

by TF-R. A terminal having uplink data (UL Data) in the transmission buffer randomly selects one RU from among the RA RUs specified by the TF-R. Thereafter, the terminal transmits a UL response signal including the transmission buffer information to the access point by using the selected RU. The access point can get to know the transmission buffer state of each of terminals on the basis of the transmission buffer information received through random access and, thus, can efficiently schedule the UL Data after random access.

[0007]

The second use of random access is to transmit an uplink signal by OFDMA even when a terminal operating in a power saving mode (also referred to as a "Power Saving (PS) terminal") returns from the power saving state, and the access point does not know that the terminal holds uplink data in the transmission buffer. This use can prevent a decrease in transmission efficiency caused by a plurality of terminals performing uplink transmission separately as a single user (SU) (refer to, for example, NPL 3).

Citation List

Non Patent Literature

[0008]

NPL 1: IEEE 802.11-15/0875r1 "Random Access with Trigger frames using OFDMA"

NPL 2: IEEE 802.11-15/0843r1 "UL MU Random Access Analysis"

NPL 3: IEEE 802.11-15/1107r0 "Power Save with Random Access"

NPL 4: IEEE 802.11-15/1066r0, "HE-SIG-B Contents"

NPL 5: IEEE Std 802.11-2012

Summary

[0009]

However, as the amount of information of the control signal (the UL response signal) transmitted by a terminal increases due to the above-described random access, the resource (for example, the time length) required for transmitting the UL response signal increases. Consequently, the resource used to transmit UL/DL Data decreases and, thus, the system throughput decreases. In contrast, if the amount of information of the control signal transmitted through random access decreases, efficient scheduling of the UL/DL Data transmission after the random access cannot be performed. As a result, the system throughput

decreases.

[0010]

An example of the present disclosure is to provide a communication device, a terminal, and a communication method capable of increasing the system throughput without an increase in the amount of information of a control signal transmitted through random access.

Solution to problem

[0011]

According to an example of the present disclosure, a communication device includes a storage unit that stores a plurality of random access IDs used to instruct a terminal which transmission frequency resources to use for random-access, where each of the random access IDs is uniquely associated with the state of communication between a terminal that performs random access and the communication device, a generation unit that generates a random access control signal including allocation information indicating at least one transmission frequency resource, where each of the at least one transmission frequency resource has one of the random access IDs assigned thereto, and a transmission unit that transmits the random access control signal.

[0011A]

In one aspect, the present disclosure refers to a terminal station, comprising, a receiver, which, in operation, receives from a communication apparatus a control signal including a user specific field, the user specific field including an ID field and indicating that a resource unit (RU) is available for the terminal station, wherein the ID field indicates one of a plurality of Association IDs (AIDs) for identifying an associated terminal station or one of a plurality of IDs for random access, values of the plurality of IDs for random access are different from any of values of the plurality of AIDs, and each of the values of the plurality of IDs for random access indicates a state of communication with the communication apparatus, and a transmitter, which, in response to the control signal, transmits uplink data using the RU.

[0012]

According to an example of the present disclosure, a terminal includes a storage unit that stores a plurality of random access IDs used to instruct a terminal which transmission frequency resources to use for random access,

where each of the random access IDs is uniquely associated with the state of communication between a terminal that performs random access and the communication device, a reception unit that receives a random access control signal including allocation information indicating at least one transmission frequency resource, where each of the at least one transmission frequency resource has one of the random access IDs assigned thereto, a selection unit that selects, from among the at least one transmission frequency resource, one of the transmission frequency resources each having a random access ID that is the same as the random access ID associated with the state of communication of the terminal, and a transmission unit that transmits a random access signal by using the selected transmission frequency resource.

[0012A]

In another aspect, the present disclosure refers to a communication method implemented by a terminal station, the method comprising, receiving from a communication apparatus a control signal including a user specific field, the user specific field including an ID field and indicating that a resource unit (RU) is available for the terminal station, wherein the ID field indicates one of a plurality of Association IDs (AIDs) for identifying an associated terminal station or one of a plurality of IDs for random access, values of the plurality of IDs for random access are different from any of values of the plurality of AIDs, and each of the values of the plurality of IDs for random access indicates a state of communication with the communication apparatus, and transmitting uplink data, in response to the control signal, using the RU.

[0013]

It should be noted that general or specific examples may be implemented as a system, an apparatus, a method, an integrated circuit, a computer program, a recording medium, or any selective combination thereof.

[0014]

According to an example of the present disclosure, the system throughput can be increased without increasing the amount of information of a control signal transmitted by random access.

[0015]

Additional benefits and advantages of the disclosed examples will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various examples and features of the specification and drawings, which need not all be provided in order to obtain one or more of such benefits and/or advantages.

Brief Description of Drawings

[0016]

[Fig. 1] Fig. 1 is a flow diagram illustrating the operations performed by an access point and a terminal according to a first embodiment.

[Fig. 2] Fig. 2 is a block diagram illustrating the main configuration of the access point according to the first embodiment.

[Fig. 3] Fig. 3 is a block diagram illustrating the main configuration of the terminal according to the first embodiment.

[Fig. 4] Fig. 4 is a block diagram illustrating the configuration of the access point according to the first embodiment.

[Fig. 5] Fig. 5 is a block diagram illustrating the configuration of the terminal according to the first embodiment.

[Fig. 6A] Fig. 6A illustrates an example of an RA ID table according to Setting Method 1 according to the first embodiment.

[Fig. 6B] Fig. 6B illustrates an example a TF-R according to Setting Method 1 according to the first embodiment.

[Fig. 7] Fig. 7 illustrates an example of a transmission format of the TF-R.

[Fig. 8] Fig. 8 illustrates another example of the transmission format of the TF-R.

[Fig. 9] Fig. 9 illustrates another example of the TF-R according to Setting Method 1 of the first embodiment.

CLAIMS

1. A terminal station, comprising:

a receiver, which, in operation, receives from a communication apparatus a control signal including a user specific field, the user specific field including an ID field and indicating that a resource unit (RU) is available for the terminal station, wherein

the ID field indicates one of a plurality of Association IDs (AIDs) for identifying an associated terminal station or one of a plurality of IDs for random access,

values of the plurality of IDs for random access are different from any of values of the plurality of AIDs, and

each of the values of the plurality of IDs for random access indicates a state of communication with the communication apparatus; and

a transmitter, which, in response to the control signal, transmits uplink data using the RU.

2. The terminal station according to claim 1, wherein one of the values of the plurality of IDs for random access indicates that the terminal station is not associated with the communication apparatus.

3. The terminal station according to claim 1, wherein the values of the plurality of IDs for random access include at least one of 0 and integers from 2008 to 2047.

4. The terminal station according to claim 1, wherein when the ID field indicates one of the plurality of IDs for random access, the ID field indicates one or more resource units (RUs), one of which is randomly selected by the terminal station.

5. The terminal station according to claim 1, wherein the control signal includes a common information field, and the common information field includes a trigger type field indicating a type of the control signal.

6. The terminal station according to claim 1, wherein the user specific field includes a Target RSSI field indicating target reception power of a signal transmitted in response to the control signal.

7. The terminal station according to claim 1, wherein when the ID field indicates one of the plurality of IDs for random access, the control signal includes a value corresponding to a traffic type of information transmitted through random access.

8. The terminal station according to claim 1, wherein each of the values of the plurality of IDs for random access is associated with communication condition information with the communication apparatus, wherein the communication condition information indicates at least one of an uplink transmission buffer amount, path loss, reception quality, received signal strength indicator (RSSI), and interference power.

9. The terminal station according to claim 1, wherein each of the values of the plurality of IDs for random access is associated with a type of information transmitted through random access, with a transmission power class, or with setting accuracy of transmission power.

10. The terminal station according to claim 1, wherein the user specific field includes an RU allocation field indicating the RU that is allocated to the terminal station.

11. A communication method implemented by a terminal station, the method comprising:

receiving from a communication apparatus a control signal including a user specific field, the user specific field including an ID field and indicating that a resource unit (RU) is available for the terminal station, wherein

the ID field indicates one of a plurality of Association IDs (AIDs) for identifying an associated terminal station or one of a plurality of IDs for random access,

values of the plurality of IDs for random access are different from any of

values of the plurality of AIDs, and

each of the values of the plurality of IDs for random access indicates a state of communication with the communication apparatus; and

transmitting uplink data, in response to the control signal, using the RU.

12. The method according to claim 11, wherein one of the values of the plurality of IDs for random access indicates that the terminal station is not associated with the communication apparatus.

13. The method according to claim 11, wherein the values of the plurality of IDs for random access include at least one of 0 and integers from 2008 to 2047.

14. The method according to claim 11, wherein when the ID field indicates one of the plurality of IDs for random access, the ID field indicates one or more resource units (RUs), one of which is randomly selected by the terminal station.

15. The method according to claim 11, wherein the control signal includes a common information field, and the common information field includes a trigger type field indicating a type of the control signal.

16. The method according to claim 11, wherein the user specific field includes a Target RSSI field indicating target reception power of a signal transmitted in response to the control signal.

17. The method according to claim 11, wherein when the ID field indicates one of the plurality of IDs for random access, the control signal includes a value corresponding to a traffic type of information transmitted through random access.

18. The method according to claim 11, wherein each of the values of the plurality of IDs for random access is associated with communication condition information with the communication apparatus, wherein the communication condition information indicates at least one of an uplink transmission buffer amount, path loss, reception quality, received signal strength indicator (RSSI), and interference power.

19. The method according to claim 11, wherein each of the values of the plurality of IDs for random access is associated with a type of information transmitted through random access, with a transmission power class, or with setting accuracy of transmission power.

20. The method according to claim 11, wherein the user specific field includes an RU allocation field indicating the RU that is allocated to the terminal station.