

METHOD AND APPARATUS FOR LOAD CONTROL ON WIRELESS COMMUNICATIONS NETWORK

TECHNICAL FIELD

[0001] The present invention relates to the field of wireless communications technologies,
5 and in particular, to a method and an apparatus for load control on a wireless communications network.

BACKGROUND

[0002] With the popularity of UMTS (Universal Mobile Telecommunications System, Universal Mobile Telecommunications System) networks and extensive application of smart
10 UEs (customer equipment (subscriber installation, user equipment), UEs have an increasingly greater impact on an RAN (Radio Access Network, radio access network).

[0003] When a UE requests access to a NodeB (base station), the UE sends an RRC (Radio Resource Control, radio resource control) connection request to the NodeB, the NodeB sends the received RRC connection request to an RNC (Radio Network Controller,
15 radio network controller), and the RNC chooses to reject or process the RRC connection request and instructs the NodeB to reject or allow access of the UE. When there are too many UEs that access one NodeB, the NodeB becomes a bottleneck of the entire UMTS network.

[0004] A method for load control on a UMTS network in the prior art is as follows: An RNC determines, according to load usage conditions of all NodeBs managed by the RNC, to
20 uniformly reject or process RRC connection requests of all NodeBs.

[0005] In the prior art, the RNC cannot distinctively process an RRC connection request of each NodeB or distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

SUMMARY

25 [0006] Embodiments of the present invention provide a method and an apparatus for load control on a wireless communications network, so that an RNC can distinctively perform

flow control on each NodeB according to a specific load usage condition of each NodeB.

[0007] In one aspect, a method for load control on a wireless communications network is provided, including:

receiving, by a radio network controller RNC, a radio resource control RRC connection request sent by a base station, and acquiring, by the RNC, a flow control level of the base station; and

choosing, by the RNC according to the flow control level of the base station, to reject or process the RRC connection request.

[0008] In another aspect, a method for load control on a wireless communications network is provided, including:

receiving, by a base station, a load status request sent by a radio network controller RNC; and

sending, by the base station, a load status report to the RNC, where the load status report carries load information of the base station, so as to enable the RNC to determine a flow control level of the base station according to the load information of the base station.

[0009] In another aspect, an apparatus for load control on a wireless communications network is provided, where the apparatus is arranged on a radio network controller RNC, and the apparatus specifically includes:

a base station flow control level acquiring module, configured to receive a radio resource control RRC connection request sent by a base station and acquire a flow control level of the base station; and

a control processing module, configured to choose, according to the flow control level of the base station acquired by the base station flow control level acquiring module, to reject or process the RRC connection request.

[0010] In another aspect, an apparatus for load control on a wireless communications network is provided, where the apparatus is arranged on a base station, and the apparatus specifically includes:

a load status request receiving module, configured to receive a load status request sent by a radio network controller RNC; and

a load status report sending module, configured to send a load status report to the RNC, where the load status report carries load information of the base station, so as to enable the RNC to determine a flow control level of the base station according to the load information of the base station.

[0011] As can be seen from the technical solutions provided in the embodiments of the

present invention, in the embodiments of the present invention, an RNC chooses, according to a flow control level of a NodeB, to reject or process the RRC connection request. In this way, the RNC can distinctively process an RRC connection request of each NodeB and distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. 1 is a processing flowchart of a method for load control on a wireless communications network according to Embodiment 1 of the present invention;

[0013] FIG. 2 is a processing flowchart of a method for load control on a wireless communications network according to Embodiment 2 of the present invention;

[0014] FIG. 3 is a schematic structural diagram of an apparatus for load control on a wireless communications network according to Embodiment 3 of the present invention;

[0015] FIG. 4 is a schematic structural diagram of another apparatus for load control on a wireless communications network according to Embodiment 3 of the present invention; and

[0016] FIG. 5 is a structural diagram of another apparatus for load control on a wireless communications network according to Embodiment 3 of the present invention.

DESCRIPTION OF EMBODIMENTS

Embodiment 1

[0017] A processing procedure of a method for load control on a wireless communications network according to this embodiment is as shown in FIG. 1, including:

[0018] 11. An RNC receives an RRC connection request sent by a NodeB, and the RNC acquires a flow control level of the NodeB.

[0019] For example, the RNC may receive a load status report that includes load information of the NodeB and is sent by the NodeB, and determine the flow control level of the NodeB according to the load information of the NodeB.

[0020] Further, the load information of the NodeB may be overload indication information or normal load indication information, and the RNC determines the flow control level of the NodeB according to the amount of the overload indication information and the normal load indication information that are received in a set time period.

[0021] 12. The RNC chooses, according to the flow control level of the NodeB, to reject or process the RRC connection request.

[0022] For example, the RNC compares the flow control level of the NodeB with a threshold and chooses, according to a comparison result, to reject or process the RRC connection request.

[0023] Further, the RNC may convert the flow control level of the NodeB into a flow control probability factor, where the flow control probability factor is proportional to the flow control level, and the flow control probability factor is an integer.

[0024] The RNC may generate a random number, where the random number is an integer; and reject the RRC connection request when the flow control probability factor is greater than the flow control probability factor; otherwise, process the RRC connection request.

[0025] As can be seen from the technical solution provided in the embodiment, in this embodiment, an RNC chooses, according to a flow control level of a NodeB, to reject or process the RRC connection request. In this way, the RNC can distinctively process an RRC connection request of each NodeB and distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

Embodiment 2

[0026] A processing procedure of a method for load control on a wireless communications network according to this embodiment is as shown in FIG. 2, including:

[0027] 21. A load status request and a load status report may be transmitted through a lub interface between an RNC and a NodeB in this embodiment of the present invention, where the load status request is used by the RNC to instruct the NodeB to report load status information, and the load status report is used by the NodeB to report the load status information to the RNC.

[0028] When the RNC needs to know the load status information of the NodeB, the RNC may send a load status request to the NodeB and start a load status statistics timer.

[0029] 22. After receiving the load status request, the NodeB sends a load status report to the RNC, where the load status report carries load information of the NodeB.

[0030] For example, after receiving the load status request, the NodeB determines, according to a set time interval, whether its load exceeds a preset threshold; if yes, sends a load status report that carries overload indication information to the RNC; otherwise, sends a load status report that carries normal load indication information to the RNC.

[0031] Further, the NodeB may determine, according to a set time interval (five seconds

for example), whether power resources used by the NodeB exceed a preset power resource congestion threshold and whether signaling resources used by the NodeB exceed a preset signaling resource congestion threshold.

[0032] When determining that the power resources used by the NodeB exceed the power resource congestion threshold and/or the signaling resources used by the NodeB exceed the signaling resource congestion threshold, the NodeB sends a load status report that carries the overload indication information to the RNC; otherwise, sends a load status report that carries the normal load indication information to the RNC.

[0033] 23. In a timing duration of the load status statistics timer, the RNC receives the load status report sent by the NodeB and determines a flow control level of the NodeB according to the load information of the NodeB carried in the load status report.

[0034] For example, the RNC may determine the flow control level of the NodeB according to the amount of the overload indication information and the normal load indication information that are received in a set time period. Specifically, in the timing duration of the load status statistics timer, the RNC adds a set value to a saved value of the flow control level of the NodeB when the load status report carries the overload indication information and reduces the saved value of the flow control level of the NodeB by the set value when the load status report carries the normal load indication information.

[0035] Exemplarily, a value range of the value of the flow control level of the NodeB may be 0–10 that indicate 10 flow control levels of the NodeB. The set value may be 1.

[0036] 24. The RNC may compare the flow control level of the NodeB with a threshold and choose, according to a comparison result, to reject or process the RRC connection request.

[0037] Further, the RNC may convert the flow control level of the NodeB into a flow control probability factor, where the flow control probability factor is proportional to the flow control level, and the flow control probability factor is an integer, for example, it may be an integer between 0 and 100.

[0038] A random number is used as the threshold in this embodiment of the present invention because an RRC connection request that is received by the NodeB and sent by a mobile terminal is random. The RNC generates a random number, where the random number is an integer, for example, it may be an integer between 0 and 100. When the flow control probability factor is greater than the random number, the RRC connection request is rejected; otherwise, the RRC connection request is processed, and the NodeB is instructed to accept an access request of the mobile terminal.

[0039] Further, in the preceding 21, a load status termination message may further be transmitted through the lub interface between the RNC and the NodeB, where the load status termination message is used by the RNC to instruct the NodeB to stop reporting the load status information.

5 [0040] Therefore, in the preceding 23, after the timing duration of the load status statistics timer expires, the RNC stops receiving the load status report after sending the load status termination message to the NodeB. After receiving the load status termination message sent by the RNC, the NodeB stops sending the load status report to the RNC.

[0041] The RNC saves the last acquired value of the flow control level of the NodeB.
10 According to the preceding processing procedure, the RNC may acquire and save values of flow control levels of all NodeBs managed by the RNC.

[0042] Further, in the preceding 21, a congestion statistics interval timer may further be started when the RNC starts the load status statistics timer in this embodiment of the present invention, where a timing duration of the congestion statistics interval timer is shorter than
15 the timing duration of the load status statistics timer.

[0043] Therefore, in the preceding 23, before the congestion statistics interval timer expires, the RNC does not process the received load status report sent by the NodeB. After the congestion statistics interval timer expires and before the load status statistics timer expires, the received load status report sent by the NodeB is processed so as to acquire the
20 overload indication information or the normal load indication information that is carried in the load status report.

[0044] The congestion statistics interval timer is configured to set a time interval for performing statistics collection on the load status information of the NodeB, so as to prevent the NodeB from frequently and repeatedly reporting the overload indication information in a
25 relatively short duration.

[0045] As can be seen from the technical solution provided in the embodiment, in this embodiment, an RNC perceives a load usage condition of a NodeB according to a received load status report sent by the NodeB and chooses, according to the load usage condition of the NodeB, to reject or process the RRC connection request. In this way, the RNC can
30 distinctively process an RRC connection request of each NodeB and distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

[0046] An RNC may flexibly control a statistics duration and a statistics time interval of a load usage condition of a NodeB by arranging a load status statistics timer and a congestion statistics interval timer, thereby preventing the NodeB from frequently and repeatedly

reporting overload indication information in a relatively short duration. The NodeB may flexibly choose, according to a condition of power resources or signaling resources used by the NodeB, to send a load status report that carries overload indication information or normal load indication information to the RNC.

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Embodiment 3

[0047] This embodiment provides an apparatus for load control on a wireless communications network, where the apparatus may be arranged on an RNC, a specific structure of the apparatus is as shown in FIG. 3, and the apparatus specifically includes:

10 a flow control level acquiring module 31, configured to receive a radio resource control RRC connection request sent by a NodeB and acquire a flow control level of the NodeB; and

a control processing module 32, configured to choose, according to the flow control level of the NodeB acquired by the flow control level acquiring module, to reject or process the RRC connection request.

15 **[0048]** As can be seen from the technical solution provided in the embodiment, in this embodiment, an RNC chooses, according to a flow control level of a NodeB, to reject or process the RRC connection request. In this way, the RNC can distinctively process an RRC connection request of each NodeB and distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

20 **[0049]** This embodiment further provides another apparatus for load control on a wireless communications network, where the apparatus may be arranged on an RNC, a specific structure of the apparatus is as shown in FIG. 4, and the apparatus specifically includes:

25 a flow control level acquiring module 41, configured to receive a radio resource control RRC connection request sent by a NodeB and acquire a flow control level of the NodeB; and

a control processing module 42, configured to compare the flow control level of the NodeB acquired by the flow control level acquiring module 41 with a threshold, and choose, according to a comparison result, to reject or process the RRC connection request.

[0050] Specifically, the flow control level acquiring module 41 may include:

30 a load status report receiving module 411, configured to receive a load status report sent by the NodeB, where the load status report carries load information of the NodeB; and

a flow control level determining module 412, configured to determine a flow

control level of the base station according to the load information of the NodeB.

[0051] Further, the flow control level determining module 412 may include:

a timing controlling module 4121, configured to send a load status request to the NodeB and start a load status statistics timer; and

5 a calculation processing module 4122, configured to determine the flow control level of the NodeB according to the amount of overload indication information and normal load indication information that are received in a timing duration of the load status statistics timer. Specifically, in the timing duration of the load status statistics timer, a load status report sent by the NodeB according to a set time interval is received; and the RNC adds a set
10 value to a saved value of the flow control level of the NodeB when the load status report carries the overload indication information, and reduces the value of the flow control level of the NodeB by the set value when the load status report carries the normal load indication information. Exemplarily, a value range of the value of the flow control level of the NodeB may be 0–10 that indicate 10 flow control levels of the NodeB. The set value may be 1. When
15 a value of a flow control level that is obtained through calculation is greater than 10, the value of the flow control value is set to 10; and when a value of a flow control level that is obtained through calculation is less than 0, the value of the flow control value is set to 0.

[0052] Further, the timing controlling module 4121 is further configured to, after the load status statistics timer expires, send a load status termination message to the NodeB.

20 **[0053]** The calculation processing module 4122 is further configured to stop receiving the load status report and save the last acquired value of the flow control level of the NodeB.

[0054] Further, the timing controlling module 4121 is further configured to start a congestion statistics interval timer when starting the load status statistics timer, where a timing duration of the congestion statistics interval timer is shorter than the timing duration
25 of the load status statistics timer.

[0055] The calculation processing module 4122 is further configured to, before the congestion statistics interval timer expires, not process the received load status report sent by the NodeB; and after the congestion statistics interval timer expires, process the received load status report sent by the NodeB.

30 **[0056]** Specifically, the control processing module 42 may include:

a comparison processing module 421, configured to compare the flow control level of the NodeB with a threshold; and

a choosing processing module 422, configured to choose, according to a comparison result acquired by the comparison processing module, to reject or process the

RRC connection request.

[0057] Further, the comparison processing module 421 is further configured to convert the flow control level of the NodeB into a flow control probability factor, where the flow control probability factor is proportional to the flow control level, and the flow control probability factor is an integer between 0 and 100.

[0058] The choosing processing module 422 is further configured to generate a random number, where the random number is an integer between 0 and 100; reject the RRC connection request when the flow control probability factor acquired by the conversion processing module is greater than the random number; otherwise, process the RRC connection request.

[0059] This embodiment further provides another apparatus for load control on a wireless communications network, where the apparatus may be arranged on a NodeB, a specific structure of the apparatus is as shown in FIG. 5, and the apparatus specifically includes:

a load status request receiving module 51, configured to receive a load status request sent by an RNC; and

a load status report sending module 52, configured to send a load status report to the RNC, where the load status report carries load information of the NodeB, so as to enable the RNC to determine a flow control level of the NodeB according to the load information of the NodeB.

[0060] Specifically, the load status report sending module 52 is further configured to, after the load status request is received, determine, according to a set time interval, whether load of the NodeB exceeds a preset threshold; if yes, send a load status report that carries overload indication information to the RNC; otherwise, send a load status report that carries normal load indication information to the RNC.

[0061] Further, the load status report sending module 52 may determine, according to a set time interval (five seconds for example) after the load status request is received, whether power resources used by the base station exceed a preset power resource congestion threshold and whether signaling resources used by the base station exceed a preset signaling resource congestion threshold, where the signaling resources may be signaling board CPUs.

[0062] When determining that the power resources used by the base station exceed the power resource congestion threshold and/or the signaling resources used by the base station exceed the signaling resource congestion threshold, the load status report sending module 52 sends a load status report that carries the overload indication information to the RNC; otherwise, sends a load status report that carries the normal load indication information to the

RNC.

[0063] Further, after receiving a load status termination message sent by the RNC, the load status report sending module 52 stops sending a load status report to the RNC.

5 [0064] In conclusion, as can be seen from the technical solution provided in the embodiment of the present invention, in this embodiment of the present invention, an apparatus for load control is arranged on an RNC, and the apparatus for load control perceives a load usage condition of a NodeB according to a received load status report sent by the NodeB and chooses, according to the load usage condition of the NodeB, to reject or process the RRC connection request. In this way, the RNC can distinctively process an RRC
10 connection request of each NodeB and distinctively perform flow control on each NodeB according to a specific load usage condition of each NodeB.

[0065] The apparatus for load control in the RNC may flexibly control a statistics duration and a statistics time interval of a load usage condition of a NodeB by arranging a load status statistics timer and a congestion statistics interval timer, thereby preventing the
15 NodeB from frequently and repeatedly reporting overload indication information in a relatively short duration.

[0066] In this embodiment of the present invention, an apparatus for load control is arranged on a NodeB, and after receiving a load status request sent by an RNC, the apparatus for load control sends a load status report that carries load information of the NodeB to the
20 RNC, so as to enable the RNC to determine a flow control level of the NodeB according to the load information of the NodeB.

[0067] The apparatus for load control on the NodeB may flexibly choose, according to a condition of power resources or signaling resources used by the NodeB, to send a load status report that carries overload indication information or normal load indication information to
25 the RNC.

[0068] A specific process of using the apparatus in this embodiment of the present invention to perform load control is similar to the foregoing method embodiments, and therefore no further details are provided herein.

[0069] A person of ordinary skill in the art may understand that all or a part of the
30 processes of the methods in the foregoing embodiments may be implemented by a computer program instructing relevant hardware. The program may be stored in a computer readable storage medium. When the program runs, the processes of the foregoing methods in the embodiments are performed. The storage medium may be a magnetic disk, an optical disk, a read-only memory (Read-Only Memory, ROM), or a random access memory (Random

Access Memory, RAM), and so on.

[0070] The foregoing descriptions are merely exemplary specific embodiments of the present invention, but are not intended to limit the protection scope of the present invention. Any variation or replacement readily figured out by a person skilled in the art within the technical scope disclosed in the present invention shall fall within the protection scope of the present invention. Therefore, the protection scope of the present invention shall be subject to the protection scope of the claims.

CLAIMS

What is claimed is:

1. A method for load control on a wireless communications network, comprising:

5 receiving, by a radio network controller RNC, a radio resource control RRC connection request sent by a base station, and acquiring, by the RNC, a flow control level of the base station; and

choosing, by the RNC according to the flow control level of the base station, to reject or process the RRC connection request.

10 2. The method for load control on a wireless communications network according to claim 1, wherein the acquiring, by the RNC, a flow control level of the base station comprises:

receiving, by the RNC, a load status report sent by the base station, wherein the load status report carries load information of the base station, and determining, by the RNC, the flow control level of the base station according to the load information of the base station.

15 3. The method for load control on a wireless communications network according to claim 2, wherein the load information of the base station comprises overload indication information or normal load indication information, and the determining, by the RNC, the flow control level of the base station according to the load information of the base station comprises:

20 determining, by the RNC, the flow control level of the base station according to the amount of the overload indication information and the normal load indication information that are received in a set time period.

4. The method for load control on a wireless communications network according to claim 3, wherein the determining, by the RNC, the flow control level of the base station according to the amount of the overload indication information and the normal load indication information that are acquired in a set time period comprises:

25 starting, by the RNC, a load status statistics timer; and

in a timing duration of the load status statistics timer, adding, by the RNC, a set value to a saved value of the flow control level of the base station when receiving the overload indication information; and reducing, by the RNC, the saved value of the flow control level of the base station by the set value when receiving the normal load indication information.

30 5. The method for load control on a wireless communications network according to claim 2, further comprising:

when starting the load status statistics timer, further starting, by the RNC, a congestion

statistics interval timer, wherein a timing duration of the congestion statistics interval timer is shorter than the timing duration of the load status statistics timer; and

before the congestion statistics interval timer expires, not processing, by the RNC, the received load status report sent by the base station; and after the congestion statistics interval timer expires, processing, by the RNC, the received load status report sent by the base station.

6. The method for load control on a wireless communications network according to any one of claims 1 to 5, wherein the choosing, by the RNC according to the flow control level of the base station, to reject or process the RRC connection request comprises:

comparing, by the RNC, the flow control level of the base station with a threshold and choosing, according to a comparison result, to reject or process the RRC connection request.

7. The method for load control on a wireless communications network according to claim 6, wherein the comparing, by the RNC, the flow control level of the base station with a threshold and choosing, according to a comparison result, to reject or process the RRC connection request comprises:

converting, by the RNC, the flow control level of the base station into a flow control probability factor, wherein the flow control probability factor is proportional to the flow control level, and the flow control probability factor is an integer; and

generating, by the RNC, a random number, wherein the random number is an integer; rejecting the RRC connection request when the flow control probability factor is greater than the random number; otherwise, processing the RRC connection request.

8. A method for load control on a wireless communications network, comprising:

receiving, by a base station, a load status request sent by a radio network controller RNC; and

sending, by the base station, a load status report to the RNC, wherein the load status report carries load information of the base station, so as to enable the RNC to determine a flow control level of the base station according to the load information of the base station.

9. The method for load control on a wireless communications network according to claim 8, further comprising:

after receiving the load status request, determining, by the base station according to a set time interval, whether its load exceeds a preset threshold; if yes, sending a load status report that carries overload indication information to the RNC; otherwise, sending a load status report that carries normal load indication information to the RNC.

10. An apparatus for load control on a wireless communications network, specifically comprising:

a flow control level acquiring module, configured to receive a radio resource control RRC

connection request sent by a base station and acquire a flow control level of the base station; and
a control processing module, configured to choose, according to the flow control level of the base station acquired by the flow control level acquiring module, to reject or process the RRC connection request.

11. The apparatus for load control on a wireless communications network according to claim 10, wherein the flow control level acquiring module comprises:

a receiving module, configured to receive a load status report sent by the base station, wherein the load status report carries load information of the base station; and

a flow control level determining module, configured to determine the flow control level of the base station according to the load information of the base station received by the receiving module.

12. The apparatus for load control on a wireless communications network according to claim 11, wherein the flow control level determining module is further configured to:

start a load status statistics timer; and

in a timing duration of the load status statistics timer, add a set value to a saved value of the flow control level of the base station when the load status report received by the receiving module carries overload indication information; and reduce the saved value of the flow control level of the base station by the set value when the load status report received by the receiving module carries normal load indication information.

13. The apparatus for load control on a wireless communications network according to any one of claims 10 to 12, wherein the control processing module comprises:

a comparison processing module, configured to compare the flow control level of the base station with a threshold; and

a choosing processing module, configured to choose, according to a comparison result acquired by the comparison processing module, to reject or process the RRC connection request.

14. The apparatus for load control on a wireless communications network according to claim 13, wherein:

the comparison processing module is further configured to convert the flow control level of the base station into a flow control probability factor, wherein the flow control probability factor is proportional to the flow control level, and the flow control probability factor is an integer, generate a random number, wherein the random number is an integer, and compare the flow control probability factor with the random number; and

the choosing processing module is further configured to reject the RRC connection request when the flow control probability factor is greater than the random number; otherwise, process the RRC connection request.

15. An apparatus for load control on a wireless communications network, specifically comprising:

a receiving module, configured to receive a load status request sent by a radio network controller RNC; and

5 a sending module, configured to send a load status report to the RNC, wherein the load status report carries load information of the base station, so as to enable the RNC to determine a flow control level of the base station according to the load information of the base station.

10 16. The apparatus for load control on a wireless communications network according to claim 15, wherein the sending module is further configured to determine, according to a set time interval, whether load of the base station exceeds a preset threshold; if yes, send a load status report that carries overload indication information to the RNC; otherwise, send a load status report that carries normal load indication information to the RNC.