TITLE METHOD AND APPARATUS FOR OFFLOADING TRAFFIC FROM CELLULAR TO WLAN USING ASSISTANCE INFORMATION

BACKGROUND:

Field:

[0001] Embodiments of the invention relate to offloading of traffic by a user equipment from a first network to a second network.

Description of the Related Art:

[0002] Long-term Evolution (LTE) is a standard for wireless communication that seeks to provide improved speed and capacity for wireless communications by using new modulation/signal processing techniques. The standard was proposed by the 3rd Generation Partnership Project (3GPP), and is based upon previous network technologies. Since its inception, LTE has seen extensive deployment in a wide variety of contexts involving the communication of data.

[0003] Traffic offloading in the telecommunication field generally relates to using complementary network technologies to transmit communication that was planned to be transmitted by a first network.

SUMMARY:

[0004] According to a first ~~embodiment~~aspect, a method may comprise receiving, by a user equipment, offloading assistance information from a network element of a first network. The method can comprise receiving, by the user equipment, at least one offloading related policy for offloading traffic to at least one second network. The offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account. The method can also comprise applying the offloading related policy in the user equipment if the policy validity criterion is met, wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.

[0005] In the method of the first embodiment, the offloading assistance information may comprise load information of the first network.

[0006] In the method of the first embodiment, the offloading assistance information may comprise an indication of whether a load of the first network is high, normal, or low.

[0007] In the method of the first embodiment, the offloading assistance information may comprise load information in the form of a value or percentage.

[0008] In the method of the first embodiment, the offloading related policy may comprise identification information of the at least one second network and related offloading priority information.

[0009] In the method of the first embodiment, at least two offloading related policies may be received and wherein only one of the received offloading related policies may be applied at a time. The policy validity criterion of each policy may be exclusive and may allow the applying of only one policy at a time for a given traffic type.

[0010] In the method of the first embodiment, the network element of the first network may be a base station.

[0011] In the method of the first embodiment, the offloading related policy for offloading traffic from the first network to the at least one second network may be received from a server.

[0012] In the method of the first embodiment, the server may comprise an access network discovery and selection function.

[0013] In the method of the first embodiment, the first network may be an access network.

[0014] In the method of the first embodiment, the second network may be a Wireless Local Area Network.

[0015] According to a second ~~embodiment~~aspect, an apparatus comprises first receiving means for receiving offloading assistance information from a network element of a first network. The apparatus can also comprise second receiving means for receiving at least one offloading related policy for offloading traffic to at least one second network. The offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account. The apparatus can also comprise applying means for applying the offloading related policy in the apparatus if the policy validity criterion is met, wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.

[0016] In the apparatus of the second embodiment, the offloading assistance information may comprise load information of the first network.

[0017] In the apparatus of the second embodiment, the offloading assistance information may comprise an indication of whether a load of the first network is high, normal, or low.

[0018] In the apparatus of the second embodiment, the offloading assistance information may comprise load information in the form of a value or percentage.

[0019] In the apparatus of the second embodiment, the offloading related policy may comprise identification information of the at least one second network and related offloading priority information.

[0020] In the apparatus of the second embodiment, at least two offloading related policies may be received and wherein only one of the received offloading related policies may be applied at a time. The policy validity criterion of each policy may be exclusive and may allow the applying of only one policy at a time for a given traffic type.

[0021] In the apparatus of the second embodiment, the network element of the first network may be a base station.

[0022] In the apparatus of the second embodiment, the offloading related policy for offloading traffic from the first network to the at least one second network may be received from a server.

[0023] In the apparatus of the second embodiment, the server may comprise an access network discovery and selection function.

[0024] In the apparatus of the second embodiment, the first network may be an access network.

[0025] In the apparatus of the second embodiment, the second network may be a Wireless Local Area Network.

[0026] In the apparatus of the second embodiment, the apparatus may be a user equipment.

[0027] According to the third ~~embodiment~~aspect, a computer program product can be embodied on a non-transitory computer readable medium. The computer program product can be configured to control a processor to perform a process comprising receiving, by a user equipment, offloading assistance information from a network

element of a first network. The process can also comprise receiving, by the user equipment, at least one offloading related policy for offloading traffic to at least one second network. The offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account. The process can also comprise applying the offloading related policy in the user equipment if the policy validity criterion is met, wherein the receiving comprising receiving at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

[0028] According to a fourth aspect ~~embodiment~~, a method can comprise transmitting, by a network element, a policy for offloading traffic from a first network to at least one second network to a user equipment. The policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting comprising transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

[0029] In the method of the fourth embodiment, the offloading related policy may comprise identification information of the at least one second network and related offloading priority information.

[0030] In the method of the fourth embodiment, the transmitting may comprise transmitting at least two policies for offloading traffic. The policy validity criterion of each policy may be exclusive and may allow the applying of only one policy at a time for a given traffic type.

[0031] In the method of the fourth embodiment, the network element may comprise a server.

[0032] In the method of the fourth embodiment, the server may comprise an access network discovery and selection function.

[0033] In the method of the fourth embodiment, the first network may be an access network.

[0034] In the method of the fourth embodiment, the second network may be a Wireless Local Area Network.

[0035] According to a fifth aspectembodiment, an apparatus can comprise transmitting means for transmitting a policy for offloading traffic from a first network to at least one second network to a user equipment. The policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting means is for transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

[0036] In the apparatus of the fifth embodiment, the offloading related policy may comprise identification information of the at least one second network and related offloading priority information.

[0037] In the apparatus of the fifth embodiment, the transmitting means may be for transmitting at least two policies for offloading traffic. The policy validity criterion of each policy may be exclusive and may allow the applying of only one policy at a time for a given traffic type.

[0038] In the apparatus of the fifth embodiment, the apparatus may comprise a server.

[0039] In the apparatus of the fifth embodiment, the server may comprise an access network discovery and selection function.

[0040] In the apparatus of the fifth embodiment, the first network may be an access network.

[0041] In the apparatus of the fifth embodiment, the second network may be a Wireless Local Area Network.

[0042] According to a sixth aspect~~embodiment~~, a computer program product can be embodied on a non-transitory computer readable medium. The computer program product can be configured to control a processor to perform a process comprising transmitting, by a network element, a policy for offloading traffic from a first network to at least one second network to a user equipment, wherein the policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting comprising transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

[0043] According to a seventh aspect ~~embodiment~~, a system can comprise a first apparatus comprising first receiving means for receiving offloading assistance information from a network element of a first network. The first apparatus can comprise second receiving means for receiving at least one offloading related

policy for offloading traffic to at least one second network, wherein the offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account. The first apparatus can also comprise applying means for applying the offloading related policy in the first apparatus if the policy validity criterion is met. The system can also comprise a second apparatus comprising

transmittingmeans for transmitting the at least one offloading related policy for offloading traffic from the first network to the at least one second network to the first apparatus, wherein the transmitting means is for transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

[0044] According to an eighth embodiment, an apparatus may comprise at least one processor and at least one memory comprising computer program code. The at least one memory and the computer program code may be configured to, with the at least one processor, cause the apparatus at least to receive offloading assistance information from a network element of a first network. The apparatus may also receive at least one offloading related policy for offloading traffic to at least one second network. The offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account. The apparatus may also apply the offloading related policy in the apparatus if the policy validity criterion is met.

[0045] In the apparatus of the eighth embodiment, the offloading assistance information may comprise load information of the first network.

[0046] In the apparatus of the eighth embodiment, the offloading assistance information may comprise an indication of whether a load of the first network is high, normal, or low.

[0047] In the apparatus of the eighth embodiment, the offloading assistance information may comprise load information in the form of a value or percentage.

[0048] In the apparatus of the eighth embodiment, the offloading related policy may comprise identification information of the at least one second network and related offloading priority information.

[0049] In the apparatus of the eighth embodiment, at least two offloading related policies may be received and wherein only one of the received offloading related policies may be applied at a time. The policy validity criterion of each policy may be exclusive and may allow the applying of only one policy at a time for a given traffic type.

[0050] In the apparatus of the eighth embodiment, the network element of the first network may be a base station.

WE CLAIM:

1. A method, comprising:

receiving, by a user equipment, offloading assistance information from a network element of a first network;

receiving, by the user equipment, at least one offloading related policy for offloading traffic to at least one second network, wherein the offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account; and

applying the offloading related policy in the user equipment if the policy validity criterion is met wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.

2. The method according to claim 1, wherein the offloading assistance information comprises load information of the first network.

3. The method according to claim 1 or 2, wherein the offloading assistance information comprises an indication of whether a load of the first network is high, normal, or low.

4. The method according to claim 1 or 2, wherein the offloading assistance information comprises load information in the form of a value or percentage.

5. The method according to any of claims 1-4, wherein the offloading related policy comprises identification information of the at least one second network and related offloading priority information.

~~6. The method according to any of claims 1-5, wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.~~

6~~7~~. The method according to any of claims 1-5~~6~~, wherein the network element of the first network is a base station.

78. The method according to any of claims 1-67, wherein the offloading related policy for offloading traffic from the first network to the at least one second network is received from a server.

89. The method according to claim 78, wherein the server comprises an access network discovery and selection function.

910. The method according to any of claims 1-81-9, wherein the first network is an access network.

1011. The method according to any of claims 1-910, wherein the second network is a Wireless Local Area Network.

1112. An apparatus, comprising:

first receiving means for receiving offloading assistance information from a network element of a first network;

second receiving means for receiving at least one offloading related policy for offloading traffic to at least one second network, wherein the offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account; and

applying means for applying the offloading related policy in the apparatus if the policy validity criterion is met, wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.

1213. The apparatus according to claim 1112, wherein the offloading assistance information comprises load information of the first network.

1314. The apparatus according to claim 11 or 12-or 13, wherein the offloading assistance information comprises an indication of whether a load of the first network is high, normal, or low.

1415. The apparatus according to claim 11 or 12-or 13, wherein the offloading assistance information comprises load information in the form of a value

or percentage.

1516. The apparatus according to any of claims 11-14 12-15, wherein the offloading related policy comprises identification information of the at least one second network and related offloading priority information.

~~17. The apparatus according to any of claims 12-16, wherein at least two offloading related policies are received and wherein only one of the received offloading related policies is applied at a time.~~

1618. The apparatus according to any of claims 11-1512-17, wherein the network element of the first network is a base station.

1719. The apparatus according to any of claims 11-1612-18, wherein the offloading related policy for offloading traffic from the first network to the at least one second network is received from a server.

1820. The apparatus according to claim 1719, wherein the server comprises an access network discovery and selection function.

1921. The apparatus according to any of claims 11-1812-20, wherein the first network is an access network.

2022. The apparatus according to any of claims 11-1912-21, wherein the second network is a Wireless Local Area Network.

2123. The apparatus according to any of claims 11-2012-22, wherein the apparatus is a user equipment.

2224. A computer program product, embodied on a non-transitory computer readable medium, the computer program product configured to control a processor to perform a process, comprising:

receiving, by a user equipment, offloading assistance information from a network element of a first network;

receiving, by the user equipment, at least one offloading related policy for offloading traffic to at least one second network, wherein the offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account; and

applying the offloading related policy in the user equipment if the policy validity criterion is met wherein the receiving comprising receiving at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

2325. A method, comprising:

transmitting, by a network element, a policy for offloading traffic from a first network to at least one second network to a user equipment, wherein the policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting comprising transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

2426. The method according to claim 2325, wherein the offloading related policy comprises identification information of the at least one second network and related offloading priority information.

~~27. The method according to claim 25 or 26, wherein the transmitting comprising transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.~~

2528. The method according to any of the claims 2325 to 2427, wherein the network element comprises a server.

2629. The method according to claim 2528, wherein the server comprises an access network discovery and selection function.

2730. The method according to any of the claims 23 to 2625 to 29, wherein

the first network is an access network.

2831. The method according to any of the claims 23 to 2725 to 30, wherein the second network is a Wireless Local Area Network.

2932. An apparatus, comprising:

transmitting means for transmitting a policy for offloading traffic from a first network to at least one second network to a user equipment, wherein the policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting means is for transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.

3033. The apparatus according to claim 2932, wherein the offloading related policy comprises identification information of the at least one second network and related offloading priority information.

~~34. The apparatus according to claim 32 or 33, wherein the transmitting means is for transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time~~.

3135. The apparatus according to any of the claims 2932 to 3034, wherein the apparatus comprises a server.

3236. The apparatus according to claim 3135, wherein the server comprises an access network discovery and selection function.

3337. The apparatus according to any of the claims 2932 to 3236, wherein the first network is an access network.

3438. The apparatus according to any of the claims 2932 to 3337, wherein the second network is a Wireless Local Area Network.

3539. A computer program product, embodied on a non-transitory computer-readable medium, the computer program product configured to control a processor to perform a process, comprising:

transmitting, by a network element, a policy for offloading traffic from a first network to at least one second network to a user equipment, wherein the policy for offloading traffic comprises a policy validity criterion taking offloading assistance information from the first network into account, wherein the transmitting comprising transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a tim.

3640. A system comprising:

a first apparatus comprising:

first receiving means for receiving offloading assistance information from a network element of a first network;

second receiving means for receiving at least one offloading related policy for offloading traffic to at least one second network, wherein the offloading related policy comprises a policy validity criterion that takes the offloading assistance information into account; and

applying means for applying the offloading related policy in the first apparatus if the policy validity criterion is met; and

a second apparatus comprising:

transmitting means for transmitting the at least one offloading related policy for offloading traffic from the first network to the at least one second network to the first apparatus, wherein the transmitting means is for transmitting at least two policies for offloading traffic, wherein the policy validity criterion of each policy are exclusive and allow the applying of only one policy at a time.