



HU000032692T2

(19) **HU**(11) Lajstromszám: **E 032 692**(13) **T2****MAGYARORSZÁG**  
Szellemi Tulajdon Nemzeti Hivatala**EURÓPAI SZABADALOM**  
**SZÖVEGÉNEK FORDÍTÁSA**(21) Magyar ügyszám: **E 13 813908**(51) Int. Cl.: **H04W 4/00** (2006.01)(22) A bejelentés napja: **2013. 06. 24.**

(86) A nemzetközi (PCT) bejelentési szám:

**PCT/US 13/047358**

(96) Az európai bejelentés bejelentési száma:

**EP 20130813908**

(87) A nemzetközi közzétételi szám:

**WO 14008026**

(97) Az európai bejelentés közzétételi adatai:

**EP 2868143 A1** **2014. 01. 09.**

(97) Az európai szabadalom megadásának meghirdetési adatai:

**EP 2868143 B1** **2017. 03. 15.**

(30) Elsőbbségi adatok:

<b>201261667325 P</b>	<b>2012. 07. 02.</b>	<b>US</b>
<b>201213592042</b>	<b>2012. 08. 22.</b>	<b>US</b>

(73) Jogosult(ak):

**Intel Corporation, Santa Clara, CA 95052 (US)**

(72) Feltalálók(k):

**ELLIOT, Brent J., Hillsboro, OR 97124 (US)**

(74) Képviselő:

**Danubia Szabadalmi és Jogi Iroda Kft.,  
Budapest**(54) **Alkalmazás folytonosság átírányítással egy vezeték nélküli kommunikációs hálózatban**

Az európai szabadalom ellen, megadásának az Európai Szabadalmi Közlönyben való meghirdetésétől számított kilenc hónapon belül, felszólalást lehet benyújtani az Európai Szabadalmi Hivatalnál. (Európai Szabadalmi Egyezmény 99. cikk(1))

A fordítást a szabadalmas az 1995. évi XXXIII. törvény 84/H. §-a szerint nyújtotta be. A fordítás tartalmi helyességét a Szellemi Tulajdon Nemzeti Hivatala nem vizsgálta.

(19)



(11)

**EP 2 868 143 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**15.03.2017 Bulletin 2017/11**

(51) Int Cl.:  
**H04W 4/00 (2009.01)**

(21) Application number: **13813908.4**

(86) International application number:  
**PCT/US2013/047358**

(22) Date of filing: **24.06.2013**

(87) International publication number:  
**WO 2014/008026 (09.01.2014 Gazette 2014/02)**

**(54) APPLICATION CONTINUITY WITH REROUTE IN A WIRELESS COMMUNICATION NETWORK**

**ANWENDUNGSKONTINUITÄT MIT SCHNELLUMLEITUNG IN EINEM DRAHTLOSEN KOMMUNIKATIONSNETZWERK**

**CONTINUITÉ D'APPLICATION AVEC REROUTAGE DANS UN RÉSEAU DE COMMUNICATION SANS FIL**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(74) Representative: **Goddar, Heinz J. Boehmert & Boehmert Anwaltspartnerschaft mbB Patentanwälte Rechtsanwälte Pettenkoferstrasse 20-22 80336 München (DE)**

(30) Priority: **02.07.2012 US 201261667325 P**  
**22.08.2012 US 201213592042**

(56) References cited:  
**US-A1- 2006 133 390 US-B1- 6 631 122**

(43) Date of publication of application:  
**06.05.2015 Bulletin 2015/19**

- **GAHNG-SEOP AHN ET AL.: 'SWAN: Service Differentiation in Stateless Wireless Ad Hoc Networks' INFOCOM 2002, page 458, XP010593606**

(73) Proprietor: **Intel Corporation Santa Clara, CA 95054 (US)**

(72) Inventor: **ELLIOT, Brent J. Hillsboro, OR 97124 (US)**

**EP 2 868 143 B1**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

**Description****Field**

[0001] Embodiments of the present invention relate generally to the field of communications, and more particularly, to migrating network flows for applications between wireless communication interfaces.

**Background**

[0002] Wireless communication devices may be capable of communicating with a remote server over a wireless communication network using a plurality of interfaces. For example, the wireless communication device may be capable of using interfaces that follow with different protocols, such as a cellular interface and a wireless local area network (WLAN) interface, to communicate with the remote server. The wireless communication device may run one or more applications that establish network flows with the remote server over the wireless communication network. However, the most optimal interface may not be used for the network flows. Further, once a network flow is established on one interface, it may be unable to transition to a more optimal interface as one becomes available.

[0003] US 2006/0133390 A1 discloses a method for providing prioritized routing table convergence in Border Gateway Protocol (BGP) hosts, as part of the BGP process that is executed by a route processor in a network, wherein the processor hosts a plurality of BGP routing tables each associated with a specified sub-address family (SAFI). A convergence priority order value is created and stored in association with each routing table. As part of performing a convergence phase of BGP processing, the convergence priority order value of each routing table is obtained. The convergence phase is then performed for the routing tables only according to an order that is represented by the convergence priority order values. Therefore, convergence proceeds more quickly and values needed by other routing processes become available earlier.

[0004] US 6,631,122 B1 relates to methods and systems for wireless QoS agent for all-IP network. The QoS agent couples to an all-IP network. The coupling means includes communication means for transfer of information between the agent and a QoS manager for the all-IP network. The agent is also able to seemingly extend QoS support for multimedia applications from wireline to wireless and control QoS of the multimedia applications sent over wireless connections on the all-IP network.

[0005] The present invention provides an apparatus according to claim 1. The dependent claims relate to special embodiments thereof.

**Brief Description of the Drawings**

[0006] Embodiments will be readily understood by the

following detailed description in conjunction with the accompanying drawings. To facilitate this description, like reference numerals designate like structural elements. Embodiments are illustrated by way of example and not by way of limitation in the figures of the accompanying drawings.

Figure 1 is a block diagram illustrating wireless communication network in accordance with various embodiments.

Figure 2 is a block diagram illustrating a user equipment in accordance with various embodiments.

Figure 3 is a flowchart illustrating a method of application continuity using reroute and reset that may be performed by a user equipment in accordance with various embodiments.

Figure 4 is a flowchart illustrating a method of managing interface priority that may be performed by a user equipment in accordance with various embodiments.

Figure 5 is a block diagram illustrating an example computing system in accordance with various embodiments.

**Detailed Description**

[0007] Illustrative embodiments of the present disclosure include, but are not limited to, methods, systems, and apparatuses for measuring the quality of available interfaces, influencing the interface preferred by individual network flows, and migrating network flows between wireless communication interfaces.

[0008] Various aspects of the illustrative embodiments will be described using terms commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. However, it will be apparent to those skilled in the art that alternate embodiments may be practiced with only some of the described aspects. For purposes of explanation, specific numbers, materials, and configurations are set forth in order to provide a thorough understanding of the illustrative embodiments. However, it will be apparent to one skilled in the art that alternate embodiments may be practiced without the specific details. In other instances, well-known features are omitted or simplified in order not to obscure the illustrative embodiments.

[0009] Further, various operations will be described as multiple discrete operations, in turn, in a manner that is most helpful in understanding the illustrative embodiments; however, the order of description should not be construed as to imply that these operations are necessarily order dependent. In particular, these operations need not be performed in the order of presentation.

[0010] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent implementations may be substituted for the specific embodiments shown and de-

scribed, without departing from the scope of the embodiments of the present disclosure. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that the embodiments of the present disclosure be limited only by the claims. The embodiments which do not fall within the scope of the claims are to be construed as examples.

**[0011]** As used herein, the term "module" may refer to, be part of, or include an Application Specific Integrated Circuit (ASIC), an electronic circuit, a processor (shared, dedicated, or group) and/or memory (shared, dedicated, or group) that execute one or more software or firmware programs, a combinational logic circuit, and/or other suitable components that provide the described functionality.

**[0012]** Figure 1 schematically illustrates a wireless communication network 100 in accordance with various embodiments. The wireless communication network (hereinafter "network 100") may include a UE 104 configured to communicate wirelessly with a remote server 116. The network 100 may include a plurality of interfaces through which the UE 104 may communicate with the remote server 116. Different interfaces may be available for use by the UE 104 at different times and/or locations.

**[0013]** The interfaces may have different properties, such as different communication protocols and/or other properties. For example, the UE 104 may be able to access the remote server 116 via a cellular interface and/or a wireless local area network (WLAN) interface. The cellular interface may be routed through a base station, such as an evolved Node B (eNB) 112. The eNB 112 may be a base station of a 3rd Generation Partnership Project (3GPP) long-term evolution (LTE) network such as an evolved universal mobile telecommunication system (UMTS) terrestrial radio access network (E-UTRAN). The WLAN interface may be routed through a WLAN access point 116. WLAN access point 116 may be an access point of an Institute of Electrical and Electronics Engineers (IEEE) 802.11 WLAN network. The network may include other components (not shown) between the UE 104 and remote server 108 to facilitate the cellular interface and/or WLAN interface.

**[0014]** Although Figure 1 shows eNB 112 and WLAN access point 116, providing a cellular interface and a WLAN interface, respectively, other embodiments may include other interfaces, that use different communication protocols, in addition to or instead of a cellular interface and/or a WLAN interface, such as a wireless personal area network (WPAN) interface, an Ethernet interface, and/or other wired or wireless interfaces which carry internet protocol (IP) traffic. The WPAN interface may use, for example, a Bluetooth protocol. Additionally, or alternatively, the network 100 may provide multiple interfaces of a same category, such as multiple cellular interfaces, WLAN interfaces, and/or WPAN interfaces. In some embodiments, interfaces may use different communication protocols (e.g., different generations/versions of a cellular interface protocol, a WLAN protocol,

and/or a WPAN protocol).

**[0015]** As shown in Figure 2, the UE 104 may include an applications module 220 and a communications module 224 coupled to one another. The applications module 220 may run one or more applications on the UE 104, and may facilitate communications between the applications and the remote server 108. The applications may be stored on the UE 104 and/or accessed by the UE 104 from remote storage. The communications module may manage the communications of the applications over network 100. In some embodiments, the communications module may be included in the applications module. In other embodiments, the communications module may be included in a separate component from the applications module, such as a transceiver of the UE 104.

**[0016]** The applications module 220 and/or communications module 224 may be further coupled with one or more of a plurality of antennas 228 of the UE 104 for communicating wirelessly over network 100. The UE 104 may include any suitable number of antennas 228. One or more of the antennas 228 may be alternately used as transmit or receive antennas. Alternatively, or additionally, one or more of the antennas 228 may be dedicated receive antennas or dedicated transmit antennas.

**[0017]** In various embodiments, the applications module 220 may run an application and the application may request communications with the remote server 108. The communications may be connection-oriented or connectionless and may be referred to as a flow or a session associated with the application and/or the process being carried out by the application. In some embodiments, the connection may be a transmission control protocol (TCP) connection, and the server 108 may be a TCP server. Other embodiments may use the user datagram protocol (UDP), and the server 108 may be a UDP server. Additionally, or alternatively, other embodiments may use other Internet Protocol (IP) based transport protocols for the communications.

**[0018]** The applications module 220 may select a first interface to form the connection from interfaces that are available at the time of the connection request. The first interface may be selected based on a route table. The route table may be stored on and/or accessed by the applications module 220. The route table may include a plurality of rules that define preferences for one or more interfaces over other interfaces.

**[0019]** The applications module 220 and/or communications module 224 may monitor for the availability of other interfaces and/or monitor the quality of the first interface and/or other available interfaces. The applications module 220 and/or communications module 224 may identify a second interface that is preferred to the first interface. For example, the second interface may have recently become available (e.g., the UE 104 entered an area that is covered by a WLAN interface), the quality of the second interface may have improved since the first interface was chosen, and/or the quality of the first interface may have worsened since the first interface was

chosen. The applications module 220 and/or communications module 224 may then modify the route table to prioritize the second interface over the first interface based on the dynamic quality of experience estimated for each available interface. In some embodiments, the mechanisms used for determining the priority of the interfaces may be derived in part or in whole from policies which either ship with and/or are subsequently delivered to the UE 104. The policies may include, but are not limited to, the types of metrics to evaluate, the types of hysteresis, and the values or thresholds against which the metrics are evaluated.

**[0020]** In some embodiments, the route table may be modified by creating one or more rules that take precedence over an existing rule to prioritize the second interface over the first interface. Thus, the existing rules in the route table may be left as they are. Accordingly, the created rule may be removed at a later time to revert back to the default setting of the route table. In some embodiments, the created rule may be associated with one or more applications, flows, and/or routes, as further discussed below. In other embodiments the priority of existing rules may be modified to influence the selection of interfaces on a per-flow basis.

**[0021]** In some embodiments, the creation and/or modification of entries in the route table will result in subsequent applications and their associated flows to initiate communications over the preferred interface. This mechanism ensures that new applications are initiated on the most optimal interface based on upon the dynamic conditions and quality of experience (QoE) metrics assessed on available interfaces at any time. In some embodiments, the preferred interface may be different for different applications and/or flows, as further discussed below.

**[0022]** In some embodiments, the ongoing flow may be migrated from the first interface to the second (e.g., more preferred) interface after evaluation of the available interfaces and corresponding changes to the route table are completed. The mechanism to trigger this migration may differ depending on the transport protocol used. For example, connectionless transports may redirect future packets over the preferred interface as indicated by the route table upon relevant changes to the route table rules. Connection-oriented transports, such as TCP, may require a reset operation to repeat the consultation of the route table to identify the preference for the second interface. The applications module 220 and/or communications module 224 may in this case execute such a reset operation. In the case of TCP, this operation is referred to as a TCP Reset. In some embodiments an instruction for the reset operation may be sent to the application and/or the remote server 108 to terminate an existing flow.

**[0023]** Many applications may seamlessly re-establish a flow upon receipt of a TCP reset operation instruction. For a connection-oriented flow (e.g., TCP flow), when a reset operation occurs, the application may terminate the existing flow and re-establish the logical flow between

the UE 104 and remote server 108. While the re-established flow may appear as a new flow at the TCP layer, it will be referred to as a continuation of the same logical flow in that the application may resume the context and/or state of the flow. When this re-established flow is created, the applications module 220 may reference the route table to re-establish the logical flow with the remote server 108. This enables the second (preferred) interface to be utilized for the re-established flow. This procedure of re-establishing a flow in response to a reset operation is often used to respond to interface drops or failures. However, using the process described herein of modifying the route table to reflect the preferred interface for the given flow at a given time and the triggering of the reset operation on a per-application and/or per-flow basis, the reset capability of the application can be used to accomplish the unique behavior of migrating the flow from one interface to another (e.g., from the first interface to the second interface). In many cases, this results in a seamless end-user experience as the application moves from one interface to another. The state (e.g., of the ongoing flow) may be maintained during the migration by the application, thereby maintaining the end-user experience of application continuity.

**[0024]** In some embodiments, the UE 104 may also send a notice/instruction to the remote server 108 of the reset operation. In other embodiments, the remote server 108 may not be explicitly notified of the reset operation by the UE 104. Sending the reset operation to both the UE 104 and the remote server 108 may reduce the resources consumed at the remote server 108 which may otherwise remain allocated until the flow times out at the remote server 108. For some applications, there may be additional benefits associated with the proper reset operation to both sides of the flow in terms of improving the re-establishment of the logical flow.

**[0025]** Additionally, the applications module 220 may start new flows (e.g., for other applications and/or processes) on the second interface (e.g., based on the modified route table). In some embodiments, only new flows may be started on the second interface, and ongoing flows may not be migrated to the second interface. In these embodiments, the applications module 220 and/or communications module 224 may not initiate a reset operation at the UE 104 and/or remote server 108. The decision not to migrate a given flow may be based upon policies present on the UE 104 or downloaded to the UE 104. These policies may indicate a preference to migrate or not migrate specific flows based on conditions including but not limited to the application's poor experience during migration, the expected short duration of the flow, or a user or service provider preference to execute (or not execute) the flow on particular interfaces.

**[0026]** Alternatively, a subset of ongoing flows may be migrated to the second interface. In that case, the applications module 220 and/or communications module 224 may execute a reset operation for the subset of ongoing flows. Alternatively, a rule may be created in the route

table that applies only to the subset of ongoing flows that are to be migrated. The applications module 220 and/or communications module 224 may determine whether to migrate ongoing flows and/or which ongoing flows to migrate based on any suitable factors, such as an estimated time remaining for the flow, the bandwidth of the flow, the identity of the application executing the flow, and/or other factors. For example, in some situations, a flow with a short time remaining may not be migrated to the second interface, and the flow may instead be finished on the first interface.

**[0027]** In some embodiments, the mechanism used to classify/prioritize a given flow by the applications module 220 and/or communications module 224 may be based upon policies present on and/or downloaded to the UE 104. These mechanisms and their representation within policies may be based on items including but not limited to the following: remote server 108 IP addresses or ranges; domain name system (DNS) names, patterns, or other mechanisms which identify a given remote server or set of servers; specific application names, fingerprints, attributes, patterns or other mechanisms which identify an application; and/or a default classification which matches all flows not identified more specifically by other classification mechanisms. The applications module 220 and/or communications module 224 may consult internal state or other resources to uniquely identify specific flows based upon the classifiers.

**[0028]** In some embodiments, the policies associated with a given flow may be inherited from the policies associated with the corresponding classifier which best matches the flow. The best matching classifier for a given flow may be determined by mechanisms including but not limited to a priority of the classifier, the order of the policies, priority of the policy provider, the specificity of the classifier, the current context of the device or its connections, and/or the type of classifier.

**[0029]** In various embodiments, the second interface may be identified as preferred to the first interface based on any number of metrics, such as connection status, availability of a valid internet protocol (IP) address, signal strength, signal to noise ratio (SNR), channel utilization, a detection of a backhaul outage, a detection of hotlining (e.g. firewall and/or redirection policies that prevent direct Internet access pending user interaction), cell loading, round-trip latency, throughput, application mean opinion score (MOS) (e.g., for voice-over-IP (VoIP)), economic considerations of the available interfaces (e.g., costs to the service provider and/or user), power consumption estimations and/or measurements of the available interfaces, velocity of movement of the UE 104, a power state of the UE 104 (e.g., remaining battery power and/or whether operating off of battery versus charging), IEEE 802.11U- and/or access network discovery and selection function (ANDSF)-asserted information about the available interfaces, prior performance on the same interface, user preferences, and/or service provider preferences (e.g., business/marketing considerations). The metrics

and mechanisms to evaluate and prioritize interfaces may be hardcoded in the implementation and/or derived from policies present or downloaded to the UE 104 or preferences specified by the user.

5 **[0030]** The relative priority of available interfaces may be updated dynamically depending on changing conditions. Thus, a given interface may not always be prioritized over another interface (e.g., a WLAN interface may not always be prioritized over a cellular interface).

10 **[0031]** For example, the applications module 220 and/or communications module 224 may require the WLAN interface to meet a QoE threshold before the WLAN interface will be prioritized over the cellular interface and/or an ongoing flow will be migrated from the cellular interface to the WLAN interface. If the available WLAN interface meets the QoE threshold, then the WLAN interface may be prioritized over the cellular interface and/or the ongoing flow may be migrated to the WLAN interface. However, if the available WLAN interface does not meet the QoE threshold, then the cellular interface may be prioritized over the WLAN interface and/or the ongoing flow may remain on the cellular interface. This may facilitate maintaining a high QoE for the user of the UE 104. Similarly, if the QoE of a current interface drops below a QoE threshold, then an ongoing flow on the current interface may be migrated to another available interface. The QoE thresholds may be different depending on the interface type, flow, application, and/or for evaluating whether to migrate from a current interface or migrate to a destination interface. In some embodiments, the migration of a flow may be delayed a variable period of time in order to give the flow an opportunity to complete on the existing interface. The duration of such a delay may be based upon mechanisms including but not limited to policies defined for the flow and/or application, the duration the flow has been active, and /or the duration measured by the applications 220 module or communications module 224 for similar flows in the past on this UE 104 or another UE.

40 **[0032]** In one example, the user may be running an application connected with the remote server 108 via a cellular interface. The user may then enter an area covered by a WLAN interface that is hotlined. The communications module 224 may not modify the route table or migrate the connection to the WLAN interface due to the detection of the hotlining condition. However, if the hotlining condition is removed (e.g., by the user and/or an automated process), then the connection may be migrated from the cellular interface to the WLAN interface. In some embodiments, the route table may be modified in a manner to enable automated or manual interaction with a captive portal to remove the hotlining condition (e.g. accepting the terms and conditions of the WLAN network). In this case, a route rule may be created to prefer the hotlined WLAN interface for the application and/or flow interacting with the captive portal. At the same time, existing applications and/or flows may be kept on the cellular interface (e.g., the routes associated with the ap-

plications may not be modified and/or a reset operation may not be executed for the applications). This may provide a seamless user experience until such a time when the hotlining condition is removed.

**[0033]** The applications module 220 and/or communications module 224 may continually monitor the current and/or available interfaces and dynamically update the route table as conditions change (e.g., as the UE 104 moves around and/or the availability and/or quality of the interfaces changes). Additionally, the applications module and/or communications module 224 may trigger a reset operation for one or more ongoing applications after the route table is updated.

**[0034]** The applications module 220 and/or communications module 224 may continually and/or periodically monitor active flows and/or applications to optimize the manner in which route rules and/or reset operations are executed for currently active and/or future flows. Information collected may include but is not limited to the application name, the application manifest contents, an application fingerprint, data consumed, session duration, destination IP addresses, interfaces used, economic cost incurred, and/or power consumed or estimated.

**[0035]** As discussed above, the relative priority of the available interfaces may vary amongst various applications, flows, and/or routes. The relative priority may be determined by the applications module 220 and/or communications module 224 based on policies associated with the UE 104. In some embodiments, the policies may be provided by the network operator and/or service provider.

**[0036]** For example, one interface may be preferred for one flow and/or application while simultaneously a different interface may be preferred for another flow and/or application. For instance, a mobile network operator may provide policies which prefer the use of a cellular interface whenever available and offering a sufficient QoE for some applications, and prefer a WLAN interface whenever available and offering a sufficient QoE for other applications. Additionally, or alternatively, flows for some applications may be migrated to a WLAN interface from a cellular interface whenever a WLAN interface is available, while flows for other applications may require a certain QoE threshold to be met on the WLAN interface before migrating the flows from the cellular interface. Still other flows may exclusively be executed over a given interface associated with a communications protocol (such as cellular or WLAN) regardless of whether other interfaces are available.

**[0037]** Under conditions when more than one interface is available, there may be cases where the first interface is preferred by a first application and simultaneously the second interface is preferred for a second application. As an example, one or more policies may prefer the use of a cellular interface (e.g., if available and offering a sufficient QoE) for an application which is not metered or charged per byte transferred (e.g., VoIP), and may prefer a WLAN interface for an application which is metered or

charged per byte transferred (e.g., streaming media over IP). Considerations influencing dissimilar application-specific, flow-specific, or service-specific interface preferences include but are not limited to different entities providing the service, cost associated with the services and/or the corresponding data consumed, manner in which the data consumed is metered for the given services, security requirements for the services, performance requirements for the services, expected duration of flows associated with the services, and whether the services are reachable only via specific interfaces (e.g. on-campus Enterprise services only available via a WLAN Intranet but not via Cellular Internet access).

**[0038]** Thus, in some embodiments, the policies used by the UE 104 to determine the relative priority of available interfaces may be associated with a subset of applications, flows, and/or routes. The route table may be modified by creating rules to achieve the determined priorities. The rules in the route table may include an interface that is preferred for particular destination IP addresses or ranges of IP addresses (e.g., the IP address of the remote server 108).

**[0039]** The applications may be identified and/or categorized by any suitable information, such as application name, pattern, and/or information from an application manifest. Alternatively, the relative priority may be associated with a specific route of the flow (e.g., based on a source IP address, destination IP address, subnet mask, and/or port identifier). The applications module 220 and/or communications module 224 may create a rule in the route table that is associated with one or more applications, flows, and/or routes. The route entries themselves may be explicitly tied to a destination IP address or a range of destination IP addresses. In some embodiments the destination IP addresses and/ IP address ranges corresponding to created and/or modified route entries in the route table can be extracted from policies, from information about currently active flows, and/or from information about previously active flows on the applications module 220.

**[0040]** Additionally, or alternatively, the applications module and/or the communications module 224 may execute a reset operation for a subset of ongoing flows depending on the applications, routes, and/or other parameters associated with the flows. The applications module 220 and/or communications module 224 may also create default rules that apply to applications, flows, and/or routes that are not covered by a more specific rule that is not application-, flow-, or route- specific.

**[0041]** In various embodiments, the application executing the ongoing flow may support TCP re-connection to maintain application continuity when executing a TCP reset. Thus a state of the ongoing flow may be maintained when migrating the flow from the first interface to the second interface. However, the reroute and reset process described herein may also be used with applications that do not support TCP re-connection. For these applications, the flow (e.g., the download and/or streaming

process) may stop when the migration is triggered by the TCP reset instruction from the applications module 220 and/or communications module 224. In some cases, the user may be required to perform an action, such as pressing a button, to resume the flow.

**[0042]** Additionally, while the reroute and reset process is described herein with respect to a connection-oriented (e.g., TCP) connection between the UE 104 and the remote server 108, the process may be used for connectionless flows, such as a UDP connection. For a UDP application, the applications module 220 and/or communications module 224 may modify the route table to prioritize the second interface over the first interface. The UDP application may continually reference the route table, and thus no reset operation may be required for the UDP application to migrate to the second interface and to achieve a similar benefit as described herein for the connection-oriented flow case.

**[0043]** Figure 3 illustrates a method 300 of maintaining application continuity using reroute and reset that may be performed by a UE (e.g., UE 104) in accordance with various embodiments. In some embodiments, the UE may include and/or have access to one or more computer-readable media having instructions, stored thereon, that, when executed, cause the UE to perform the method 300.

**[0044]** At 304, an application being run by the UE may establish a TCP flow with a remote server using a first interface. The first interface may be selected based on a route table.

**[0045]** At 308, the application may send data to the remote server that alters the state of the flow (e.g., in an application- and/or protocol- specific manner).

**[0046]** At 312, the UE may identify a second interface to which to migrate the TCP flow. The second interface may be identified as preferable to the first interface based on any suitable factors, as discussed herein. The second interface may have recently become available (e.g., may not have been available at block 304), the QoE of the second interface may have recently met a threshold value, the QoE of the first interface may have recently met a threshold value, and/or the relative QoE of the second interface relative to the first interface may have recently changed sufficiently to change their relative priority for the flow.

**[0047]** At 316, the UE may modify the route table to prioritize the second interface over the first interface. For example, the UE may create a rule that takes precedence over an existing rule to prioritize the second interface over the first interface. In some embodiments, the rule may be associated with the application and/or with the flow.

**[0048]** At 320, the UE may execute a TCP reset to re-establish the TCP flow between the application and the remote server. The TCP flow may be re-established using the second interface (e.g., chosen based on the created rule in the route table).

**[0049]** At 324, the application may re-establish the

state of the TCP flow (e.g., in an application- and/or protocol- specific manner). The application and remote server may then continue their communications using the second interface. This re-establishment may be seamless or non-seamless from the UE 104 user point of view.

**[0050]** The first and second interfaces may be any suitable type of interfaces. For example, in some embodiments, the first interface may be a cellular interface and the second interface may be a WLAN interface. In other embodiments, the first interface may be a WLAN interface and the second interface may be a cellular interface. In yet other embodiments, both the first and second interfaces may be WLAN interfaces or cellular interfaces. While first and second interface are used throughout the document, an arbitrary number of changes to route rules and optional flow migrations may occur over the lifetime of a logical flow and/or application. In each case first interface is considered the currently active interface and second interface is the most preferred alternative interface.

**[0051]** Figure 4 illustrates a method 400 of managing interface priority that may be performed by a UE (e.g., UE 104) in accordance with various embodiments. In some embodiments, the UE may include and/or have access to one or more computer-readable media having instructions, stored thereon, that, when executed, cause the UE to perform the method 400.

**[0052]** At 404, the UE may establish a flow between a first application and a remote server using a first interface.

The first interface may be selected based on a route table.

**[0053]** At 408, the UE may identify a second interface that is available for communications with the UE

**[0054]** At 412, the UE may detect the presence of a hotlining condition on the second interface.

**[0055]** At 416, the UE may modify, based on the detection of the hotlining condition, the route table to prioritize the second interface over the first interface for a second application that is configured to remove the hotlining condition. For example, the second application may interact (e.g., manually or automatically) with a captive portal associated with the second interface. The UE may maintain the flow between the first application and the remote server on the first interface while the hotlining condition is present on the second interface.

**[0056]** In some instances, the second application may remove the hotlining condition on the second interface. Thereafter, at 420, the UE may detect an absence of the hotlining condition on the second interface. At 424, the UE may modify the route table to prioritize the second interface over the first interface for the first application. In some embodiments, the UE may execute a reset operation to migrate the ongoing flow between the first application and the remote server from the first interface to the second interface.

**[0057]** The UE 104 described herein may be implemented into a system using any suitable hardware and/or software to configure as desired. Figure 5 illustrates, for one embodiment, an example system 500 comprising

one or more processor(s) 504, system control logic 508 coupled with at least one of the processor(s) 504, system memory 512 coupled with system control logic 508, non-volatile memory (NVM)/storage 516 coupled with system control logic 508, a network interface 520 coupled with system control logic 508, and input/output (I/O) devices 532 coupled with system control logic 508.

**[0058]** The processor(s) 504 may include one or more single-core or multi-core processors. The processor(s) 504 may include any combination of general-purpose processors and dedicated processors (e.g., graphics processors, application processors, baseband processors, etc.).

**[0059]** System control logic 508 for one embodiment may include any suitable interface controllers to provide for any suitable interface to at least one of the processor(s) 504 and/or to any suitable device or component in communication with system control logic 508.

**[0060]** System control logic 508 for one embodiment may include one or more memory controller(s) to provide an interface to system memory 512. System memory 512 may be used to load and store data and/or instructions, for example, for system 500. System memory 512 for one embodiment may include any suitable volatile memory, such as suitable dynamic random access memory (DRAM), for example.

**[0061]** NVM/storage 516 may include one or more tangible, non-transitory computer-readable media used to store data and/or instructions, for example. NVM/storage 516 may include any suitable non-volatile memory, such as flash memory, for example, and/or may include any suitable non-volatile storage device(s), such as one or more hard disk drive(s) (HDD(s)), one or more compact disk (CD) drive(s), and/or one or more digital versatile disk (DVD) drive(s), for example.

**[0062]** The NVM/storage 516 may include a storage resource physically part of a device on which the system 500 is installed or it may be accessible by, but not necessarily a part of, the device. For example, the NVM/storage 516 may be accessed over a network via the network interface 520 and/or over Input/Output (I/O) devices 532.

**[0063]** Network interface 520 may have a transceiver 522 to provide a radio interface for system 500 to communicate over one or more network(s) and/or with any other suitable device. In some embodiments, the transceiver 522 may implement communications module 224 of UE 104. In various embodiments, the transceiver 522 may be integrated with other components of system 500. For example, the transceiver 522 may include a processor of the processor(s) 504, memory of the system memory 512, and NVM/Storage of NVM/Storage 516. Network interface 520 may include any suitable hardware and/or firmware. Network interface 520 may include a plurality of antennas to provide a multiple input, multiple output radio interface. Network interface 520 for one embodiment may include, for example, a wired network adapter, a wireless network adapter, a telephone modem, and/or a wireless modem.

**[0064]** For one embodiment, at least one of the processor(s) 504 may be packaged together with logic for one or more controller(s) of system control logic 508. For one embodiment, at least one of the processor(s) 504 may be packaged together with logic for one or more controllers of system control logic 508 to form a System in Package (SiP). For one embodiment, at least one of the processor(s) 504 may be integrated on the same die with logic for one or more controller(s) of system control logic 508. For one embodiment, at least one of the processor(s) 504 may be integrated on the same die with logic for one or more controller(s) of system control logic 508 to form a System on Chip (SoC).

**[0065]** In various embodiments, the I/O devices 532 may include user interfaces designed to enable user interaction with the system 500, peripheral component interfaces designed to enable peripheral component interaction with the system 500, and/or sensors designed to determine environmental conditions and/or location information related to the system 500.

**[0066]** In various embodiments, the user interfaces could include, but are not limited to, a display (e.g., a liquid crystal display, a touch screen display, etc.), a speaker, a microphone, one or more cameras (e.g., a still camera and/or a video camera), a flashlight (e.g., a light emitting diode flash), and a keyboard.

**[0067]** In various embodiments, the peripheral component interfaces may include, but are not limited to, a non-volatile memory port, a universal serial bus (USB) port, an audio jack, and a power supply interface.

**[0068]** In various embodiments, the sensors may include, but are not limited to, a gyro sensor, an accelerometer, a proximity sensor, an ambient light sensor, and a positioning unit. The positioning unit may also be part of, or interact with, the network interface 520 to communicate with components of a positioning network, e.g., a global positioning system (GPS) satellite.

**[0069]** In various embodiments, the system 500 may be a mobile computing device such as, but not limited to, a laptop computing device, a tablet computing device, a netbook, a smartphone, etc. In various embodiments, system 500 may have more or less components, and/or different architectures.

#### 45 EXAMPLES

**[0070]** Example 1 is an apparatus to be employed by a user equipment, the apparatus comprising: means to select a first interface, based on a route table, for an Internet Protocol (IP)-based flow with a remote server to be used by an application for communications with the remote server over a wireless communication network; means to establish the flow with the remote server using the first interface; means to identify a second interface to which to migrate the flow; means to modify the route table to prioritize the second interface over the first interface; and means to execute a reset operation to re-establish the flow with the remote server using the second

interface.

**[0071]** Example 2 is the apparatus of Example 1, wherein the second interface is identified based on an availability of a valid IP address or a detection of hotlining or a backhaul outage on one or more of a plurality of available interfaces including the first and second interfaces.

**[0072]** Example 3 is the apparatus of Example 1, wherein the means to execute the reset operation is to execute the reset operation to re-establish the flow using the second interface for a subset of applications run by the computing system.

**[0073]** Example 4 is the apparatus of Example 1, wherein the route table is modified by creating a rule that takes precedence over an existing rule in the route table.

**[0074]** Example 5 is an apparatus for managing communications for one or more applications, comprising: an applications module configured to run an application and to facilitate communications between the application and a remote server over a communication network via a first interface, the first interface selected based on a route table; and a communications module coupled with the applications module. The communications module is configured to: identify a second interface for communications between the application and the remote server; and modify the route table to prioritize the second interface over the first interface.

**[0075]** Example 6 is the apparatus of Example 5, wherein the applications module is further configured to execute a reset operation to re-establish communications between the application and the remote server using the second interface.

**[0076]** Example 7 is the apparatus of Example 6, wherein the applications module is configured to execute the reset operation after a delay from the identification of the second interface to allow a flow between the application and the remote server to finish.

**[0077]** Example 8 is the apparatus of Example 6, wherein the applications module is configured to execute the reset operation for a subset of ongoing flows.

**[0078]** Example 9 is the apparatus of Example 5, wherein the communications module is configured to identify the second interface based on signal measurements on a plurality of available interfaces including the first and second interfaces, an estimation or a measurement of power consumption for communications on the available interfaces, economic considerations associated with the available interfaces, loading conditions associated with the available interfaces, or performance measurements on the available interfaces.

**[0079]** Example 10 is the apparatus of Example 5, wherein the communications module is configured to select the second interface based on an availability of a valid Internet Protocol (IP) address or a detection of hotlining or a backhaul outage on one or more of a plurality of available interfaces including the first and second interfaces.

**[0080]** Example 11 is the apparatus of Example 5,

wherein the first interface is a cellular interface and the second interface is a wireless local area network (WLAN) interface.

**[0081]** Example 12 is the apparatus of Example 5, wherein the first interface is a wireless local area network (WLAN) interface and the second interface is a cellular interface.

**[0082]** Example 13 is the apparatus of Example 5, wherein the route table is modified by creating a rule that takes precedence over an existing rule in the route table.

**[0083]** Example 14 is the apparatus of Example 5, wherein the route table is modified to prioritize the second interface over the first interface for a subset of applications run by the applications module.

**[0084]** Example 15 is the apparatus of Example 5, wherein the communications module is configured to identify the second interface based on a policy, wherein the policy is associated with a flow between the application and the remote server based on an internet protocol (IP) address, a domain name system (DNS) name, or a pattern of the remote server, a name, fingerprint, attribute, or pattern of the application or flow, or a default classification which matches flows not identified by other classifications.

**[0085]** Example 16 is a system for managing communications for one or more applications, the system including an applications processor configured to run a plurality of applications including a first application, the applications processor configured to establish a flow between the first application and a remote server using a first interface based on a route table. The system of Example 16 further includes a communications processor coupled with the applications processor and configured to: identify a second interface that is available for communications with the UE; detect a hotlining condition on the second interface; and modify, based on the detection, the route table to prioritize the second interface over the first interface for a second application that is configured to remove the hotlining condition.

**[0086]** Example 17 is the system of Example 16, wherein the applications processor is configured to maintain the flow between the first application and the remote server on the first interface when the hotlining condition is present on the second interface.

**[0087]** Example 18 is the system of Example 17, wherein after the detection of the hotlining condition, the communications processor is further configured to: detect an absence of the hotlining condition on the second interface; and modify the route table to prioritize the second interface over the first interface for the flow between the first application and the remote server.

**[0088]** Example 19 is the system of Example 18, wherein the applications processor is further configured to execute a reset operation to re-establish the flow between the first application and the remote server using the second interface.

**[0089]** Example 20 is the system of Example 16, wherein the route table is modified by creating a rule that

takes precedence over an existing rule in the route table.

[0090] Example 21 is one or more non-transitory computer-readable media having instructions, stored thereon, that, when executed cause a computing system to: select a first interface, based on a route table, for an Internet Protocol (IP)-based flow with a remote server to be used by an application for communications with the remote server over a wireless communication network; establish the flow with the remote server using the first interface; identify a second interface to which to migrate the flow;

modify the route table to prioritize the second interface over the first interface; and execute a reset operation to re-establish the flow with the remote server using the second interface.

[0091] Example 22 is the one or more computer-readable media of Example 21, wherein the second interface is identified based on signal measurements on a plurality of available interfaces including the first and second interfaces, an estimation or a measurement of power consumption for communications on the available interfaces, economic considerations associated with the available interfaces, loading conditions associated with the available interfaces, or performance measurements on the available interfaces.

[0092] Example 23 is the one or more computer-readable media of Example 21, wherein the second interface is identified based on an availability of a valid IP address or a detection of hotlining or a backhaul outage on one or more of a plurality of available interfaces including the first and second interfaces.

[0093] Example 24 is the one or more computer-readable media of Example 21, wherein the instructions, when executed, cause the computing system to execute the reset operation to re-establish the flow using the second interface for a subset of applications run by the computing system.

Claims

- 1. An apparatus to be employed by a user equipment, UE, (104), the apparatus comprising:

means to select a first interface, based on a route table, for an Internet Protocol, IP,- based flow with a remote server (108) to be used by a first application for communications with the remote server over a wireless communication network; means to establish the flow between the first application and the remote server using the first interface based on the route table; means to identify a second interface that is available for communications with the UE characterized in that the apparatus further comprising means to detect the presence of a hotlining condition on the second interface; means to modify, based on the detection, the

route table to prioritize the second interface over the first interface for a second application configured to remove the hotlining condition; means to detect an absence of the hotlining condition on the second interface; and means to modify the route table to prioritize the second interface or the first interface for the first application

- 2. The apparatus of claim 1, wherein the second interface is identified based on an availability of a valid IP address or a detection of hotlining or a backhaul outage on one or more of a plurality of available interfaces including the first and second interfaces.

- 3. The apparatus of claim 1, wherein the route table is modified by creating a rule that takes precedence over an existing rule in the route table.

- 4. The apparatus of any of claims 1-3, comprising a means to execute a reset operation to migrate an ongoing flow between the first application and the remote server from the first interface to the second interface.

- 5. The apparatus of claim 4, wherein the means to execute the reset operation is to execute the reset operation to re-establish the flow using the second interface for a subset of applications run by the computing system.

- 6. The apparatus of claim 4 or 5, wherein the means to execute the reset operation is configured to execute the reset operation after a delay from the identification of the second interface to allow a flow between the application and the remote server to finish.

- 7. The apparatus of any of claims 1 -6, wherein the means to identify the second interface is configured to identify the second interface based on signal measurements on a plurality of available interfaces including the first and second interfaces, an estimation or a measurement of power consumption for communications on the available interfaces, economic considerations associated with the available interfaces, loading conditions associated with the available interfaces, or performance measurements on the available interfaces.

- 8. The apparatus of any of claims 1-7, wherein the first interface is a cellular interface (112) and the second interface is a wireless local area network, WLAN, interface (116), or, alternatively, wherein the first interface is a wireless local area network, WLAN, interface (116) and the second interface is a cellular interface (112).

- 9. The apparatus of any of claims 1-8, wherein the route

table is modified by creating a rule that takes precedence over an existing rule in the route table, or, alternatively, wherein the route table is modified to prioritize the second interface over the first interface for a subset of applications run by the means to execute the reset operation.

10. The apparatus of any of claims 1-6, wherein the means to identify the second interface is configured to identify the second interface based on a policy, wherein the policy is associated with a flow between the application and the remote server (116) based on an internet protocol, IP, address, a domain name system, DNS, name, or a pattern of the remote server, a name, fingerprint, attribute, or pattern of the application or flow, or a default classification which matches flows not identified by other classifications.
11. The apparatus of any of claims 1 to 10, wherein the means to establish the flow is configured to maintain the flow between the first application and the remote server (116) on the first interface when the hotlining condition is present on the second interface.

#### Patentansprüche

1. Vorrichtung, die von einer Benutzerausrüstung, UE, (104) zu nutzen ist, die Vorrichtung umfassend:

Mittel zum Auswählen einer ersten Schnittstelle, basierend auf einer Leitwegtabelle, für einen Internetprotokoll- bzw. IP-basierten Fluss mit einem entfernten Server (108), zu verwenden von einer ersten Anwendung für Kommunikation mit dem entfernten Server über ein drahtloses Kommunikationsnetzwerk;

Mittel zum Herstellen des Flusses zwischen der ersten Anmeldung und dem entfernten Server unter Verwendung der ersten Schnittstelle basierend auf der Leitwegtabelle;

Mittel zum Identifizieren einer zweiten Schnittstelle, die für Kommunikation mit der UE verfügbar ist;

**dadurch gekennzeichnet, dass** die Vorrichtung ferner umfasst:

Mittel zum Detektieren des Vorliegens eines Hotlining-Zustands in der zweiten Schnittstelle;

Mittel zum Modifizieren, basierend auf der Detektion, der Leitwegtabelle, um die zweite Schnittstelle gegenüber der ersten Schnittstelle für eine zweite Anwendung, die konfiguriert ist, den Hotlining-Zustand zu entfernen, zu priorisieren;

Mittel zum Detektieren eines Nichtvorliegens des Hotlining-Zustands in der zweiten

Schnittstelle; und

Mittel zum Modifizieren der Leitwegtabelle, um die zweite Schnittstelle oder die erste Schnittstelle für die erste Anwendung zu priorisieren.

2. Vorrichtung nach Anspruch 1, wobei die zweite Schnittstelle basierend auf einer Verfügbarkeit einer gültigen IP-Adresse oder einer Detektion von Hotlining oder eines Backhaul-Ausfalls in einer oder mehreren einer Vielzahl von verfügbaren Schnittstellen einschließlich der ersten und der zweiten Schnittstelle identifiziert wird.
3. Vorrichtung nach Anspruch 1, wobei die Leitwegtabelle durch Erzeugen einer Regel, die Vorrang vor einer existierenden Regel in der Leitwegtabelle erhält, modifiziert wird.
4. Vorrichtung nach einem der Ansprüche 1-3, umfassend ein Mittel zum Ausführen einer Rücksetzungsoperation, um einen laufenden Fluss zwischen der ersten Anwendung und dem entfernten Server von der ersten Schnittstelle zu der zweiten Schnittstelle zu übertragen.
5. Vorrichtung nach Anspruch 4, wobei das Mittel zum Ausführen der Rücksetzungsoperation dient, die Rücksetzungsoperation auszuführen, um den Fluss unter Verwendung der zweiten Schnittstelle für eine Teilmenge der Anwendungen, die von dem Berechnungssystem ausgeführt werden, wiederherzustellen.
6. Vorrichtung nach Anspruch 4 oder 5, wobei das Mittel zum Ausführen der Rücksetzungsoperation konfiguriert ist, die Rücksetzungsoperation nach einer Verzögerung von der Identifikation der zweiten Schnittstelle auszuführen, um zu gestatten, dass ein Fluss zwischen der Anwendung und dem entfernten Server endet.
7. Vorrichtung nach einem der Ansprüche 1-6, wobei das Mittel zum Identifizieren der zweiten Schnittstelle konfiguriert ist, die zweite Schnittstelle basierend auf Signalmessungen an einer Vielzahl von verfügbaren Schnittstellen einschließlich der ersten und der zweiten Schnittstelle, einer Schätzung oder einer Messung des Leistungsverbrauchs für Kommunikation in den verfügbaren Schnittstellen, wirtschaftlichen Überlegungen, die mit den verfügbaren Schnittstellen assoziiert sind, Belastungsbedingungen, die mit den verfügbaren Schnittstellen assoziiert sind, oder Leistungsmessungen an den verfügbaren Schnittstellen zu identifizieren.
8. Vorrichtung nach einem der Ansprüche 1-7, wobei die erste Schnittstelle eine zellulare Schnittstelle

(112) ist und die zweite Schnittstelle eine Schnittstelle eines drahtlosen Nahbereichsnetzwerks, WLAN, (116) ist oder alternativ wobei die erste Schnittstelle eine Schnittstelle eines drahtlosen Nahbereichsnetzwerks, WLAN, (116) ist und die zweite Schnittstelle eine zellulare Schnittstelle (112) ist.

9. Vorrichtung nach einem der Ansprüche 1-8, wobei die Leitwegtabelle durch Erzeugen einer Regel, die Vorrang vor einer existierenden Regel in der Leitwegtabelle erhält, modifiziert wird oder alternativ wobei die die Leitwegtabelle modifiziert wird, um die zweite Schnittstelle gegenüber der ersten Schnittstelle für eine Teilmenge von Anwendungen, die von dem Mittel zum Ausführen der Rücksetzungsoperation ausgeführt werden, zu priorisieren.
10. Vorrichtung nach einem der Ansprüche 1-6, wobei das Mittel zum Identifizieren der zweiten Schnittstelle konfiguriert ist, die zweite Schnittstelle basierend auf einer Richtlinie zu identifizieren, wobei die Richtlinie mit einem Fluss zwischen der Anwendung und dem entfernten Server (116) basierend auf einer Internetprotokoll- bzw. IP-Adresse, einem Domänennamensystem- bzw. DNS-Namen oder einem Muster des entfernten Servers, einem Namen, Fingerabdruck, Attribut oder Muster der Anwendung oder des Flusses oder einer Standardklassifizierung, die nicht durch andere Klassifizierungen identifizierten Flüssen entspricht, assoziiert ist.
11. Vorrichtung nach einem der Ansprüche 1 bis 10, wobei das Mittel zum Herstellen des Flusses konfiguriert ist, den Fluss zwischen der ersten Anwendung und dem entfernten Server (116) an der ersten Schnittstelle aufrechtzuerhalten, wenn der Hotlining-Zustand in der zweiten Schnittstelle vorliegt.

## Revendications

1. Appareil à employer par un équipement utilisateur, UE, (104), l'appareil comprenant :
- un moyen pour sélectionner une première interface, en se basant sur une table de routage, pour un flux basé sur un protocole Internet, IP, avec un serveur éloigné (108) à utiliser par une première application pour des communications avec le serveur éloigné sur un réseau de communication sans fil ;
- un moyen pour établir le flux entre la première application et le serveur éloigné à l'aide de la première interface en se basant sur la table de routage ;
- un moyen pour identifier une seconde interface qui est disponible pour des communications

avec l'UE **caractérisé en ce que** l'appareil comprend en outre un moyen pour détecter la présence d'une condition de téléassistance sur la seconde interface ;

- 5 un moyen pour modifier, en se basant sur la détection, la table de routage pour prioriser la seconde interface par rapport à la première interface pour une seconde application configurée pour supprimer la condition de téléassistance ;
- 10 un moyen pour détecter une absence de la condition de téléassistance sur la seconde interface ; et
- 15 un moyen pour modifier la table de routage pour prioriser la seconde interface ou la première interface pour la première application.

2. Appareil selon la revendication 1, dans lequel la seconde interface est identifiée en se basant sur une disponibilité d'une adresse IP valide ou une détection de téléassistance ou une indisponibilité de liaison terrestre sur une ou plusieurs d'une pluralité d'interfaces disponibles y compris les première et seconde interfaces.

- 25 3. Appareil selon la revendication 1, dans lequel la table de routage est modifiée par création d'une règle qui prime sur une règle existante dans la table de routage.

- 30 4. Appareil selon l'une quelconque des revendications 1 à 3, comprenant un moyen pour exécuter une opération de réinitialisation pour faire migrer un flux en cours entre la première implication et le serveur éloigné de la première interface à la seconde interface.

- 35 5. Appareil selon la revendication 4, dans lequel le moyen pour exécuter l'opération de réinitialisation consiste à exécuter l'opération de réinitialisation pour rétablir le flux à l'aide de la seconde interface pour un sous-ensemble d'applications exécuté par le système informatique.

- 40 6. Appareil selon la revendication 4 ou 5, dans lequel le moyen pour exécuter l'opération de réinitialisation est configuré pour exécuter l'opération de réinitialisation après un délai à partir de l'identification de la seconde interface pour laisser finir un flux entre l'application et le serveur éloigné.

- 45 7. Appareil selon l'une quelconque des revendications 1 à 6, dans lequel le moyen pour identifier la seconde interface est configuré pour identifier la seconde interface en se basant sur des mesures de signal sur une pluralité d'interfaces disponibles, dont les première et seconde interfaces, une estimation ou une mesure de consommation de puissance pour des communications sur les interfaces disponibles, des considérations économiques associées aux interfa-

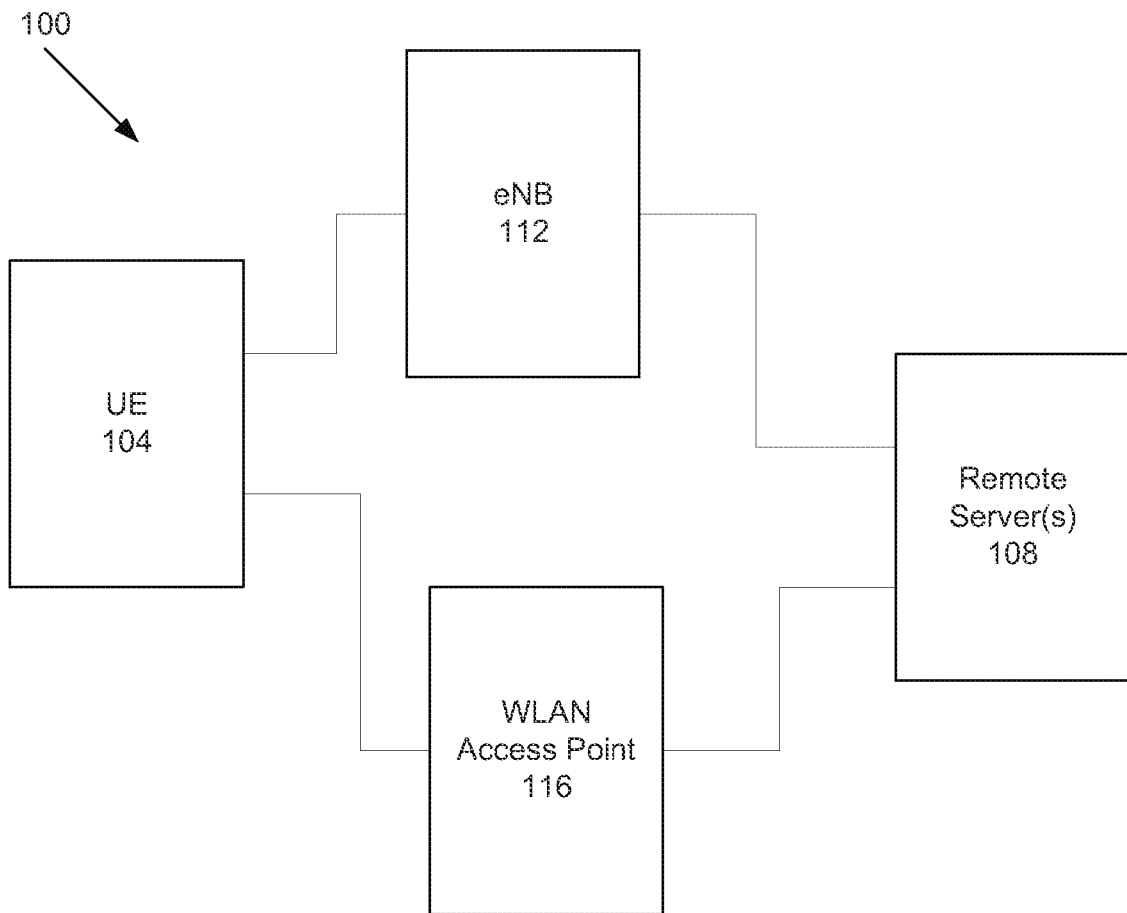
ces disponibles, des conditions de chargement associées aux interfaces disponibles, ou des mesures de performance sur les interfaces disponibles.

8. Appareil selon l'une quelconque des revendications 1 à 7, dans lequel la première interface est une interface cellulaire (112) et la seconde interface est une interface de réseau local sans fil, WLAN, (116), ou, en variante, dans lequel la première interface est une interface de réseau local sans fil, WLAN, (116) et la seconde interface est une interface cellulaire (112). 5  
10
9. Appareil selon l'une quelconque des revendications 1 à 8, dans lequel la table de routage est modifiée par création d'une règle qui prime sur une règle existante dans la table de routage ou, en variante, dans lequel la table de routage est modifiée pour prioriser la seconde interface sur la première interface pour un sous-ensemble d'applications exécuté par le moyen pour exécuter l'opération de réinitialisation. 15  
20
10. Appareil selon l'une quelconque des revendications 1 à 6, dans lequel le moyen pour identifier la seconde interface est configuré pour identifier la seconde interface en se basant sur une politique, dans lequel la politique est associée à un flux entre l'application et le serveur éloigné (116) en se basant sur une adresse de protocole Internet, IP, un nom de système de nom de domaine, DNS, ou un motif du serveur éloigné, un nom, une empreinte, un attribut ou un motif de l'application ou du flux, ou une classification par défaut qui fait concorder des flux non identifiés par d'autres classifications. 25  
30  
35
11. Appareil selon l'une quelconque des revendications 1 à 10, dans lequel le moyen pour établir le flux est configuré pour maintenir le flux entre la première application et le serveur éloigné (116) sur la première interface lorsque la condition de téléassistance est présente sur la seconde interface. 40

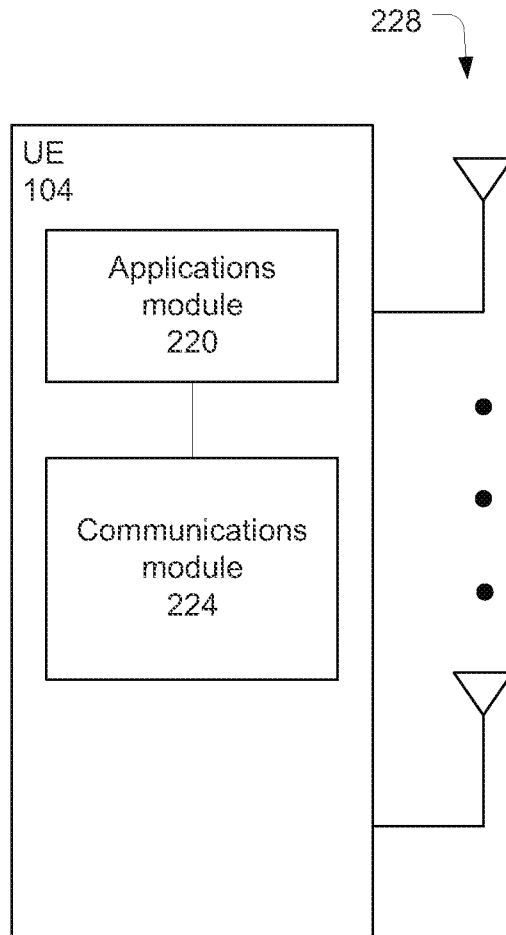
45

50

55

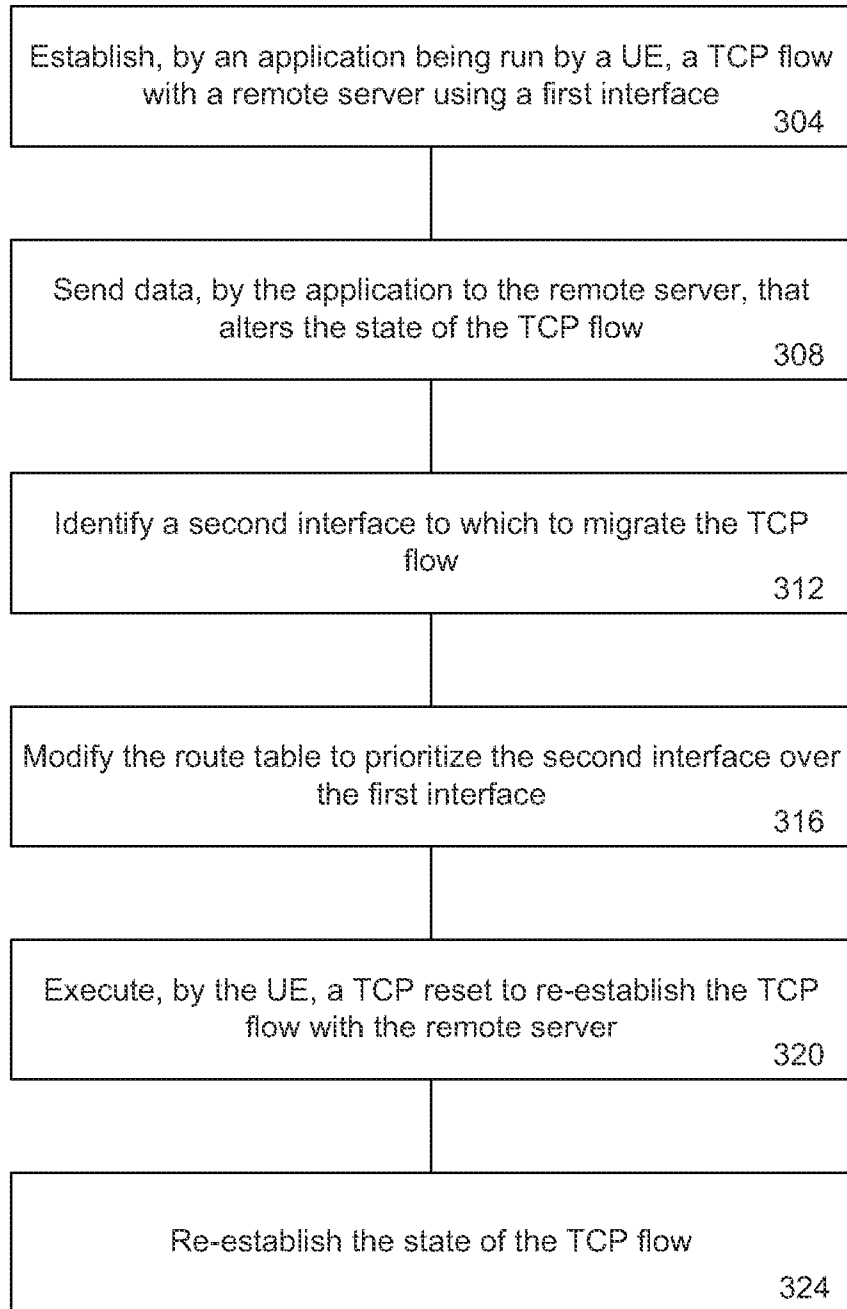


**Figure 1**



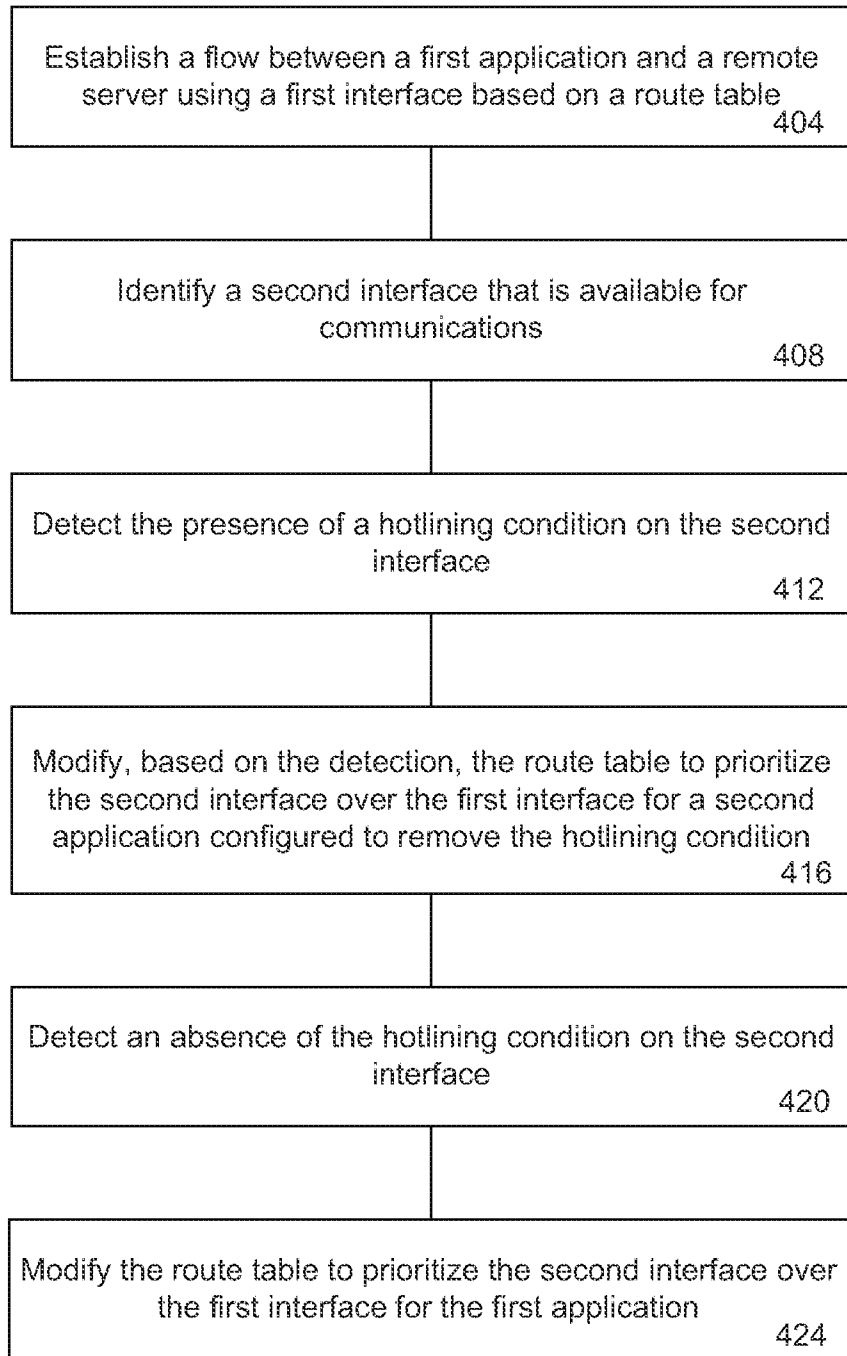
**Figure 2**

300  
↙

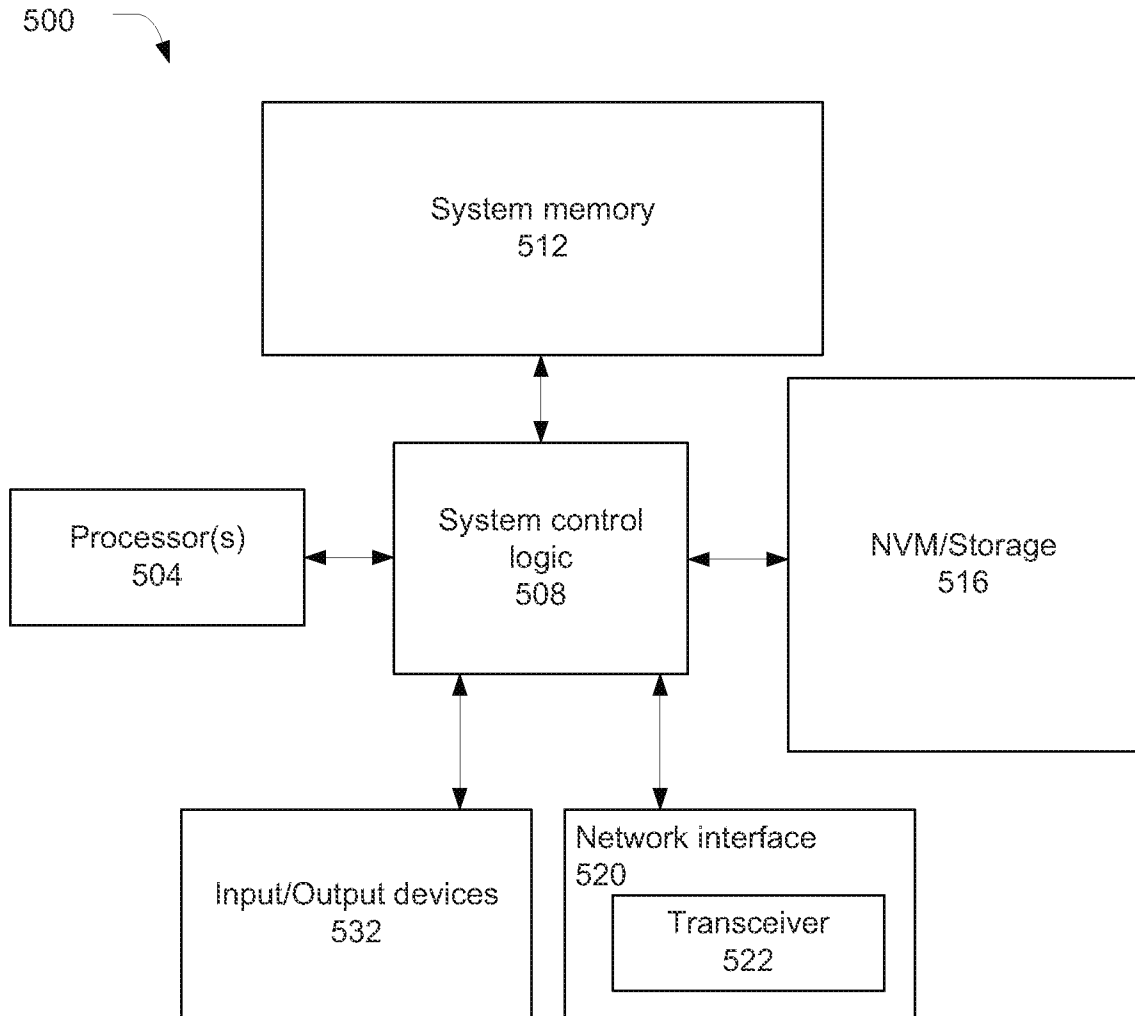


**Figure 3**

400  
↓



**Figure 4**



**Figure 5**

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- US 20060133390 A1 [0003]
- US 6631122 B1 [0004]

Alkalmazás folytonosság átírányítással egy vezeték nélküli kommunikációs hálózatban

Szabadalmi igénypontok



1. Egy felhasználói készülékkel, UE, (104) alkalmazandó berendezés, amely tartalmaz:

eszközt egy útvonaltáblázat alapján egy első interfész kiválasztására egy távoli kiszolgálóval (108) létesítendő, Internet Protocol, IP, alapú folyam számára, mely útvonaltáblázatot egy első alkalmazással kell használni a távoli kiszolgálóval egy vezeték nélküli kommunikációs hálózaton keresztül folytatandó kommunikációkhoz;

eszközt a folyam létrehozására az első alkalmazás és a távoli kiszolgáló között az első interfész használatával az útvonaltáblázat alapján,

eszközt egy olyan második interfész azonosítására, amely az UE-vel folytatandó kommunikációkhoz rendelkezésre áll, *azzal jellemezve*, hogy a berendezés tartalmaz továbbá

eszközt a második interfészen egy hotlining-feltétel fennállásának detektálására;

eszközt a detektálás alapján az útvonaltáblázat módosítására elsőbbség biztosításához a második interfész számára az első interfészhez képest, a hotlining-feltétel megszüntetésére konfigurált második alkalmazáshoz;

eszközt a második interfészen a hotlining-feltétel fennállása hiányának detektálására; és

eszközt az útvonaltáblázat módosítására a második interfész vagy az első interfész számára elsőbbség biztosításához az első alkalmazás számára.

2. Az 1. igénypont szerinti berendezés, ahol a második interfész egy érvényes IP cím elérhetősége alapján, vagy egy hotlining-feltétel detektálása, vagy az első és második interfészt magában foglaló több rendelkezésre álló interfész közül egy vagy több interfésznél jelentkező backhaul kiesés alapján azonosított.

3. Az 1. igénypont szerinti berendezés, ahol az útvonaltáblázat egy olyan szabály létrehozása útján módosított, amely egy az útvonaltáblázatban létező szabályt felülír.

4. Az 1-3. igénypontok bármelyike szerinti berendezés, amely egy eszközt tartalmaz egy alaphelyzetbe visszaállító művelet végrehajtására, egy az első alkalmazás és a második kiszolgáló közötti folyam első interfésztől a második interfészhez történő átmozgatására.

5. A 4. igénypont szerinti berendezés, ahol az alaphelyzetbe visszaállító műveletet végrehajtó eszköz az alaphelyzetbe visszaállító művelet végrehajtására szolgál a folyam második interfész használatával történő ismételt létrehozásához egy a számítógépes rendszer által futtatott alkalmazás alkészletre vonatkozóan.

6. A 4. vagy 5. igénypont szerinti berendezés, ahol az alaphelyzetbe visszaállító műveletet végrehajtó eszköz úgy van konfigurálva, hogy az alaphelyzetbe visszaállító műveletet a második interfész azonosítását követő késleltetéssel hajtsa végre, hogy lehetővé tegye egy az alkalmazás és a távoli kiszolgáló közötti folyamat befejeződését.

7. Az 1-6. igénypontok bármelyike szerinti berendezés, ahol a második interfészt azonosító eszköz úgy van konfigurálva, hogy a második interfészt több rendelkezésre álló interfészen, beleértve az első és második interfészt, végzett jellemzések, a rendelkezésre álló interfészeken folytatható kommunikációkhoz a teljesítmény felvétel mérése vagy becslése, a rendelkezésre álló interfészekkel társított gazdasági megfontolások, a rendelkezésre álló interfészekkel társított terhelési körülmények, vagy a rendelkezésre álló interfészeken végzett teljesítmény mérések alapján azonosítsa.

8. Az 1-7. igénypontok bármelyike szerinti berendezés, ahol az első interfész egy cellás interfész (112) és a második interfész egy vezeték nélküli helyi hálózati, WLAN, interfész (116), vagy alternatív módon ahol az első interfész egy vezeték nélküli helyi hálózati, WLAN, interfész (116) és a második interfész egy cellás interfész (112).

9. Az 1-8. igénypontok bármelyike szerinti berendezés, ahol az útvonaltáblázat egy az útvonaltáblázatban létező szabályt felülíró szabály létrehozása útján módosított, vagy alternatív módon ahol az útvonaltáblázat úgy módosított, hogy a második interfésznek az első interfészhez képest elsőbbséget adjon az alaphelyzetbe visszaállítást végrehajtó eszköz által futtatott alkalmazás alkatrész számára.

10. Az 1-6. igénypontok bármelyike szerinti berendezés, ahol a második interfészt azonosító eszköz úgy van konfigurálva, hogy a második interfészt egy házirend alapján azonosítsa, ahol a házirend egy az alkalmazás és a távoli kiszolgáló (116) közötti folyamattal van társítva egy Internet Protocol, IP, cím, egy domainnév rendszer, DNS, név vagy a távoli kiszolgáló mintája, az alkalmazás vagy folyamat neve, ujjlenyomata, attribútuma vagy mintája, vagy más osztályozás által nem azonosított folyamatokra érvényes alapértelmezett osztályozás alapján.

11. Az 1-10. igénypontok bármelyike szerinti berendezés, ahol a folyamat létrehozó eszköz úgy van konfigurálva, hogy ha hotlining-feltétel jelen van a második interfészen, akkor fenntartsa a folyamatot az első alkalmazás és a távoli kiszolgáló (116) között az első interfészen.