowchart showing an example of a processing steps of a data transmission process by the information processing device 710 in the third embodiment of the present technology. Moreover, FIG. 31 shows an example in which group authentication is started by directly touching the information processing device 710 to the information processing device 730. Further, since FIG. 31 is a modified example of FIG. 27, some of the explanations of the parts common to FIG. 27 will be omitted.

[0367]

Further, in FIG. 31, the information processing device 710 has an NFC tag function, and the information processing device 730 has an NFC Read/Write function. Further, the information processing device 730 is assumed to function as a DHCP server.

[0368]

First, the control unit of the information processing device 710 determines whether the information processing device 710 has been touched by the information processing device 730 (step S1071). If the information processing device 710 is not touching the information processing device 730 (step S1071), the information processing device 710 continues to monitor the information processing device 730.

[0369]

When the information processing device 710 touches the information processing device 730 (step S1071), the control unit of the information processing device 710 starts a direct connection with the information processing device 730 (step S1072). That is, the information processing device 710 becomes a P2P client, and the information processing device 730 becomes a P2P GO. Then, the control unit of the information processing device 710 receives wireless parameters from the information processing device 730 and performs connection processing based on the received wireless parameters (step S1073).

[0370]

Next, the control unit of the information processing device 710 obtains an IP address from the information processing device 730 (DHCP server) (step S1074).

[0371]

Next, the control unit of the information processing device 710 determines whether or not connection permission information has been received from the information processing device 730 (step S1075). If no connection permission information is received from the information processing device 730 (step S1075), the data transmission processing operation is terminated.

[0372]

When connection permission information is received from the information processing device 730 (step S1075), the control unit of the information processing device 710 transmits Capability information regarding the information processing device 710 to the information processing device 730 (step S1076).

[0373]

Next, the control unit of the information processing device 710 determines whether or not setting request information has been received from the information processing device 730 (step S1077). If no setting request information is received (step S1077), monitoring continues.

[0374]

When the setting request information is received (step S1077), the image transmission mode is set in the information processing device 710 as the initial state. Then, the control unit of the information processing device 710 makes a connection request to the information processing device 730 based on the setting request information received from the information processing device 730 (step S1078).

[0375]

Next, the control unit of the information processing device 710 determines whether or not confirmation information indicating that reception of the image corresponding to the connection request is permitted is received from the information processing device 730 (step S1079). If no confirmation information is received from the information processing device 730 (step S1079), monitoring continues.

[0376]

When the confirmation information is received from the information processing device 730 (step S1079), the control unit of the information processing device 710 starts a P2P direct connection with the information processing device 730 (step S1080). Then, the control unit of the information processing device 710 negotiates image parameters and audio parameters with the information processing device 730 based on a connection request corresponding to the received confirmation information, and transmits image data (step S1081).

[0377]

Next, the control unit of the information processing device 710 determines whether or not the image transmission mode is set (step S1082). Then, if the image transmission mode is set in the information processing device 710 (step S1082), the process returns to step S1081.

[0378]

Next, the control unit of the information processing device 710 determines whether the information processing device 710 has left the group (step S1083). Then, when the information processing device 710 leaves the group (step S1083), the data transmission processing operation is terminated.

[0379]

Further, if the information processing device 710 has not left the group (step S1083), the control unit of the information processing device 710 receives AP connection information from the information processing device 730 (step S1084). This AP connection information is information for disconnecting the connection between the information processing device 710 and the information processing device 730 and connecting the information processing device 710 to the access point 701.

[0380]

Next, the control unit of the information processing device 710 cuts the direct connection with the information processing device 730 (step S1085). Next, the control unit of the information processing device 710 performs connection processing to connect to the information processing device 730 via the access point 701 (step S1086).

[0381]

Next, the control unit of the information processing device 710 determines whether or not confirmation information indicating that the connection is permitted is received from the information processing device 730 via the access point (step S1087). If no confirmation information is received from the information processing device 730 (step S1087), monitoring continues.

[0382]

If confirmation information is received from the information processing device 730 (step S1087), a connection is established with the information processing device 730 via the access point 701. Then, the control unit of the information processing device 710 determines whether or not the standby mode is set (step S1088). If the information processing device 710 is set to standby mode (step S1088), monitoring continues.

[0383]

If standby mode is not set (if image transmission mode is set) (step S1088), the control unit of the information processing device 710 determines whether the line has been disconnected (step S1089). If the line is disconnected (step S1089), the data transmission process ends.

[0384]

If the line is not disconnected (step S1089), the control unit of the information processing device 710 disconnects the connection with the information processing device 730 via the access point 701 (step S1090) and returns to step S1078.

[0385]

In this manner, the control unit of the information processing device 710 can control the exchange of information for direct communication using short-range wireless communication (e.g., NFC).

[0386]

Moreover, it may be possible to determine whether or not a touch operation on the information processing device 730 is to be validated based on whether or not it is registered in the control device 740, for example. For an information processing device whose terminal identification information is stored in the terminal identification information 751 (shown in FIG. 20) of the group management information storage unit 750, the control unit of the information processing device 730 validates the touch operation and makes a decision to permit the device to join the group, for example. However, in this case, the control unit of the information processing device 730 makes the decision to allow the device to join the group only if it is within the group participation time 756 (shown in FIG. 20) in the group management information storage unit 750. Further, the time period during which a user can join a group after a touch operation may be limited to a certain period. For example, it may be possible to allow participation in a group only during a meeting time period (e.g., within one hour after touching). Further, a different session key may be used after a predetermined time has elapsed since the touch.

[0387]

In this manner, NFC can be used to easily set up a connection between a source device and a sink device. This allows, a user to intuitively activate a trigger for participating in a conference, making it easier to participate in a conference, for example.

[0388]

4. Fourth embodiment

The second and third embodiments of the present technology showed an example in which a source device is connected to a sink device or an access point by a user operation or a user action.

[0389]

Here, it is assumed that a source device is connected to an access point or sink device using a wireless LAN and then the connection is disconnected. In this case, the wireless LAN connection settings may be saved in the source device even after the connection is disconnected. In this case, it is expected that the source device will be automatically connected to the access point or sink device without the user of the source device performing any setting operations or the like for connection.

[0390]

Accordingly, the fourth embodiment of the present technology shows an example in which a source device is automatically connected to an access point or a sink device. In an environment where a source device is automatically connected to an access point or sink device, it is assumed that there are multiple access points connected to various sink devices. For this reason, such an environment can be realized by having the source device continuously connect to these multiple access points using soft handover.

[0391]

First, an example will be given in which a source device automatically connects to an access point. It is assumed that the device will be automatically and continuously connected to the on-site wireless LAN, for example.

[0392]

[Example of operation of information processing device (source device)]

FIG. 32 is a flowchart showing an example of a processing steps of a data transmission process by the information processing device 710 in the fourth embodiment of the present technology. Since FIG. 32 is a modified example of FIG. 27, the parts common to FIG. 27 are given the same reference numerals and some of the explanations thereof will be omitted.

[0393]

First, the information processing device 710 is automatically handed over and connected to an access

point installed in the location where the information processing device 710 is located (step S1100). A case may be assumed in which a user who owns the information processing device 710 moves to a particular floor to join a group, for example. In this environment, an application is launched on the information processing device 710 (step S1101). After this startup, the control unit of the information processing device 710 attempts to perform device discovery processing for a sink device that desires to be connected.

[0394]

It is assumed that this device discovery process will result in the discovery of multiple sink devices that correspond to the launched application. In this case, a selection screen for selecting a desired sink device from the multiple discovered sink devices is displayed on the display unit 711 of the information processing device 710, and the user can select a desired sink device through a user operation on the selection screen (step S1102). Further, from among the multiple discovered sink devices, the device closest to the source device may be automatically selected and connected (step S1102).

[0395]

Next, an example will be shown in which a source device is automatically connected to a sink device and an access point. It is assumed that the connection settings of the sink device are stored in the source device, and when the source device moves within the radio wave coverage area of the sink device, the connection is automatically established, for example.

[0396]

[Example of operation of information processing device (source device)]

FIG. 33 is a flowchart showing an example of a processing steps of data transmission processing by the information processing device 710 in the fourth embodiment of the present technology. Since FIG. 33 is a modified example of FIG. 27, the parts common to FIG. 27 are given the same reference numerals and some of the explanations thereof will be omitted.

[0397]

First, the control unit of the information processing device 710 determines whether the information processing device 710 has a concurrent function (time-division concurrent function or simultaneous use concurrent function) as a wireless LAN function (step S1111). In the case where the information processing device 710 has a concurrent function, the information processing device 710 can connect to both the access point and the sink device in a time-division or simultaneous manner without disconnecting and switching the access point and the sink device.

[0398]

If the information processing device 710 has a concurrent function (step S1111), the control unit of the information processing device 710 automatically sets up to layer 3 (up to obtaining an IP address) through the established connection (step S1112). Next, the control unit of the information processing device 710 attempts to connect to the sink device via the access point (step S1113). Here, when sink devices are connected via both links, via an access point and via a P2P direct connection, it is preferable not to perform device discovery processing on both links. Priority may be given to connections via an access point, and only a link connection may be maintained for P2P direct connections, with image transmission via Wi-Fi CERTIFIED Mirror being stopped, for example. In this case, in image transmission mode, the next switching time can be achieved quickly without wasting the frequency band used by Wi-Fi CERTIFIED Miracast.

[0399]

If the information processing device 710 does not have a concurrent function (step S1111), the control unit of the information processing device 710 checks the connection status to the sink device (step S1114). Here, for example, if the sink device is connected via a P2P direct connection, the P2P direct connection is temporarily disconnected and changed to a connection via an access point. Further, if the connection is established via an access point, the connection is maintained. Further, if the device does not have a concurrent function, the information processing device 710 will retain and reuse port information and IP information regarding the connection status.

[0400]

Next, the control unit of the information processing device 710 performs device discovery processing

via the access point (step S1115). After this device discovery process, the control unit of the information processing device 710 determines whether or not connection permission information has been received from the sink device via the access point (step S1116).

[0401]

Here, in an environment where the number of participating devices is small, the P2P direct connection may be continued as is. In this case, if connection permission information is received from the sink device via the access point (step S1116), the process proceeds to step S1038.

[0402]

In this manner, the user can easily grasp the current setting information without having to worry about the connection settings. Then, it is possible to adapt it so that the operation is equivalent to that of the second embodiment of the present technology.

[0403]

5. Application Examples

The technology disclosed herein can be applied to a variety of products. The information processing devices 200, 300, 400, 703, 704, 710, 720, 730 and the control device 740 may be realized as mobile terminals such as a smartphone, a tablet PC (Personal Computer), a notebook PC, a portable game terminal, or a digital camera, fixed terminals such as a television receiver, a printer, a digital scanner, or a network storage, or an in-vehicle terminal such as a car navigation device, for example. Further, the information processing devices 200, 300, 400, 703, 704, 710, 720, 730 and the control device 740 may be realized as terminals performing M2M (Machine To Machine) communication (also called MTC (Machine Type Communication) terminals), such as smart meters, vending machines, remote monitoring devices, or POS (Point Of Sale) terminals. Further, the information processing devices 200, 300, 400, 703, 704, 710, 720, 730, and the control device 740 may be wireless communication modules (for example, integrated circuit modules configured on a single die) mounted on these terminals.

[0404]

[5-1. First application example]

FIG. 34 is a block diagram showing an example of a schematic configuration of a smartphone 900 to which technology 1 of the present disclosure can be applied. The smartphone 900 comprises a processor 901, a memory 902, a storage 903, an external connection interface 904, a camera 906, a sensor 907, a microphone 908, an input device 909, a display device 910, a speaker 911, a wireless communication interface 913, an antenna switch 914, an antenna 915, a bus 917, a battery 918, and a peripheral controller 919.

[0405]

The processor 901 may be a CPU (Central Processing Unit) or a SoC (System on Chip) and controls the functions of the application layer and other layers of the smartphone 900, for example. The memory 902 includes RAM (Random Access Memory) and ROM (Read Only Memory), and stores programs and data executed by the processor 901. Storage 903 may include a storage medium such as a semiconductor memory or a hard disk. The external connection interface 904 is an interface for connecting external devices such as memory cards or USB (Universal Serial Bus) devices to the smartphone 900.

[0406]

The camera 906 has an imaging element such as a CCD (Charge Coupled Device) or a CMOS (Complementary Metal Oxide Semiconductor) and generates a captured image. The sensor 907 may include a group of sensors such as a positioning sensor, a gyro sensor, a geomagnetic sensor, and an acceleration sensor. The microphone 908 converts the audio input to the smartphone 900 into an audio signal. The input device 909 includes a touch sensor that detects a touch on the screen of the display device 910, a keypad, a keyboard, a button or a switch, and accepts operations or information input from the user, for example. The display device 910 has a screen such as a liquid crystal display (LCD) or an organic light emitting diode (OLED) display, and displays the output image of the smartphone 900. The speaker 911 converts the audio signal output from the smartphone 900 into audio.

[0407]

The wireless communication interface 913 supports one or more of the wireless LAN, ~~SAM~~ **SAMSUNG** as

IEEE802. 11a, 11b, 11g, 11n, 11ac, and 11ad, and performs wireless communication. In infrastructure mode, the wireless communication interface 913 can communicate with other devices via a wireless LAN access point. Further, the wireless communication interface 913 can communicate directly with other devices in an ad-hoc mode or a direct communication mode such as Wi-Fi Direct. Unlike ad-hoc mode, with Wi-Fi Direct, one of the two devices acts as an access point, but communication is carried out directly between the devices. The wireless communication interface 913 may typically include a baseband processor, an RF (Radio Frequency) circuit, a power amplifier, and the like. The wireless communication interface 913 may be a one-chip module that integrates a memory for storing a communication control program, a processor for executing the program, and related circuits. In addition to the wireless LAN system, the wireless communication interface 913 may support other types of wireless communication systems, such as a short-range wireless communication system, a proximity wireless communication system, or a cellular communication system. The antenna switch 914 switches the connection of the antenna 915 between multiple circuits (e.g., circuits for different wireless communication methods) included in the wireless communication interface 913. The antenna 915 may have a single or multiple antenna elements (e.g., multiple antenna elements constituting a MIMO antenna) and may be used to transmit and receive radio signals via the wireless communication interface 913.

[0408]

In addition, without being limited to the example of FIG. 34, the smartphone 900 may be equipped with multiple antennas (e.g., an antenna for wireless LAN and an antenna for a close-proximity wireless communication method, and the like). In that case, the antenna switch 914 may be omitted from the configuration of the smartphone 900.

[0409]

The bus 917 connects the processor 901, the memory 902, the storage 903, the external connection interface 904, the camera 906, the sensor 907, the microphone 908, the input device 909, the display device 910, the speaker 911, the wireless communication interface 913, and the cardiac controller 919 to each other. The battery 918 supplies power to each block of the smartphone 900 shown in FIG. 34 via a power supply line partially shown by a dashed line. The auxiliary controller 919 operates the minimum necessary functions of the smartphone 900, for example, in sleep mode.

[0410]

In the smartphone 900 shown in FIG. 34, the control unit 240 described using FIG. 2 and the control unit 370 described using FIG. 3 may be implemented in the wireless communication interface 913. Further, at least some of these functions may be implemented in the processor 901 or the auxiliary controller 919.

[0411]

Moreover, the smartphone 900 may operate as a wireless access point (software AP) by the processor 901 executing an access point function at the application level. Further, the wireless communication interface 913 may have a wireless access point function.

[0412]

[5 - 2. Second Application Example]

FIG. 35 is a block diagram showing an example of a schematic configuration of a car navigation device 920 to which the technology of the present disclosure can be applied. The car navigation device 920 comprises a processor 921, a memory 922, a GPS (Global Positioning System) module 924, a sensor 925, a data interface 926, a content player 927, a storage medium interface 928, an input device 929, a display device 930, a speaker 931, a wireless communication interface 933, an antenna switch 934, an antenna 935, and a battery 938.

[0413]

The processor 921 may be, for example, a CPU or SoC, and controls the navigation functions and other functions of the car navigation device 920. The memory 922 includes RAM and ROM and stores programs and data executed by the processor 921.

[0414]

The GPS module 924 measures the position (e.g., latitude, longitude, and altitude) of the car navigation

device 920 using GPS signals received from GPS satellites. The sensor 925 may include a group of sensors such as a gyro sensor, a geomagnetic sensor, and an air pressure sensor. The data interface 926 is connected to an in-vehicle network 941 via a terminal (not shown), for example, and acquires data generated on the vehicle side, such as vehicle speed data.

[0415]

The content player 927 plays content stored on a storage medium (e.g., a CD or DVD) inserted into the storage medium interface 928. The input device 929 includes, for example, a touch sensor that detects a touch on the screen of the display device 930, a button or a switch, and accepts operations or information input from the user. The display device 930 has a screen such as an LCD or OLED display and displays images of the navigation functions or the content being played. The speaker 931 outputs the audio for the navigation function or the content being played.

[0416]

The wireless communication interface 933 supports one or more of the wireless LAN standards such as IEEE802. 11a, 11b, 11g, 11n, 11ac and 11ad and performs wireless communication. In infrastructure mode, the wireless communication interface 933 can communicate with other devices via a wireless LAN access point. Further, the wireless communication interface 933 can communicate directly with other devices in an ad-hoc mode or a direct communication mode such as Wi-Fi Direct. The wireless communication interface 933 may typically include a baseband processor, an RF circuit, a power amplifier, and the like. The wireless communication interface 933 may be a one-chip module that integrates a memory for storing a communication control program, a processor for executing the program, and related circuits. In addition to the wireless LAN system, the wireless communication interface 933 may support other types of wireless communication systems such as a short-range wireless communication system, a proximity wireless communication system or a cellular communication system. The antenna switch 934 switches the connection of the antenna 935 between multiple circuits included in the wireless communication interface 933. The antenna 935 has single or multiple antenna elements and is used for transmitting and receiving radio signals via the wireless communication interface 933.

[0417]

Moreover, the car navigation device 920 is not limited to the example of FIG. 35 and may be equipped with multiple antennas. In that case, the antenna switch 934 may be omitted from the configuration of the car navigation device 920.

[0418]

The battery 938 supplies power to each block of the car navigation device 920 shown in FIG. 35 via a power supply line partially shown by a dashed line in the drawing. In addition, the battery 938 stores power supplied from the vehicle side.

[0419]

In the car navigation device 920 shown in FIG. 35, the control unit 240 described using FIG. 2 and the control unit 370 described using FIG. 3 may be implemented in the wireless communication interface 933. Further, at least some of these functions may be implemented in the processor 921.

[0420]

Further, the technology according to the present disclosure may be realized as an in-vehicle system (or vehicle) 940 including one or more blocks of the above-mentioned car navigation device 920, an in-vehicle network 941, and a vehicle-side module 942. The vehicle-side module 942 generates vehicle-side data such as vehicle speed, engine RPM, or fault information, and outputs the generated data to the in-vehicle network 941.

[0421]

Moreover, the above-described embodiment shows an example for realizing the present technology, and the matters in the embodiment correspond to the matters specifying the invention in the Claims. Similarly, there is a corresponding relationship between the matters specifying the invention in the Claims and the matters in the embodiments of the present technology having the same names. However, the present technology is not limited to the embodiments, and can be realized by making various modifications to the embodiments without departing from the spirit of the technology.

[0422]

Further, the processing steps described in the above embodiments may be regarded as a method having a series of procedures, or as a program for causing a computer to execute the series of procedures, or a recording medium for storing the program. Examples of recording media that can be used include CDs (Compact Discs), MDs (MiniDiscs), DVDs (Digital Versatile Discs), memory cards, and Blu-ray (registered trademark) Discs.

[0423]

Moreover, the effects described in this specification are merely examples and are not limiting, and other effects may also be obtained.

[0424]

The present technology can also be configured as follows.

(1)

An information processing device that performs real-time image transmission between another information processing device according to Wi-Fi (Wireless Fidelity) CERTIFIED Microcast specifications, the information processing device comprising a control unit that receives setting request information for making settings related to the real-time image transmission from another information processing device via an access point, and controls the information processing device to transmit a setting request for making the settings based on the setting request information to another information processing device by direct communication.

(2)

The information processing device according to (1), wherein the control unit exchanges CAPABILITY information related to the information processing device with another information processing device via the access point, and another information processing device generates the setting request information based on the capability information.

(3)

The information processing device according to (1) or (2), wherein the control unit, when switching between a connection status with another information processing device via the access point and a connection status with another information processing device by the direct communication, controls to perform a connection process using at least one of port information and IP information related to the connection before switching.

(4)

The information processing device according to any one of (1) to (3), wherein the control unit controls another information processing device to transmit an image according to Wi-Fi CERTIFIED MIRACAST specification via the direct communication after transmitting the setting request to the other information processing device.

(5)

The information processing device according to (4) above, wherein the control unit controls the transmission of an image to be displayed in a predetermined area on the display unit to be performed over a low-frequency band wireless transmission path, and the transmission of an image to be displayed in an area larger than the predetermined area on the display unit to be performed over a high-frequency band wireless transmission path.

(6)

The information processing device according to any one of (1) to (5), wherein the control unit controls the device to transmit the setting request to another information processing device through the direct communication based on a user operation.

(7)

The information processing device according to any one of (1) to (5), wherein, when there is a plurality of information processing devices that transmit images through the direct communication, the control unit controls the information processing device to transmit the setting request to the other information processing devices through the direct communication based on a predetermined order.

(8)

The information processing device according to any one of (1) to (7), wherein the control unit exchanges, via the access point, permission information indicating whether or not to permit a connection with another information processing device via an access point other than the access point or a base station, and when the control unit receives the permission information indicating that the connection is permitted, controls to exchange with another information processing device via an access point other than the access point or the base station.

(9)

The information processing device according to (8) above, wherein when the control unit receives the permission information to permit the connection, the control unit controls another information processing device to receive and output at least one of image data and audio data via an access point other than the access point or the base station.

(10)

The information processing device according to any one of (1) to (9), wherein the control unit controls the exchange of information for performing the direct communication using short-range wireless communication.

(11)

An information processing device that performs real-time image transmission between another information processing device according to the Wi-Fi CERTIFIED Miracast specification, the information processing device comprising a control unit that controls the information processing device to transmit setting request information for making settings related to the real-time image transmission to another information processing device via an access point, and receives a setting request for making the settings based on the setting request information from another information processing device by direct communication.

(12)

An information processing device, comprising a control unit that performs control to set a communication mode for a source device to one of a standby mode in which the sink device and the source device are connected via an access point and an image transmission mode in which the sink device and the source device are connected by direct communication when real-time image transmission is performed between the sink device and multiple source devices according to the Wi-Fi CERTIFIED Miracast specification.

(13)

The information processing device according to (12), wherein the control unit causes an image representing the plurality of source devices to be displayed on an input/output unit, and performs control to set the communication mode to the source devices based on an operation input on the input/output unit.

(14)

The information processing device according to (12), wherein the control unit performs control to set the communication mode to the source device based on a predetermined order.

(15)

An information processing system, comprising: a sink device that performs real-time image transmission with a source device according to the Wi-Fi CERTIFIED Miracast specification, the sink device transmitting setting request information for making settings related to the real-time image transmission to the source device via an access point, and controlling the sink device to receive a setting request from the source device for making the settings based on the setting request information by direct communication with the source device; and a control device that performs control to set, in the source device, a communication mode between the sink device and the source device via the access point, either a standby mode in which the sink device and the source device are connected via the access point, or an image transmission mode in which the sink device and the source device are connected by the direct communication, when the real-time image transmission is performed between the sink device and the source device.

(16)

An information processing method, comprising: a first step of performing real-time image transmission

with another information processing device according to a Wi-Fi CERTIFIED Miracast specification; a second step of receiving setting request information for making settings related to the real-time image transmission from another information processing device via an access point; and a third step of transmitting a setting request for making the settings based on the setting request information to another information processing device by direct communication.

[Explanation of Symbols]

[0 4 2 5]

100	communication system
200	information processing device
210	antenna
220	wireless communication unit
230	control signal reception unit
240	control unit
250	image/audio signal generation unit
260	image/audio compression unit
270	stream transmission unit
300	information processing device
310	antenna
320	wireless communication unit
330	stream reception unit
340	image/audio expansion unit
350	image/audio output unit
351	display unit
352	audio output unit
360	user information acquisition unit
370	control unit
380	control signal transmission unit
390	management information storage unit
400	information processing device
610	source device
611	access point
612	sink device
700	communication system
701	access point
702	network
703-705, 710, 720, 730	information processing device
711, 721	display unit
731	display device
732	display unit
740	control device
741	antenna
742	wireless communication unit
743	input/output unit
744	display unit
745	input unit
746	operation reception unit
747	control unit
750	group management information storage
900	smartphone

9 01	processor
9 02	memory
9 03	storage
9 04	external connection interface
9 06	camera
9 07	sensors
9 08	microphone
9 09	input device
9 10	display device
9 11	speaker
9 13	wireless communication interface
9 14	antenna switch
9 15	antenna
9 17	bus
9 18	battery
9 19	auxiliary controller
9 20	car navigation device
9 21	processor
9 22	memory
9 24	GPS Module
9 25	sensors
9 26	data interface
9 27	content player
9 28	storage media interface
9 29	input device
9 30	display device
9 31	speaker
9 33	wireless communication interface
9 34	antenna switch
9 35	antenna
9 38	battery
9 41	in-vehicle network
9 42	vehicle side module

[Document Name] Claims

[Claim 1]

An information processing device that performs real-time image transmission between another information processing device according to Wi-Fi (Wireless Fidelity) CERTIFIED Microcast specifications, the information processing device comprising a control unit that receives setting request information for making settings related to the real-time image transmission from another information processing device via an access point, and controls the information processing device to transmit a setting request for making the settings based on the setting request information to another information processing device by direct communication.

[Claim 2]

The information processing device according to Claim 1, wherein the control unit exchanges capability information related to the information processing device with another information processing device via the access point, and another information processing device generates the setting request information based on the capability information.

[Claim 3]

The information processing device according to Claim 1, wherein the control unit, when switching between a connection status with another information processing device via the access point and a connection status with another information processing device by the direct communication, controls the connection process to be performed using at least one of port information and IP information related to the connection before switching.

[Claim 4]

The information processing device according to Claim 1, wherein the control unit controls another information processing device to transmit an image according to a Wi-Fi CERTIFIED Miracast specification through the direct communication after transmitting the setting request to the other information processing device.

[Claim 5]

The information processing device according to Claim 4, wherein the control unit controls the transmission of an image to be displayed in a predetermined area of the display unit to be performed over a low-frequency band wireless transmission path, and the transmission of an image to be displayed in an area of the display unit larger than the predetermined area to be performed over a high-frequency band wireless transmission path.

[Claim 6]

The information processing device according to Claim 1, wherein the control unit controls the setting request to be transmitted to another information processing device through the direct communication based on a user operation.

[Claim 7]

The information processing device according to Claim 1, wherein, when there are a plurality of information processing devices performing image transmission through the direct communication, the control unit controls the information processing device to transmit the setting request through the direct communication to the other information processing devices in a predetermined order.

[Claim 8]

The information processing device according to Claim 1, wherein the control unit performs, via the access point, exchange of permission information indicating whether or not to permit a connection with another information processing device via an access point other than the access point or a base station, and when the control unit receives the permission information indicating that the connection is permitted, controls to perform exchanges with another information processing device via an access point other than the access point or the base station.

The information processing device according to Claim 8, wherein the recording control unit, when receiving the permission information to permit the connection, controls to receive and output at least one of image data and audio data from another information processing device via an access point other than the access point or the base station.

[Claim 10]

The information processing device according to Claim 1, wherein the control unit controls the exchange of information for performing the direct communication by utilizing short-range wireless communication.

[Claim 11]

An information processing device that performs real-time image transmission between another information processing device according to the Wi-Fi CERTIFIED Miracast specification, the information processing device comprising a control unit that controls the information processing device to transmit setting request information for making settings related to the real-time image transmission to another information processing device via an access point, and receives a setting request for making the settings based on the setting request information from another information processing device by direct communication.

[Claim 12]

An information processing device, comprising a control unit that performs control to set a communication mode for a source device to one of a standby mode in which the sink device and the source device are connected via an access point and an image transmission mode in which the sink device and the source device are connected by direct communication when real-time image transmission is performed between the sink device and multiple source devices according to the Wi-Fi CERTIFIED Miracast specification.

[Claim 13]

The information processing device according to Claim 12, wherein the control unit causes an input/output unit to display an image representing the plurality of source devices, and performs control to set the communication mode to the source device based on an operation input on the input/output unit.

[Claim 14]

The information processing device according to Claim 12, wherein the control unit performs control to set the communication mode to the source device based on a predetermined order.

[Claim 15]

An information processing system, comprising: a sink device that performs real-time image transmission with a source device according to the Wi-Fi CERTIFIED Miracast specification, the sink device transmitting setting request information for making settings related to the real-time image transmission to the source device via an access point, and controlling the sink device to receive a setting request from the source device for making the settings based on the setting request information by direct communication with the source device; and a control device that performs control to set, in the source device, a communication mode between the sink device and the source device via the access point, either a standby mode in which the sink device and the source device are connected via the access point, or an image transmission mode in which the sink device and the source device are connected by the direct communication, when the real-time image transmission is performed between the sink device and the source device.

[Claim 16]

An information processing method, comprising: a first step of performing real-time image transmission with another information processing device according to a Wi-Fi CERTIFIED Miracast specification; a second step of receiving setting request information for making settings related to the real-time image transmission from another information processing device via an access point; and a third step of transmitting a setting request for making the settings based on the setting request information to another information processing device by direct communication.

[Document Name] Abstract

[Abstract]

[Problem] An object of the present invention is to perform proper control when communication is performed between a plurality of information processing devices.

[Solution] An information processing device performs real-time image transmission between another information processing device according to the Wi-Fi CERTIFIED Miracast specification. The information processing device also includes a control unit. The control unit controls so that setting request information for making settings related to real-time image transmission is received from another information processing device via an access point. The control unit also controls the transmission of a setting request for performing settings based on the request information to another information processing device through direct communication.

[Selected Drawing] FIG. 2

[FIG.1]

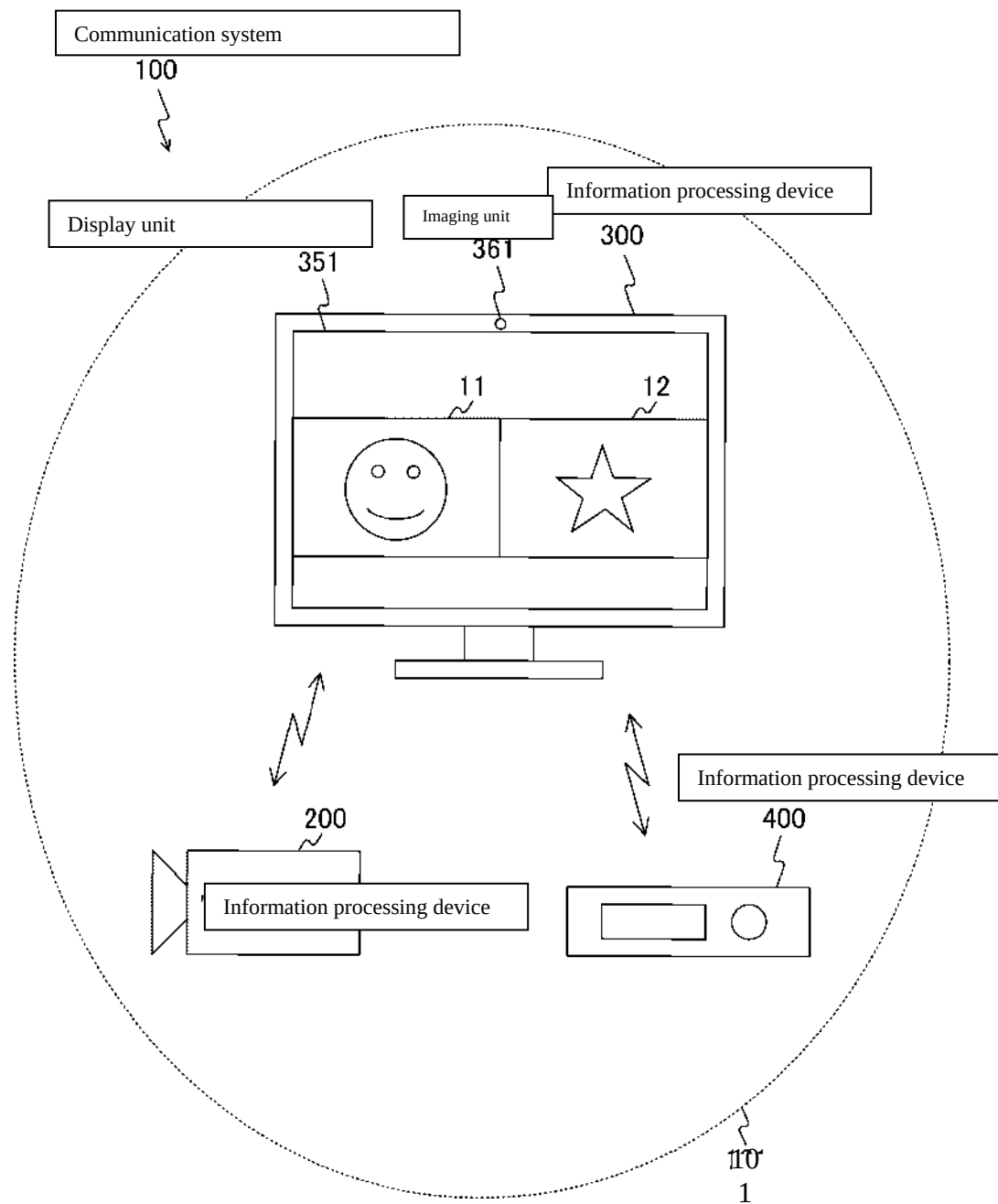


FIG.2

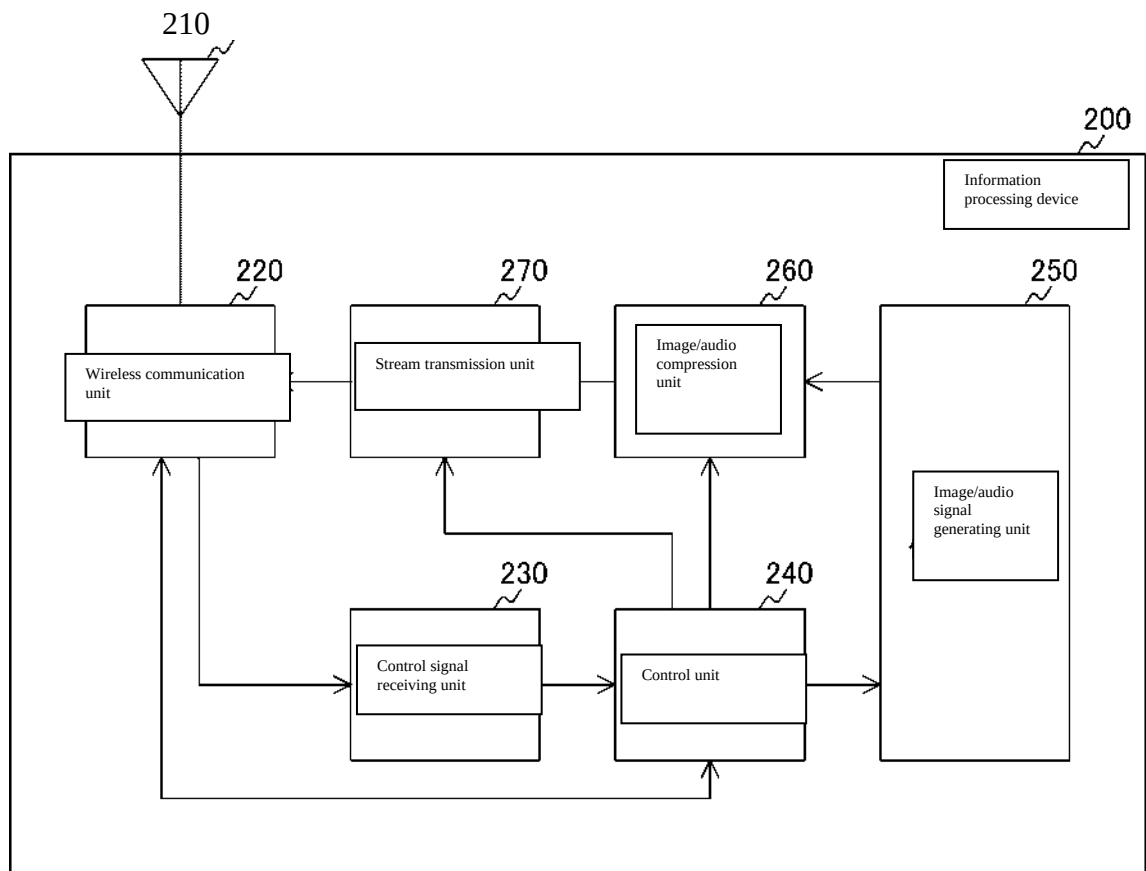


FIG.3

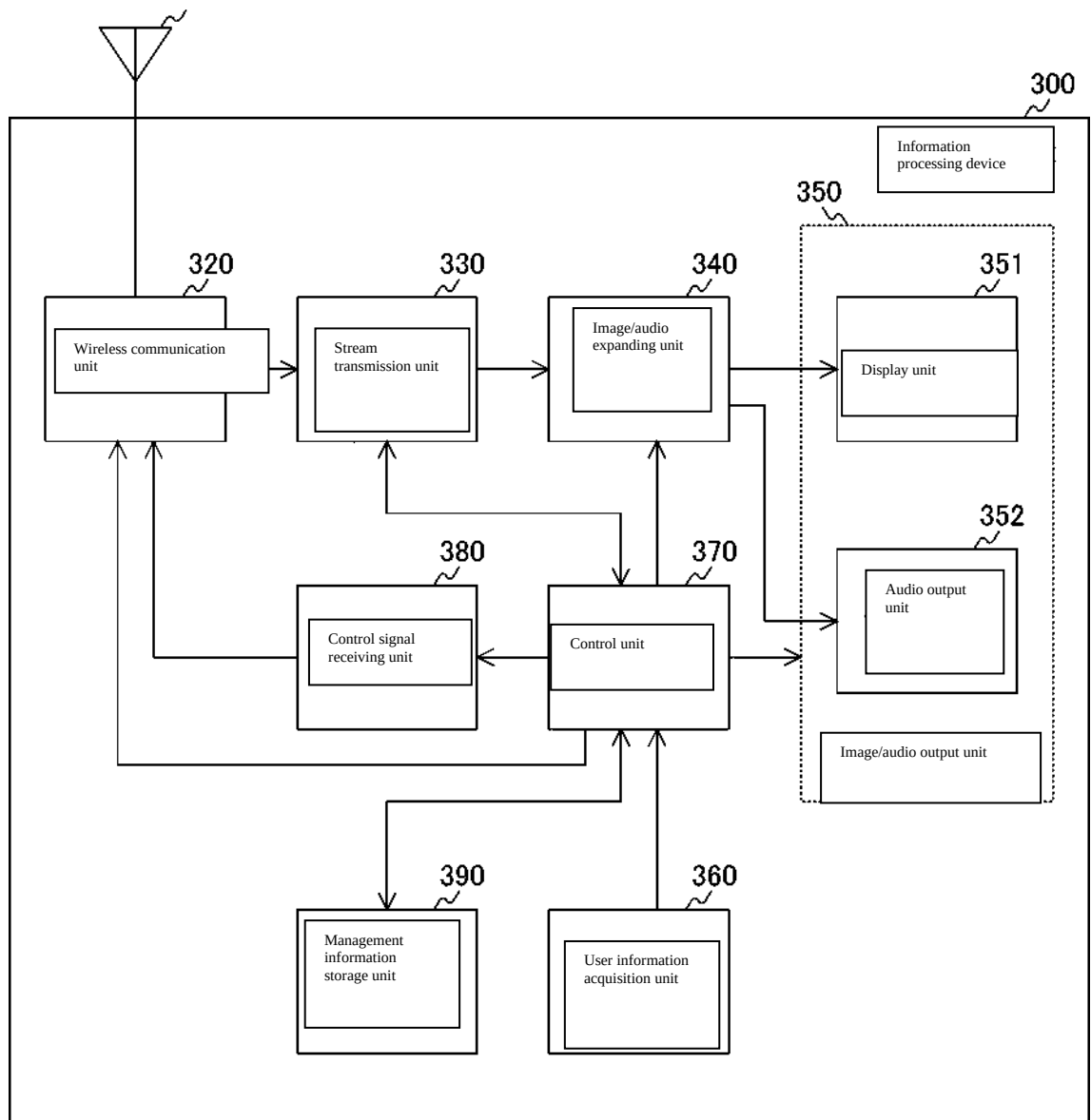
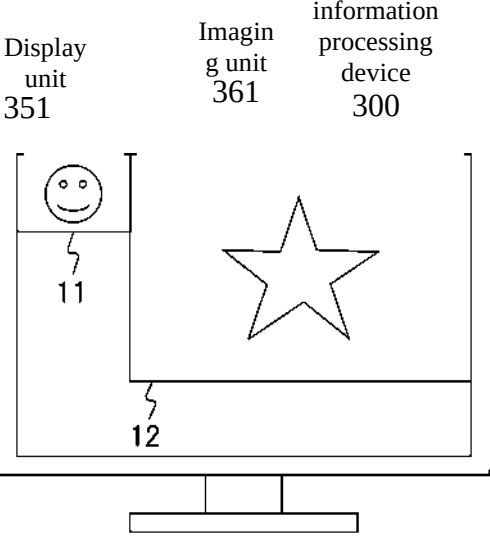
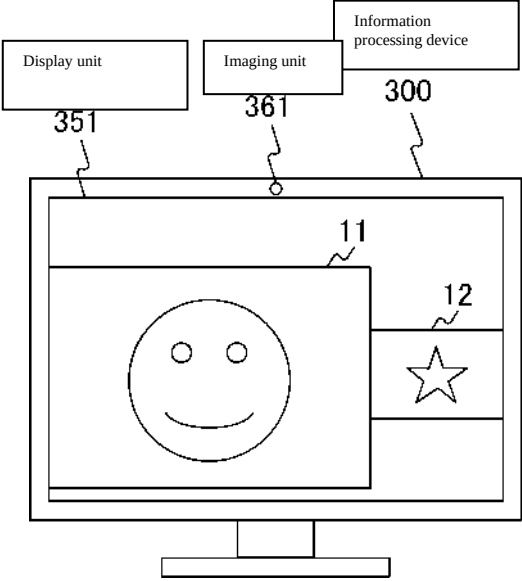


FIG.4

management information storage unit 390

391	392	393						394	395	396	397	398
Terminal identification information	Frequency channel	Radio wave propagation measurement information						equipment information	Bandwidth usage level	Format of display	Standby/wakeup	Multi-reception diversity support
		PER	BER	Packet retransmissi on count	Throughput	Dropped frames	SIR (RSSI)					
DSC200	60GHz	- . .	■ . -	. . .	- . .	---	■--	Mobile	20Mbps	Sub (peripheral channel)	standby	None
DR400	2. 4GHz	. . .	■ . -	. . .	- . .	---	■--	Fixed	20Mbps	Main (center channel)	wakeup	Available

FIG.5



b

FIG.6

Example of setting the mode for controlling sink devices

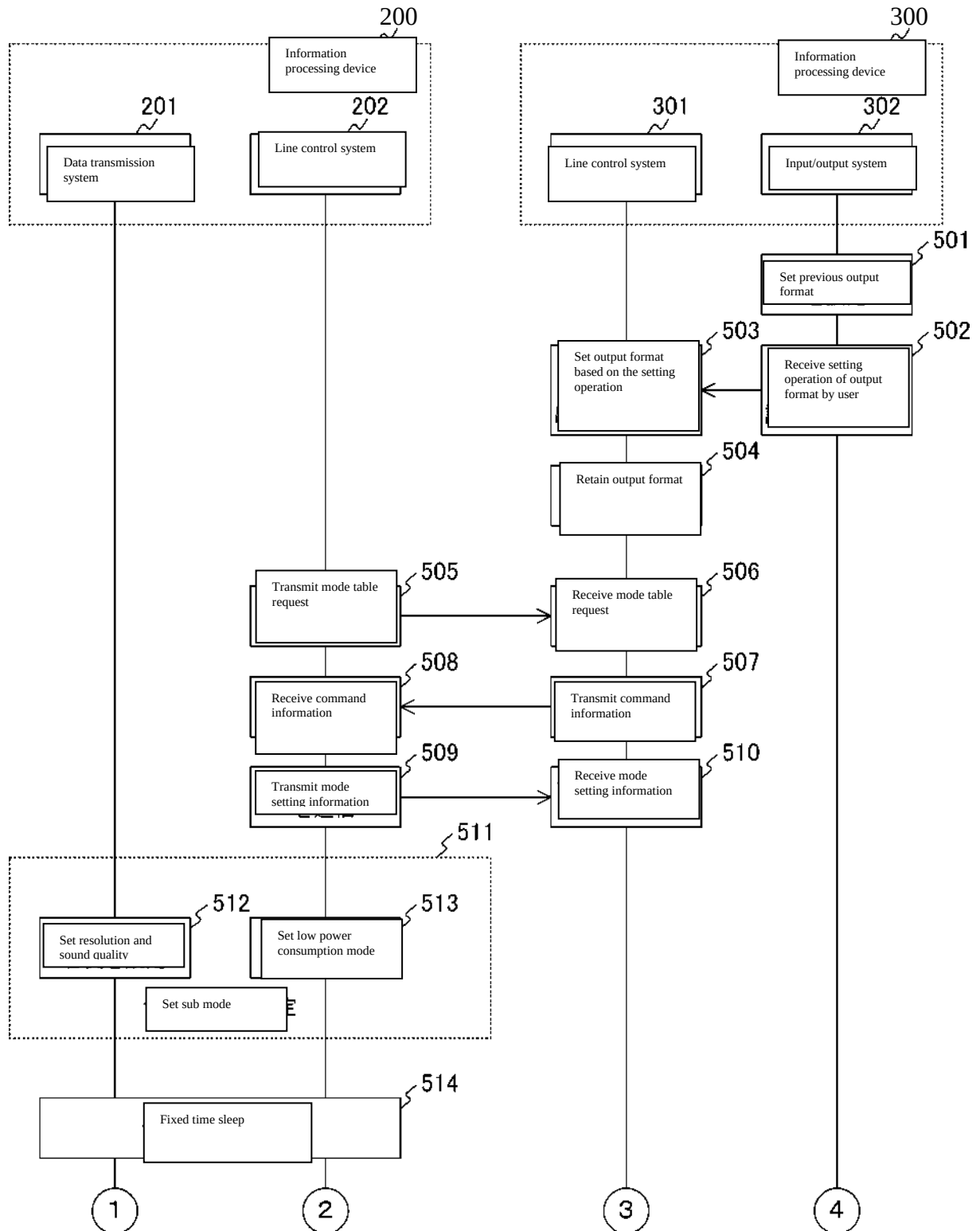


FIG.7

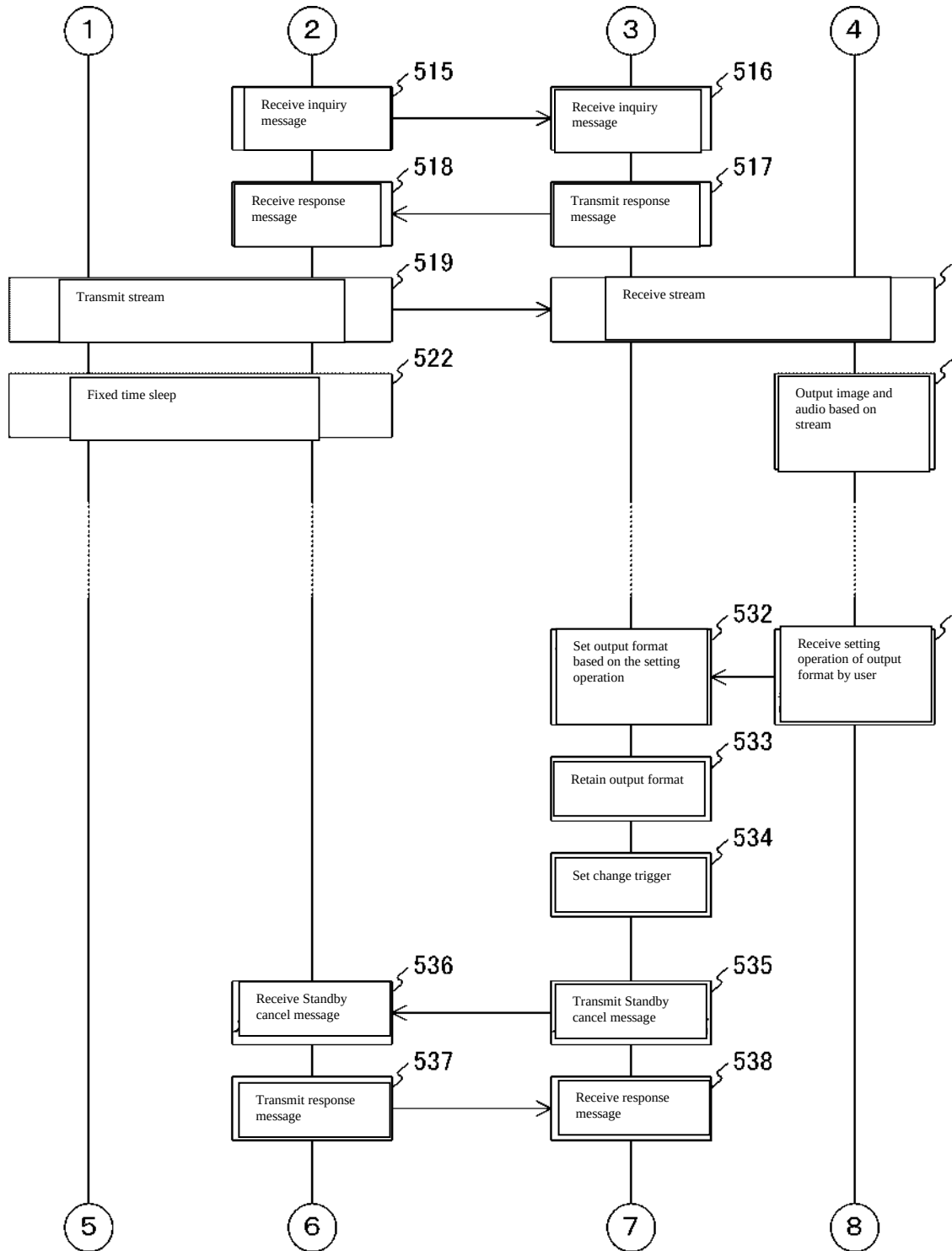


FIG.8

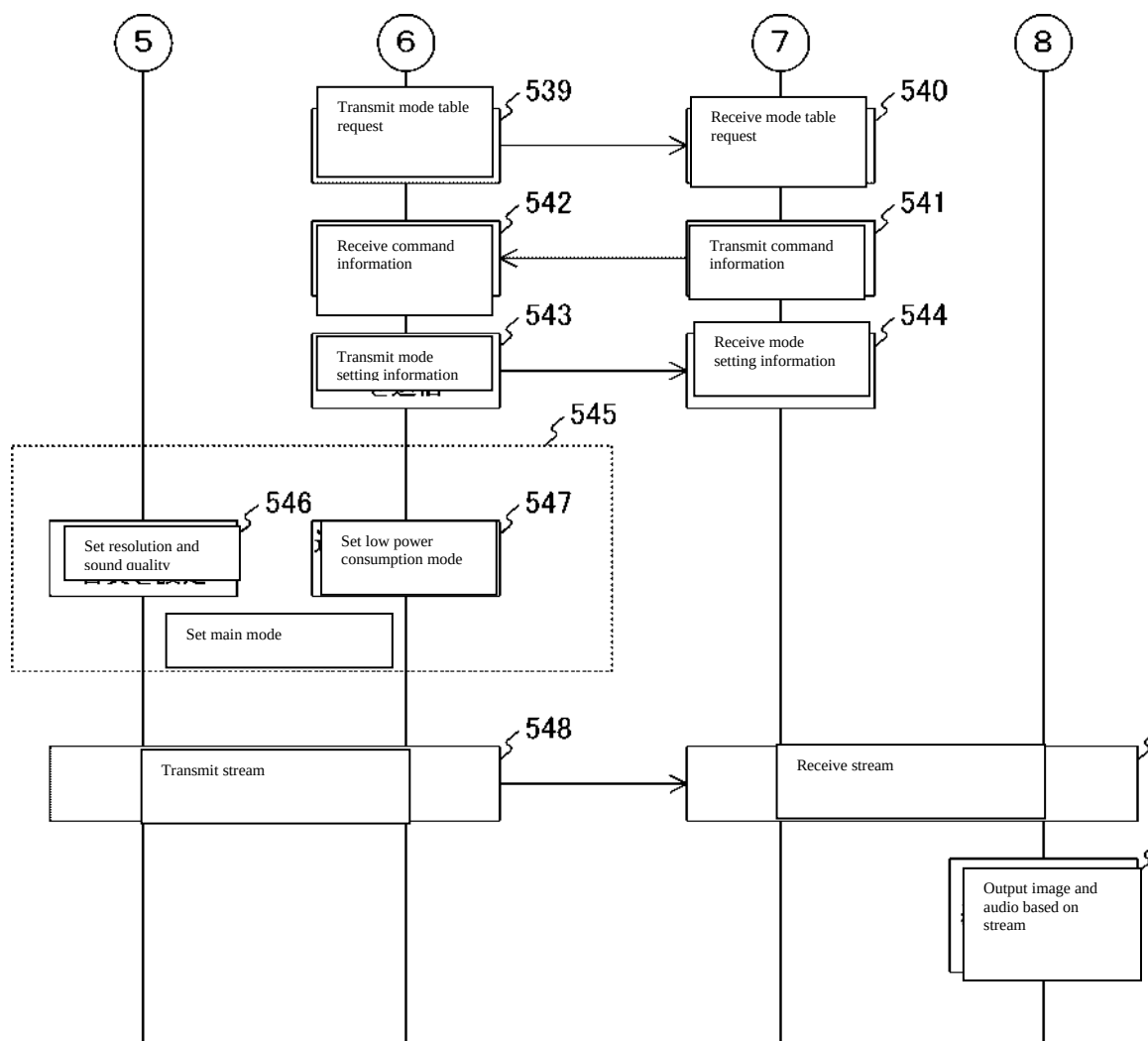


FIG.9

Example of setting the mode based on source device control

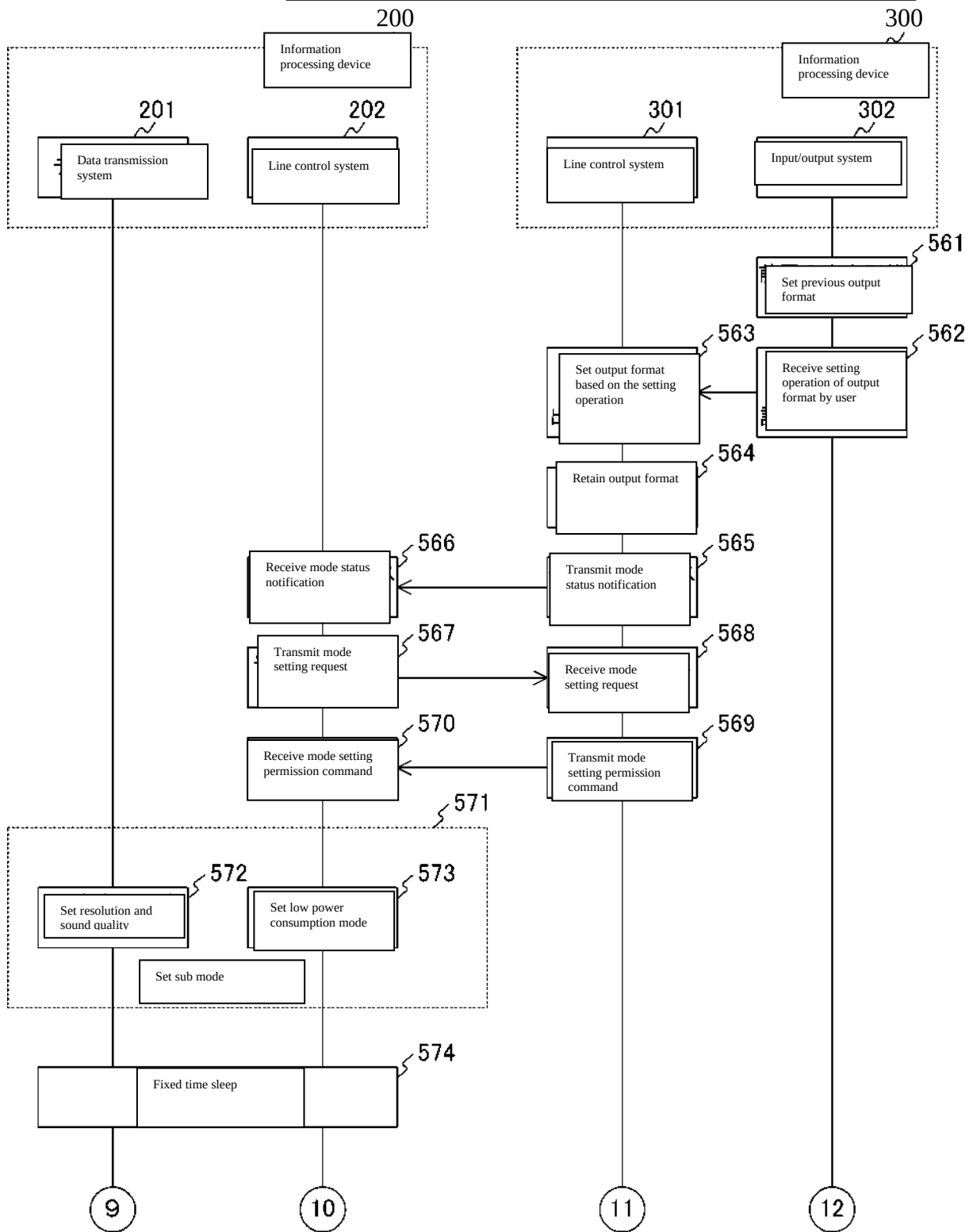


FIG.10

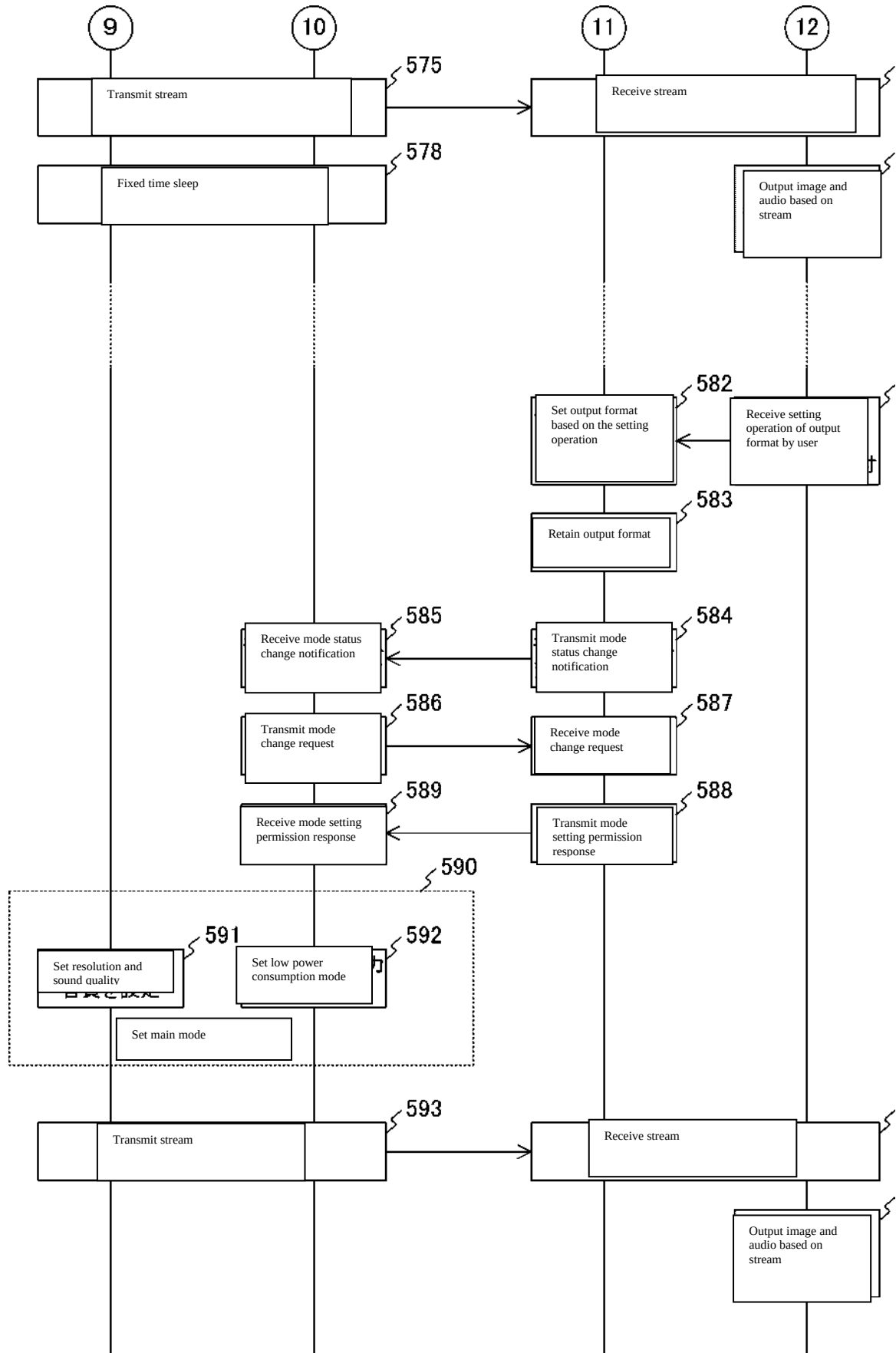


FIG.11

Example of setting the mode based on source device control

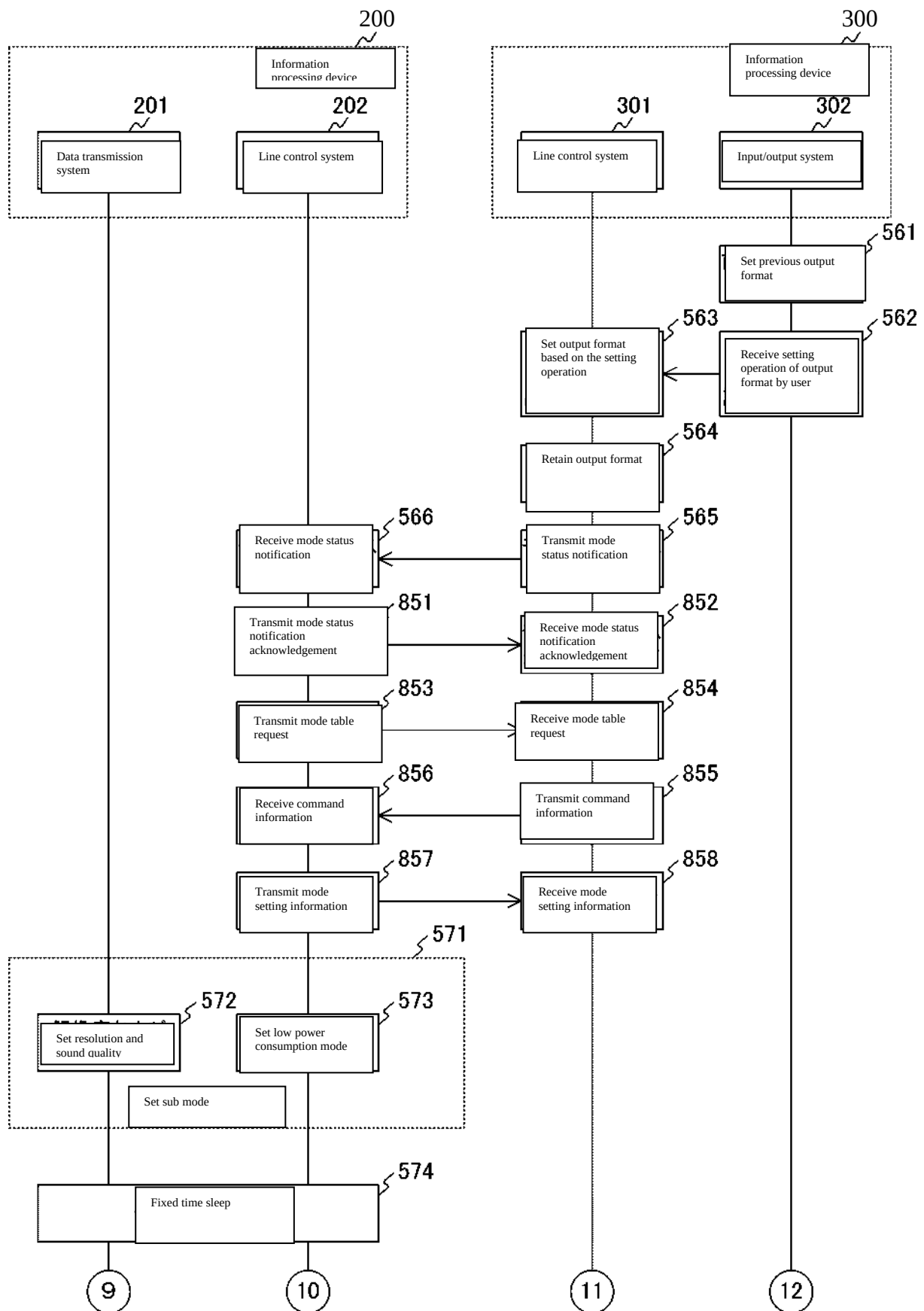


FIG.12

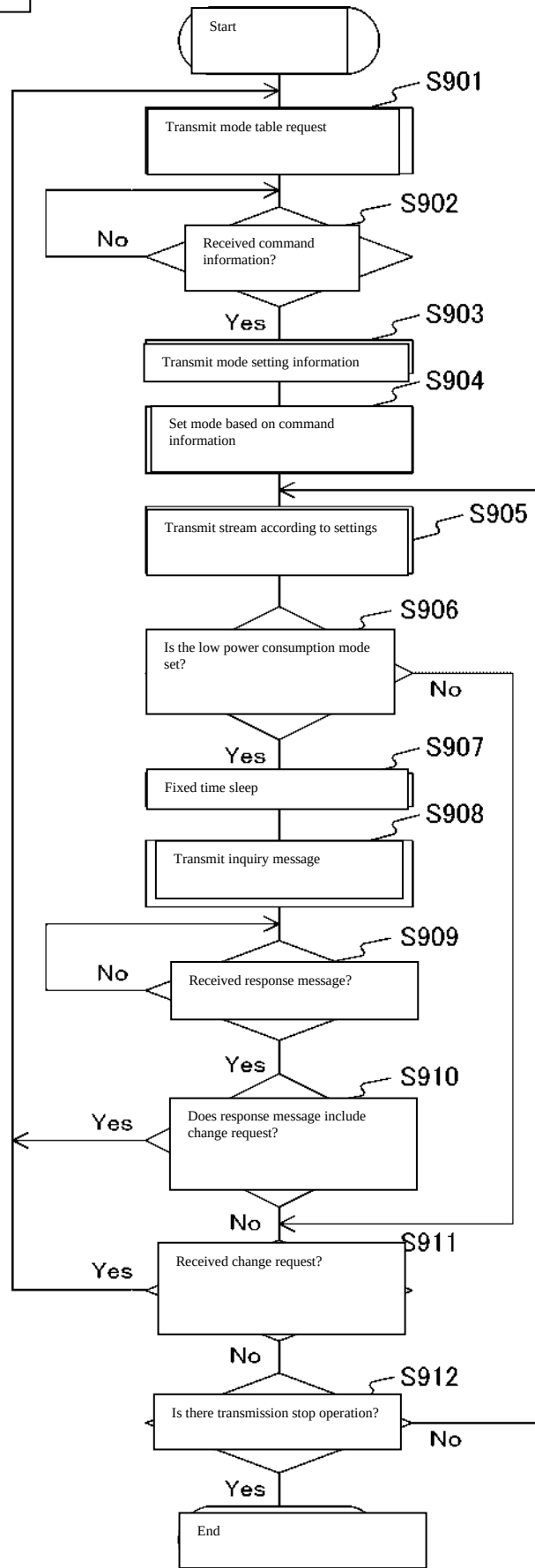


FIG.13

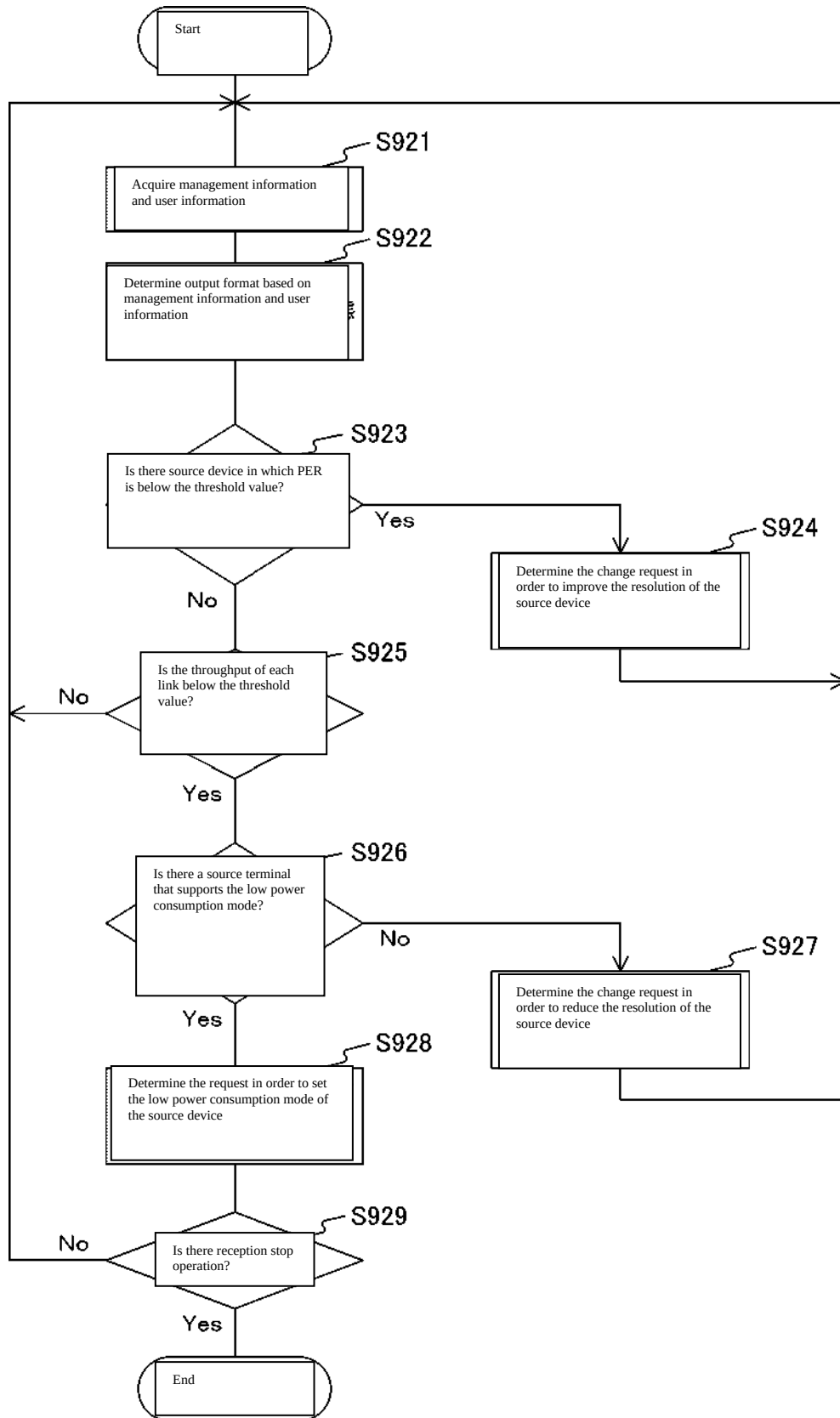


FIG.14

Communication example of WFD capability negotiation using RTSP protocol

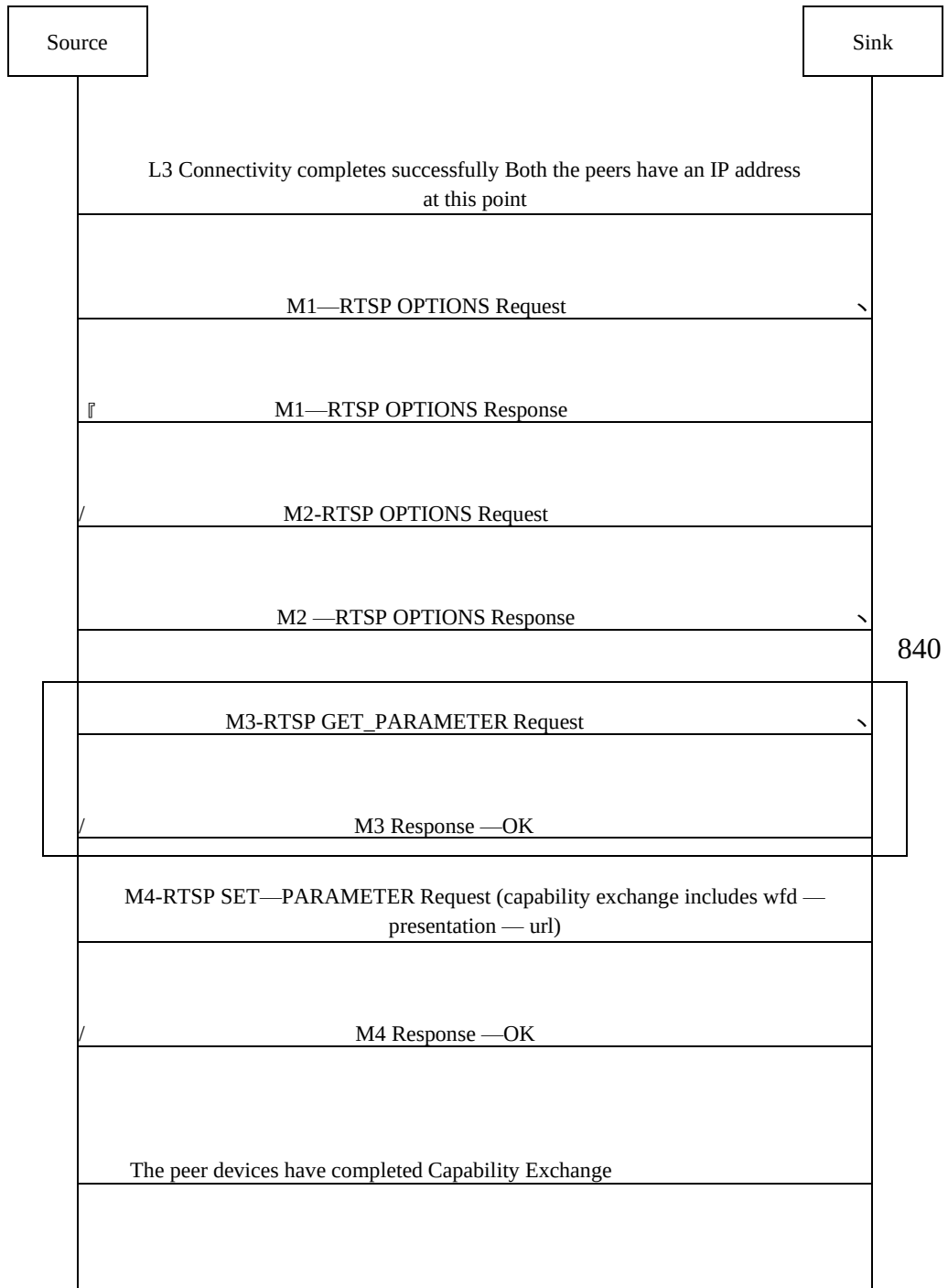


FIG.15

Communication example when in standby mode

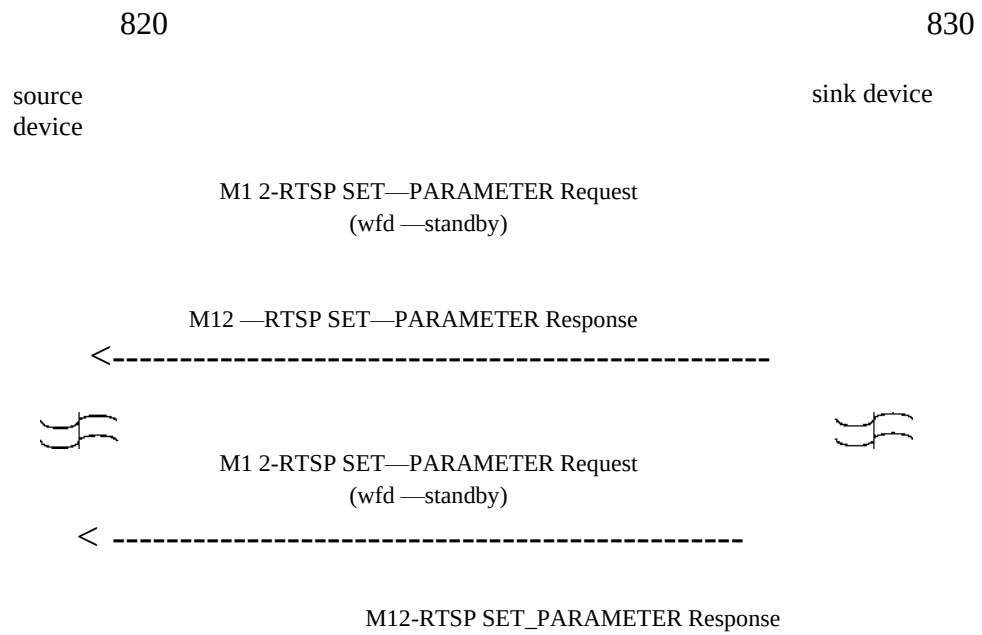


FIG.16

Communication example when turning off standby mode

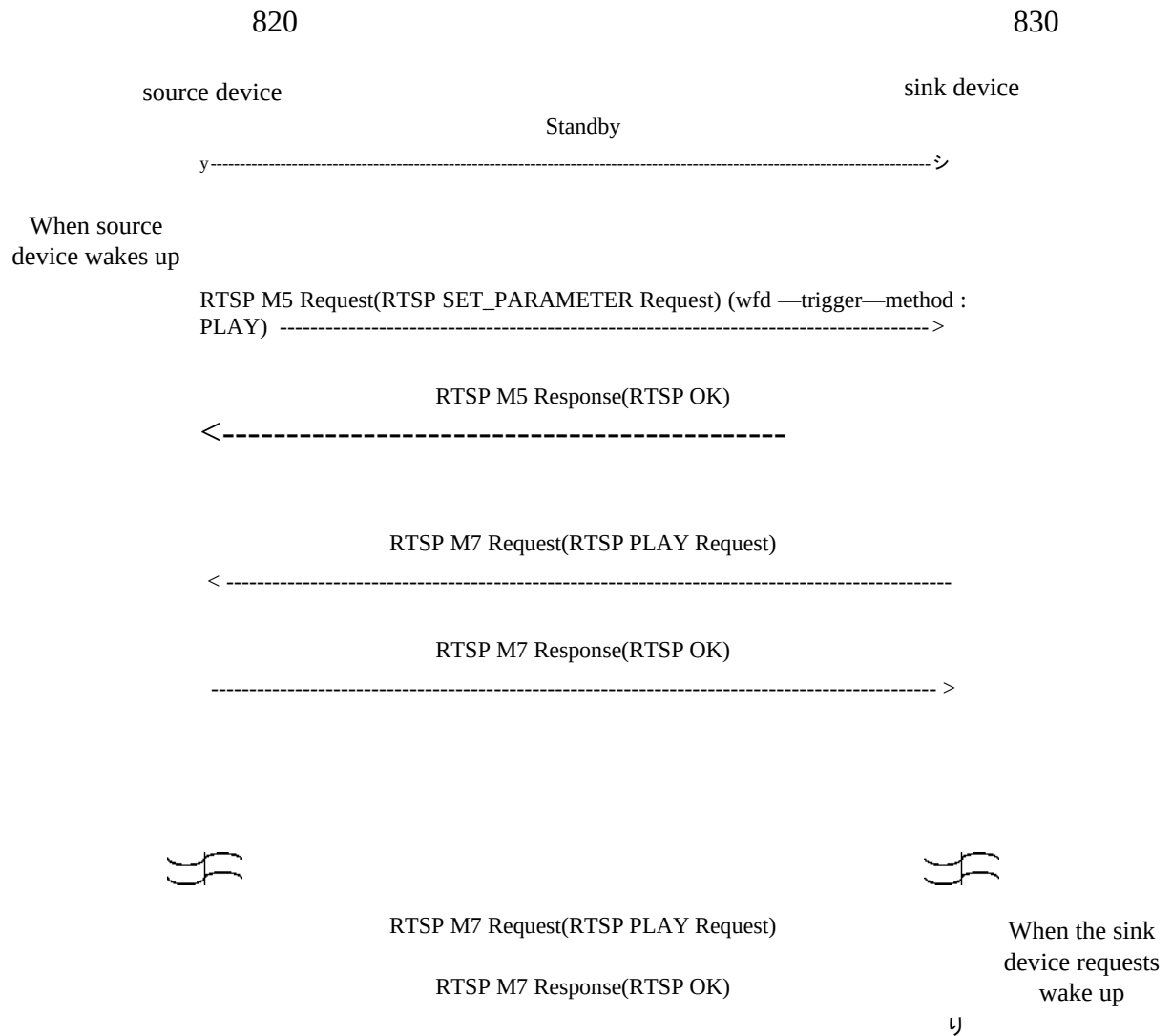


FIG.17

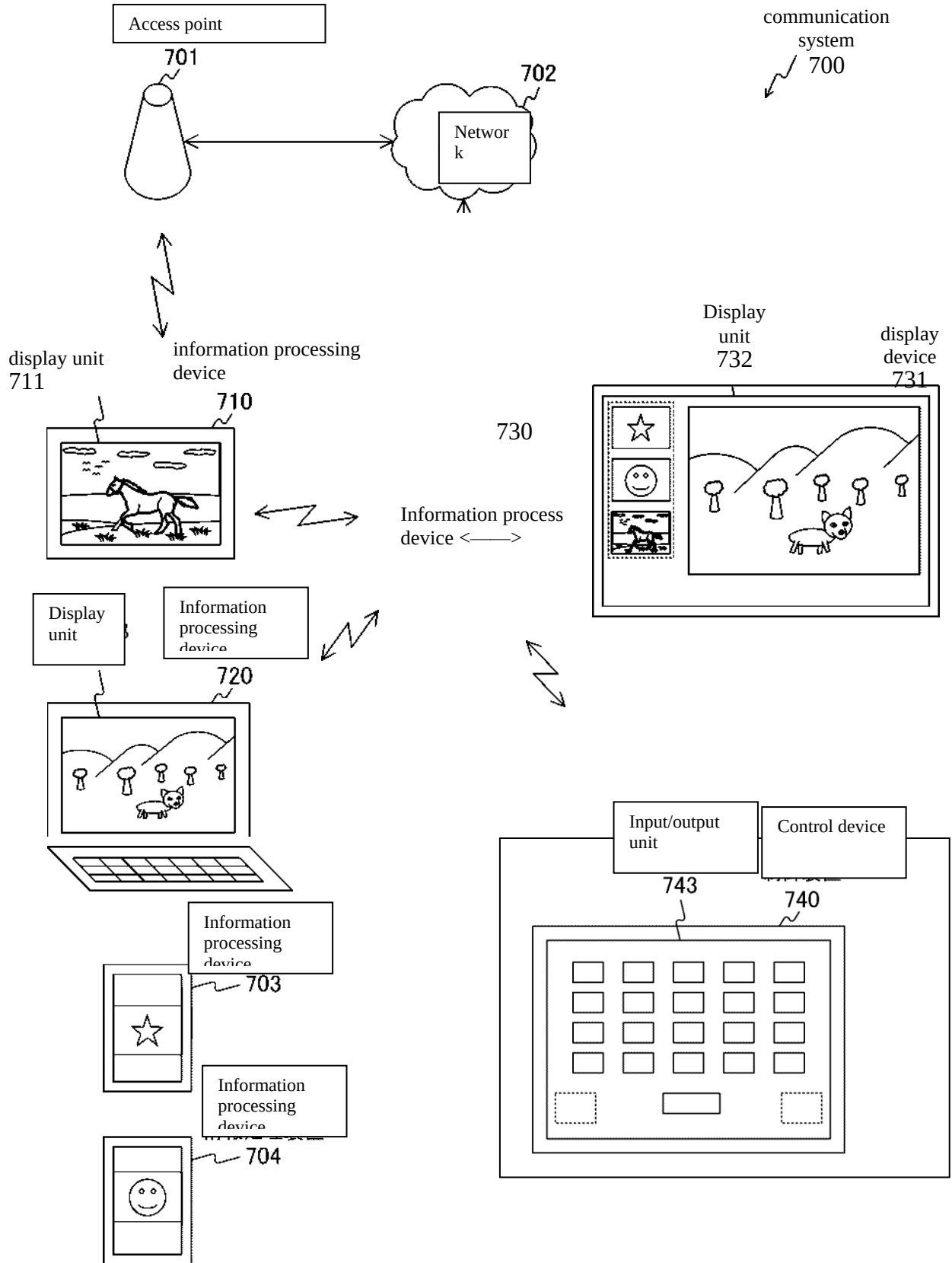


FIG.18

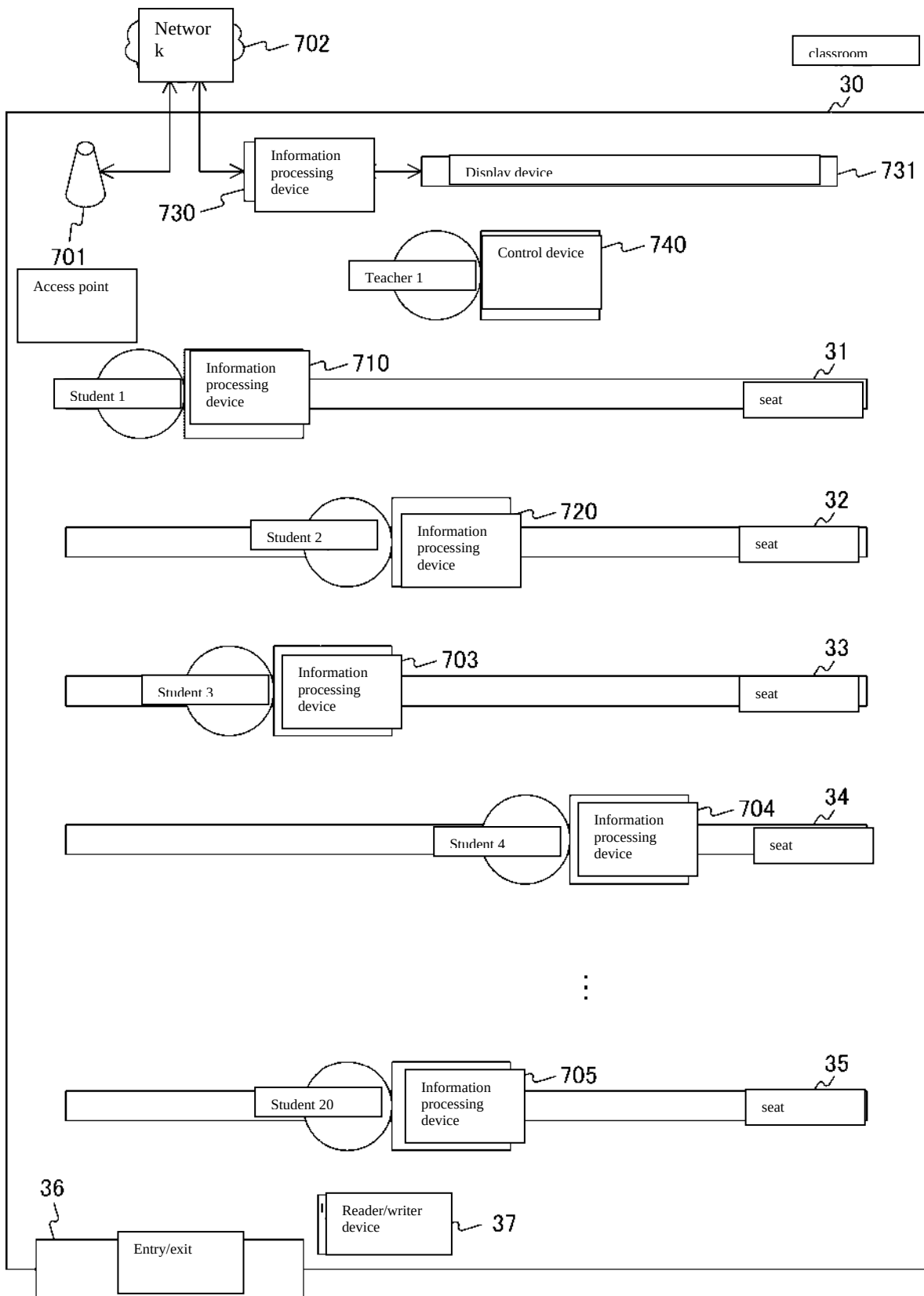


FIG.19

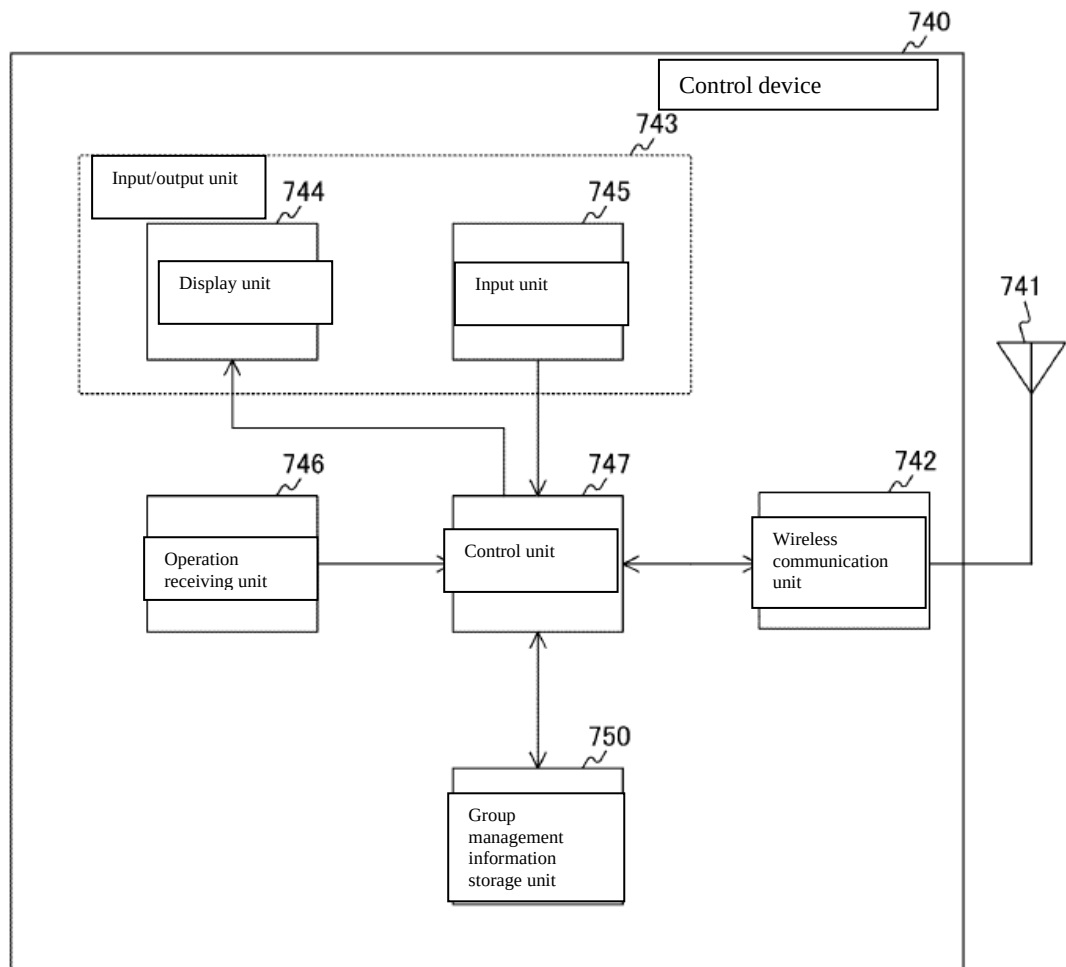


FIG.20

Group management information storage unit 750					
751 Terminal identification information	752 User information	753 Communication mode	754 Group participation status	755 Outdoor usage	756 Group participation time
0001	Student 1	Image transmission mode (peripheral channel)	Participating	Permitted	All day
0002	Student 2	Image transmission mode (center channel)	Participating	Denied	20140206. 10:00~ 15:00
0003	Student 3	Standby mode	Participating	Permitted	Only 20140206
0004	Student 4	—	Not Participating	Permitted	20140206. 10:00~ 15:00
⋮	⋮	⋮	⋮	⋮	⋮

FIG.21

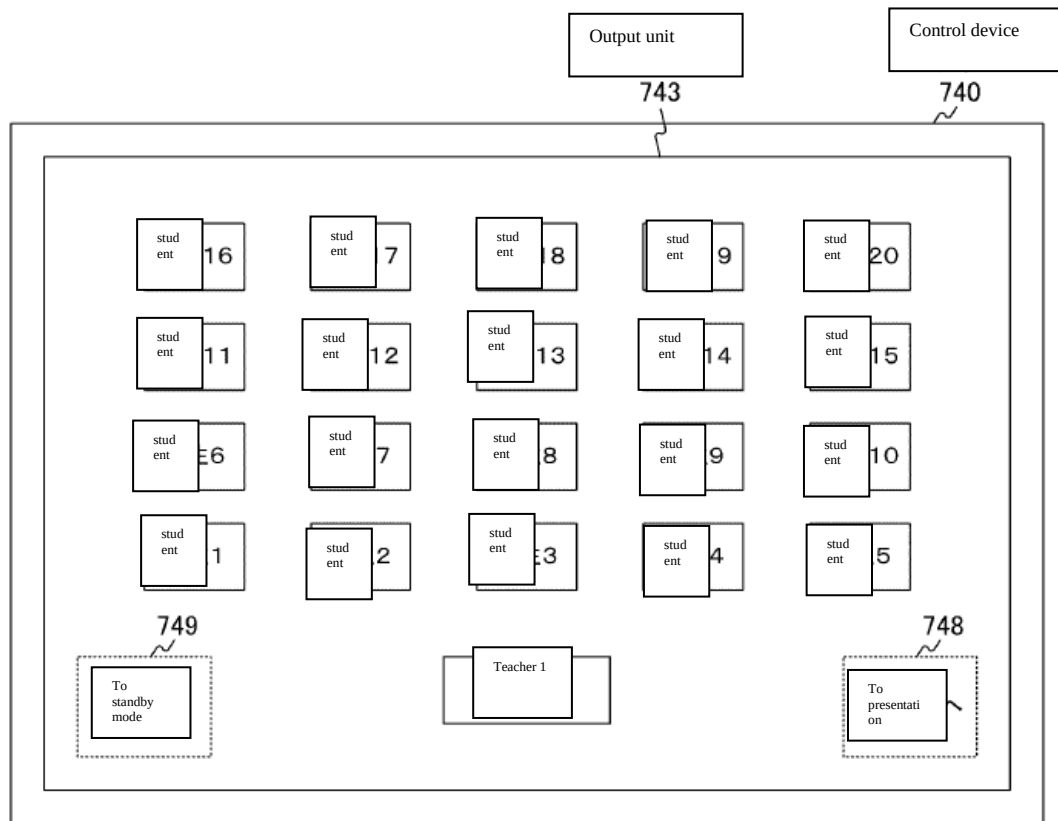


FIG.22

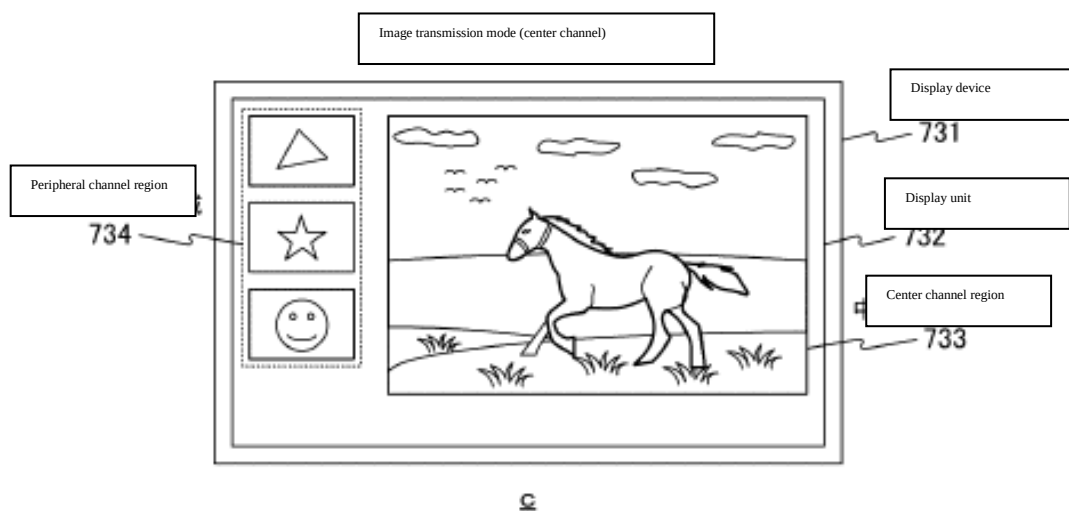
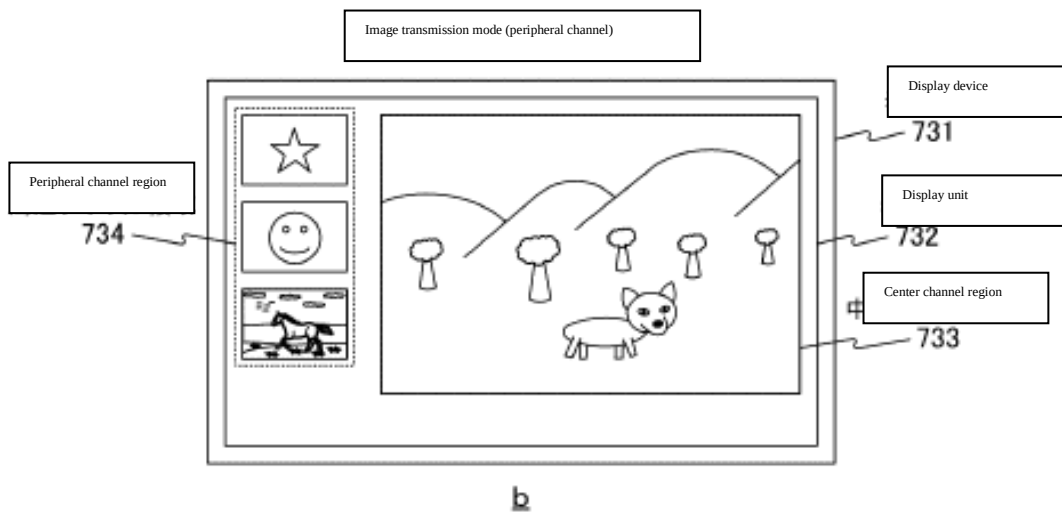
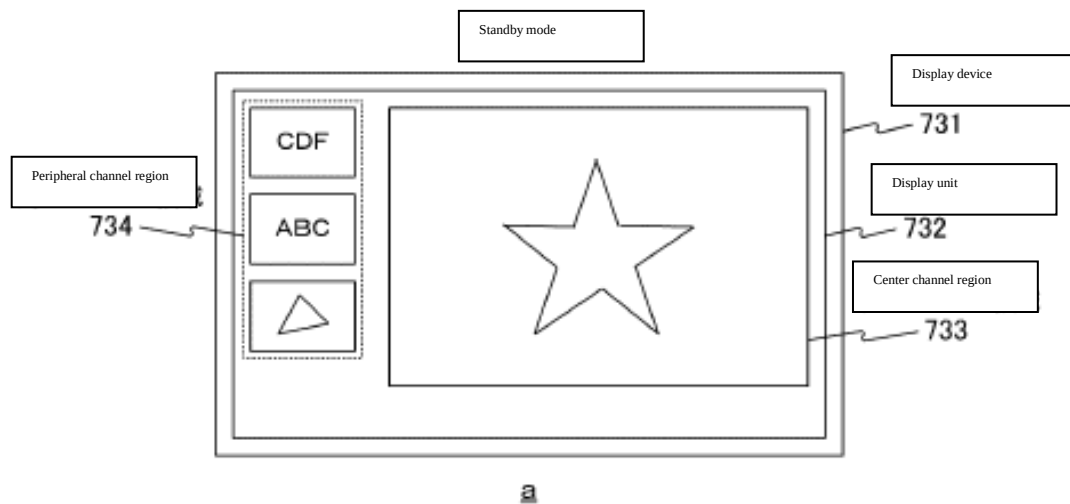


FIG.23

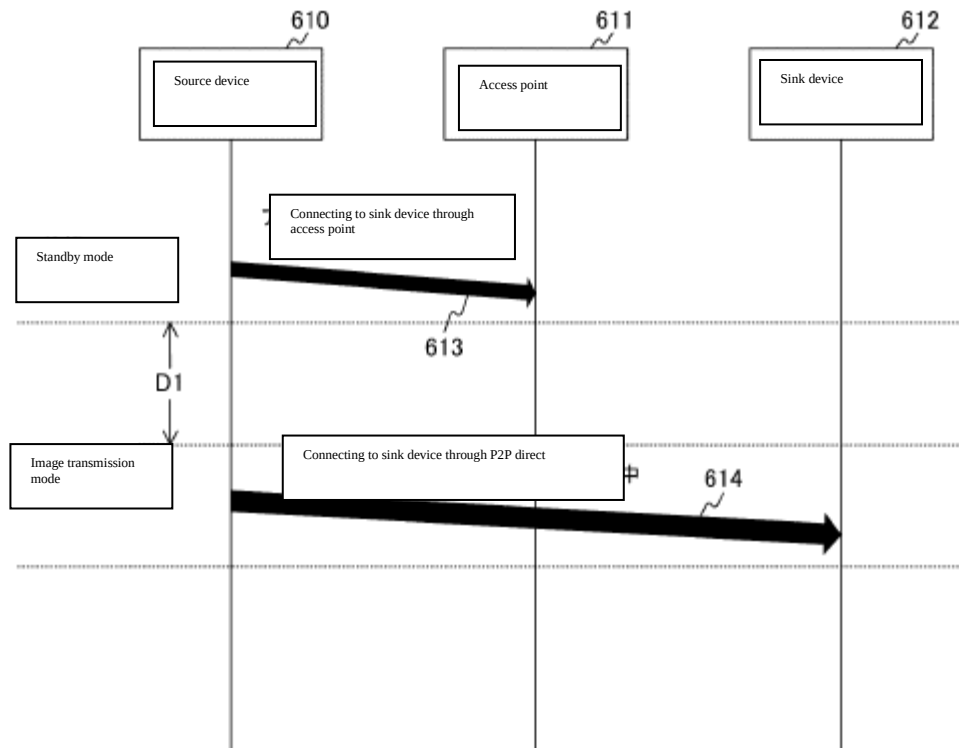


FIG.24

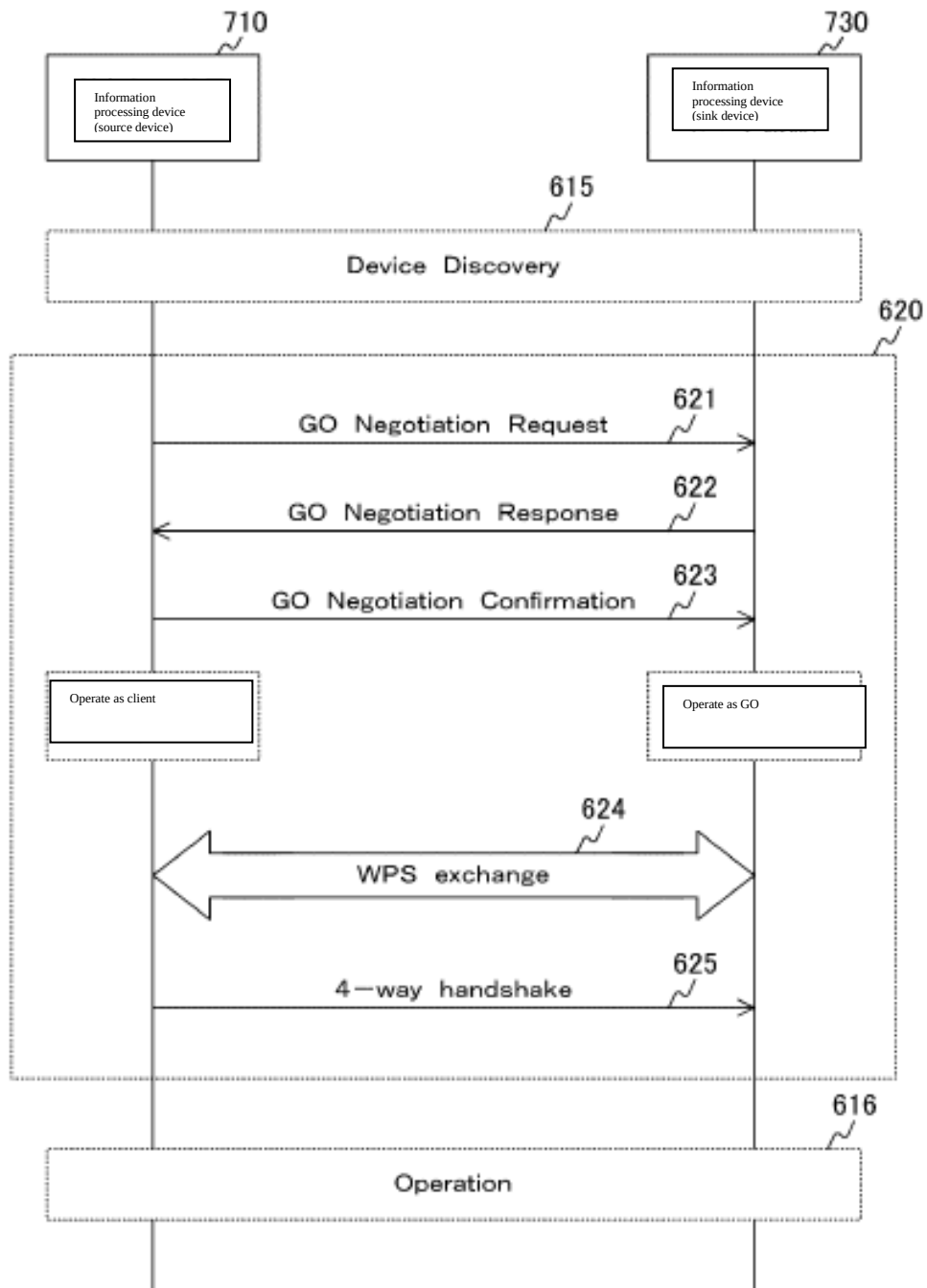


FIG.25

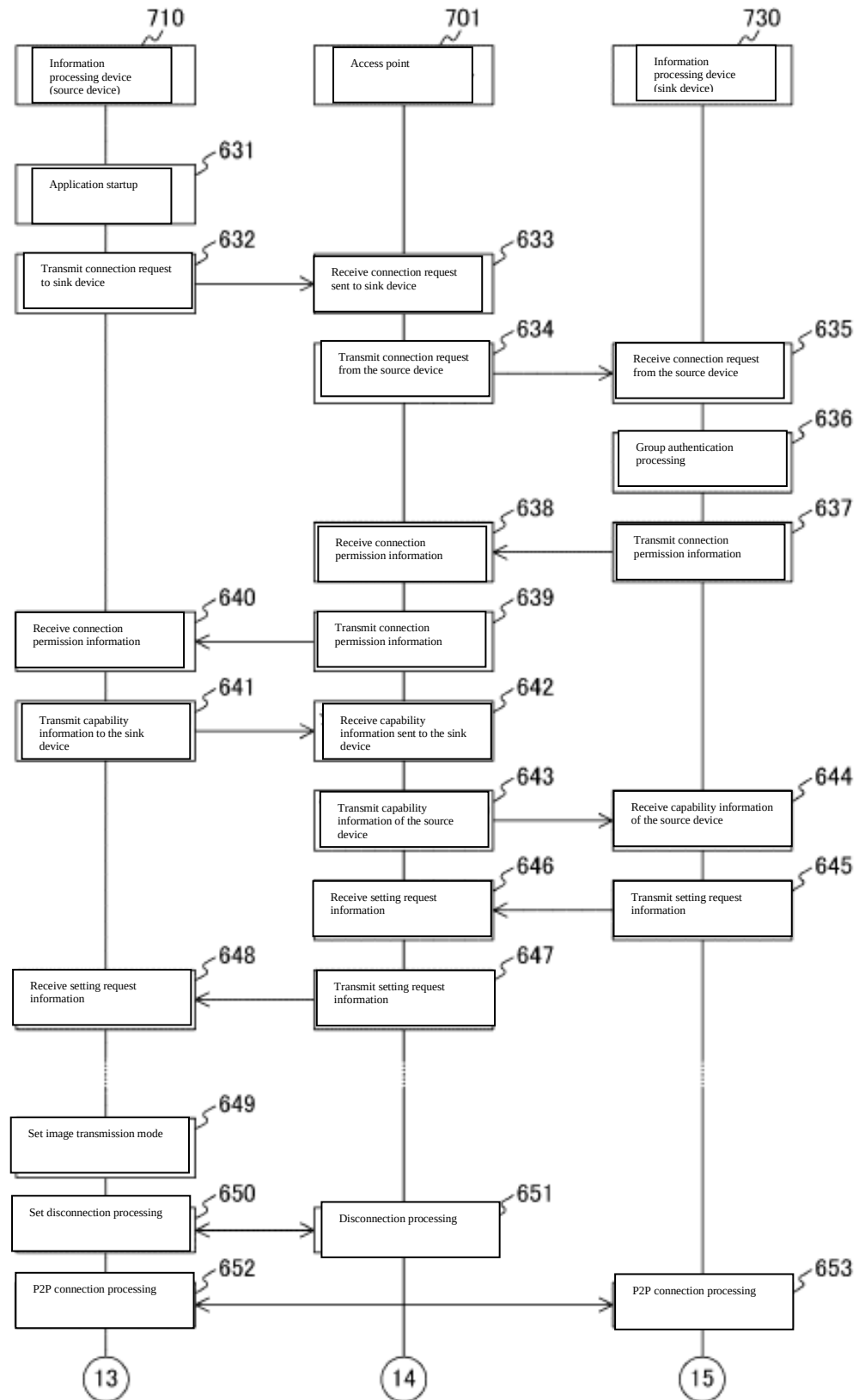


FIG.26

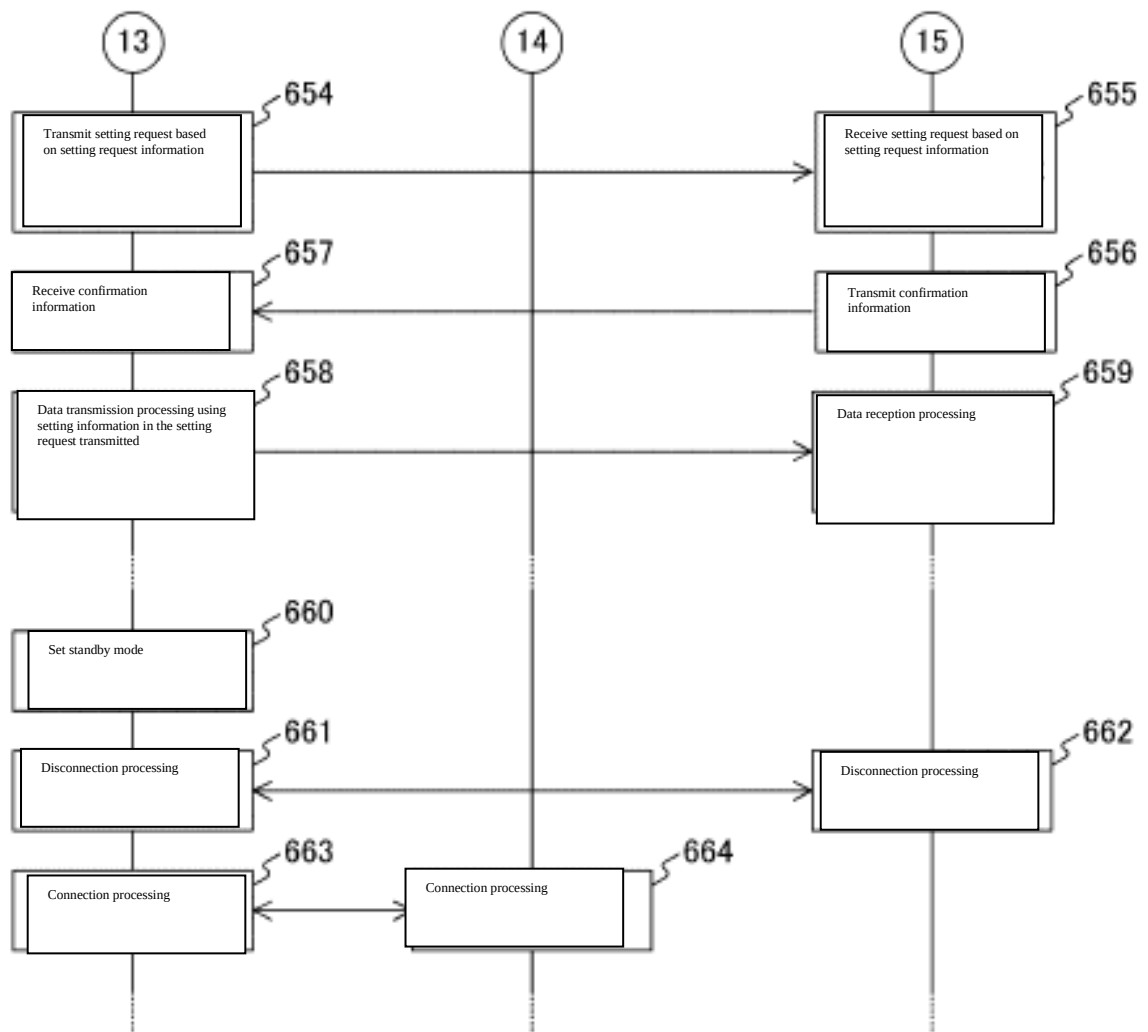


FIG.27

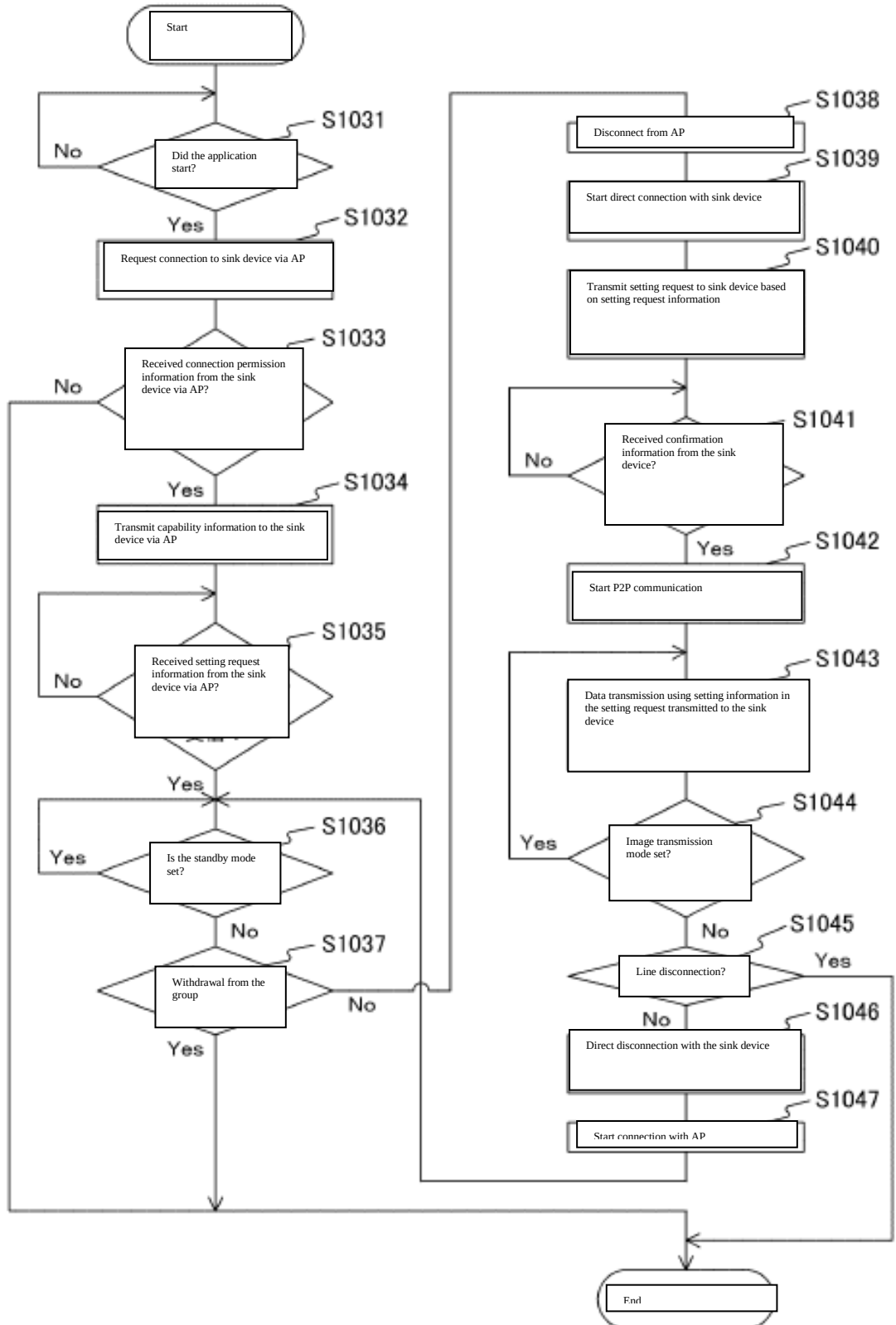


FIG.28

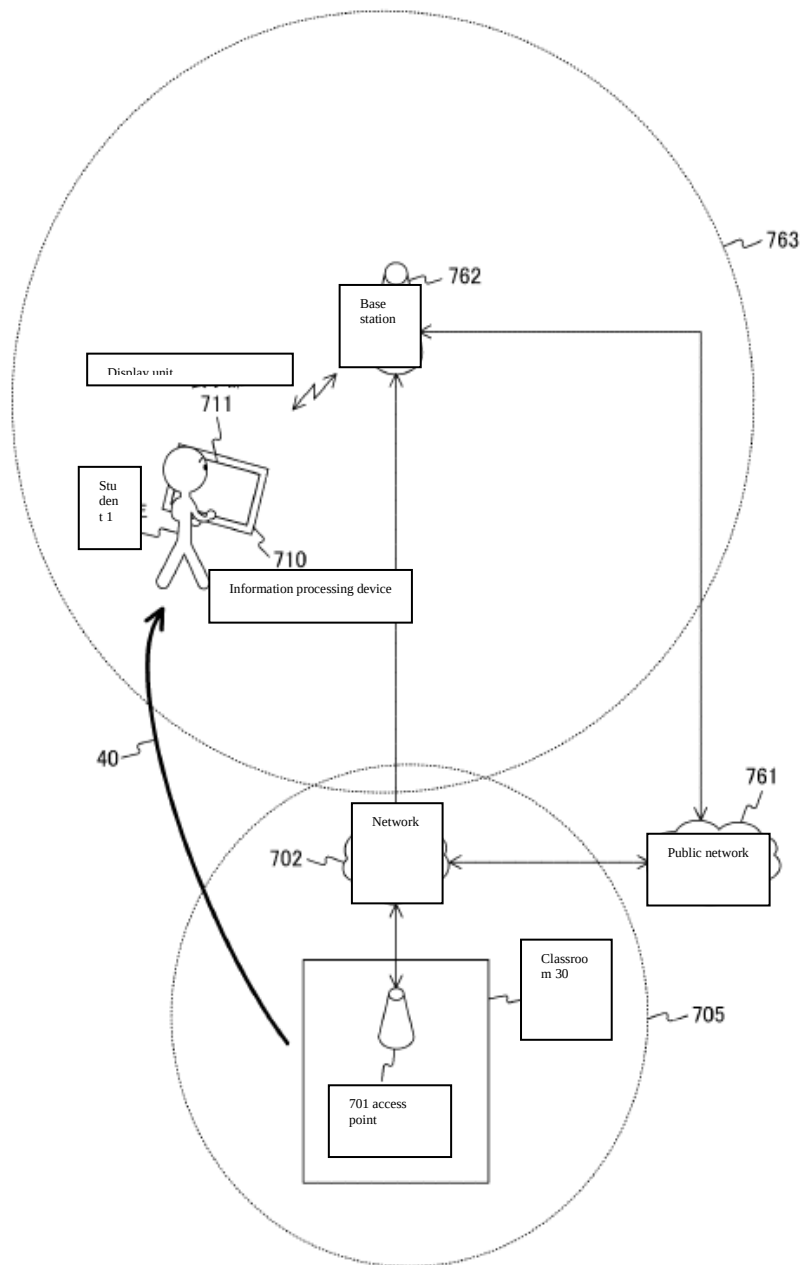


FIG.29

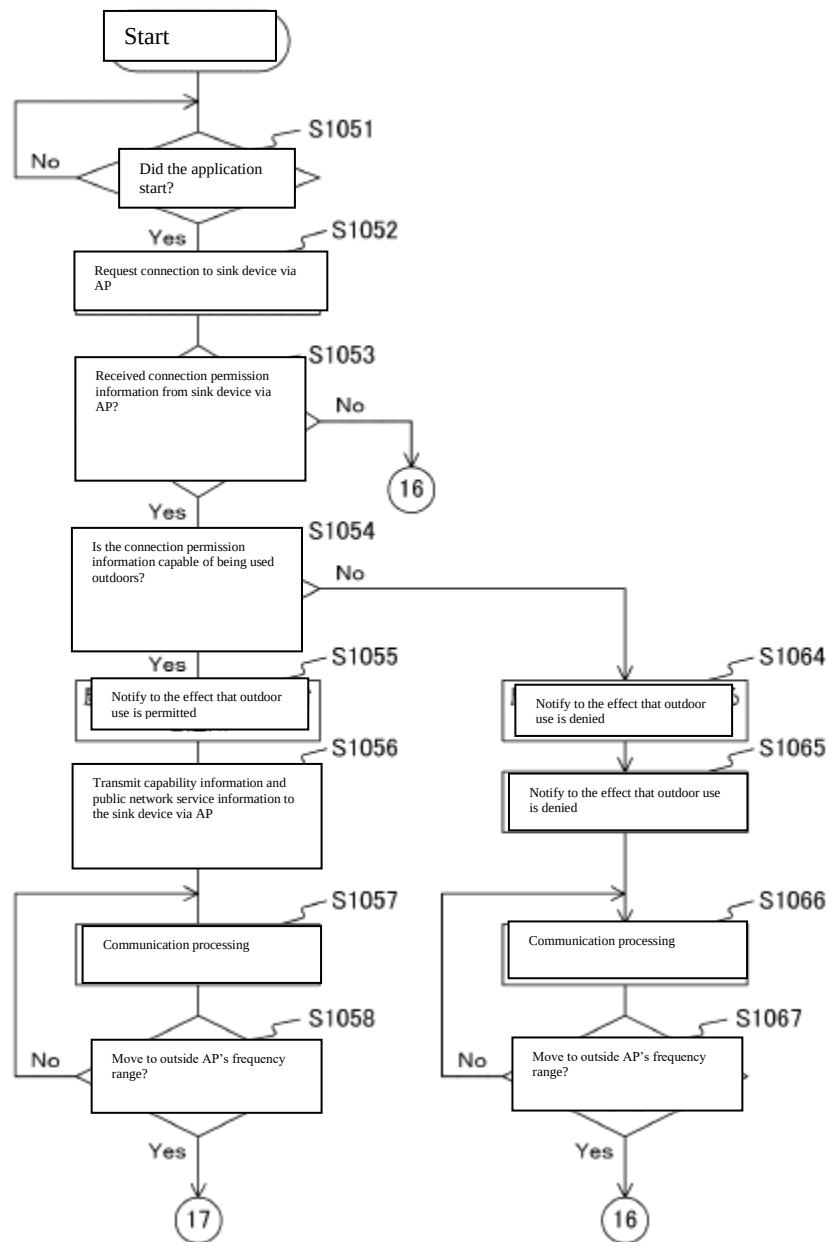


FIG.30

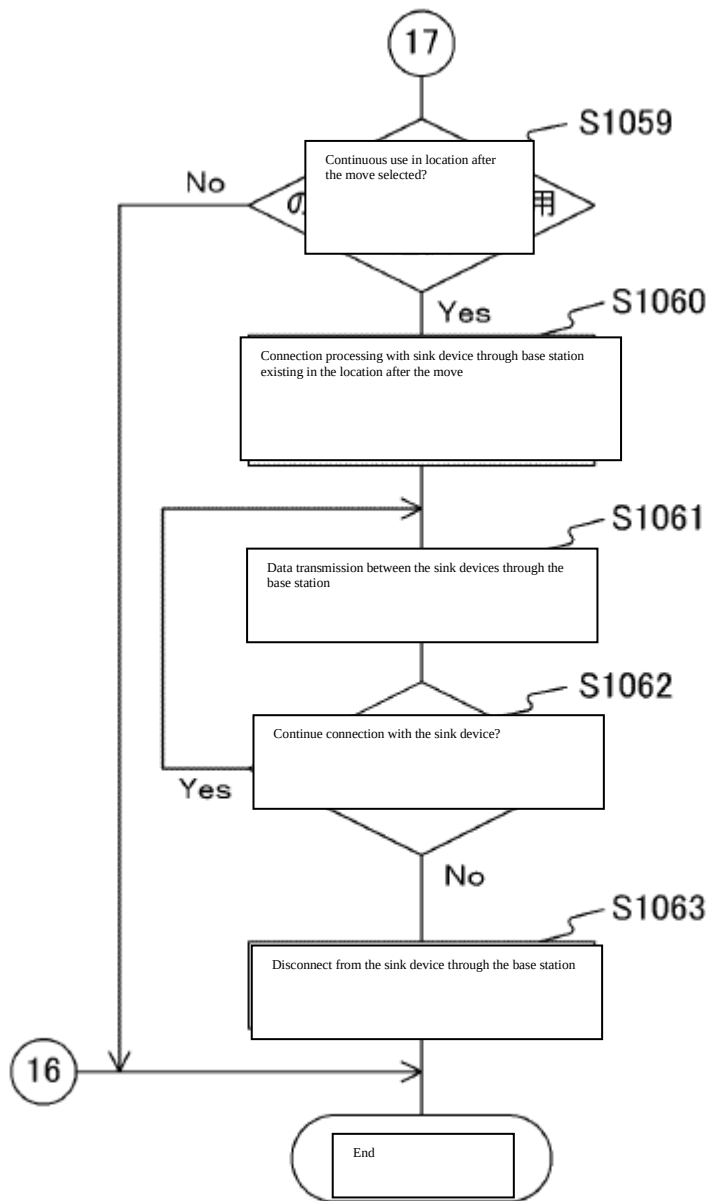


FIG.31

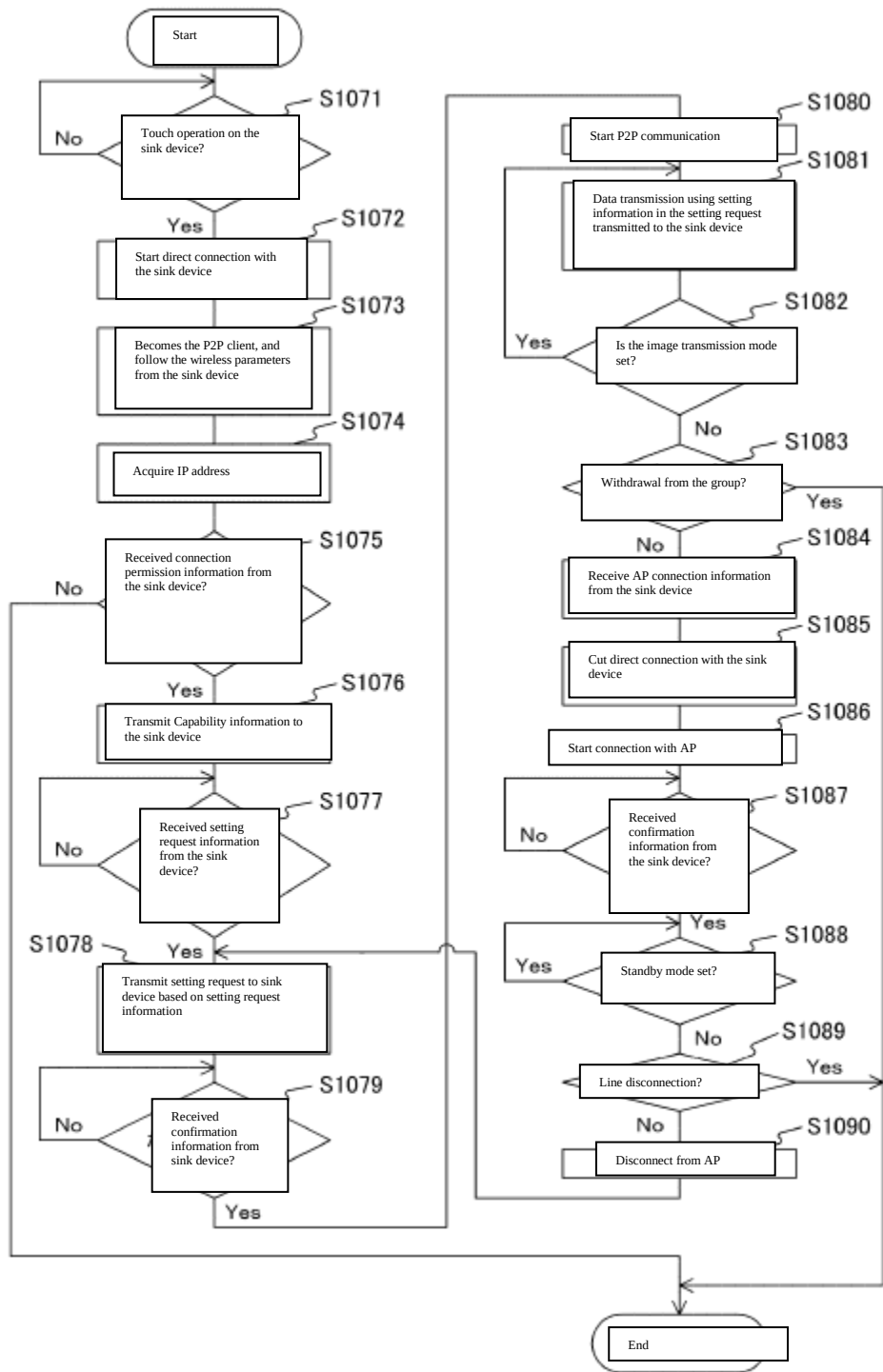


FIG.32

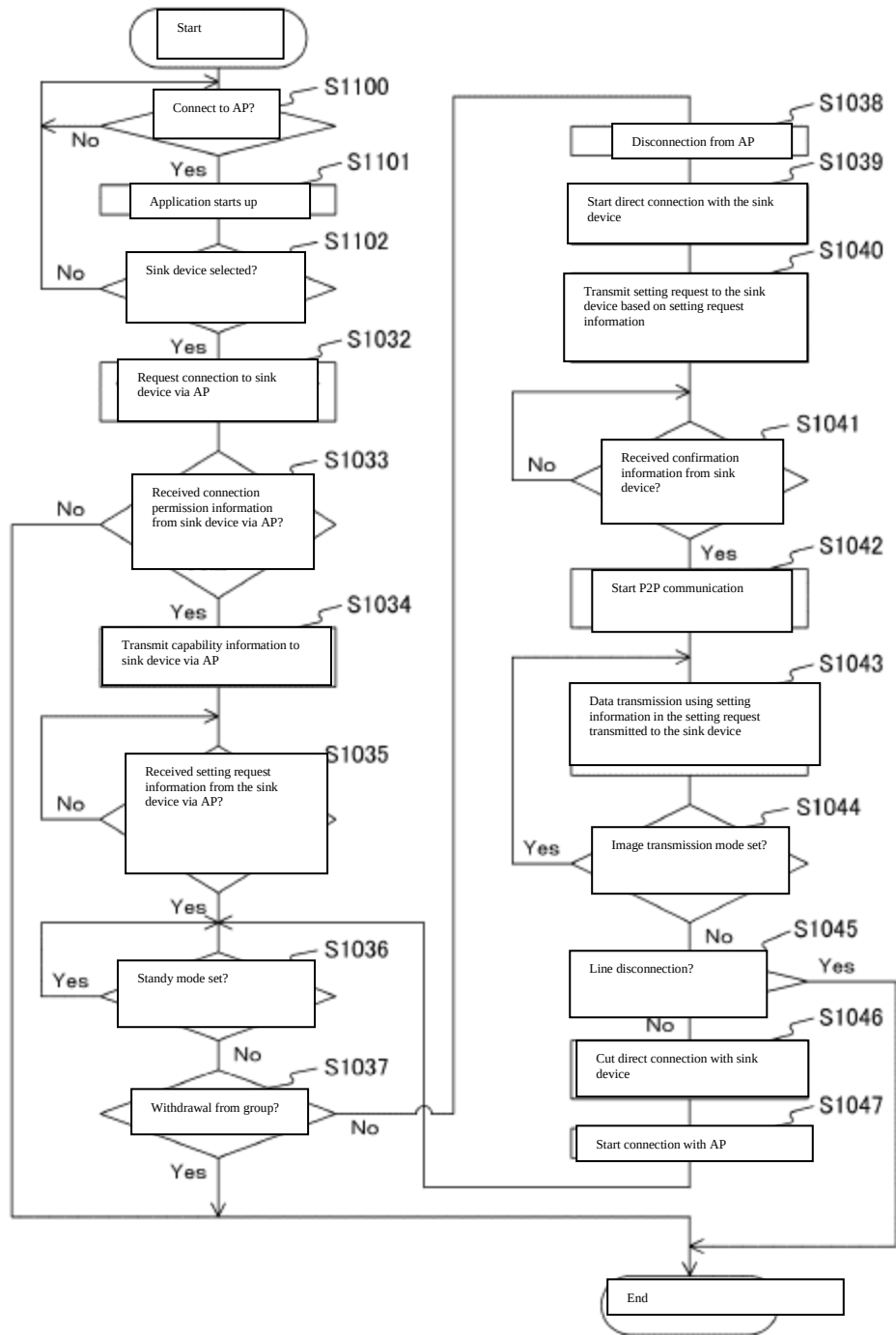


FIG.33

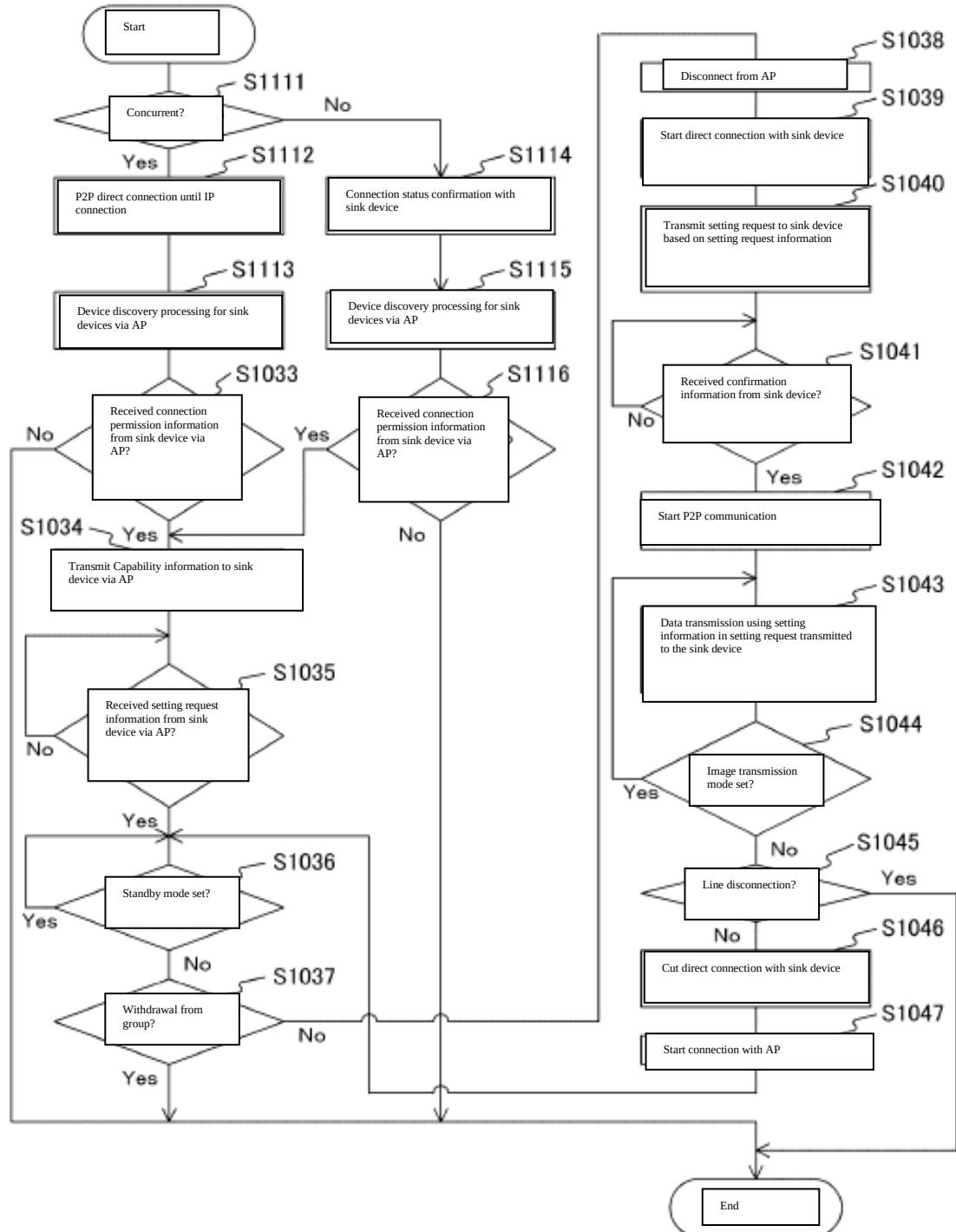


FIG.34

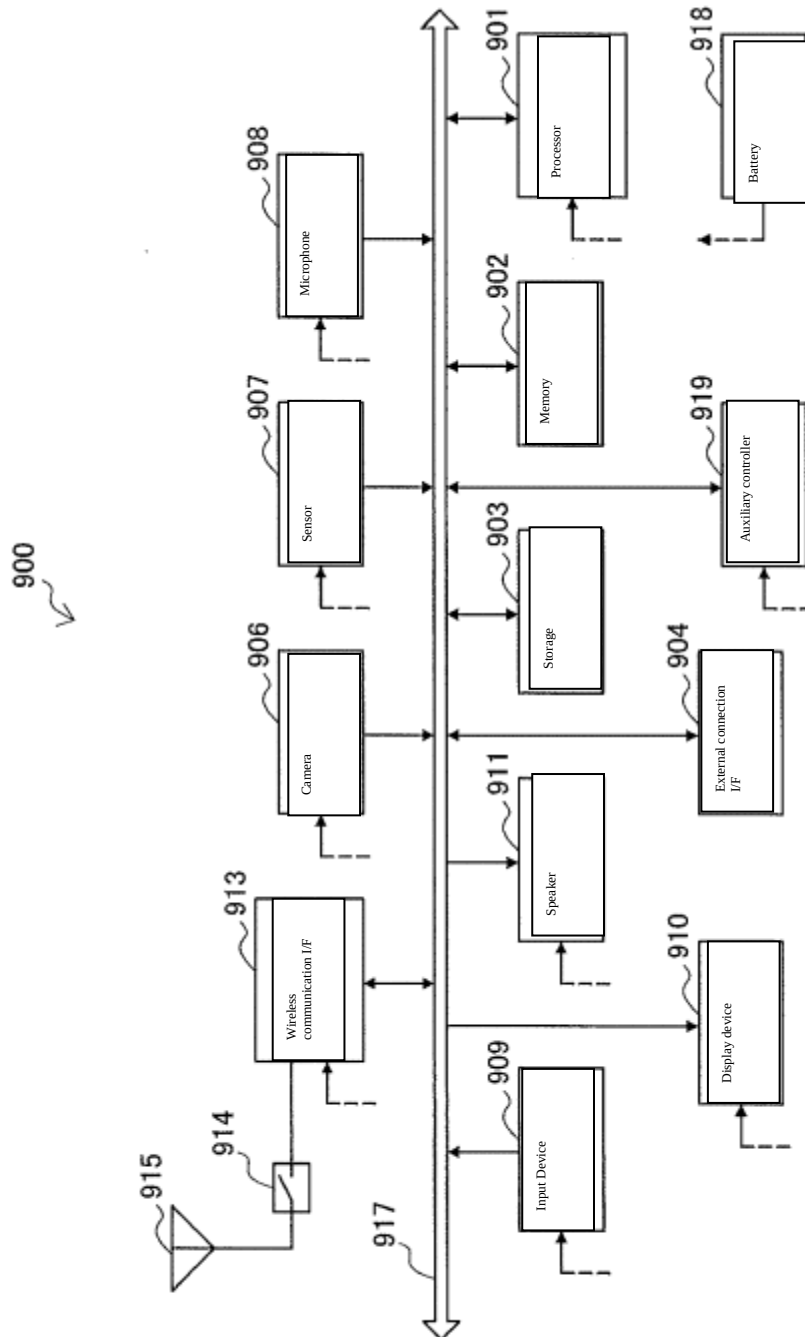
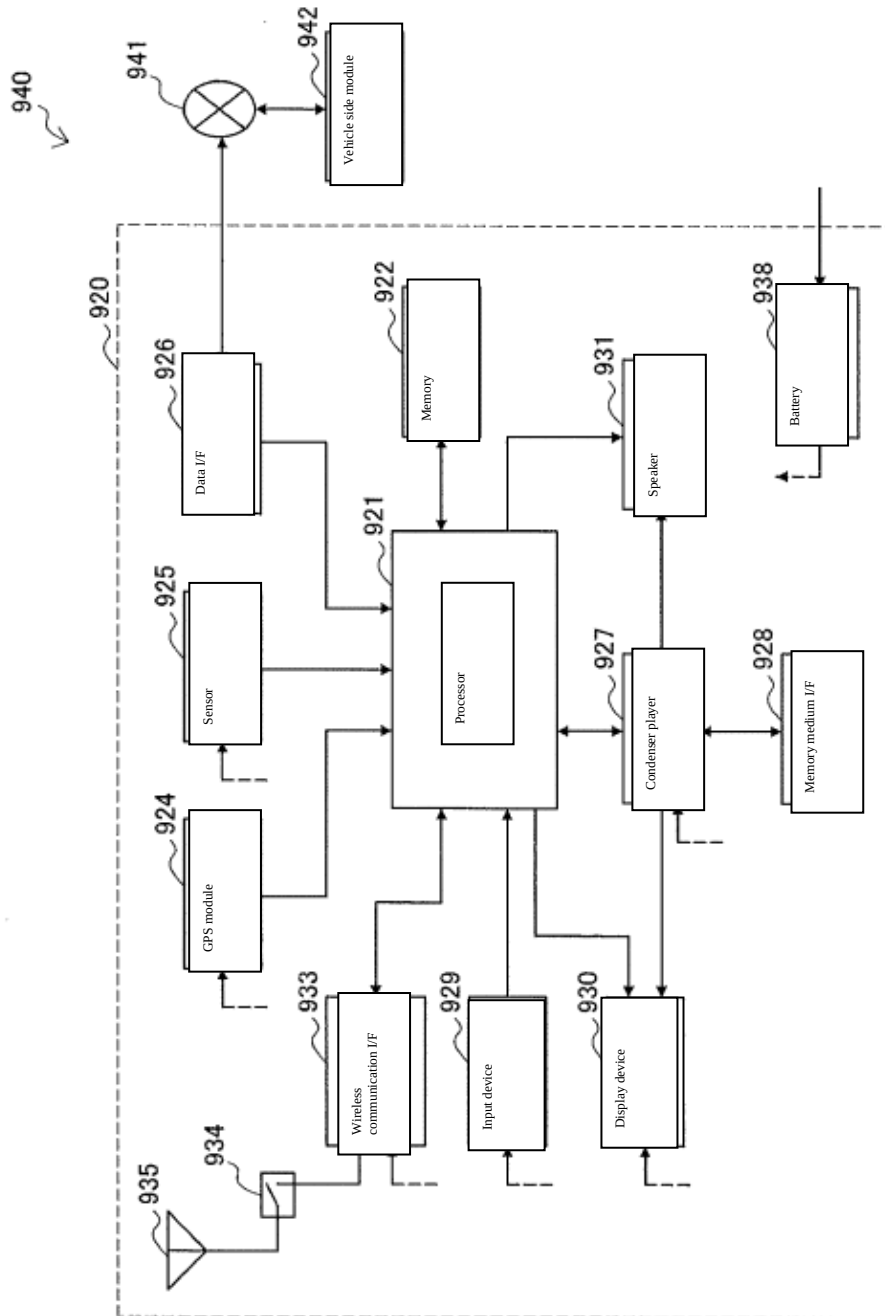


FIG.35



Applicant History

000002185
20070129
Address change
597062993

Sony Corporation
1-7-1 Shounan, Minato-ku, Tokyo

TRANSLATOR CERTIFICATION

Date: June 12, 2025

County of LOS ANGELES

State of CALIFORNIA

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Signature



SHAUN WU

Print

Sworn before me on this day
June 12, 2025

(See Attached Document)
Notary Public

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A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

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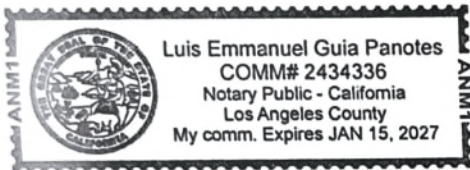
County of **LOS ANGELES**

On June 12, **2025** before me, **Luis Emmanuel Guia Panotes**, Notary Public,

personally appeared

Shawn

Wu



who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

Witness my hand and official seal.

Place Notary Seal Above

Signature

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