APPARATUS, METHODS, AND COMPUTER PROGRAMS

Field of the disclosure

The present disclosure relates to an apparatus, methods, and computer programs and in particular but not exclusively for apparatus, methods and computer programs to be used in a communications system.

Background

A communication system can be seen as a facility that enables communication sessions between two or more entities such as user terminals, base stations/access points and/or other nodes by providing carriers between the various entities involved in the communications path. A communication system can be provided for example by means of a communication network and one or more compatible communications devices.

Access to the communication system may be by means of an appropriate communications device or terminal. A communications device is provided with an appropriate signal receiving and transmitting apparatus for enabling communications, for example enabling access to a communication network or communications directly with other communications device. The communications device may access a carrier provided by a station or access point, and transmit and/or receive communications on the carrier.

The communication system and associated devices typically operate in accordance with a given standard or specification which sets out what the various entities associated with the system are permitted to do and how that should be achieved.

Summary

According to an aspect, there is provided a method comprising: receiving information at a first network entity indicating a first data network identity associated with a request from a communications device; and selecting at the first network entity a second data network identity which is usable with respect to the communications device and supported by a network for replacing the first data network identity when ~~said~~the first data network identity is not usable with respect to ~~said~~the communications device and not supported by the network, ~~optionally said~~the selecting being in dependence on information associated with ~~said~~the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

The method may comprise determining at the first network entity that said first data network identity is not usable.

According to an aspect, there is a method comprising:

receiving a request at a second network entity from a first network entity comprising a first data network identity associated with a request from a communications device and which is not usable with respect to ~~said~~the communications device and not supported by a network and a second data network identity which is usable with respect to the communications device and supported by the network, the second data network identity being selected to replace the first data network identity, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

providing by ~~said~~the second network entity a response to ~~said~~the request, ~~said~~the response to be directed to ~~said~~the communications device and comprising at least one of ~~said~~the second data network identity and ~~said~~the first data network identity.

According to an aspect, there is a method comprising:

causing by a third network entity, a request to be sent to a first network entity that ~~said~~the first entity notify ~~said~~the third network entity when ~~said~~the first network entity selects a second data network identity which is usable with respect to a communications device and is supported by a network when a first data network identity is not usable with respect to ~~said~~the communications device and is not supported by the network, ~~said~~ the first data network identity being associated with a request from the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

receiving at the third network entity a notification from ~~said~~ the first network entity when ~~said~~ the first network entity selects the second data network identity for replacing the first data network identity, ~~said~~ the notification comprising ~~said~~ the second data network identity and optionally ~~said~~ the first data network identity.

According to an aspect, there is a method comprising:

causing by a communications device a request to be sent with a first data network identity which is not supported by a network; and

receiving information at the communications device indicating that ~~said~~the first data network identity is ~~updated to~~replaced by a second data network identity which is supported by the network, wherein each of the first data network identity and the second data network

identity is configured to identify a data network for a data session with the communications device.

According to an aspect, there is provided a method comprising:

causing by a third network entity, a request to be sent to a first network entity that ~~said~~the first network entity notify ~~said~~the third network entity when ~~said~~the first network entity determines a misconfiguration of a communications device, wherein notifying the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

According to an aspect, there is provided a method comprising:

determining at a first network entity information about a misconfiguration of communications device; and

causing information to be provided to a third network entity about ~~said~~the determined misconfiguration of ~~said~~the communications device, wherein providing the information to the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

According to an aspect, there is an apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

receive information indicating a first data network identity associated with a request from a communications device; and

select a second data network identity which is usable with respect to the communications device and supported by a network for replacing the first data network identity when ~~said~~the first data network identity is not usable with respect to ~~said~~the communications device and not supported by the network, ~~said~~the selecting being in dependence on information associated with ~~said~~the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

According to an aspect, there is an apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

receive a request from a first network entity comprising a first data network identity associated with a request from a communications device and which is not usable with respect to ~~said~~the communications device and not supported by a network and a second data network identity which is usable with respect to the communications device and supported by the network for replacing the first data network identity, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

provide a response to ~~said~~the request, ~~said~~the response to be directed to ~~said~~the communications device and comprising at least one of ~~said~~the second data network identity and ~~said~~the first data network identity.

According to an aspect, there is an apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

cause a request to be sent to a first network entity that ~~said~~the first entity notify a third network entity when ~~said~~the first network entity selects a second data network identity which is usable with respect to a communications device and supported by a network for replacing a first data network identity when ~~a~~ the first data network identity is not usable with respect to ~~said~~the communications device and is not supported by a network, ~~said~~the first data network identity being associated with a request from the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

receive a notification from ~~said~~the first network entity when ~~said~~the first network entity selects the second data network identity, ~~said~~the notification comprising ~~said~~the second data network identity and optionally ~~said~~the first data network identity.

According to an aspect, apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

cause a request to be sent with a first data network identity which is not supported by a network; and

receive information indicating that ~~said~~the first data network identity is ~~updated to~~replaced by a second data network identity which is supported by the network, wherein each

of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

According to an aspect, there is provided an apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

determine information about a misconfiguration of a communications device; and

cause information to be provided to a third network entity about ~~said~~the determined misconfiguration of ~~said~~the communications device, wherein providing the information to the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

The method may comprise determining that ~~said~~the first data network identity is not usable by determining that ~~said~~the first data network identity is one or more of: not supported by a network; not permitted in relation to ~~said~~the communications device; not permitted by a policy

CLAIMS

1. A method comprising:

receiving information at a first network entity indicating a first data network identity associated with a request from a communications device; and

selecting at the first network entity a second data network identity which is usable with respect to the communications device and supported by a network for replacing the first data network identity when ~~said~~the first data network identity is not usable with respect to ~~said~~the communications device and not supported by the network, ~~said~~the selecting being in dependence on information associated with ~~said~~the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

2. A method as claimed in claim 1, wherein ~~said~~the method comprises determining that ~~said~~the first data network identity is not usable by determining that ~~said~~the first data network identity is one or more of: not supported by ~~a~~ the network; not permitted in relation to ~~said~~the communications device; not permitted by a policy associated with the communications device; and not permitted by a subscription associated with the communications device.

3. A method as claimed in any preceding claim, wherein ~~said~~the information associated with ~~said~~the communications device used to select ~~said~~the second network identity comprises one or more of single network slice selection assistance information, an expected service set, communications device capabilities subscription data and service related data.

4. A method as claimed in any preceding claim, wherein at least a part of ~~said~~the information associated with ~~said~~the communications device is provided by ~~said~~the communications device.

5. A method as claimed in any preceding claim, comprising using ~~said~~the second data network identity to select a second network entity and causing a message with at least one of ~~said~~the first and second data identities to be sent to the second network entity.

6. A method as claimed in claim 5, comprising causing information to be provided to ~~said~~the second network entity indicating which of ~~said~~the first and second data identities is to

be used when ~~said~~the second network entity communicates with ~~said~~the communications device.

7. A method as claimed in any preceding claim, comprising causing information about a configuration issue of ~~said~~the communications device to be sent to a third network entity, ~~said~~the third network entity providing policy information associated with the communications device.

8. A method as claimed in claim 7, wherein ~~said~~the information about ~~said~~the configuration issue of ~~said~~the communications device is associated with the first data network identity of the communications device.

9. A method as claimed in any of claim 7 or 8, comprising receiving information at the first network entity from the third network entity requesting a notification of ~~said~~the configuration issue of ~~said~~the communications device.

10. A method comprising:

receiving a request at a second network entity from a first network entity comprising a first data network identity associated with a request from a communications device and which is not usable with respect to ~~said~~the communications device and not supported by a network and a second data network identity which is usable with respect to the communications device and supported by the network, the second data network identity being selected to replace the first data network identity, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

providing by ~~said~~the second network entity a response to ~~said~~the request, ~~said~~the response to be directed to ~~said~~the communications device and comprising at least one of ~~said~~the second data network identity and ~~said~~the first data network identity.

11. A method as claimed in claim 10, comprising receiving information from ~~said~~the first network entity indicating which one or more of ~~said~~the first and second data identities is to be used when ~~said~~the second network entity provides ~~said~~the response.

12. A method comprising:

causing by a third network entity, a request to be sent to a first network entity that ~~said~~the first entity notify ~~said~~the third network entity when ~~said~~the first network entity selects a second data network identity which is usable with respect to a communications device and is supported by a network when a first data network identity is not usable with respect to ~~said~~the communications device and is not supported by the network, ~~said~~the first data network identity being associated with a request from the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

receiving at the third network entity a notification from ~~said~~the first network entity when ~~said~~the first network entity selects the second data network identity for replacing the first data network identity, ~~said~~the notification comprising ~~said~~the second data network identity and optionally ~~said~~the first data network identity.

13. A method as claimed in claim 12, comprising updating a routing policy associated with ~~said~~the communications device in response to receiving ~~said~~the notification.

14. A method comprising:

causing by a communications device a request to be sent with a first data network identity which is not supported by a network; and

receiving information at the communications device indicating that ~~said~~the first data network identity is ~~updated to~~replaced by a second data network identity which is supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

15. A method as claimed in claim 14, wherein ~~said~~the receiving information comprises receiving a response to ~~said~~the request with ~~said~~the second data network identity.

16. A method as claimed in claim 14, wherein ~~said~~the receiving information comprises receiving an update to routing information.

17. A method comprising:

causing by a third network entity, a request to be sent to a first network entity that ~~said~~the first network entity notify ~~said~~the third network entity when ~~said~~the first network entity

determines a misconfiguration of a communications device, wherein notifying the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

18. A method comprising:

determining at a first network entity information about a misconfiguration of a communications device; and

causing information to be provided to a third network entity about ~~said~~the determined misconfiguration of ~~said~~the communications device, wherein providing the information to the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

19. A method as claimed in claim 18, comprising receiving a request at the first network entity from the third network entity requesting that ~~said~~the first network entity notify ~~said~~the third network entity when ~~said~~the first network entity determines ~~a~~ the misconfiguration of ~~a~~ the communications device.

20. A method as claimed in claim 18 or 19, wherein determining ~~said~~the misconfiguration comprises determining one or more of:

a request associated with the communications device comprises a data network identity which is not usable with respect to ~~said~~the communications device;

a request associated with the communications device indicates a session type which is not usable with respect to ~~said~~the communications device;

a request associated with the communications device indicates single network slice selection assistance information which is not usable with respect to ~~said~~the communications device; and

a request associated with the communications device indicates a session and service continuity mode which is not usable with respect to ~~said~~the communications device.

21. An apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

receive information indicating a first data network identity associated with a request from a communications device; and

select a second data network identity which is usable with respect to the communications device and supported by a network for replacing the first data network identity when ~~said~~the first data network identity is not usable with respect to ~~said~~the communications device and not supported by the network, ~~said~~the selecting being in dependence on information associated with ~~said~~the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

22. An apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

receive a request from a first network entity comprising a first data network identity associated with a request from a communications device and which is not usable with respect to ~~said~~the communications device and not supported by a network and a second data network identity which is usable with respect to the communications device and supported by the network for replacing the first data network identity, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

provide a response to ~~said~~the request, ~~said~~the response to be directed to ~~said~~the communications device and comprising at least one of ~~said~~the second data network identity and ~~said~~the first data network identity.

23. An apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

cause a request to be sent to a first network entity that ~~said~~the first entity notify a third network entity when ~~said~~the first network entity selects a second data network identity which is usable with respect to a communications device and supported by a network for replacing a

first data network identity when ~~a~~ the first data network identity is not usable with respect to ~~said~~the communications device and is not supported by a network, ~~said~~the first data network identity being associated with a request from the communications device, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device; and

receive a notification from ~~said~~the first network entity when ~~said~~the first network entity selects the second data network identity, ~~said~~the notification comprising ~~said~~the second data network identity and optionally ~~said~~the first data network identity.

24. An apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

cause a request to be sent with a first data network identity which is not supported by a network; and

receive information indicating that ~~said~~the first data network identity is ~~updated~~ replaced ~~to~~ by a second data network identity which is supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

25. An apparatus comprising at least one processor and at least one memory including computer code for one or more programs, the at least one memory and the computer code configured, with the at least one processor, to cause the apparatus at least to:

determine information about a misconfiguration of a communications device; and

cause information to be provided to a third network entity about ~~said~~the determined misconfiguration of ~~said~~the communications device, wherein providing the information to the third network entity is to cause a first data network identity associated with a request from the communications device and not supported by a network to be replaced by a second data network identity supported by the network, wherein each of the first data network identity and the second data network identity is configured to identify a data network for a data session with the communications device.

26. A computer program comprising computer executable instructions which when run on at least one processor cause the method of any of claims 1 to 20 to be performed.