Claims

What is claimed is:

1. A mobile data offload method for associating a mobile client device with a wireless access point, the method comprising:

transmitting a first authentication request from the mobile client device to the wireless access point via a first network, the first network being a Cellular Wide Area radio communication network;

transmitting a second authentication request from the mobile client device to the wireless access point via a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network;

upon receiving at least one of the first authentication request and the second authentication request at the wireless access point, transmitting an authentication response from the wireless access point to the mobile client device via the second network; and

upon receiving the authentication response at the mobile client device, associating the mobile client device with the wireless access point.

2. The method of claim 1, wherein transmitting the first authentication request via the first network comprises:

transmitting the first authentication request from the mobile client device to an offload server via the first network; and

transmitting the first authentication request from the offload server to the wireless access point via the first network.

3. The method of claim 1 or 2, wherein

the sequence of transmitting the first authentication request and transmitting the second authentication request is interchangeable.

4. The method of any one of claims 1 to 3, wherein associating the mobile client device with the wireless access point comprises:

upon receiving the authentication response at the mobile client, transmitting a first association request from the mobile client device to the wireless access point via the first network;

transmitting a second association request from the mobile client device to the wireless access point via the second network;

upon receiving at least one of the first association request and the second association request at the wireless access point, transmitting an association response from the wireless access point to the mobile client via the second network.

5. The method of claim 4, wherein transmitting the first association request via the first network comprises:

transmitting the first association request from the mobile client device to an offload server via the first network; and

transmitting the first association request from the offload server to the wireless access point via the first network;

6. The method of claim 4 or 5, wherein

the sequence of transmitting the first association request and transmitting the second association request is interchangeable.

7. The method of any one of claims 1 to 3, further comprising:

after transmitting the authentication response from the wireless access point for a predetermined time period, transmitting one or more association responses continuously from the wireless access point to the mobile client via the second network;

transmitting an association request from the mobile client device to the wireless access point;

determining whether the mobile client device receives the one or more association responses after the transmission of the association request; and

associating the mobile client device with the wireless access point, if it is determined that the mobile client device receives the one or more association responses after the transmission of the association request.

8. The method of any one of claims 1 to 7, further comprising:

before transmitting the first authentication request and the second authentication request from the mobile client device, transmitting a first probe request from the mobile client device to the wireless access point via the first network;

transmitting a second probe request from the mobile client device to the wireless access point via the second network; and

upon receiving at least one of the first probe request and the second probe request at the wireless access point, transmitting a probe response from the wireless access point to the mobile client via the second network.

9. The method of claim 8, wherein transmitting the first probe request via the first network comprises:

transmitting the first probe request from the mobile client device to an offload server via the first network; and

transmitting the first probe request from the offload server to the wireless access point via the first network;

10. The method of any one of claims 1 to 9,

wherein the Cellular Wide Area radio communication network comprises one of GSM, GPRS, EDGE, 3G, 4G, LTE, W-CDMA.

11. The method of any one of claims 1 to 10,

wherein the Short Range radio communication network comprises one of wireless LAN, WiFi; and

the Metropolitan Area System radio communication network comprises one of wireless MAN, WiMAX, WiBro.

12. A mobile client device, comprising:

a first interface providing access to a first network, the first network being a Cellular Wide Area radio communication network;

a second interface providing access to a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a transceiver configured to transmit one or more probe requests, authentication requests and/or association requests to a wireless access point both through the first interface via the first network and through the second interface via the second network in a mobile data offload process, and the transceiver is configured to receive responses from the wireless access point through the second interface via the second network.

13. The mobile client device of claim 12, further comprising:

a determining circuit configured to determine whether the mobile client device receives an association response after the transmission of the association request.

14. A wireless access point comprising a plurality of wireless transceivers, wherein upon receiving one or more probe requests, authentication requests and/or association requests from an offload server via a first network and/or from a mobile client device via a second network in a mobile data offload process, the wireless transceivers are configured to transmit a probe response, an authentication response and/or an association response to the mobile client device via the second network;

wherein the first network is a Cellular Wide Area radio communication network, and the second network is a Short Range radio communication network or a Metropolitan Area System radio communication network.

15. The wireless access point of claim 14,

wherein the wireless access point is a long range WiFi access point providing a radio range of more than 100m.

16. The wireless access point of claim 14 or 15, further comprising

a virtual wireless transceiver configured to route the probe requests, authentication requests and/or association requests to a desired wireless transceiver determined out of the plurality of wireless transceivers.

17. The wireless access point of claim 14 or 15, further comprising

a driver configured to route the probe requests, authentication requests and/or association requests to a desired wireless transceiver determined out of the plurality of wireless transceivers.

18. The wireless access point of claim 16 or 17,

wherein the desired wireless transceiver is determined based on the location of mobile client device.

19. A mobile data offload method, comprising:

transmitting uplink data from a mobile client device via a first network, the first network being a Cellular Wide Area radio communication network; and

transmitting downlink data to the mobile client device via a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network.

20. The method of claim 19, comprising:

initiating the transmission of downlink data from a wireless access point to the mobile client device using a two-way handshake or a four-way handshake.

21. The method of claim 20, further comprising:

transmitting a data packet from the wireless access point to the mobile client device via the second network;

faking, at the wireless access point, an ACK packet as if the ACK packet originates from the mobile client device; and

sending the ACK packet to a desired wireless transceiver of the wireless access point.

22. The method of claim 21, further comprising:

before transmitting the data packet, transmitting a RTS (Ready to send) message from the wireless access point to the mobile client device via the second network;

faking, at the wireless access point, a CTS (Clear to send) message as if the CTS message originates from the mobile client device; and

sending the CTS message to a desired wireless transceiver of the wireless access point.

23. The method of claim 21 or 22, further comprising:

upon receiving the data packet at the mobile client device, intercepting transmission of a data response packet from the mobile client device to the wireless access point via the second network; and

transmitting the data response packet from the mobile client device to the wireless access point via the first network.

24. The method of any one of claims 19 to 23, further comprising

intercepting, at the mobile client device, the transmission of the uplink data via the second network.

25. The method of claim 23 or 24, wherein transmitting the data response packet or the uplink data via the first network comprises tunneling the data response packet or the uplink data to the wireless access point using a tunneling protocol.

26. The method of any one of claims 19 to 25,

wherein the Cellular Wide Area radio communication network comprises one of GSM, GPRS, EDGE, 3G, 4G, LTE, W-CDMA.

27. The method of any one of claims 19 to 26,

wherein the Short Range radio communication network comprises one of wireless LAN, WiFi, and

the Metropolitan Area System radio communication network comprises one of wireless MAN, WiMAX and WiBro.

28. A mobile client device, comprising:

a first interface providing access to a first network, the first network being a Cellular Wide Area radio communication network;

a second interface providing access to a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network;

a transceiver configured to transmit uplink data to the wireless access point through the first interface via the first network, and to receive downlink data from the wireless access point through the second interface via the second network; and

an interception circuit configured to intercept uplink data to be transmitted to the wireless access point via the second network.

29. A wireless access point, comprising:

a plurality of wireless transceivers configured to transmit downlink data to a mobile client device via a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a virtual wireless transceiver configured to fake one or more packets as if the packets originate from the mobile client device, and to send the faked packets to a desired wireless transceiver determined out of the plurality of wireless transceivers.

30. A wireless access point, comprising:

a plurality of wireless transceivers configured to transmit downlink data to a mobile client device via a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a driver configured to fake one or more packets as if the packets originate from the mobile client device, and to send the faked packets to a desired wireless transceiver determined out of the plurality of wireless transceivers.

Claims

What is claimed is:

1. A mobile data offload method for associating a mobile client device with a wireless access point, the method comprising:

transmitting a first authentication request from the mobile client device to the wireless access point via a first network, the first network being a Cellular Wide Area radio communication network;

transmitting a second authentication request from the mobile client device to the wireless access point via a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network;

upon receiving at least one of the first authentication request and the second authentication request at the wireless access point, transmitting an authentication response from the wireless access point to the mobile client device via the second network; and

upon receiving the authentication response at the mobile client device, associating the mobile client device with the wireless access point.

2. The method of claim 1, wherein transmitting the first authentication request via the first network comprises:

transmitting the first authentication request from the mobile client device to an offload server via the first network; and

transmitting the first authentication request from the offload server to the wireless access point via the first network.

3. The method of claim 1 or 2, wherein

the sequence of transmitting the first authentication request and transmitting the second authentication request is interchangeable.

4. The method of any one of claims 1 to 3, wherein associating the mobile client device with the wireless access point comprises:

upon receiving the authentication response at the mobile client, transmitting a first association request from the mobile client device to the wireless access point via the first network;

transmitting a second association request from the mobile client device to the wireless access point via the second network;

upon receiving at least one of the first association request and the second association request at the wireless access point, transmitting an association response from the wireless access point to the mobile client via the second network.

5. The method of claim 4, wherein transmitting the first association request via the first network comprises:

transmitting the first association request from the mobile client device to an offload server via the first network; and

transmitting the first association request from the offload server to the wireless access point via the first network;

6. The method of claim 4 or 5, wherein

the sequence of transmitting the first association request and transmitting the second association request is interchangeable.

7. The method of any one of claims 1 to 3, further comprising:

after transmitting the authentication response from the wireless access point for a predetermined time period, transmitting one or more association responses continuously from the wireless access point to the mobile client via the second network;

transmitting an association request from the mobile client device to the wireless access point;

determining whether the mobile client device receives the one or more association responses after the transmission of the association request; and

associating the mobile client device with the wireless access point, if it is determined that the mobile client device receives the one or more association responses after the transmission of the association request.

8. The method of any one of claims 1 to 7, further comprising:

before transmitting the first authentication request and the second authentication request from the mobile client device, transmitting a first probe request from the mobile client device to the wireless access point via the first network;

transmitting a second probe request from the mobile client device to the wireless access point via the second network; and

upon receiving at least one of the first probe request and the second probe request at the wireless access point, transmitting a probe response from the wireless access point to the mobile client via the second network.

9. The method of claim 8, wherein transmitting the first probe request via the first network comprises:

transmitting the first probe request from the mobile client device to an offload server via the first network; and

transmitting the first probe request from the offload server to the wireless access point via the first network;

10. The method of any one of claims 1 to 9,

wherein the Cellular Wide Area radio communication network comprises one of GSM, GPRS, EDGE, 3G, 4G, LTE, W-CDMA.

11. The method of any one of claims 1 to 10,

wherein the Short Range radio communication network comprises one of wireless LAN, WiFi; and

the Metropolitan Area System radio communication network comprises one of wireless MAN, WiMAX, WiBro.

12. A mobile client device, comprising:

a first interface providing access to a first network, the first network being a Cellular Wide Area radio communication network;

a second interface providing access to a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a transceiver configured to transmit one or more probe requests, authentication requests and/or association requests to a wireless access point both through the first interface via the first network and ~~to transmit the one or more requests to the wireless access point throughtt~~through the second interface via the second network in a mobile data offload process, ~~respectively,~~ and the transceiver is configured to receive responses from the wireless access point through the second interface via the second network.

13. The mobile client device of claim 12, further comprising:

a determining circuit configured to determine whether the mobile client device receives an association response after the transmission of the association request.

~~14. An offload server comprising a transceiver, wherein the transceiver is configured to receive a probe request, an authentication request and/or an association request from a mobile client device via a first network; and to transmit the received probe request, the received authentication request and/or the received association request to a wireless access point via the first network; wherein the first network is a Cellular Wide Area radio communication network.~~

~~15~~14. A wireless access point comprising a plurality of wireless transceivers, wherein ~~the wireless transceivers are configured to receive~~upon receiving one or more probe requests, authentication requests and/or association requests from an offload server via a first network and/or from a mobile client device via a second network in a mobile data offload process, ~~and~~ the wireless transceivers are configured to transmit a probe response, an authentication response and/or an association response to the mobile client device via the second network;

wherein the first network is a Cellular Wide Area radio communication network, and the second network is a Short Range radio communication network or a Metropolitan Area System radio communication network.

~~16~~15. The wireless access point of claim ~~15~~14,

wherein the wireless access point is a long range WiFi access point providing a radio range of more than 100m.

~~17~~16. The wireless access point of claim ~~15~~ 14 or ~~16~~15, further comprising

a virtual wireless transceiver configured to route the probe requests, authentication requests and/or association requests to a desired wireless transceiver determined out of the plurality of wireless transceivers.

~~18~~17. The wireless access point of claim ~~15~~ 14 or ~~16~~15, further comprising

a driver configured to route the probe requests, authentication requests and/or association requests to a desired wireless transceiver determined out of the plurality of wireless transceivers.

~~19~~18. The wireless access point of claim ~~17~~ 16 or ~~18~~17,

wherein the desired wireless transceiver is determined based on the location of mobile client device.

~~20~~19. A mobile data offload method, comprising:

transmitting uplink data from a mobile client device via a first network, the first network being a Cellular Wide Area radio communication network; and

transmitting downlink data to the mobile client device via a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network.

~~21~~20. The method of claim ~~20~~19, comprising:

initiating the transmission of downlink data from a wireless access point to the mobile client device using a two-way handshake or a four-way handshake.

~~22~~21. The method of claim ~~21~~20, further comprising:

transmitting a data packet from the wireless access point to the mobile client device via the second network;

faking, at the wireless access point, an ACK packet as if the ACK packet originates from the mobile client device; and

sending the ACK packet to a desired wireless transceiver of the wireless access point.

~~23~~22. The method of claim ~~22~~21, further comprising:

before transmitting the data packet, transmitting a RTS (Ready to send) message from the wireless access point to the mobile client device via the second network;

faking, at the wireless access point, a CTS (Clear to send) message as if the CTS message originates from the mobile client device; and

sending the CTS message to a desired wireless transceiver of the wireless access point.

~~24~~23. The method of claim ~~22~~ 21 or ~~23~~22, further comprising:

upon receiving the data packet at the mobile client device, intercepting transmission of a data response packet from the mobile client device to the wireless access point via the second network; and

transmitting the data response packet from the mobile client device to the wireless access point via the first network.

~~25~~24. The method of any one of claims ~~20~~ 19 to ~~24~~23, further comprising

intercepting, at the mobile client device, the transmission of the uplink data via the second network.

~~26~~25. The method of claim ~~24~~ 23 or ~~25~~24, wherein transmitting the data response packet or the uplink data via the first network comprises tunneling the data response packet or the uplink data to the wireless access point using a tunneling protocol.

~~27~~26. The method of any one of claims ~~20~~ 19 to ~~26~~25,

wherein the Cellular Wide Area radio communication network comprises one of GSM, GPRS, EDGE, 3G, 4G, LTE, W-CDMA.

~~28~~27. The method of any one of claims ~~20~~ 19 to ~~27~~26,

wherein the Short Range radio communication network comprises one of wireless LAN, WiFi, and

the Metropolitan Area System radio communication network comprises one of wireless MAN, WiMAX and WiBro.

~~29~~28. A mobile client device, comprising:

a first interface providing access to a first network, the first network being a Cellular Wide Area radio communication network;

a second interface providing access to a second network, the second network being a Short Range radio communication network or a Metropolitan Area System radio communication network;

a transceiver configured to transmit uplink data to the wireless access point through the first interface via the first network, and to receive downlink data from the wireless access point through the second interface via the second network; and

an interception circuit configured to intercept uplink data to be transmitted to the wireless access point via the second network.

~~30~~29. A wireless access point, comprising:

a plurality of wireless transceivers configured to transmit downlink data to a mobile client device via a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a virtual wireless transceiver configured to fake one or more packets as if the packets originate from the mobile client device, and to send the faked packets to a desired wireless transceiver determined out of the plurality of wireless transceivers.

~~31~~30. A wireless access point, comprising:

a plurality of wireless transceivers configured to transmit downlink data to a mobile client device via a Short Range radio communication network or a Metropolitan Area System radio communication network; and

a driver configured to fake one or more packets as if the packets originate from the mobile client device, and to send the faked packets to a desired wireless transceiver determined out of the plurality of wireless transceivers.