MANAGING VPLMN CONFIGURATION UPDATES IN THE UE DUE TO HOME PLMN CONFIGURATION CHANGES

Cross-Reference to Related Applications

[001] This application claims the benefit of and priority to U.S. Provisional Application No. 62/674,465, entitled "Managing VPLMN Configuration Updates in the UE Due to Home PLMN Configuration Changes," filed May 21, 2018, the entire contents of which are hereby incorporated herein by reference for all purposes.

Field

[002] The subject matter described herein relates to wireless.

Background

[003] As the cellular system including the Fifth Generation (5G) system supports an increasing number of devices and services including applications with a wide range of use cases and diverse needs with respect to bandwidth, latency, and reliability requirements, the cellular system may need to prioritize resources across the wireless access network and the core network (and/or for example, prioritizing across the control plane and the user plane) to support differentiation among different services.

Summary

[004] Methods and apparatus, including computer program products, are provided for managing configuration updates.

[0005] In an aspect, there is a method comprising: receiving, at a user equipment, an indication representing a change to configuration information or subscription information, the

configuration information or subscription information being associated with the user equipment and stored at a home network of the user equipment; and

based on the indication representing the change made to the configuration information or the subscription information stored at the home network of the user equipment, deleting first network slice configuration information and second network slice configuration information, the first network slice configuration information being stored at the user equipment and associated with a visited network currently serving the user equipment, the second network slice configuration information being stored at the user equipment and associated with one or more other visited networks. In an aspect, there is an apparatus comprising: at least one processor; and at least one memory storing program codes, first network slice configuration information for a visited network currently serving the apparatus and second network slice configuration information for another visited network, the at least one memory and the program codes being configured to, with the at least one processor, cause the apparatus to at least: receive an indication representing a change to configuration information or subscription information, the configuration information or subscription information being associated with the apparatus and stored at a home network of the apparatus; and based on the indication representing the change made to the configuration information or the subscription information stored at the home network of the apparatus, delete the first network slice configuration information and the second network slice configuration information. In an aspect, there is provided method comprising: determining a change was made to configuration information or subscription information associated with a user equipment and stored at a home network of the user equipment; and providing, to said user equipment, an indication representing a change to the configuration information or the subscription information stored at the home network of the user equipment, wherein the indication is operable to cause the user equipment to delete first network slice configuration information stored at the user equipment and associated with a visited network currently serving the user equipment and wherein the indication is further operable to cause the user equipment to delete other second network slice configuration information stored at the user equipment and associated with one or more other visited networks, the second network slice configuration information being different from the first network slice configuration information. In an aspect, there is an apparatus comprising: at least one processor; and at least one memory

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

determine a change was made to configuration information or subscription information associated with a user equipment and stored at a home network of the user equipment; and

provide, to said user equipment, an indication representing a change to the configuration information or the subscription information stored at the home network of the user equipment,

wherein the indication is operable to cause the user equipment to delete first network slice configuration information associated with a visited network currently serving the user equipment, and wherein the indication is further operable to cause the user equipment to delete second network slice configuration information associated with one or more other visited networks, the second network slice configuration information being different from the first network slice configuration information. In an aspect, there is an apparatus comprising:

at least one processor; and

at least one memory storing program codes, wherein the at least one memory and the program codes are configured to, with the at least one processor, cause the apparatus at least to:

receive an indication representing a change to subscription information stored at a home network of the apparatus; and

based on said indication representing the change to the subscription information stored at the home network of the apparatus, delete first network slice configuration information stored at the apparatus and delete second network slice configuration information stored at the apparatus, the first network slice configuration information being for a visited network currently serving the apparatus, the second network slice configuration information being for another visited network. In an aspect, there is an apparatus comprising:

at least one processor; and

at least one memory storing program codes, first network slice configuration information for a visited network currently serving the apparatus, and second network slice configuration information for another visited network,

wherein the at least one memory and the program codes are configured to, with the at least one processor, cause the apparatus at least to:

receive a cause code indicating a reason for a change to subscription information associated with the apparatus and stored at a home network of the apparatus; and

based on the cause code indicating the reason for the change to the subscription information associated with the apparatus and stored at the home network of the apparatus, delete the first network slice configuration information for the visited network currently serving the apparatus and delete the second network slice configuration information for said another visited network.In an embodiment, there is a method comprising receiving, at a user equipment, an indication regarding whether a home network of the user equipment makes a change to a first network slice configuration information stored at the home network for the user equipment, the first network slice configuration information being associated with the user equipment; and deleting, when the received indication represents the change, a second network slice configuration information regarding one or more network slice configurations associated with a visited network currently serving the user equipment and other network slice configuration information regarding one or more network slice configurations associated with the one or more other visited networks, the second network slice configuration information and the other network slice configuration information being stored at the user equipment. In an aspect, there is a method comprising: determining a change was made to a first network slice configuration information stored at a home network for a user equipment, the first network slice configuration information being associated with the user equipment; and providing, to said user equipment, an indication regarding said change was made to said first network slice configuration information stored at said home network for the user equipment wherein the indication is operable to cause the user equipment to delete a second network slice configuration information regarding one or more network slice configurations associated with a visited network currently serving the user equipment and operable to cause the user equipment to delete other network slice configuration information regarding one or more network slice configurations associated with one or more other visited networks, the second network slice configuration information and the other network slice configuration information being stored at the user equipment. In some example embodiment, there may be provided an apparatus including at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to at least: receive an indication regarding whether a home network makes a change to a previous

WHAT IS CLAIMED:

1. A method comprising:

receiving, at a user equipment, an indication ~~regarding whether a home network of the user equipment makes~~ representing a change to ~~a first network slice~~ configuration information or subscription information, the configuration information or subscription information being associated with the user equipment and stored at ~~the~~ a home network ~~for~~ of the user equipment~~, the first network slice configuration information being associated with the user equipment~~; and

~~deleting, when the received~~ based on the indication ~~represents~~ representing the change made to the configuration information or the subscription information stored at the home network of the user equipment, deleting first network slice configuration information and second network slice configuration information, the first network slice configuration information being stored at the user equipment and associated with ~~a second network slice configuration information regarding one or more network slice configurations associated with~~ a visited network currently serving the user equipment, the second network slice configuration information being stored at the user equipment and ~~and other network slice configuration information regarding one or more network slice configurations~~ associated with ~~the~~ one or more other visited networks~~, the second network slice configuration information and the other network slice configuration information being stored at the user equipment~~.

2. The method of claim 1, wherein the ~~first network slice~~ configuration information or the subscription information stored at the home network of the user equipment is different from the first network slice configuration information and the second network slice configuration information ~~and the other network slice configuration information~~ stored at the user equipment.

3. The method of any one of claims 1 or 2, further comprising:~~wherein deleting comprises deleting, when the received indication represents the change,~~

receiving a message comprising said indication, wherein the message further comprises ~~a~~ third network slice configuration information~~, stored at the user equipment, the third network slice configuration information being associated with said home network of the user equipment~~

to replace the first network slice configuration information or the second network slice configuration information stored at the user equipment.

4. The method of any one of claims 1-3, wherein the first network slice configuration information is different from the second network slice configuration information.

5. The method of any one of claims 1-4, wherein the configuration information or the subscription information stored at the home network of the user equipment comprises one or more of: a quantity of network slices, a Quality of Service (QoS) of services provided via respective network slices of said network slices, or an identifier of respective network slices of said network slices.

~~4. The method of any one of claims 1-3, further comprising:~~

~~receiving, at the user equipment, updated network slice configuration information including or together with the indication.~~

6~~5~~. The method of any one of claims 1-4~~5~~, wherein at least one of the first network slice configuration information or the second network slice configuration information ~~and the other network slice configuration information, stored at the use equipment, includes at least one~~ comprises at least one network slice identifier.

~~6~~7. The method of any one of claims 1-~~5~~6, further comprising:

~~wherein the deleting enables~~ requesting ~~obtaining~~ updated network slice configuration information for at least the visited network currently serving the user equipment.

~~7~~8. The method of any one of claims 1-~~6~~7, further comprising:

receiving the updated network slice configuration information for ~~at least one other visited network~~ to replace the ~~deleted~~ first network slice configuration information for the visited network currently serving the user equipment~~, when the indication represents the change associated with the home network is received~~.

9~~8~~. The method of claim ~~7~~8, further comprising:

waiting to perform, after ~~obtaining the received network slice configuration information~~indication representing the change to the configuration information or the subscription information stored at the home network of the user equipment, a registration to obtain the updated network slice configuration information until an updated user equipment route and access selection policy ~~are~~ is received.

~~9~~10. The method of any one of claims 1-~~8~~9, further comprising:

~~updating said second~~ in an instance in which the indication representing the change is received, flagging the first network slice configuration information to indicate that the first network slice configuration information is outdated.~~ stored at the user equipment for the visited network currently serving the user equipment and updating the other network slice configuration information stored at the user equipment for the one or more other visited networks, when the indication is received representing the change associated with the home network of the user equipment; and~~

~~updating said second network slice configuration information stored at the user equipment for the visited network currently serving the user equipment only, when no indication is received that represents the change associated with the home network of the user equipment.~~

~~10~~11. The method of any one of claims 1-~~9~~10, wherein the indication represents the home network indicating to the visited network currently serving the user equipment that the change in the home network is to be taken into account in the visited network currently serving the user equipment when ~~for~~ configuring the user equipment.

~~11~~12. An apparatus comprising:

at least one processor; and

at least one memory ~~including computer~~ storing program codes, first network slice configuration information for a visited network currently serving the apparatus and second network slice configuration information for another visited network, the at least one memory and the ~~computer~~ program codes being configured to, with the at least one processor, cause the apparatus to at least ~~carry out the method of any one of claims 1-10.~~:

receive an indication representing a change to configuration information or subscription information, the configuration information or subscription information being associated with the apparatus and stored at a home network of the apparatus; and

based on the indication representing the change made to the configuration information or the subscription information stored at the home network of the apparatus, delete the first network slice configuration information and the second network slice configuration information.

13. The apparatus of claim 12, wherein the configuration information or the subscription information stored at the home network of the apparatus is different from the first network slice configuration information and the second network slice configuration information stored at the apparatus.

14. The apparatus of any one of claims 12 or 13, wherein the at least one memory and the program codes are further configured to cause the apparatus to at least:

receive a message comprising said indication, wherein the message further comprises third network slice configuration information to replace the first network slice configuration information or the second network slice configuration information stored at the apparatus.

15. The apparatus of any one of claims 12-14, wherein the first network slice configuration information is different from the second network slice configuration information.

16. The apparatus of any one of claims 12-15, wherein the configuration information or the subscription information stored at the home network of the apparatus comprises one or more of: a quantity of network slices, a Quality of Service (QoS) of services provided via respective

network slices of said network slices, or an identifier of respective network slices of said network slices.

17. The apparatus of any one of claims 12-16, wherein at least one of the first network slice configuration information or the second network slice configuration information comprises at least one network slice identifier.

18. The apparatus of any one of claims 12-17, wherein the at least one memory and the program codes are further configured to cause the apparatus to at least:

request updated network slice configuration information for at least the visited network currently serving the apparatus.

19. The apparatus of any one of claims 12-18, wherein the at least one memory and the program codes are further configured to cause the apparatus to at least:

receive the updated network slice configuration information to replace the first network slice configuration information for the visited network currently serving the apparatus.

20. The apparatus of claim 19, wherein the at least one memory and the program codes are further configured to cause the apparatus to at least:

wait to perform, after indication representing the change to the configuration information or the subscription information stored at the home network of the apparatus, a registration to obtain the updated network slice configuration information until an updated user equipment route and access selection policy is received.

21. The method of any one of claims 12-20, wherein the at least one memory and the program codes are further configured to cause the apparatus to at least:

in an instance in which the indication representing the change is received, flag the first network slice configuration information to indicate that the first network slice configuration information is outdated.

22. The method of any one of claims 12-21, wherein the indication represents the home network indicating to the visited network currently serving the apparatus that the change in the home network is to be taken into account in the visited network for configuring the apparatus.

~~12~~23. A non-transitory computer readable medium including program code which, when executed, causes operations comprising the method of any one of claims 1-11.

~~13~~24. A method comprising:

determining a change was made to ~~a first network slice~~ configuration information or subscription information associated with a user equipment and stored at a home network ~~for a~~ of the user equipment~~, the first network slice configuration information being associated with the user equipment~~; and

providing, to said user equipment, an indication representing a change to the configuration information or the subscription information stored at the home network of the user equipment ~~regarding said change was made to said first network slice configuration information stored at said home network for the user equipment~~,

wherein the indication is operable to cause the user equipment to delete ~~a second~~ first network slice configuration information ~~regarding one or more network slice configurations~~ stored at the user equipment and associated with a visited network currently serving the user equipment and wherein the indication is further operable to cause the user equipment to delete other second network slice configuration information ~~regarding one or more network slice configurations~~ stored at the user equipment and associated with one or more other visited networks, the second network slice configuration information being different from the first ~~and the other~~ network slice configuration information ~~being stored at the user equipment~~.

~~14~~25. The method of claim ~~13~~24, further comprising:

providing to said user equipment, with said indication representing the change to the ~~of said change to the first network slice~~ configuration information or the subscription information stored at said home network of the user equipment, ~~to said user equipment updated~~ third

network slice configuration information associated with one or more of: the visited network currently serving the user equipment ~~and~~ or the one or more other visited networks.

~~15~~26. An apparatus comprising:

at least one processor; and

at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to ~~carry out the method of either of claims 13 or 14.~~:

determine a change was made to configuration information or subscription information associated with a user equipment and stored at a home network of the user equipment; and

provide, to said user equipment, an indication representing a change to the configuration information or the subscription information stored at the home network of the user equipment,

wherein the indication is operable to cause the user equipment to delete first network slice configuration information associated with a visited network currently serving the user equipment, and wherein the indication is further operable to cause the user equipment to delete second network slice configuration information associated with one or more other visited networks, the second network slice configuration information being different from the first network slice configuration information.

27. The method of claim 26, further comprising:

providing to said user equipment, with said indication representing the change to the configuration information or the subscription information stored at said home network of the user equipment, third network slice configuration information associated with one or more of: the visited network currently serving the user equipment or the one or more other visited networks.

~~16~~28. A non-transitory computer readable medium including program code which, when executed, causes operations comprising the method of either of claims ~~13~~ 24 or ~~14~~25.

29. An apparatus comprising:

at least one processor; and

at least one memory storing program codes, wherein the at least one memory and the program codes are configured to, with the at least one processor, cause the apparatus at least to:

receive an indication representing a change to subscription information stored at a home network of the apparatus; and

based on said indication representing the change to the subscription information stored at the home network of the apparatus, delete first network slice configuration information stored at the apparatus and delete second network slice configuration information stored at the apparatus, the first network slice configuration information being for a visited network currently serving the apparatus, the second network slice configuration information being for another visited network.

30. An apparatus comprising:

at least one processor; and

at least one memory storing program codes, first network slice configuration information for a visited network currently serving the apparatus, and second network slice configuration information for another visited network,

wherein the at least one memory and the program codes are configured to, with the at least one processor, cause the apparatus at least to:

receive a cause code indicating a reason for a change to subscription information associated with the apparatus and stored at a home network of the apparatus; and

based on the cause code indicating the reason for the change to the subscription information associated with the apparatus and stored at the home network of the apparatus, delete the first network slice configuration information for the visited network currently serving the apparatus and delete the second network slice configuration information for said another visited network.