

COMMUNICATION APPARATUS AND COMMUNICATION METHOD

Technical Field

[0001]

The invention disclosed in the present specification relates to a communication apparatus which controls channel access operation under a multi user environment, and a communication method.

Background Art

[0002]

In a wireless LAN typified by IEEE 802.11, or the like, increase of communication speed can be realized by orthogonal frequency division multiple access (OFDMA) and multi user multi-input multi-output (MU-MIMO) being introduced (see, for example, Patent Literature 1).

[0003]

Here, in OFDM, which is a multi-carrier scheme in which a plurality of pieces of data is allocated to frequency subcarriers which are “orthogonal”, that is, which do not interfere with each other, each subcarrier on a frequency axis can be converted into a signal on a time axis and transmitted by inverse fast Fourier transform (FFT) being performed on each subcarrier. OFDMA is a multiple access scheme in which, instead of one communication station occupying all subcarriers of an OFDM signal, subcarrier sets on the frequency axis are allocated to a plurality of communication stations, so that subcarriers are shared among the plurality of communication stations.

[0004]

Further, MIMO is a communication scheme which realizes a spatial multiplexed stream by a plurality of antenna elements being provided at both a transmitter side and a receiver side. It can be said that MU-MIMO is a spatial division multiple access scheme in which wireless resources on a spatial axis are shared among a plurality of users.

[0005]

Communication using OFDMA or MU-MIMO is called a multi user (MU) mode. In contrast to this, one-to-one communication without multiple access is called a single user (SU) mode.

Citation List

Patent Literature

[0006]

Patent Literature 1: JP 5437307B

Disclosure of Invention

Technical Problem

[0007]

Embodiments of the present invention provide an excellent communication apparatus and communication method which enables preferable control of channel access operation under a multi user environment.

Solution to Problem

[0008]

According to a first aspect of the present invention, there is provided a communication apparatus (AP) configured to transmit a frame in which information regarding a transmission waiting period of another terminal is described, operate as an access point, and describe in the frame which notifies a subordinate terminal of allowance of multi user transmission, the information designating a transmission waiting period of the terminal after the multi user transmission is finished, wherein the communication apparatus is configured to transmit the frame in which the information designating a transmission waiting period in accordance with a number of times of transmission of the terminal is described.

[0009]

In an embodiment, the communication apparatus according to the first aspect is configured to operate as an access point, and describe in the frame which notifies a subordinate terminal of allowance of multi user transmission, the information designating a transmission waiting period of the terminal after the multi user transmission is finished.

[0010]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating to each terminal a transmission waiting period longer than a transmission waiting period in a case where the communication apparatus performs multi user transmission after the multi user transmission is finished, is described.

[0011]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a transmission waiting period different for each terminal is described.

[0012]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a transmission waiting period in accordance with the number of times of transmission of the terminal is described.

[0013]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a transmission waiting period such that a terminal whose number of times of transmission is smaller has a shorter transmission waiting period than a terminal whose number of times of transmission is larger, is described.

[0014]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a shorter transmission waiting period for a terminal which performs data retransmission than a transmission waiting period of another terminal, is described.

[0015]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a longer transmission waiting period for the terminal which is allowed to perform multi user transmission, than a remaining transmission waiting period of a terminal which performs data retransmission, is described.

[0016]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which a category favorable for the multi user transmission and the information designating a transmission waiting period for the terminal after the multi user transmission is finished, are described.

[0017]

In an embodiment, the communication apparatus according to the first aspect is configured to transmit the frame in which the information designating a transmission waiting period for the terminal in accordance with the category is described.

[0018]

In an embodiment, the communication apparatus according to the first aspect is configured to describe, in the frame in which a category with higher priority is designated, the information designating a transmission waiting period shorter than a remaining period of a transmission waiting period set in a case where a category with lower priority is designated.

[0019]

Disclosed herein is a communication method including: a step of transmitting a frame in which information regarding a transmission waiting period of another terminal is described.

[0020]

Disclosed herein is a communication apparatus that is configured to set, on the basis of information regarding a transmission waiting period of the communication apparatus described in a received frame, a transmission waiting period after communication processing relating to the received frame is performed.

[0021]

In an embodiment, the above communication is configured to transmit a frame in which information regarding a transmission waiting period of the communication apparatus upon next frame transmission is described.

[0022]

In an embodiment, the communication apparatus according to the fourth aspect is configured to operate as an access point, and describe the information regarding the transmission waiting period of the communication apparatus upon the next frame

transmission in the frame which notifies a subordinate terminal of allowance of multi user transmission.

[0023]

In an embodiment, the communication apparatus according to the fourth aspect is configured to describe a predetermined value as the information in a case where a next frame is not transmitted for a while after the frame is transmitted.

[0024]

In an embodiment, the communication apparatus according to the fourth aspect is configured to further describe in the frame, information regarding a transmission waiting period upon retransmission of a frame transmitted by the terminal through the multi user transmission.

[0025]

In an embodiment, the communication apparatus according to the fourth aspect is configured to transmit the frame in which a category favorable for multi user transmission and the information regarding a transmission waiting period upon retransmission in accordance with the category are described.

[0026]

Disclosed herein is a communication method including: a step of transmitting a frame in which information regarding a transmission waiting period of an own communication apparatus upon next frame transmission is described.

[0027]

In an embodiment, the above communication apparatus is configured to set, on a basis of information regarding a transmission waiting period upon next frame transmission by a transmission source of a frame described in the received frame, a transmission waiting period of the communication apparatus after communication processing relating to the received frame is performed.

[0027a]

According to a second aspect of the present invention, there is provided a communication method including the steps of: transmitting a frame in which information regarding a transmission waiting period of another terminal is described, operating as an access point, and describing in the frame which notifies a subordinate terminal of allowance

of multi user transmission, the information designating a transmission waiting period of the terminal after the multi user transmission is finished, wherein, in transmitting the frame, information designating a transmission waiting period in accordance with a number of times of transmission of the terminal is described.

[0027b]

According to a third aspect of the present invention, there is provided a communication apparatus (STA) configured to set, on a basis of information regarding a transmission waiting period of the communication apparatus described in a received frame, a transmission waiting period after communication processing relating to the received frame is performed, wherein the communication apparatus is configured to set the transmission waiting period in accordance with a number of times of transmission of the communication apparatus.

[0027c]

According to a fourth aspect of the present invention, there is provided a communication method including the steps of: setting, on a basis of information regarding a transmission waiting period of the communication apparatus described in a received frame, a transmission waiting period after communication processing relating to the received frame is performed, wherein the transmission waiting period is set in accordance with a number of times of transmission of the communication apparatus.

Advantageous Effects of Invention

[0028]

According to embodiments of the present invention, it is possible to provide an excellent communication apparatus and communication method which enables preferable control of channel access operation of subordinate terminals as an access point under a multi user environment where a plurality of terminals exists.

[0029]

According to embodiments of the present invention, it is possible to provide an excellent communication apparatus and communication method which enables preferable control of channel access operation of an own terminal under a multi user environment where a plurality of terminals exists.

[0030]

Note that the effects described in the present specification are merely examples, and effects of embodiments of the present invention are not limited to these. Further, there is also a case where embodiments of the present invention further provide additional effects other than the above-described effects.

[0031]

Other aspects, features and advantages of the invention disclosed in the present specification will become more clear from the detailed description based on embodiments described later and the accompanying drawings.

Brief Description of Drawings

[0032]

[FIG. 1] FIG. 1 is a diagram illustrating a communication sequence example in the case where a mode is switched in a wireless LAN network.

[FIG. 2] FIG. 2 is a diagram illustrating a communication sequence example in the case where a mode is switched in a wireless LAN network.

[FIG. 3] FIG. 3 is a diagram illustrating a communication sequence example in the case where a mode is switched in a wireless LAN network.

[FIG. 4] FIG. 4 is a diagram illustrating a configuration example of a wireless LAN system.

[FIG. 5] FIG. 5 is a diagram illustrating a configuration example of a communication apparatus 500.

[FIG. 6] FIG. 6 is a flowchart illustrating operation procedure within the wireless LAN system.

[FIG. 7] FIG. 7 is a diagram illustrating a configuration example of a trigger frame.

[FIG. 8] FIG. 8 is a diagram illustrating a communication sequence example (CW setting by the number of times of transmission) in which a parameter value of CW of each STA is set at the discretion of an AP.

[FIG. 9] FIG. 9 is a diagram illustrating a communication sequence example (CW setting by retransmission) in which the parameter value of the CW of each STA is set at the discretion of the AP.

CLAIMS

1. A communication apparatus (AP) configured to
transmit a frame in which information regarding a transmission waiting period of
another terminal is described,
operate as an access point, and
describe in the frame which notifies a subordinate terminal of allowance of multi
user transmission, the information designating a transmission waiting period of the terminal
after the multi user transmission is finished,
wherein the communication apparatus is configured to transmit the frame in which the
information designating a transmission waiting period in accordance with a number of times of
transmission of the terminal is described.
2. The communication apparatus according to claim 1,
wherein the communication apparatus is configured to transmit the frame in which
information designating to each terminal a transmission waiting period longer than a
transmission waiting period in a case where the communication apparatus performs multi user
transmission after the multi user transmission is finished is described.
3. The communication apparatus according to claim 1 or 2,
wherein the communication apparatus is configured to transmit the frame in which
the information designating a transmission waiting period different for each terminal is
described.
4. The communication apparatus according to claim 1,
wherein the communication apparatus is configured to transmit the frame in which
the information designating a transmission waiting period such that a terminal whose number
of times of transmission is smaller has a shorter transmission waiting period than a terminal
whose number of times of transmission is larger is described.
5. The communication apparatus according to claim 1,
wherein the communication apparatus is configured to transmit the frame in which
the information designating a shorter transmission waiting period for a terminal which

performs data retransmission than a transmission waiting period of another terminal, is described.

6. The communication apparatus according to any one of the preceding claims, wherein the communication apparatus is configured to transmit the frame in which the information designating a longer transmission waiting period for the terminal which is allowed to perform multi user transmission, than a remaining transmission waiting period of a terminal which performs data retransmission is described.

7. The communication apparatus according to any one of the preceding claims, wherein the communication apparatus is configured to transmit the frame in which a category favorable for the multi user transmission and the information designating a transmission waiting period for the terminal after the multi user transmission is finished are described.

8. The communication apparatus according to any one of the preceding claims, wherein the communication apparatus is configured to transmit the frame in which the information designating a transmission waiting period for the terminal in accordance with the category is described.

9. The communication apparatus according to any one of the preceding claims, wherein, in the frame in which a category with higher priority is designated, the information designating a transmission waiting period shorter than a remaining period of a transmission waiting period set in a case where a category with lower priority is designated is described.

10. The communication apparatus according to any one of the preceding claims, wherein the communication apparatus is configured to transmit a frame in which information regarding a transmission waiting period of the communication apparatus upon next frame transmission is described.

11. The communication apparatus according to claim 10,
wherein the communication apparatus is configured to operate as an access point,
and to describe the information regarding the transmission waiting period of the
communication apparatus upon the next frame transmission in the frame which notifies a
subordinate terminal of allowance of multi user transmission.
12. The communication apparatus according to claim 11,
wherein the communication apparatus is configured to describe a predetermined
value as the information in a case where a next frame is not transmitted for a while after the
frame is transmitted.
13. The communication apparatus according to claim 11,
wherein the communication apparatus is further is configured to describes in the
frame, information regarding a transmission waiting period upon retransmission of a frame
transmitted by the terminal through the multi user transmission.
14. The communication apparatus according to claim 13,
wherein the communication apparatus is configured to transmit the frame in which a
category favorable for multi user transmission and the information regarding a transmission
waiting period upon retransmission in accordance with the category are described.
15. A communication method comprising the steps of:
transmitting a frame in which information regarding a transmission waiting period of
another terminal is described,
operating as an access point, and
describing in the frame which notifies a subordinate terminal of allowance of multi
user transmission, the information designating a transmission waiting period of the terminal
after the multi user transmission is finished,
wherein, in transmitting the frame, information designating a transmission waiting
period in accordance with a number of times of transmission of the terminal is described.
16. A communication apparatus (STA) configured to set, on a basis of information
regarding a transmission waiting period of the communication apparatus described in a

received frame, a transmission waiting period after communication processing relating to the received frame is performed,

wherein the communication apparatus is configured to set the transmission waiting period in accordance with a number of times of transmission of the communication apparatus.

17. The communication apparatus according to claim 16, wherein the communication apparatus is configured to set, on a basis of information regarding a transmission waiting period upon next frame transmission by a transmission source of a frame described in the received frame, a transmission waiting period of the communication apparatus after communication processing relating to the received frame is performed.

18. A communication method comprising the steps of:

setting, on a basis of information regarding a transmission waiting period of the communication apparatus described in a received frame, a transmission waiting period after communication processing relating to the received frame is performed,

wherein the transmission waiting period is set in accordance with a number of times of transmission of the communication apparatus.