Claims

What is claimed is:

1. User Equipment (UE) comprising:

a Universal Subscriber Identity Module (USIM);

at least one processor; and

at least one memory including computer program code;

wherein the UICC stores UE configuration parameters for the UE, the at least one memory and the computer program code being configured to, with the at least one processor, cause the UE at least to:

receive, from an Access and Mobility Management Function (AMF) element, a first Non-Access Stratum (NAS) message having a container that includes a UE configuration parameter update for the UE, the UE configuration parameter update including a UE parameter being encapsulated in a secured packet;

perform a first security check to verify the UE configuration parameter update; and

if the first security check is successful, forward the secured packet to the USIM, wherein the USIM is operable to perform a second security check to verify the secured packet, and if the second security check is successful, to update one or more of the UE configuration parameters in the USIM based on the UE parameter encapsulated in the security packet.

2. The UE of claim 1, wherein:

the UE parameter encapsulated in the secured packet is a routing indicator parameter.

3. The UE of claim 1, wherein:

the first security check verifies the integrity of the UE configuration parameter update using a NAS security context of the UE.

4. The UE of claim 1, wherein:

the USIM resides on a Universal Integrated Circuit Board (UICC) within the UE.

5. The UE of claim 1, wherein:

the first NAS message comprises a NAS registration accept message sent to the UE during a NAS registration procedure.

6. The UE of claim 5, wherein:

when the NAS registration accept message includes a UE acknowledgement indicator, the processor is further configured to cause the UE to send a second NAS message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received;

wherein the second NAS message comprises a NAS registration complete message or an Uplink NAS Transport message.

7. The UE of claim 1, wherein:

the first NAS message comprises a Downlink NAS Transport message of a NAS transport procedure.

8. The UE of claim 7, wherein:

when the Downlink NAS Transport message includes a UE acknowledgement indicator, the processor is further configured to cause the UE to send an Uplink NAS Transport message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received.

9. The UE of claim 1, wherein:

when the first NAS message includes a re-registration indicator, the processor is further configured to cause the UE to initiate a NAS registration procedure to re-register using the updated UE configuration parameters.

10. A method comprising:

receiving, at a user equipment (UE), from an Access and Mobility Management Function (AMF) element, a first Non-Access Stratum (NAS) message having a container that includes a UE configuration parameter update for the UE, the UE configuration parameter update including a UE parameter being encapsulated in a secured packet;

performing a first security check to verify the UE configuration parameter update; and

if the first security check is successful, forwarding the secured packet to a Universal Subscriber Identify Module (USIM) in operable communication with the UE, wherein the USIM is operable to perform a second security check to verify the secured packet, and if the second security check is successful, to update one or more of the UE configuration parameters in the USIM based on the UE parameter encapsulated in the security packet.

11. The method of claim 10, wherein the UE parameter encapsulated in the secured packet is a routing indicator parameter.

12. The method of claim 10, wherein the first security check verifies the integrity of the UE configuration parameter update using a NAS security context of the UE.

13. The method of claim 10, wherein the USIM resides on a Universal Integrated Circuit Board (UICC) within the UE.

14. The method of claim 10, wherein the first NAS message comprises a NAS registration accept message sent to the UE during a NAS registration procedure.

15. The method of claim 14, wherein, when the NAS registration accept message includes a UE acknowledgement indicator, the method further comprises:

causing the UE to send a second NAS message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received, wherein the second NAS message comprises a NAS registration complete message or an Uplink NAS Transport message.

16. The method of claim 10, wherein the first NAS message comprises a Downlink NAS Transport message of a NAS transport procedure.

17. The method of claim 16, wherein, when the Downlink NAS Transport message includes a UE acknowledgement indicator, the method further comprises:

causing the UE to send an Uplink NAS Transport message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received.

18. The method of claim 10, wherein, when the first NAS message includes a re-registration indicator, the method further comprises:

causing the UE to initiate a NAS registration procedure to re-register using the updated UE configuration parameters.

19. An Access and Mobility Management Function (AMF) element comprising:

at least one processor; and

at least one memory including computer program code, the at least one memory and the computer program code being configured, with the at least one processor, to cause the AMF element at least to:

generate a first Non-Access Stratum (NAS) message having a container that includes a UE configuration parameter update for the UE, the UE configuration parameter update including a UE parameter being encapsulated in a secured packet; and

transmit the first NAS message towards a User Equipment (UE), wherein the first NAS message is operable to (i) cause the UE to perform a first security check to verify the UE configuration parameter update, (ii) if the first security check is successful, to cause the UE to forward the secured packet to a Universal Subscriber Identify Module (USIM) in operable communication with the UE, (iii) cause the USIM to perform a second security check to verify the secured packet, and (iv) if the second security check is successful, to update one or more of the UE configuration parameters in the USIM based on the UE parameter encapsulated in the security packet.

20. The AMF element of claim 19, wherein the UE parameter encapsulated in the secured packet is a routing indicator parameter.

21. The AMF element of claim 19, wherein the first security check is operable to verify the integrity of the UE configuration parameter update using a NAS security context of the UE.

22. The AMF element of claim 19, wherein the first NAS message comprises a NAS registration accept message sent to the UE during a NAS registration procedure.

23. The AMF element of claim 22, wherein, when the NAS registration accept message includes a UE acknowledgement indicator, the NAS registration accept message is further operable to cause the UE to send a second NAS message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received;

wherein the second NAS message comprises a NAS registration complete message or an Uplink NAS Transport message.

24. The AMF element of claim 19, wherein the first NAS message comprises a Downlink NAS Transport message of a NAS transport procedure.

25. The AMF element of claim 24, wherein, when the Downlink NAS Transport message includes a UE acknowledgement indicator, the first NAS message is further operable to cause the UE to send an Uplink NAS Transport message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received.

26. The AMF element of claim 19, wherein, when the first NAS message includes a re-registration indicator, the first NAS message is further operable to cause the UE to initiate a NAS registration procedure to re-register using the updated UE configuration parameters.

27. The AMF element of claim 19, wherein the at least one memory and the computer program code being configured, with the at least one processor, to cause the AMF element at least to:

receive a control plane message from a Unified Data Management (UDM) element including the UE configuration parameter update for the UE; and

insert the UE configuration parameter update into the container of the first NAS message.

28. The AMF element of claim 27, wherein the at least one memory and the computer program code being configured, with the at least one processor, to cause the AMF element at least to:

receive the second NAS message from the UE during the NAS registration procedure with a container including a UE acknowledgement that the UE configuration parameter update was received; and

send another control plane message to the UDM element with the UE acknowledgement, wherein the second NAS message received from the UE comprises a NAS registration complete message or an Uplink NAS Transport message.

29. A method comprising:

generating a first Non-Access Stratum (NAS) message having a container that includes a UE configuration parameter update for the UE, the UE configuration parameter update including a UE parameter being encapsulated in a secured packet; and

transmitting the first NAS message towards a User Equipment (UE), wherein the first NAS message is operable to (i) cause the UE to perform a first security check to verify the UE configuration parameter update, (ii) if the first security check is successful, to cause the UE to forward the secured packet to a Universal Subscriber Identify Module (USIM) in operable communication with the UE, (iii) cause the USIM to perform a second security check to verify the secured packet, and (iv) if the second security check is successful, to update one or more of the UE configuration parameters in the USIM based on the UE parameter encapsulated in the security packet.

30. The method of claim 29, wherein the UE parameter encapsulated in the secured packet is a routing indicator parameter.

31. The method of claim 29, wherein the first security check verifies the integrity of the UE configuration parameter update using a NAS security context of the UE.

32. The method of claim 29, wherein the first NAS message comprises a NAS registration accept message sent to the UE during a NAS registration procedure.

33. The method of claim 32, wherein, when the NAS registration accept message includes a UE acknowledgement indicator, the method further comprises:

causing the UE to send a second NAS message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received, wherein the second NAS message comprises a NAS registration complete message or an Uplink NAS Transport message.

34. The method of claim 29, wherein the first NAS message comprises a Downlink NAS Transport message of a NAS transport procedure.

35. The method of claim 34, wherein, when the Downlink NAS Transport message includes a UE acknowledgement indicator, the method further comprises:

causing the UE to send an Uplink NAS Transport message to the AMF element with a container including a UE acknowledgement from the UE that the UE configuration parameter update was received.

36. The method of claim 29, wherein, when the first NAS message includes a re-registration indicator, the method further comprises:

causing the UE to initiate a NAS registration procedure to re-register using the updated UE configuration parameters.

37. The method of claim 29, further comprising:

receiving a control plane message from a Unified Data Management (UDM) element including the UE configuration parameter update for the UE; and

inserting the UE configuration parameter update into the container of the first NAS message.

38. The method of claim 37, further comprising:

receiving the second NAS message from the UE during the NAS registration procedure with a container including a UE acknowledgement that the UE configuration parameter update was received; and

sending another control plane message to the UDM element with the UE acknowledgement, wherein the second NAS message received from the UE comprises a NAS registration complete message or an Uplink NAS Transport message.