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(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	
Examiner Name	
Attorney Docket Number	20145-054US

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Name/Print	Michael North	Registration Number	46963

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(54) **COMMUNICATIONS NETWORK**

KOMMUNIKATIONSNETZ

RESEAU DE TELECOMMUNICATIONS

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(73) Proprietor: **Shared Band Limited**
Ipswitch, IP4 1JE (GB)

(72) Inventor: **EVANS, Paul, Andrew**
Ipswich, IP6 9LR (GB)

(74) Representative: **Wilson, Peter David et al**
Dummett Copp
25 The Square
Martlesham Heath
Ipswich
IP5 3SL (GB)

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Description

[0001] The invention relates to communications networks in which a local area network (LAN) is connected to a wide area network (WAN), via a plurality of communications links.

[0002] For domestic users it is conventional to access the Internet and the World Wide Web using dial-up connections over telephony links. There is an increase in the use of broadband connections, which are either provided over cable TV networks or by DSL over the PSTN. However, there are some communities for which it is not possible to provide with broadband connections, either because they are too far from a CATV network or a PSTN exchange or because there are insufficient numbers to make a broadband installation economic for the network operator.

[0003] Patent application number US 2003/081582 discloses a system in which a packet is fragmented into several packet fragments, transmitted via concurrently operating satellite channels and recombined on receipt by a ground controller.

[0004] According to a first aspect of the present invention there is provided a method of sending data over a communications network, the method comprising the steps of an originating terminal in a local area network comprising a plurality of terminals for running client applications and connecting to the Internet generating a request for a content server; the originating terminal dividing the request into a plurality of packets; the originating terminal distributing the plurality of packets between a first plurality of terminals in the local area network, each of said first plurality of terminals having a respective wide area connection to the Internet, the plurality of packets being distributed over the local area network; each of said first plurality of terminals transmitting packets received during step (c) over said associated wide area connection to a reconstitution server located on the Internet; the reconstitution server receiving the plurality of packets and sending the plurality of packets to the content server. Additionally, the content server sending content data to the reconstitution server in response to the request received in step (e), the data being sent as a plurality of content data packets; the reconstitution server distributing the plurality of content data packets to the first plurality of terminals over the respective wide area connections; the first plurality of terminals sending the plurality of content data packets to the originating terminal; and the originating terminal receiving the plurality of content data packets to re-create the content data.

[0005] Preferably the plurality of packets are distributed to the first plurality of terminals in a round-robin basis. It is further preferred that the round-robin distribution of the plurality of packets is weighted and that the round-robin weighting is determined in accordance with the bandwidth of the respective wide area connection between the terminal and the Internet.

[0006] According to a second aspect of the present invention there is provided a communications network comprising; a plurality of terminals for running client applications and connecting to the Internet, the terminals being connected by a local area network and at least some of said plurality of terminals having a respective wide area connection to the Internet, the Internet including a reconstitution server and a plurality of content servers, wherein, in use, an originating terminal in the local area network generates a request for one of the content servers, divides the request into a plurality of packets and distributes the plurality of packets between a plurality of terminals via the local area network, each of said plurality of terminals sends packets received to the reconstitution server via respective wide area connections, and the reconstitution server sends the plurality of packets to the content server. Furthermore, the content server sends content data to the reconstitution server in the form of a plurality of content data packets, the reconstitution server distributes the plurality of content data packets between the plurality of terminals over the respective wide area connections, the plurality of terminals route the plurality of content data packets to the originating terminal; the originating terminal receives the plurality of content data packets and re-creates the content data.

[0007] One or more of said plurality of terminals may have more that one respective wide area connection. The local area network may comprise one or more terminals, further to said plurality of terminals, not having a wide area connection.

[0008] Each of the active terminals in the local area network may comprise a list identifying the other active terminals. Each active terminal may periodically send a first status message to the other terminals in the local area network to indicate that it is active. Furthermore, an active terminal may send a second status message to the other terminals in the local area network prior to becoming inactive.

[0009] A preferred embodiment of the invention will now be described by way of illustration only and with respect to the accompanying drawings, in which

Figure 1 shows a schematic depiction of a communications network according to the present invention; and
Figure 2 shows schematic depiction of the implementation of Layered Service Providers (LSP) in a communications network according to the present invention.

[0010] Figure 1 shows a schematic depiction of a communications network according to the present invention, comprising LAN 100 and WAN 200. The LAN 100 comprises a plurality of LAN terminals 110a, 110b, 110c, ... each of which are connected to one or more other terminals 110 by LAN connections 115. Furthermore, the LAN comprises one or

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more WAN connections 120 that connect a LAN terminal to the WAN 200. The WAN 200 comprises one or more network access servers (NAS) 210a, 210b, reconstitution server 230 and a plurality of content servers 240. LAN terminal 110c has a WAN connection 120 to both NAS 210a and 210b, whilst LAN terminal 110e has no WAN connection 120 and only a LAN connection 115.

[0011] In operation, a LAN terminal 110 may communicate with one of the content servers using a plurality of the WAN connections, so as to provide increased bandwidth for the communication. Conventionally, the request to access a data resource stored on a content server comprises a number of packets and these packets are transmitted to the content server using the WAN connection associated with the terminal.

[0012] Using a method according to the present invention, terminal 110a distributes the request packets amongst the other LAN terminals, with the LAN terminals transmitting the request packets to the WAN via the WAN connections. The request packets are numbered sequentially and are routed, via the NAS 210 to the reconstitution server 230, where the request packets are sent to the appropriate content server 240.

[0013] In response, the content server delivers the requested data resource in the form of a plurality of data resource packets to the reconstitution server. The data resource packets are then transmitted to the plurality of LAN terminals, via the respective NAS, using the plurality of WAN connections.

[0014] When the data resource packets are received by the LAN terminals the packets are forwarded to the LAN terminal that initially requested the data where the data resource packets can be re-assembled in the correct order and the data resource accessed by the terminal. Thus, the present invention enables a LAN terminal to aggregate the plurality of WAN connections in order to provide a virtual connection having an increased bandwidth.

[0015] It is preferred that the LAN terminals are connected via the LAN using the Internet Protocol. Any LAN transport medium may be used, including standard Ethernet cables, wireless LAN technology (such as 802.11b/g or Bluetooth), IP over electricity lines, etc. It is also preferred that each LAN terminal has an active WAN link in addition to a LAN interface (it is possible to have one or more LAN terminals which do not have a WAN connection, although this will have the effect of reducing the efficiency of the present invention as the ratio of LAN terminals to WAN connections will be reduced. Typically the WAN link will be a PSTN or ISDN dialup connection, with connectivity to the global Internet via any ISP. It should be understood, however, that other access technologies such as DSL, cable modems, satellite, etc. can also be shared using the method of the present invention. Typically the WAN will be the Internet, although it may be a corporate or academic WAN. The NAS will typically be operating protocols such as SLIP (Shared Line Internet Protocol) and/or PPP (Point to Point Protocol) to control the communications over the plurality of WAN connections.

[0016] The LAN terminals typically comprise a standard PC running popular client applications such as e-mail, WWW browser, media streaming, network games, etc. Additional routing software is installed onto the LAN terminals which ensure that outgoing packets are re-directed to active LAN terminals. There are various ways of accomplishing this including placing the network card into promiscuous mode, creating a 'default route' or a platform specific method, such as Layered Service Providers (LSP) for Microsoft Windows. In the example discussed below it will be assumed that the LSP method is used. It will be understood that the invention may also be implemented on PCs using other operating systems, such as Linux and Macintosh OS, or on other devices such as set top boxes, game consoles, etc that are capable of making network connections.

[0017] Figure 2 shows a schematic depiction of the implementation of LSP, in which LSP (Layered Service Providers) 113 is created as a 'dummy' layer, in between the TCP/IP application 112 and the TCP/IP stack 114. If LSP is implemented then outgoing packets are trapped: if the packet is destined for a local host, then the packet is allowed to pass unmodified to the TCP/IP stack; whilst if the packet is destined for a remote network the packet is sent to one of the LAN terminals. As the packet's destination address has now changed, the original intended destination IP address and port need to be appended to the packet's payload. It is possible to determine whether a packet is routed to a remote or local host using known methods, such as examining the LAN card's host mask.

[0018] In order for packets to be routed to LAN terminals efficiently it is necessary that each LAN terminal is aware which of the other LAN terminals are active. Each active LAN terminal notifies the other LAN terminals and the reconstitution server that they are still active by periodically transmitting an "ACTIVE" message. If a LAN terminal is to be shut down, i.e. the terminal is being switched off then a "SHUT DOWN" message will be transmitted. In the event that a LAN terminal goes down unexpectedly e.g. power is lost, then the other LAN terminals and the reconstitution server can infer that a LAN terminal is no longer active by the failure to receive "ACTIVE" messages.

[0019] If a LAN terminal fails to transmit an "ACTIVE" message for a predetermined period of time then it will be removed from the table of active LAN terminals, which is used to determine which terminals packets may be sent to. If a LAN terminal has shut down unexpectedly and other LAN terminals are still sending packets to it then there is no way to recover this situation. To the applications generating a request packet it will appear as if there was network congestion and the packets were dropped. If the application uses a reliable transport such as TCP then lost packets will be automatically recovered.

[0020] The LAN terminals status messages may be sent using unicast (typically UDP) messages to each of the other LAN terminals, however since LANs are generally a shared media, a more efficient means of accomplishing this is by

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sending multicast or broadcast messages. It is preferred for the LAN terminals to send status messages to the reconstitution server using UDP or TCP. In a preferred embodiment, a LAN terminal can be inferred to be active if it is still sending packets for forwarding and thus there is no requirement for LAN terminals to send status messages if they are currently sending packets.

Table 1.

LAN terminal IP address	Port Number	Missed Announces	Weight
10.0.1.3	7654	0	1
10.0.1.4	7654	5	1
10.0.1.5	4567	2	3

[0021] Table 1 shows a typical LAN terminal router list. As well as listing the IP address of active LAN terminals a port number is also advertised. This allows a single LAN terminal to run multiple instances of the router software e.g. a single computer could have 8 phone lines and modems connected to it. LAN terminals allocate one port which other LAN terminals send packets to, and may possibly allocate a further port for packets being received from the reconstitution server.

[0022] When a LAN terminal sends requests to the other LAN terminals, the request may be sent using a simple round-robin technique. While this is simple to implement, it may not be particularly efficient if the different LAN terminals are have WAN connections that have significantly different bandwidth capacities.

[0023] According to a preferred embodiment of the present invention all LAN terminals have an associated weighting value which signifies the capacity of the WAN connection to route packets to the WAN. For example a 28.8kbps modem might have a weighting of 1, a 56kbps modem a weighting of 2, a dual ISDN dialup a weighting of 4, 500kbps ADSL a weighting of 18, etc. These weightings are used to determine the LAN terminals to which packets will be routed. For example, if LAN terminal A has a 56kbps connection, LAN terminal B has a 28.8kbps connection and LAN terminal C has a 56kbps connection and the reconstitution server wants to send a 5 packet response, it would balance the responses across the 3 LAN terminals as follows: A, B, C, A, C.

[0024] The LAN terminals may have different weightings for upstream and downstream transmissions as many access methods do not have symmetrical upstream and downstream bandwidths. Weightings can either be set manually by a user (or the network administrator) or can be worked out automatically by monitoring the throughput associated with various upstream and downstream data transfers

[0025] When a LAN terminal receives a packet from one of the other LAN terminals it verifies that the packet is valid, e.g. the checksums are correct, and if not the packet is dropped. If the packet is valid, the packet header is modified whereby the new source IP address and port are that of the LAN terminal's and the new destination address is that of the reconstitution server.

[0026] On LAN terminal start-up, the terminal contacts a reconstitution server in order to log onto the server (some form of terminal identification and authentication may be required). The reconstitution server will inform the LAN terminal which port it should communicate on and information is stored as an additional field in the active LAN terminal list held on the reconstitution server. The LAN terminal will use this port to communicate with the reconstitution server until the reconstitution server advises of an update.

[0027] As well as modifying the packet header, the LAN terminal needs to append the IP address of the originating LAN terminal to the packet, adding 4 additional bytes to the payload. This is in addition to the 6 payload bytes already added recording the content server IP address and port when the LSP layer forwarded the packet. The port number of the originating LAN terminal does not need to be encapsulated in the payload as the outgoing port of this packet will be set to have the same value.

[0028] When the reconstitution server receives an IP packet from a LAN terminal, it checks that the sender is authorised to use the service. It then creates a dedicated output port that is associated with the IP address and port of the originating LAN terminal. It then knows that any responses received on that dedicated port are destined for the particular IP address and port.

Table 2

Dedicated Port	54725
Source IP	10.0.1.1
Source Port	5173

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(continued)

LAN identifier	15
Last used timestamp	2135325385

[0029] The reconstitution server maintains a table of the dedicated output ports, and what hosts they map to (see Table 2). If an incoming dedicated port is not used for a pre-determined period, for example 5 minutes, then the port is made available again for re-use as it is assumed that there is no further traffic coming. When the port is used, that 'last used' timestamp is updated, where the timestamp is stored in 32 bit UTC time format (UTC represents the number of milliseconds since 1st January 1970). When a packet is received containing an IP address and port number for an originating LAN terminal that are not currently represented in the table a new port entry is made.

[0030] The reconstitution server then sends the packet to the IP address and port of the content server from the dedicated port (specifying its own IP address as the source IP address for the hop), after stripping out the 10 bytes added to the payload as they are no longer needed. When the content server responds it will send its response to the dedicated port at the reconstitution server. The reconstitution server determines which LAN the packets are destined for and performs a weighted round-robin decision to determine which of the LAN terminals the packets should be sent to. Before the packets are sent the IP address of the content server and the IP address and port numbers of the originating LAN terminal are appended to the packet payload so that the originating LAN terminal can re-create the intended packet header. The content server's port number can be inferred by setting the outgoing port number to the same - thus saving 2 bytes payload overhead.

[0031] When the LAN terminal receives a packet, it extracts and removes the originating LAN terminal IP address and content server IP address/port numbers. It then re-creates the header that the originating LAN terminal expects to see, by replacing the source/destination IP address and ports. The LSP stack on the LAN terminal will only modify outgoing packets, not incoming, and so the packet is passed to the application layer unmodified.

[0032] This system uses principles similar to IP firewalls and network/port address translation software and as such inherits some of its inherent limitations such as outgoing initiated data transfers are only allowed, and externally initiated data transfers are not generally allowed without building exception rules into the software. This prevents, for example, many peer to peer and locally hosted web services from working.

[0033] An example of packet routing is given in Appendices A-D below. A UDP client-server application called 'AddItUp' is assumed, in which the client sends three packets each containing a number. The server responds by echoing the negative of the number back to the client. When the server receives the third number, it adds all three numbers up and sends back a fourth packet containing the summation of the three numbers.

[0034] The LAN terminal IP address is 10.0.1.1 and uses port 8111 for incoming and outgoing traffic for that application. The content server's IP address is 132.146.15.101 and uses port 7111 for incoming and outgoing traffic for that application. The LAN housing the LAN terminal has identity 15 and has been given the port 10015 on the reconstitution server for incoming traffic. The reconstitution server's IP address is 200.101.55.1 The reconstitution server and the originating

[0035] LAN terminal know that the following LAN terminals are currently active on LAN 15:

Table 3

IP Address	Port	Missed Announces	Weight
10.0.1.3	7654	0	1
10.0.1.4	4567	2	1

[0036] The present invention will work even if the LAN terminals use different ISPs to connect to the internet. However, if all LAN terminals use the same ISP and the ISP deploys a reconstitution server on their network, the amount of overall backbone traffic is reduced as there is less traversing of backbone networks. In addition the data flow will be more predictable, increasing the quality of some services such as media streaming, as packets routed via the networks of a number of ISPs may take radically different paths across the Internet, and this can be a cause of packet jitter.

[0037] Extensive research has shown that single user Internet connections are typically left unused 90% to 95% of the time as users. Therefore it is unlikely that there would be much local contention problem. Additional policy enforcement can easily be added to ensure a single user within the community does not use a disproportionate amount of the shared bandwidth.

[0038] With shared network connectivity it is possible for users to utilise their phone line for voice calls etc. whilst still using the Internet (via the collective connections). Normally a user has to disconnect from the Internet to use their phone line for calls. The same principles can be applied to non-IP networking technologies such as AppleTalk.

[0039] It is envisaged that the invention is suitable for use in communities in which it is not possible, for economic or

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technological reasons, to provide broadband services such as DSL or cable internet links. By aggregating a number of PSTN and/or ISDN links it is possible to provide users with a greater bandwidth, that with a sufficient number of users may approach or exceed that provided by DSL. The invention may also be used to aggregate broadband connections to provide a connection having further increased bandwidth. Groups of LAN terminals may be organised into a community that share a number of WAN connections. It is possible that a single LAN may comprise more than one such community of LAN terminals and that a LAN terminal may be a concurrent member of more than one community of LAN terminals.

[0040] The invention may also be implemented within offices and campuses, etc., as telephone lines can be used for data services when not being used for voice services. The use of the phone lines may replace or complement a dedicated Internet connection. ISDN would be ideal for such an application as it has a quick setup/tear down process.

APPENDIX A

[0041]

Packet 1

AddItUp Client. Send '44'.	Source: 10.0.1.1 port 8111 Destination: 132.146.15.101 port 7111 Payload: 44
LSP intercepts. Sends to first LAN terminal in active list	Source: 10.0.1.1 port 8111 Destination: 10.0.1.3 port 7654 Payload: 44 (132.146.15.101,7111)
LAN terminal forwards to Reconstitution server	Source: 10.0.1.3 port 8111 Destination: 200.101.55.1 port 10015 Payload:44 (132.146.15.101,7111,10.0.1.1)
Reconstitution server allocates dedicated port 20001 for source 10.0.1.1 / 8111	Source: 200.101.55.1 port 20001 Destination: 132.146.15.101 port 7111 Payload: 44
AddItUp server echoes back the negative number.	Source: 132.146.15.101 port 7111 Destination: 200.101.55.1 port 20001 Payload: -44
The reconstitution server looks up the dedicated port entry and sends the packet to the next round-robin LAN terminal on LAN 15 (which happens to be 10.0.1.4)	Source: 200.101.55.1 port 8111 Destination: 10.0.1.4 port 4567 Payload: -44 (132.146.15.101,7111,10.0.1.1)
The LAN terminal receives the packet, reconstructs the header and forwards to the originating LAN terminal.	Source: 132.146.15.101 port 7111 Destination: 10.0.1.1 port 8111 Payload: -44

APPENDIX B

[0042]

Packet 2

AddItUp Client Send '5'	Source: 10.0.1.1 port 8111 Destination: 132.146.15.101 port 7111 Payload: 5
LSP intercepts. Sends to second LAN terminal in active list.	Source: 10.0.1.1 port 8111 Destination: 10.0.1.4 port 4567 Payload: 5 (132.146.15.101,7111)

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(continued)

LAN terminal forwards to Reconstitution server	Source: 10.0.1.4 port 8111 Destination: 200.101.55.1 port 10015 Payload: 5 (132.146.15.101,7111,10.0.1.1)
Reconstitution server has already allocated dedicated port 20001 for Source 10.0.1.1 / 8111	Source: 200.101.55.1 port 20001 Destination: 132.146.15.101 port 7111 Payload: 5
AddItUp server echoes back the negative number	Source: 132.146.15.101 port 7111 Destination: 200.101.55.1 port 20001 Payload: -5
The reconstitution server looks up the dedicated port entry and sends the packet to the next round-robin LAN terminal on LAN 15(happens to be 10.0.1.3)	Source: 200.101.55.1 port 8111 Destination: 10.0.1.3 port 7654 Payload: -5 (132.146.15.101,7111,10.0.1.1)
The LAN terminal receives the packet, reconstructs the header and forwards to the originating LAN terminal,	Source: 132.146.15.101 port 7111 Destination: 10.0.1.1 port 8111 Payload: -5

APPENDIX C

[0043]

Packet 3

AddItUp Client. Send '18'	Source: 10.0.1.1 port 8111 Destination: 132.146.15.101 port 7111 Payload: 18
LSP intercepts. Sends to next LAN terminal in active list	Source: 10.0.1.1 port 8111 Destination: 10.0.1.3 port 7654 Payload: 18(132.146.15.101,7111)
LAN terminal forwards to reconstitution server	Source: 10.0.1.3 port 8111 Destination: 200.101.55.1 port 10015 Payload: 18(132.146.15.101,7111,10.0.1.1)
Reconstitution server has already allocated dedicated port 20001 for Source 10.0.1.1 / 8111	Source: 200.101.55.1 port 20001 Destination: 132.146.15.101 port 7111 Payload: 18
AddItUp server echoes back the negative number.	Source: 132.146.15.101 port 7111 Destination: 200.101.55.1 port 20001 Payload: -18
The reconstitution server looks up the dedicated port entry and sends The packet to the next round-robin LAN terminal on LAN 15 (happens to be 10.0.1.4).	Source: 200.101.55.1 port 8111 Destination: 10.0.1.4 port 4567 Payload: - 18(132.146.15.101,7111,10.0.1.1)
The LAN terminal receives the packet, reconstructs the header and forwards to the originating LAN terminal.	Source: 132.146.15.101 port 7111 Destination: 10.0.1.1 port 8111 Payload: -18

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APPENDIX D

[0044]

Packet 4 (Summation Packet)

AddItUp server adds up the 3 numbers (to 67)	Source: 132.146.15.101 port 7111 Destination: 200.101.55.1 port 20001 Payload: 67
The reconstitution server looks up the dedicated port entry and sends the packet to the next round-robin LAN terminal on LAN 15 (happens to be 10.0.1.3	Source: 200.101.55.1 port 8111 Destination: 10.0.1.3 port 7654 Payload: 67(132.146.15.101,7111,10.0.1.1)
The LAN terminal receives the packet, reconstructs the header and forwards to the originating LAN terminal	Source: 132.146.15.101 port 7111 Destination: 10.0.1.1 port 8111 Payload: 67

Claims

1. A method of sending data over a Communications network, the method comprising the steps of

   (a) an originating terminal (110a) in a local area network (100) comprising a plurality of terminals (110a, 110b, 110c, 110d, 110e) for running client applications and connecting to the Internet generating a request for a content server (240);
   (b) the originating terminal (110) dividing the request into a plurality of packets;
   (c) the originating terminal (110a) distributing the plurality of packets between a first plurality of terminals (110a, 110b, 110c, 110d) in the local area network (100), each of said first plurality of terminals (110a, 110b, 110c, 110d) having a respective wide area connection (120) to the Internet (200), the plurality of packets being distributed over the local area network (100);
   (d) each of said first plurality of terminals (110a, 110b, 110c, 110d) transmitting packets received during step (c) over said associated wide area connection (120) to a reconstitution server (230) located on the Internet (200);
   (e) the reconstitution server (230) receiving the plurality of packets and sending the plurality of packets to the content server (240).

2. A method according to claim 1, comprising the further steps of:

   (f) the content server (240) sending content data to the reconstitution server (230) in response to the request received in step (e), the data being sent as a plurality of content data packets;
   (g) the reconstitution server (230) distributing the plurality of content data packets to the first plurality of terminals (110a, 110b, 110c, 110d) over the respective wide area connections (120);
   (h) the first plurality of terminals (110a, 110b, 110c, 110d) sending the plurality of content data packets to the originating terminal (110a) ; and
   (i) the originating terminal (110a) receiving the plurality of content data packets to re-create the content data.

3. A method according to claim 1 or claim 2, wherein in step (c) and/or step (g), the plurality of packets are distributed to the first plurality of terminals (110a, 110b, 110c, 110d) in a round-robin basis.

4. A method according to claim 3, wherein the round-robin distribution of the plurality of packets is weighted.

5. A method according to claim 4, whereon the round-robin weighting is determined in accordance with the bandwidth of the respective wide area connection (120) between the terminal (110) and the Internet (200).

6. A communications network comprising;
   a plurality of terminals (110a, 110b, 110c, 110d, 110e) for running client applications and connecting to the Internet (200), the terminals being connected by a local area network (100) and at least some of said terminals (110a, 110b, 110c, 110d) having a respective wide area connection (120) to the Internet (200),
   the Internet (200) including a reconstitution server (230) and a plurality of content servers (240),

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wherein, in use,
an originating terminal (100a) in the local area network (100) adapted to generate a request for one of the content servers (240), to divide the request into a plurality of packets and to distribute the plurality of packets between a plurality of terminals (110a, 110b, 110c, 110d) via the local area network (100),
each of said plurality of terminals (110a, 110b, 110c, 110d) adapted to send packets received to the reconstitution server (230) via respective wide area connections (120), and the reconstitution server (230) adapted to send the plurality of packets to the content server (240).

7. A communications network according to claim 6, wherein, in use,
the content server (240) sends content data to the reconstitution server (230) in the form of a plurality of content data packets,
the reconstitution server (230) distributes the plurality of content data packets between the plurality of terminals (110a, 110b, 110c, 110d) over the respective wide area connections (120),
the plurality of terminals (110a, 110b, 110c, 110d) route the plurality of content data packets to the originating terminal (110a);
the originating terminal (110a) receives the plurality of content data packets and re-creates the content data.

8. A communications network according to claim 6 or claim 7, wherein one (110c) or more of said plurality of terminals (110a, 110b, 110c, 110d) has more than one respective wide area connection (120).

9. A communications network according to claim 6 or claim 7, wherein the local area network (100) comprises one or more terminals (110e), further to said plurality of terminals (110a, 110b, 110c, 110d), not having a wide area connection.

10. A communications network according to any of claims 6 to 9, wherein each of the active terminals in the local area network comprises a list identifying the other active terminals.

11. A communications network according to claim 10, wherein, in use, each active terminal periodically sends a first status message to the other terminals in the local area network to indicate that it is active.

12. A communications network according to claim 10 or claim 11, wherein an active terminal sends a second status message to the other terminals in the local area network prior to becoming inactive.

Patentansprüche

1. Verfahren zum Versenden von Daten über ein Kommunikationsnetzwerk, wobei das Verfahren folgende Schritte aufweist

(a) ein Ursprungsendgerät (110a) in einem lokalen Netzwerk (LAN) (100), das eine Vielzahl von Endgeräten (110a, 110b, 110c, 110d, 110e) umfasst, um Nutzeranwendungen ablaufen zu lassen und eine Verbindung zum Internet herzustellen, erzeugt eine Anfrage für einen Content-Server (240);
(b) das Ursprungsendgerät (110a) unterteilt die Anfrage in eine Vielzahl von Paketen;
(c) das Ursprungsendgerät (110a) verteilt die Vielzahl von Paketen zwischen einer ersten Vielzahl von Endgeräten (110a, 110b, 110c, 110d) in dem lokalen Netzwerk (LAN) (100), wobei jedes der ersten Vielzahl von Endgeräten (110a, 110b, 110c, 110d) eine entsprechende weitflächige Verbindung (120) zum Internet (200) hat, wobei die Vielzahl der Pakete über das lokale Netzwerk (LAN) (100) verteilt wird;
(d) jedes der ersten Vielzahl von Endgeräten (110a, 110b, 110c, 110d) übermittelt empfangene Pakete während des Schrittes (c) über die zugehörige weitflächige Verbindung (120) an einen Rekonstitutionsserver (230), der im Internet (200) lokalisiert ist;
(e) der Rekonstitutionsserver (230) empfängt die Vielzahl von Paketen und sendet die Vielzahl von Paketen an den Content-Server (240).

2. Verfahren nach Anspruch 1, das die weiteren Schritte aufweist:

(f) der Content-Server (240) sendet als Reaktion auf die in Schritt (e) empfangene Anfrage Inhaltsdaten an den Rekonstitutionsserver (230), wobei die Daten als eine Vielzahl von Inhaltsdaten-Paketen gesendet werden;
(g) der Rekonstitutionsserver (230) verteilt die Vielzahl von Inhaltsdaten-Paketen an die erste Vielzahl von

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Endgeräten (110a, 110b, 110c, 110d) über die entsprechenden weitflächigen Verbindungen (120);
(h) die erste Vielzahl von Endgeräten (110a, 110b, 110c, 110d) sendet die Vielzahl von Inhaltsdaten-Paketen an das Ursprungsendgerät (110a); und
(i) das Ursprungsendgerät (110a) empfängt die Vielzahl von Inhaltsdaten-Paketen, um die Inhaltsdaten wiederherzustellen.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** in Schritt (c) und/oder Schritt (g) die Vielzahl von Paketen an die erste Vielzahl von Endgeräten (110a, 110b, 110c, 110d) in einer Round-Robin-Basis verteilt wird.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** die Round-Robin-Verteilung der Vielzahl von Paketen gewichtet wird.

5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Round-Robin-Gewichtung in Übereinstimmung mit der Bandbreite der entsprechenden weitflächigen Verbindung (120) zwischen dem Endgerät (110) und dem Internet (200) bestimmt wird.

6. Kommunikationsnetzwerk mit
einer Vielzahl von Endgeräten (110a, 110b, 110c, 110d, 110e), um Nutzeranwendungen ablaufen zu lassen und eine Verbindung zum Internet (200) herzustellen, wobei die Endgeräte über ein lokales Netzwerk (LAN) (100) verbunden sind, und wobei zumindest einige der Endgeräte (110a, 110b, 110c, 110d) eine entsprechende weitflächige Verbindung (120) zum Internet (200) haben,
dem Internet (200), das einen Rekonstitutionsserver (230) und eine Vielzahl von Content-Servern (240) umfasst,
dadurch gekennzeichnet, dass im Einsatz
ein Ursprungsendgerät (100a) im lokalen Netzwerk (LAN) (100) geeignet ist, eine Anfrage für einen der Content-Server (240) zu erzeugen, die Anfrage in eine Vielzahl von Paketen zu unterteilen und die Vielzahl von Paketen zwischen einer Vielzahl von Endgeräten (110a, 110b, 110c, 110d) über das lokale Netzwerk (LAN) (100) zu verteilen, und dass jedes der Vielzahl von Endgeräten (110a, 110b, 110c, 110d) geeignet ist, um empfangene Pakete an den Rekonstitutionsserver (230) über entsprechende weitflächige Verbindungen (120) zu senden, und der Rekonstitutionsserver (230) geeignet ist, um die Vielzahl von Paketen an den Content-Server (240) zu senden.

7. Kommunikationsnetzwerk nach Anspruch 6, **dadurch gekennzeichnet, dass** im Einsatz, der Content-Server (240) Inhaltsdaten an den Rekonstitutionsserver (230) in Form einer Vielzahl von Inhaltsdaten-Paketen sendet,
der Rekonstitutions-Server (230) die Vielzahl von Inhaltsdaten-Paketen zwischen der Vielzahl von Endgeräten (110a, 110b, 110c, 110d) über die entsprechenden weitflächigen Verbindungen (120) verteilt,
die Vielzahl von Endgeräten (110a, 110b, 110c, 110d) die Vielzahl von Inhaltsdaten-Paketen an das Ursprungsendgerät (110a) leitet;
das Ursprungsendgerät (110a) die Vielzahl von Inhaltsdaten-Paketen empfängt und die Inhaltsdaten wiederherstellt.

8. Kommunikationsnetzwerk nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** eines (110c) oder mehrere der Vielzahl von Endgeräten (110a, 110b, 110c, 110d) mehr als eine entsprechende weitflächige Verbindung (120) hat/haben.

9. Kommunikationsnetzwerk nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** das lokale Netzwerk (LAN) (100) zusätzlich zu der Vielzahl von Endgeräten (110a, 110b, 110c, 110d), die keine weitflächige Verbindung haben ein oder mehrere Endgerät(e) (110e) umfasst.

10. Kommunikationsnetzwerk nach einem beliebigen der Ansprüche 6 bis 9, **dadurch gekennzeichnet, dass** jedes der aktiven Endgeräte im lokalen Netzwerk (LAN) eine Liste umfasst, die die anderen aktiven Endgeräte identifiziert.

11. Kommunikationsnetzwerk nach Anspruch 10, **dadurch gekennzeichnet, dass** im Einsatz, jedes aktive Endgerät regelmäßig eine erste Statusinformation an die anderen Endgeräte im lokalen Netzwerk (LAN) sendet, um anzuzeigen, dass es aktiv ist.

12. Kommunikationsnetzwerk nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** ein aktives Endgerät eine zweite Statusinformation an die anderen Endgeräte im lokalen Netzwerk (LAN) sendet bevor es inaktiv wird.

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Revendications

1. Procédé d'envoi de données sur un réseau de communication, le procédé comprenant les étapes de :

   (a) un terminal d'origine (110a) dans un réseau local (100) comprenant une pluralité de terminaux (110a, 110b, 110c, 110d, 110e) pour exécuter des applications clients et pour connecter à l'Internet générant une demande pour un serveur de contenu (240) ;
   (b) le terminal d'origine (110) divisant la demande en une pluralité de paquets ;
   (c) le terminal d'origine (110a) distribuant la pluralité de paquets entre une première pluralité des terminaux (110a, 110b, 110c, 110d) dans un réseau local (100), chacun de ladite pluralité de terminaux (110a, 110b, 110c, 110d) ayant une connexion de zone étendue respective (120a) à l'Internet (200), la pluralité de paquets étant distribués sur le réseau local (100) ;
   (d) chacun de ladite première pluralité de terminaux (110a, 110b, 110c, 110d) transmettant des paquets reçus pendant l'étape (c) sur ladite connexion de réseau large associée (120) à un serveur de reconstitution (230) situé sur l'Internet (200) ;
   (e) le serveur de reconstitution (230) recevant la pluralité de paquets et envoyant la pluralité de paquets au serveur de contenu (240).

2. Procédé selon la revendication 1, comprenant en outre les étapes de :

   (f) le serveur de contenu (240) envoyant des données de contenu au serveur de reconstitution (230) en réponse à la demande reçue dans l'étape (e), les données étant envoyées comme une pluralité de paquets de données de contenu ;
   (g) le serveur de reconstitution (230) distribuant la pluralité de paquets de données de contenu à la première pluralité de terminaux (110a, 110b, 110c, 110d) sur les connexions de zone étendue respectives (120) ;
   (h) la première pluralité de terminaux (110a, 110b, 110c, 110d) envoyant la pluralité de paquets de données de contenu au terminal d'origine (110a) ; et
   (i) le terminal d'origine (110a) recevant la pluralité de paquets de données de contenu pour re-créer les données de contenu.

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel dans l'étape (c) et/ou l'étape (g), la pluralité de paquets sont distribués à la première pluralité des terminaux (110a, 110b, 110c, 110d), dans une base round-robin.

4. Procédé selon la revendication 3, dans lequel la distribution round-robin de la pluralité de paquets est pondérée.

5. Procédé selon la revendication 4, dans lequel la pondération round-robin est déterminée selon la bande passante de la connexion de zone étendue respective (120a) entre le terminal (110) et l'Internet (200).

6. Réseau de communication comprenant :

   une pluralité de terminaux (110a, 110b, 110c, 110d, 110e) pour exécuter des applications clients et connecter à l'Internet (200), les terminaux étant connectés par un réseau local (100) et au moins certains desdits terminaux (110a, 110b, 110c, 110d) ayant une connexion de zone étendue respective (120) à l'Internet (200),
   l'Internet (200) comprenant un serveur de reconstitution (230) et une pluralité de serveurs de contenu (240),
   dans lequel, en utilisation,
   un terminal d'origine (100a) dans le réseau local (100) adapté pour générer une demande pour un des serveurs de contenu (240), pour diviser la demande dans une pluralité de paquets et pour distribuer la pluralité de paquets entre une pluralité de terminaux (110a, 110b, 110c, 110d) via le réseau local (100),
   chacun de la pluralité de terminaux (110a, 110b, 110c, 110d) adapté pour envoyer des paquets reçus au serveur de reconstitution (230) via des connexions de zone étendue respectives (120), et le serveur de reconstitution (230) pour envoyer la pluralité de paquets au serveur de contenu (240).

7. Réseau de communication selon la revendication 6, dans lequel, en utilisation,
   le serveur de contenu (240) envoie des données de contenu au serveur de reconstitution (230) sous la forme d'une pluralité de paquets de données de contenu,
   le serveur de reconstitution (230) distribue la pluralité de paquets de données de contenu entre la pluralité de terminaux (110a, 110b, 110c, 110d) sur les connexions de zone étendue respectives (120),
   la pluralité de terminaux (110a, 110b, 110c, 110d) routent la pluralité de paquets de données de contenu au terminal

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d'origine (110a) ;
le terminal d'origine (110a) reçoit la pluralité de paquets de données de contenu et recrée les données de contenu.

8. Réseau de communication selon la revendication 6 ou la revendication 7, dans lequel un (110c) ou plusieurs de ladite pluralité de terminaux (110a, 110b, 110c, 110d) a plus qu'une connexion de zone étendue respective (120).

9. Réseau de communication selon la revendication 6 ou la revendication 7, dans lequel le réseau local (100) comprend un ou plusieurs terminaux (110e), de plus pour ladite pluralité de terminaux (110a, 110b, 110c, 110d), n'ayant pas une connexion à zone étendue.

10. Réseau de communication selon l'une quelconque des revendications 6 à 9, dans lequel chacun des terminaux actifs dans le réseau local comprend une liste identifiant les autres terminaux actifs.

11. Réseau de communication selon la revendication 10, dans lequel, lors d'utilisation, chaque terminal actif envoie périodiquement un premier message d'état aux autres terminaux dans le réseau local pour indiquer qu'il est actif.

12. Réseau de communication selon la revendication 10 ou la revendication 11, dans lequel le terminal actif envoie un second message d'état aux autres terminaux dans le réseau local avant de devenir inactifs.

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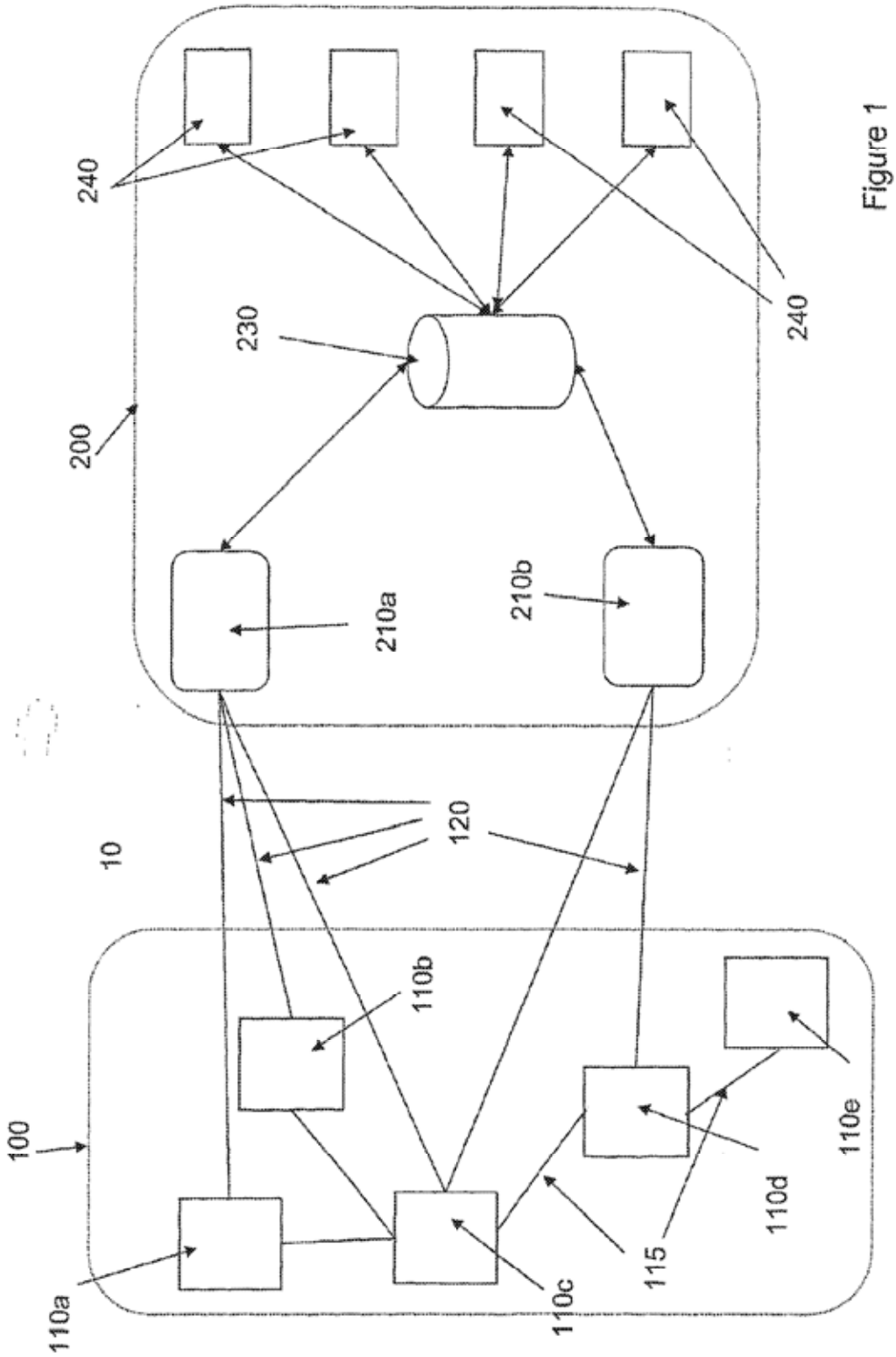


Figure 1

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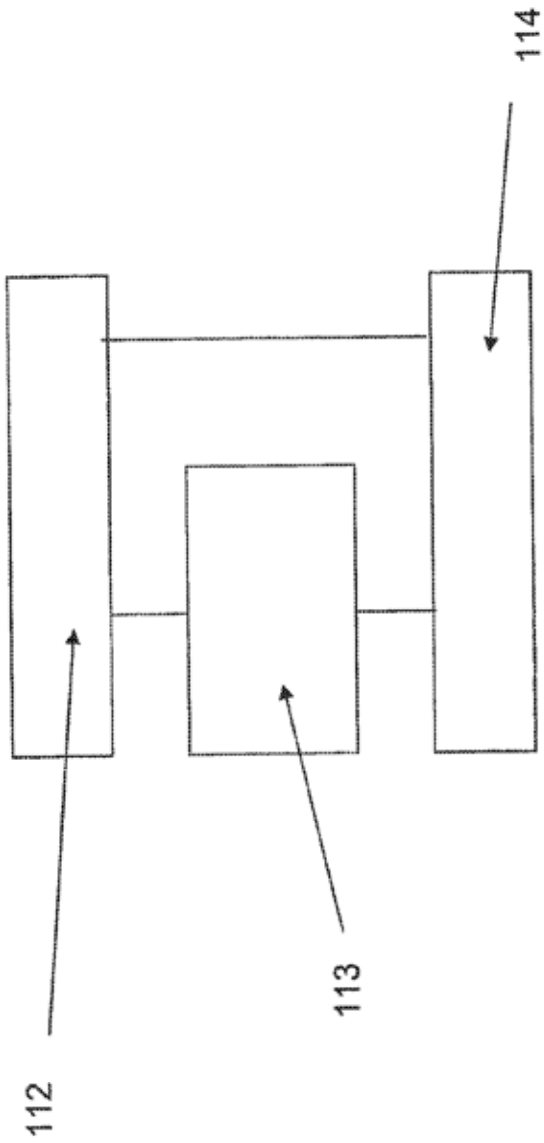


Figure 2

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2003081582 A **[0003]**

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Electronic Patent Application Fee Transmittal

Application Number:	14356581
Filing Date:	06-May-2014
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Filer:	Michael V. North/Nita Miller
Attorney Docket Number:	20145-054US

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	35258991
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	26-FEB-2019
Filing Date:	06-MAY-2014
Time Stamp:	17:19:17
Application Type:	U.S. National Stage under 35 USC 371

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Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	022719INTEFSW17195200
Deposit Account	502776
Authorized User	Nita Miller
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.17 (Patent application and reexamination processing fees) 37 CFR 1.19 (Document supply fees)	

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	054US_IDS_Trans.pdf	28166 75b920d1cb362cd9d1ce2cd7495c14a8956a528f	no	3
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	054US_IDS_SB08.pdf	612100 47192e296029c5a66179342525ada99521dd0721	no	4
Warnings:					
Information:					
3	Foreign Reference	054US_IDS_FR1.pdf	258595 a41238c50553c206dea8fcf03e11cc91e62a85c0e	no	15
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30626 fdc196c0fc02635d91f9babd1254065774e745f7a	no	2
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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2019-02-26 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

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☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

☐ Pursuant to 37 CFR § 1.704(d), Applicant certifies that each of the references cited herein were first cited in a communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in 37 CFR § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement.

Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2019-02-26

By: /Michael North/
Michael North
Reg. No. 46963

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/356,581	05/06/2014	Wonjong Rhee	20145-054US	4319

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North Weber & Baugh LLP - ASSIA
3260 Hillview Avenue, 1st Floor
Palo Alto, CA 94304

EXAMINER
GRIJALVA LOBOS, BORIS D

ART UNIT	PAPER NUMBER
2446	

NOTIFICATION DATE	DELIVERY MODE
01/31/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket1@northweber.com

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Office Action Summary	Application No. 14/356,581	Applicant(s) Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	Art Unit 2446	AIA Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 12/18/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b)☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1,3-5,8,10,12-16,34,36-37,53-54 and 56-57 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1,3-5,8,10,12-16,34,36-37,53-54 and 56-57 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 1/17/2019

3) ☑ Interview Summary (PTO-413) Paper No(s)/Mail Date 1/28/2019.

4) ☐ Other: _____.

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 1/17/2019 is being considered by the examiner.

Response to Amendment

This Office action is in response to amendments filed on 12/18/2018. The amendments have been fully considered.

Claims 1, 10, 15, 34, 53, have been amended.

Claims 2, 6-7, 9, 11, 17-33, 35, 38-52, and 55 have been cancelled.

Claims 1, 3-5, 8, 10, 12-16, 34, 36-37, 53-54, and 56-57 are pending.

Response to Arguments

Applicant's arguments with respect to claims 1, 3-5, 8, 10, 12-16, 34, 36-37, 53-54, and 56-57 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Claim Objections

Claims 1, 10, and 34 objected to because of the following informalities:

In claims 1, 10, and 34, the phrase "that, in response to receiving the policy implemented one or more algorithms" should be - - that, in response to receiving the policy, implement one or more algorithms - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

35 U.S.C. 112 rejections with respect to the phrase "to improve a performance of the one or more communication units", as recited in the independent claims, are withdrawn. The examiner notes that the limitations recite "in response to receiving the policy" implement "one or more algorithms [...] to improve a performance of the one or more communication units". Initially, the claims appear to require experimentation in order to determine an algorithm that improves a performance of the one or more communication units. However, experimentation is not undue because the specification, as filed, describes at least one algorithm to improve performance (see paragraph [0049] of specification, as published). Therefore, the claims are not rejected under 35 U.S.C. 112(a). Furthermore, 35 U.S.C. 112(b) rejections are withdrawn because, even though an algorithm is not explicitly recited in the claims, the phrase "to improve a performance of the one or more communication units" properly limits the function of the algorithm, that is, the algorithm has to be one that improves performance, as opposed to one that doesn't improve performance or one that degrades performance.

The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 3-5, 8, 10, 12-16, 34, 36-37, 53-54, and 56-57 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to

reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claim 1, it recites the limitations "receiving, by a server, from a network monitoring device, [...], data associated with an operation two or more communication units". That is, the claims require the server to receive, from a single device, data associated with an operation of two or more communication units. While the specification has support for the server receiving, from multiple devices, data associated with the operation of the multiple devices (e.g. paragraph [0039] of the specification as published), the specification is silent regarding a single device (such as the AP of paragraph [0039]) transmitting all of the data from the multiple devices to the server. Therefore, the limitations introduce new matter.

Regarding claims 1, 3-5, 8, and 53-54, the limitations invoke, by reference, all of the limitations of claim 1. Therefore, claims 1, 3-5, 8, and 53-54 are rejected for the same reasons as set forth in claim 1, above.

Regarding claim 10, the limitations recite features similar in scope to those of claim 1. Therefore, claim 10 is rejected for the same reasons as set forth in claim 1, above.

Regarding claims 12-16, the limitations invoke, by reference, all of the limitations of claim 10. Therefore, claims 12-16 are rejected for the same reasons as set forth in claim 10, above.

Regarding claim 34, the limitations recite features similar in scope to those of claim 1. Therefore, claim 34 is rejected for the same reasons as set forth in claim 1, above.

Regarding claims 36-37 and 56-57, the limitations invoke, by reference, all of the limitations of claim 34. Therefore, claims 36-37 and 56-57 are rejected for the same reasons as set forth in claim 34, above.

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3, 14, and 36 rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Regarding claim 3, it recites the limitations "the method of claim 1, wherein monitoring comprises [...]". Claim 1 does not recite a monitoring step, therefore it's unclear what limitation, if any, claim 3 refers to.

Regarding claim 14, it recites the limitation "the non-transitory machine-readable storage medium of claim 10, wherein monitoring comprises [...]". Claim 10 does not recite a monitoring step, therefore it's unclear what limitation, if any, claim 14 refers to.

Regarding claim 36, it recites the limitation "the apparatus of claim 34, further comprising a monitoring device coupled to the processor". It's unclear if the monitoring device of claim 36 is the "network monitoring device" of claim 34.

The following is a quotation of 35 U.S.C. 112(d):

(d) REFERENCE IN DEPENDENT FORMS.—Subject to subsection (e), a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers.

The following is a quotation of pre-AIA 35 U.S.C. 112, fourth paragraph:

Subject to the following paragraph [i.e., the fifth paragraph of pre-AIA 35 U.S.C. 112], a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers.

Claims 3 and 14 are rejected under 35 U.S.C. 112(d) or pre-AIA 35 U.S.C. 112, 4th paragraph, as being of improper dependent form for failing to further limit the subject matter of the claim upon which it depends, or for failing to include all the limitations of the claim upon which it depends.

Regarding claim 3, it recites the limitations "the method of claim 1, wherein monitoring comprises [...]". Claim 1 does not recite a monitoring step. Therefore, claim 3 fails to further limit the subject matter of claim 1.

Regarding claim 14, it recites the limitation "the non-transitory machine-readable storage medium of claim 10, wherein monitoring comprises [...]". Claim 10 does not recite a monitoring step. Therefore, claim 14 fails to further limit the subject matter of claim 10.

Applicant may cancel the claim(s), amend the claim(s) to place the claim(s) in proper dependent form, rewrite the claim(s) in independent form, or present a sufficient showing that the dependent claim(s) complies with the statutory requirements.

Claim Rejections - 35 USC § 101

The examiner notes new guidelines regarding subject matter eligibility were introduced on January 2019. Examination of the present application requires analysis under the new guidelines.

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1, 3-5, 10, 12-16, 34, 36-37, 53-54, and 56-57 are rejected under 35 U.S.C. 101 because the claimed invention is directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

The following is the Principles of Law:

A patent may be obtained for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof'.

The Supreme Court has "long held that this provision contains an important implicit exception [:] Laws of nature, natural phenomena, and abstract ideas are not patentable".

Under the now familiar two-part test described by the Supreme Court in Alice, "[W]e must first determine whether the claims at issue are directed to a patent-ineligible concept", such as an abstract idea. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014). If so, we must then "consider the elements of each claim both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application. Id. (quoting Mayo, 132 S. Ct. at 1298, 1297). For the reasons set forth below, we find that the claims are directed to the abstract idea of classifying and storing digital images in an organized manner and fail to add an inventive concept sufficient to confer patent eligibility.

The examiner is bound by and applies the framework as set forth by the Court in Mayo and reaffirmed by the Court in Alice for determining whether the claims are directed to patent-eligible subject matter.

Step one: Are the claims at issue directed to a process, machine, manufacture, or composition of matter?

The examiner concludes that claims 1, 3-5, 8, 10, 12-16, 34, 36-37, 53-54, and 56-57, are directed to one of the four statutory categories.

Step two: Are the claims directed to a law of nature, a natural phenomenon, or an abstract idea? In accordance with judicial precedent, and to increase consistency in examination practice, the 2019 Revised Patent Subject Matter Eligibility Guidance sets forth a procedure to determine whether a claim is ''directed to'' a judicial exception. The procedures for step two includes two sub-steps:

Step 2A: This is a two prong inquiry. In Prong One, examiners evaluate whether the claim recites a judicial exception.

Regarding claim 1, the examiner has determined that the limitations include an abstract idea. For example, the limitations recite:

A method for improving performance of one or more communication units, the method comprising:

receiving, by a server, from a network monitoring device, in real-time, data associated with an operation of two or more communication units located in different geographical areas, the data comprising a parameter;

processing, by the server, at least one of the data and historical data;

based on the processed data, determining a policy for at least one of the two or more communication units; and

communicating the policy, by the server, via a network, to at least one or more communication units that, in response to receiving the policy implemented one or more algorithms based on at least a rule or a condition to improve a performance of the one or more communication units.

The underlined portions indicate the abstract idea. The underlined limitations are directed to the abstract idea of "Mental Processes", since the idea as a whole could be performed by a human. For example, receiving "data associated with an operation of two or more communication units located in different geographical areas, the data comprising a parameter" could be performed through observation. Processing "at least one of the data and historical data" could be performed through evaluation. Determining a policy "based on the processed data" "for at least one of the two or more communication units" could be performed through judgement. Communicating the policy "to at least one or more communication units" could be performed through opinion. "Receiving the policy" could be performed through observation. Implementing one or more algorithms, in response to receiving the policy, "based on at least a rule or a condition" could be performed through evaluation and/or

judgement and opinion. Note that a "communication unit" may encompass humans and are thus not considered additional elements.

In prong two, the examiners evaluate whether the claim, as a whole, integrates the recited judicial exception into a practical application. To do this, additional elements recited in the claim are identified. The additional elements recited in claim 1 include a server to receive and process the data, and determine and communicate the policy; a network monitoring device to transmit the data to the server; and a network, to communicate the policy.

The examiner concludes that the additional elements do not reflect an improvement in the functioning of a computer, or other technology or technical field (the devices, systems, and networks in the claim are simply there to transmit/receive and process information). Transmitting, receiving, and processing information could be performed by systems that are well-known in the art. See, for example,

The additional elements also fail to implement the judicial exception with a particular machine or manufacture integral to the claim. As mentioned above, transmitting, receiving, and processing data could be performed by any known computer in the art. For example, in Electric Power Group LLC v. Alstom, a computer device received, via a network, monitored data from multiple, geographical separated, sources, in real-time, and processed the data, the data comprising parameters, to generate and provide a result as feedback. The court held that the invention did not require more than conventional computers and networks. In contrast to the present application, the feedback was provided to users, as opposed to the sources. However, communicating a policy to other devices and the other devices processing the policy is performed in a similar manner, since the policy is essentially data, transmitted over a network, and the communication units simply process the data.

Furthermore, the additional elements do not reflect a transformation or reduction of a particular article to a different state, do not apply the judicial exception to effect a particular treatment or prophylaxis for a disease or medical condition, and do not apply the judicial exception in some other

meaningful way beyond generally linking the use of the judicial exception to a particular technology environment.

Therefore, under Step 2A, the claim is found to be directed towards a judicial exception.

Step 2B: Does the claim provide an inventive concept? The examiner concludes that the claim lacks specific limitations that are not well-understood, routine, or conventional in the field. In essence, what is being claimed is a feedback system, in which an observation is made by a system comprising the server and communication units, and the systems provides feedback to improve future operations. Using a feedback loop to evaluate current operations to improve future operations is a well-known concept. See, for example, OODA loop (Wikipedia, Feb. 2009). The OODA look is a concept that is applied in both business and military strategy, where feedback is provided based on observations to improve operations (OODA loop, page 1). The acronym standing for Observe, Orient, Decide, and Act. Therefore, feedback systems are well-understood, routine, or conventional.

Regarding claim 3, the limitations recite *wherein monitoring comprises determining a received signal strength indication*. Measuring RSSI is a practice that vendors of 802.11 network interfaces routinely apply (because it's part of the 802.11 standard), and mechanisms for measuring RSSI are defined in the 802.11 standard (see Measuring RSSI with WIFI card – TOMATOUSB - 2010). Therefore, the additional elements of claim 3 are routine or conventional.

Regarding claim 4, it recites the limitation *based on a change in the operation, updating the policy*. The limitations further narrow the abstract idea of claim 1 in the sense that a change causes an update to a result. The OODA loop described above is, as the name implies, a looping system. That means, the system is constantly taking inputs and as the inputs change so do the results. The limitations don't include any additional elements that must be considered.

Regarding claim 5, it recites the limitations *wherein determining the policy comprises selecting the policy from a set of policies*. The limitations further narrow the abstract idea of claim 1 in the sense

that a result must be derived from an existing set of results. The additional limitations fall under the abstract idea of mental processes because in essence, what is being performed, is evaluation of data (the set of policies) to determine a suitable policy. The claim does not recite additional elements that must be considered.

Regarding claim 53, it recites the limitations *wherein processing comprises storing at least one of the data and historical data in a memory*. Storing information in a memory is a well stablished practice and thus the additional elements do not transform the abstract idea into significantly more. For example, in Electric Power Group LLC v. Alstom, a computer device accumulated received data. A memory is then inherent in the claims, yet the courts found the claims to be directed towards an abstract idea.

Regarding claim 54, it recites the limitations *wherein updating the policy comprises updating the parameter*. The limitations simply set forth what data is updated in the abstract idea recited in claim 4. However, the claims lacks additional elements that would transform the abstract idea into significantly more.

Regarding claims 10, 14, 16, and 56 the limitations recite features similar in scope to those of claims 1, 3, 5, and 53. Additional elements in the claims include a non-transitory machine-readable storage medium storing instructions and a processor to execute the instructions. However, the additional elements amount to nothing more than a computer device. A server, such as the server of claim 1 is a computer device. Therefore, claims 10, 14, 16, and 56 are rejected for the same reasons as set forth in claims 1, 3, 5 and 53 above.

Regarding claim 12, it recites the limitations *wherein processing comprises storing at least one of the data and the historical data in a memory of the device*. Storing information in a memory is a well stablished practice and thus the additional elements do not transform the abstract idea into significantly more. For example, in Electric Power Group LLC v. Alstom, a computer device accumulated received

data. A memory is then inherent in the claims, yet the courts found the claims to be directed towards an abstract idea.

Regarding claim 13, it recites the limitations *wherein determining the policy comprises determining a condition for communicating the policy*. A fundamental human behavior is to "make decisions and act on them", see OODA loop (Wikipedia, Feb. 2009). Therefore, the claim further limits the subject matter of claim 10, but the limitations are directed to the same abstract idea of claim 10. Claim 13 also fails to incorporate additional limitations which would transform the abstract idea into significantly more.

Regarding claims 34, and 57, the limitations recite features similar in scope to those in claims 10 and 13. Therefore, claims 34 and 57 are rejected for the same reasons as set forth in claims 10 and 13, above.

Regarding claim 36, it recites the limitations *a monitoring device coupled to the processor, the monitoring device determines a received signal strength*. Measuring RSSI is a practice that vendors of 802.11 network interfaces routinely apply (because it's part of the 802.11 standard), and mechanisms for measuring RSSI are defined in the 802.11 standard (see Measuring RSSI with WIFI card – TOMATOUSB - 2010). Therefore, the additional elements of claim 36 are routine or conventional.

Regarding claim 37, it recites features similar in scope to those of claims 5 and 15. Therefore, claim 37 is rejected for the same reasons as claims 5 and 15, above.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim(s) 1, 4, 8, 10, 12-13, 15, 34, 53-54, and 56-57 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Clark et al. (US 5970064 A, hereinafter Clark).

Regarding claim 1, Clark discloses a method for improving performance of one or more communication units **(col. 12, lines 17-20, discloses improving performance of communication units)**, the method comprising:

receiving, by a server **(col. 12, lines 21-22, discloses collecting information; col. 10, lines 52-55, discloses that the information is collected by a network controller)**,

from a network monitoring device **(Fig. 7 discloses that the network controller may receive the collected information from a single node (S1) (see col. 6, lines 20-21))**,

in real-time **(col. 10, lines 52-55, discloses that the data transmitted to the network controller is current information)**,

data associated with an operation of two or more communication units **(col. 12, lines 21-23, discloses that the information is information associated with the operation of multiple nodes (see also col. 12, lines 61-65, QoS information is also transmitted))**

located in different geographical areas **(see Fig. 3, and col. 6, 9-30, discloses that switches are physical devices located at different locations)**,

the data comprising a parameter **(col. 12, lines 21-23, discloses that the information includes admission policies (see also col. 12, lines 61-65, QoS information is also transmitted))**;

processing, by the server, at least one of the data and historical data **(col. 12, lines 24-31, discloses processing the collected information)**;

based on the processed data, determining a policy for at least one of the two or more communication units **(col. 12, lines 24-31, discloses producing, as a result of the processing, at least one policy to be implemented by the nodes)**

communicating the policy **(col. 13, lines 6-10, discloses distributing the one or more policies)**,

by the server **(col. 13, lines 6-10, discloses that the policies are distributed by the network controller)**,

via a network **(col. 13, lines 6-10, the policies are distributed from the network controller to the nodes;)**,

to at least one or more communication units that **(col. 6, lines 20-21, discloses that the network controller is connected to switches via a network)**,

in response to receiving the policy implemented one or more algorithms based on at least a rule or a condition **(col. 17, line 54-65, discloses selecting, in response to receiving policy data, a decision table, based on a condition)**

to improve a performance of the one or more communication units **(col. 12, lines 17-20, discloses improving performance of communication units in response to performing the steps described)**.

Regarding claim 4, Clark discloses the method of claim 1, further comprising, based on a change in the operation, updating the policy **(col. 17, line 51, to col. 18, line 3, discloses updating the policy based on operational changes)**.

Regarding claim 8, Clark discloses the method of claim 1, wherein the one or more communication units comprise at least one of: an access point (AP); a base station; a wireless LAN device; a DSLAM; a gateway; a performance enhancement device; a Digital Subscriber Line (DSL)

Customer Premises Equipment (CPE) modem; an in-home powerline device; a Home Phoneline Network Alliance (HPNA) based device; an in-home coax distribution device; a G.hn (Global Home Networking Standard) compatible device; an in-home metering communication device; an in-home appliance communicatively interfaced with the LAN; a wireless femtocell base station; a wireless WiFi compatible base station; a wireless mobile device repeater; a wireless mobile device base station; a set-top box (STB)/set-top unit (STU) customer electronics device; an Internet Protocol (IP) enabled television; an IP enabled media player; an IP enabled gaming console; an Ethernet gateway; a computing device connected to the LAN; an Ethernet connected computer peripheral device; an Ethernet connected router; an Ethernet connected wireless bridge; an Ethernet connected network bridge; or an Ethernet connected network switch **(col. 6, line 13, discloses that the nodes may be network switches)**.

Regarding claim 10, Clark discloses a non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor of a server to perform a method for improving performance of one or more communication units **(col. 11, lines 11-44, discloses a computer device including a memory with instructions to be executed by a processor to execute a process at a network controller; col. 12, lines 17-20, discloses improving performance of communication units in response to performing steps by the network controller)**. The remaining limitations of claim(s) 10 do not read or further define over the limitations of claim(s) 1. Therefore, claim(s) 10 is/are rejected for the same reasons as set forth in claim(s) 1, above.

Regarding claim 12, Clark discloses the non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory of the device **(col. 12, lines 55-58, discloses that the network controller collects the information)**.

Regarding claim 13, Clark discloses the non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises determining a condition for communicating the policy **(col. 13, line 6-10, discloses that the policies are transmitted once the policies are determined)**.

Regarding claim 15, Clark discloses the non-transitory machine-readable storage medium of claim 10, further comprising updating the parameter based on a change in the operation to update the policy **(col. 12, lines 21-23, discloses that the information includes admission policies (see also col. 12, lines 61-65, QoS information is also transmitted); Fig. 10 discloses that the method steps are repeated (element 1006 points back to 1000), and current parameters are obtained in each iteration (element 1002), which results in new policy (element 1004))**.

Regarding claim 34, Clark discloses an apparatus comprising:

a memory; and a processor, coupled to the memory **(col. 11, lines 11-44, discloses a computer device including a memory with instructions to be executed by a processor to execute a process at a network controller; col. 12, lines 17-20, discloses improving performance of communication units in response to performing steps by the network controller)**. The remaining limitations of claim(s) 34 do not read or further define over the limitations of claim(s) 1. Therefore, claim(s) 34 is/are rejected for the same reasons as set forth in claim(s) 34, above.

Regarding claim 53, Clark discloses the method of claim 1, wherein processing comprises storing at least one of the data and historical data in a memory **(col. 12, lines 55-58, discloses that the network controller collects the information)**.

Regarding claim 54, Clark discloses the method of claim 4, wherein updating the policy comprises updating the parameter **(col. 12, lines 21-23, discloses that the information includes admission policies (see also col. 12, lines 61-65, QoS information is also transmitted); Fig. 10 discloses that the method steps are repeated (element 1006 points back to 1000), and current parameters are obtained in each iteration (element 1002), which results in new policy (element 1004))**.

Regarding claim 56, Clark discloses the method of claim 34. The remaining limitations of claim(s) 56 do not read or further define over the limitations of claim(s) 53. Therefore, claim(s) 56 is/are rejected for the same reasons as set forth in claim(s) 53, above.

Regarding claim 57, Clark discloses the method of claim 34. The remaining limitations of claim(s) 57 do not read or further define over the limitations of claim(s) 13. Therefore, claim(s) 57 is/are rejected for the same reasons as set forth in claim(s) 13, above.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 3, 14, and 36 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Clark (US 5970064 A) in view of Malik et al. (US 2009/0147697 A1, hereinafter Malik).

Regarding claim 3, Clark discloses the method of claim 1.

Clark does not disclose that monitoring comprises determining a received signal strength indication.

Malik discloses that monitoring comprises determining a received signal strength indication **(paragraph [0025] discloses a first network element receiving from a second network element performance data related to communications between the second network element and a third network element of a plurality of elements (see paragraph [0018]); paragraph [0030] discloses that monitored parameters may include signal strength indicators; paragraphs [0046]-[0047] discloses transmitting new policies to node devices based on the monitoring)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Clark in view of Malik for monitoring to comprise determining a received signal strength indication.

One of ordinary skill in the art would have been motivated because it would improve techniques for associating user devices with access points (Malik, paragraph [0003]).

Regarding claim 14, Clark discloses the non-transitory machine-readable storage medium of claim 10. The remaining limitations of claim(s) 14 do not read or further define over the limitations of claim(s) 3. Therefore, claim(s) 14 is/are rejected for the same reasons as set forth in claim(s) 3, above.

Regarding claim 36, Clark discloses the apparatus of claim 34, further comprising a monitoring device coupled to the processor **(Fig. 7 discloses that the network controller may receive the collected information from a single node (S1) (see col. 6, lines 20-21))**.

Clark does not disclose that the monitoring device determines a received signal strength.

Malik discloses a monitoring device coupled to the processor, and that the monitoring device determines a received signal strength **(paragraph [0025] discloses a first network element receiving from a second network element performance data related to communications between the second network element and a third network element of a plurality of elements (see paragraph [0018]); paragraph [0030] discloses that monitored parameters may include signal strength indicators; paragraphs [0046]-[0047] discloses transmitting new policies to node devices based on the monitoring)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Clark in view of Malik for monitoring to comprise determining a received signal strength indication.

One of ordinary skill in the art would have been motivated because it would improve techniques for associating user devices with access points (Malik, paragraph [0003]).

Claim 5, 16, and 37 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Clark (US 5970064 A) in view of Roy (US 2006/0187885 A1).

Regarding claim 5, Clark discloses the method of claim 1.

Clark does not disclose that determining the policy comprises selecting the policy from a set of policies.

Roy discloses that determining a policy comprises selecting the policy from a set of policies **(Fig. 3 discloses monitoring a node (elements 310-330), and based on monitored parameters, selecting one of two policies (elements 330, 320, and 335))**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Clark in view of Roy so that determining a policy comprises selecting the policy from a set of policies.

One of ordinary skill in the art would have been motivated because predetermined policies improve processing time by not having to create policies from scratch.

Regarding claim 16, Clark discloses the non-transitory machine-readable storage medium of claim 10. The remaining limitations of claim(s) 16 do not read or further define over the limitations of claim(s) 5. Therefore, claim(s) 16 is/are rejected for the same reasons as set forth in claim(s) 5, above.

Regarding claim 37, Clark discloses the apparatus of claim 34, wherein determining the policy comprises updating the parameter **(col. 12, lines 21-23, discloses that the information includes admission policies and what's updated is the admission policies (see col. 13, lines 10-12))**.

Clark does not disclose that determining the policy comprises selecting the policy from a set of policies.

Roy discloses that determining a policy comprises selecting the policy from a set of policies **(Fig. 3 discloses monitoring a node (elements 310-330), and based on monitored parameters, selecting one of two policies (elements 330, 320, and 335))**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Clark in view of Roy so that determining a policy comprises selecting the policy from a set of policies.

One of ordinary skill in the art would have been motivated because predetermined policies improve processing time by not having to create policies from scratch.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1, 10, and 34 are rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 10171298 B2 in view of Clark (US 5970064 A).

Regarding claim 1,

14356581			10171298	
Claims	Description		Claims	Description
1	A method for improving performance of one or more communication units, the method comprising:		1	A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
	receiving, by a server, from a network monitoring device, in real-time, data associated with an operation			a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
	of two or more communication units located in different geographical areas,			
	the data comprising a parameter; processing, by the server, at least one of the data and historical data; based on the processed data, determining a policy for at least one of the two or more communication units; and			an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
	communicating the policy, by the server, via a network, to at least one or more communication units that, in response to receiving the policy implemented one or more algorithms based on at least a rule or a condition			a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.
	to improve a performance of the one or more communication units.			

US Patent No. 10171298 B2 does not disclose that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

Clark discloses that the data is associated with an operation of two or more communication units located in different geographical areas **(col. 12, lines 21-23, discloses that the information is information associated with the operation of multiple nodes (see also col. 12, lines 61-65, QoS information is also transmitted); see Fig. 3, and col. 6, 9-30, discloses that switches are physical devices located at different locations)**; and

that the algorithm is to improve a performance of the one or more communication units **(col. 12, lines 17-20, discloses improving performance of communication units in response to performing the steps described)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify US Patent No. 10171298 B2 in view of Clark so that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

One of ordinary skill in the art would have been motivated because it would prevent loss of data due to overloading (Clark, implied, col. 2, lines 21-41).

Regarding claim 10,

14356581			10171298	
Claims	Description		Claims	Description
10	A non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor to perform a method for improving performance of one or more communication units, the method comprising:		1	A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
	receiving, from a network monitoring device, in real time, data associated with an operation			a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
	of two or more communication units located in different geographical areas,			
	the data comprising a parameter; processing at least one of the data and historical data; determining a policy for each of the one or more communication units,			an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
	based on the processed data, communicating, via a network, the policy to two or more communication units that, in response to receiving the policy implemented one or more algorithms based on at least a rule or a condition			a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.
	to improve a performance of the one or more communication units.			

US Patent No. 10171298 B2 does not disclose that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

Clark discloses that the data is associated with an operation of two or more communication units located in different geographical areas **(col. 12, lines 21-23, discloses that the information is information associated with the operation of multiple nodes (see also col. 12, lines 61-65, QoS**

information is also transmitted); see Fig. 3, and col. 6, 9-30, discloses that switches are physical devices located at different locations); and

that the algorithm is to improve a performance of the one or more communication units **(col. 12, lines 17-20, discloses improving performance of communication units in response to performing the steps described)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify US Patent No. 10171298 B2 in view of Clark so that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

One of ordinary skill in the art would have been motivated because it would prevent loss of data due to overloading (Clark, implied, col. 2, lines 21-41).

Regarding claim 34,

14356581			10171298	
Claims	Description		Claims	Description
34	An apparatus comprising: a memory; and a processor, coupled to the memory, and operable to:		1	A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
	receive, from a network monitoring device, in real-time, data associated with an operation of two or more communication units			a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
	located in different geographical areas,			
	the data comprising a parameter; analyze at least one of the data and historical data; based on the analyzed data, determine a policy for at least one of the two or more communication units; and			an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
	communicate the policy, via a network that is communicatively coupled to the processor, to at least one or more communication units that in response to receiving the policy implemented one or more algorithms based on at least a rule or a condition			a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.
	to improve a performance of the one or more communication units.			

US Patent No. 10171298 B2 does not disclose that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

Clark discloses that the data is associated with an operation of two or more communication units located in different geographical areas **(col. 12, lines 21-23, discloses that the information is information associated with the operation of multiple nodes (see also col. 12, lines 61-65, QoS information is also transmitted); see Fig. 3, and col. 6, 9-30, discloses that switches are physical devices located at different locations)**; and

that the algorithm is to improve a performance of the one or more communication units **(col. 12, lines 17-20, discloses improving performance of communication units in response to performing the steps described)**.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify US Patent No. 10171298 B2 in view of Clark so that the data is associated with an operation of two or more communication units located in different geographical areas; and that the algorithm is to improve a performance of the one or more communication units.

One of ordinary skill in the art would have been motivated because it would prevent loss of data due to overloading (Clark, implied, col. 2, lines 21-41).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BORIS D GRIJALVA LOBOS whose telephone number is (571)272-0767. The examiner can normally be reached on M-F 10:30AM to 6:30PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Gillis can be reached on 571-272-7952. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BORIS D GRIJALVA LOBOS/
Examiner, Art Unit 2446

Applicant-Initiated Interview Summary	**Application No.** 14/356,581	**Applicant(s)** Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	**Art Unit** 2446	**AIA Status** No

All participants (applicant, applicants representative, PTO personnel):

(1) BORIS D. GRIJALVA LOBOS. (3) _____.

(2) ALI UYANIK (67080). (4) _____.

Date of Interview: 28 January 2019.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☑101 ☐112 ☑102 ☑103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: Clark et al. (US 5970064 A).

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative requested information regarding the status of the application. The examiner explained that at this time the application was not in condition for allowance because Clark et al. (US 5970064 A) anticipated the claimed limitations. There is also 35 USC 101 and 112 issues that need to be resolved. The examiner and applicant's representative agreed that 35 USC 101 and 112 issues can be resolved with minor modifications to the claims..

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/BORIS D GRIJALVA LOBOS/ Examiner, Art Unit 2446	

Charter Communications, Inc.
Exhibit 1006
Page #629

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

Notice of References Cited	Application/Control No. 14/356,581	Applicant(s)/Patent Under Reexamination Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	Art Unit 2446	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A					
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	OODA Loop - Wikipedia, the free encyclopedia - Feb 2009
	V	Measuring RSSI with Wifi Cards - TomatoUSB - 2010
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/21/2015	11/16/2016	12/20/2017	10/21/2018	01/27/2019				
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	3	✓	✓	✓	✓	✓				
	4	✓	✓	✓	✓	✓				
	5	✓	✓	✓	✓	✓				
	6	✓	-	-	-	-				
	7	✓	✓	✓	✓	-				
	8	✓	✓	✓	✓	✓				
	9	✓	✓	✓	✓	-				
	10	✓	✓	✓	✓	✓				
	11	✓	-	-	-	-				
	12	✓	✓	✓	✓	✓				
	13	✓	✓	✓	✓	✓				
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	42	-	-	-	-	-				

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
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CLAIM		DATE								
Final	Original	12/21/2015	11/16/2016	12/20/2017	10/21/2018	01/27/2019				
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	46	-	-	-	-	-				
	47	-	-	-	-	-				
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	49	-	-	-	-	-				
	50	-	-	-	-	-				
	51	-	-	-	-	-				
	52	-	-	-	-	-				
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	54				✓	✓				
	55				✓	-				
	56				✓	✓				
	57				✓	✓				

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

CPC - Searched*		
Symbol	Date	Examiner
H04L7/00,0004	12/21/2015	BGL
H04L12/00,14,16,24,2414,2415,2417-2419,2424-2426,2428-2433,2439,244-2442,2447,2464,2465,2468-247,2472,2473,2476,2478,26,2602,2618,2634-2642,2668-2678,2692	12/21/2015	BGL
H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038	12/21/2015	BGL
H04L43/00,04,08-0817,0876-10,16	12/21/2015	BGL
H04L47/00,10,11,12,28,29,32	12/21/2015	BGL
H04L7/00,0004 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32	10/21/2018	BGL

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

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Search Notes		
Search Notes	**Date**	**Examiner**
EAST Inventor Name Search Performed	12/21/2015	BGL
EAST Text Limited Classification Search Performed (see attached search notes)	12/21/2015	BGL
EAST Text Search Performed (see attached search notes)	12/21/2015	BGL
EAST Inventor Name Search Performed	11/16/2016	BGL
EAST Text Search Performed	11/16/2016	BGL
Updated EAST Text Search (see attached search notes)	12/20/2017	BGL
Updated EAST Inventor Name Search (see attached search notes)	12/20/2017	BGL
Updated EAST Inventor Name Search (see attached search notes)	10/21/2018	BGL
Updated EAST Text Limited Classification Search (see attached search notes)	10/21/2018	BGL
Updated EAST Text Search (see attached search notes)	10/21/2018	BGL
GOOGLE Search Performed	10/21/2018	BGL
Updated EAST Inventor Name Search (see attached search notes)	01/28/2019	BGL
Updated EAST Text Search (see attached search notes)	01/28/2019	BGL
Google search performed	01/28/2019	BGL

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1026	((access near1 point) (base near1 station) (wireless near1 LAN near1 device) (DSLAM) (gateway) (performance near1 device) DSL CPE (customer near1 premises near1 equipment) modem (in-home near1 powerline) (in-home coax) (HPNA) (metering near1 device) (LAN near3 appliance) (femtocell) (wifi near1 base) (repeater) STB STU (IP near2 TV) (IP near2 media near1 device) (gam$3 near1 console) gateway device computer router bridge switch) with ((transmit$4 send$3 forward$3 receiv$3) near5 policy) with operation	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 12:31
S2	84	((access near1 point) (base near1 station) (wireless near1 LAN near1 device) (DSLAM) (gateway) (performance near1 device) DSL CPE (customer near1 premises near1 equipment) modem (in-home near1 powerline) (in-home coax) (HPNA) (metering near1 device) (LAN near3 appliance) (femtocell) (wifi near1 base) (repeater) STB STU (IP near2 TV) (IP near2 media near1 device) (gam$3 near1 console) gateway device computer router bridge switch) with ((transmit$4 send$3 forward$3 receiv$3) near5 policy) with operation with (location time)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 12:48
S3	26692	RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:31
S4	1040	monitor$3 near3 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:32
S6	0	(monitor$3 near3 RSSI) with (adjust$3 near3 rate)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:32
S7	8	((transmit$3 send$3 receiv$3 forward$3 monitor$3) near3 RSSI) with (adjust$3 near3 rate)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:33
S8	26	((send$3 transmit$4 receiv$3 forward$3) near5 conditions near3 operation) with ((access near1 point) AP)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:26

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S9	4998	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:58
S10	3	(adaptation near1 algorithm) with ((real near1 time) real-time) with historical	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:58
S11	1	"14356581"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:14
S12	0	((send$3 transmit$4 forward$3 receiv$3) near3 policy) near20 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S13	0	((send$3 transmit$4 forward$3 receiv$3) near3 policy) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S14	31	((send$3 transmit$4 forward$3 receiv$3) near7 policy) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S15	1	(policy near1 server) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:59
S16	26	(policy near1 server) same2 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:59
S17	0	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19
S18	178	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19
S19	1	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19
S20	2	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) with AP	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:20

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S21	7	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and (((access near1 point) AP) with server)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:20
S22	109	rhee near1 wonjong	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 13:24
S23	10	(rhee near1 wonjong) and policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 13:30
S24	58484	(H04L7/00,0004 H04L12/00,14,16,24,2414,2415,2417-2419,2424-2426,2428-2433,2439,244-2442,2447,2464,2465,2468-247,2472,2473,2476,2478,26,2602,2618,2634-2642,2668-2678,2692 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32).cpc.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:17
S25	25	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and S24	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:17
S26	41	(rhee near1 wonjong) and S24	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:18
S27	1	"7840220".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 16:50
S28	1672280	adaptation algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:55
S29	5390	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:55
S30	394	(creat$3 generat$3 comput$3 calculat$3) near5 (adaptation near1 algorithm)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:56
S31	0	((creat$3 generat$3 comput$3 calculat$3) near5 (adaptation near1 algorithm)) with policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:56
S32	5	((creat$3 generat$3 comput$3 calculat$3)	US-	OR	ON	2016/11/14

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		near5 (adaptation near1 algorithm)) same2 policy	PGPUB; USPAT; EPO; JPO			19:56
S33	13	(rhee near1 wonjong) and policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:17
S34	2862	(generat$3 creat$3 develop$3) near10 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:18
S35	361	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:19
S36	0	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state)) with policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:19
S37	4	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state)) same2 policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S38	5394	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S39	2	S35 and S38	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S40	5784	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 14:02
S41	451	(transmit$4 send$3 receiv$3 forward$3 push$3) near5 (adaptation near1 algorithm)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 14:03
S42	4	"7840220".pn. "2007136337"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 15:43
S43	46	(policy near7 algorithm) and (communication near5 algorithm) and WIFI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 21:13
S44	0	S43 and S41	US-	OR	ON	2017/12/20

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			PGPUB; USPAT; EPO; JPO			21:13
S51	33	("2006/0187885").URPN.	USPAT	OR	OFF	2018/10/19 20:09
S52	10158	monitor$3 near7 (signal near1 strength)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:07
S53	86958	(H04L7/00,0004 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32).cpc.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2018/10/19 23:08
S54	335	S52 and S53	US-PGPUB; USPAT; EPO; JPO	OR	ON	2018/10/19 23:08
S55	38	("4161628" | "4229734" | "4279032" | "4430788" | "4558358" | "4694453" | "4730302" | "4799211" | "4816825" | "4860001" | "4890278" | "4896315" | "4926162" | "5048009" | "5115199").PN. OR ("5198805").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/10/19 23:11
S56	316	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 adapt$3)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:27
S57	58	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 adapt$5) not S56	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:33
S58	5	("2009/0059872").URPN.	USPAT	OR	OFF	2018/10/19 23:51
S59	1	("2012/0077533").URPN.	USPAT	OR	OFF	2018/10/19 23:54
S60	839	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 (adapt$5 chang$3 modif$3)) not (S56 S57)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:57
S61	433	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 (adapt$5 chang$3 modif$3)) and @AD<="20111110" not (S56 S57)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/20 00:04
S62	15	("2004/0223470").URPN.	USPAT	OR	OFF	2018/10/20 00:09
S63	31	remote$2 near3 manag$5 near3 QOS	USPAT	OR	OFF	2018/10/20 00:15
S64	6276	S52 and @AD<="20111110"	US-PGPUB; USPAT; EPO;	OR	OFF	2018/10/20 00:20

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			JPO			
S65	1349	RSSI and S64	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/20 00:21
S66	15	("2004/0223470").URPN.	USPAT	OR	OFF	2018/10/20 00:33
S67	89	("2007/0082677").URPN.	USPAT	OR	OFF	2018/10/20 00:40
S71	20	("20030031180" | "20030076784" | "20050261915" | "20060126613" | "20060187885" | "20070153807" | "20080186873" | "20090055900" | "20100290465" | "20110013529" | "20110110359" | "20110182182" | "20110273979" | "20120294310" | "5970064" | "5974106" | "6430612" | "7840220" | "8520586" | "8880666").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/20 23:05
S72	1	("20120151540").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/20 23:23
S73	7	("20160315976" | "20180248984" | "6469982" | "6618356" | "6678247" | "6680907" | "7864669").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/21 00:11
S74	3178	(monitor$3 with ((real near1 time) real-time)) and (parameter with algorithm)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2019/01/27 14:58
S75	56	(monitor$3 with ((real near1 time) real-time)) and (parameter with algorithm) and (policy with (rule condition))	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2019/01/27 14:59

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S45	100	rhee near1 wonjong	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S46	889	(policy with algorithm).clm.	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S47	1	S45 and S46	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S48	42097	((transmission near1 control$4) (communication near1 algorithm)).clm.	US-PGPUB; USPAT	OR	ON	2017/12/20 20:55
S49	13	S46 and S48	US-PGPUB; USPAT	OR	ON	2017/12/20 20:55
S50	5	S48 and S45	US-PGPUB; USPAT	OR	ON	2017/12/20 20:56

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S68	104	rhee near1 wonjong	US-PGPUB; USPAT	OR	ON	2018/10/20 02:52
S69	106792	((transmission near1 control$4) (communication near1 algorithm) policy).clm.	US-PGPUB; USPAT	OR	ON	2018/10/20 02:53
S70	7	S68 and S69	US-PGPUB; USPAT	OR	ON	2018/10/20 02:53
S76	105	rhee near1 wonjong	US-PGPUB; USPAT	OR	ON	2019/01/27 14:41
S77	7741	(monitor$3 with real-time).clm.	US-PGPUB; USPAT	OR	ON	2019/01/27 14:55
S78	2	S76 and S77	US-PGPUB; USPAT	OR	ON	2019/01/27 14:55
S79	37017	(monitor$3 with parameter).clm.	US-PGPUB; USPAT	OR	ON	2019/01/27 14:56
S80	4	S76 and S79	US-PGPUB; USPAT	OR	ON	2019/01/27 14:56
S81	3094	(policy and algorithm).clm.	US-PGPUB; USPAT	OR	ON	2019/01/27 14:57
S82	1	S76 and S81	US-PGPUB; USPAT	OR	ON	2019/01/27 14:57

1/ 27/ 2019 3:00:25 PM
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Google

Measuring RSSI with Wifi Cards

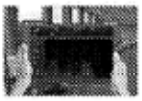
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Settings Tools

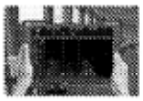
Before Dec 31, 2011 ▾ Sorted by relevance ▾ All results ▾ Clear

See Measuring RSSI with Wifi Cards

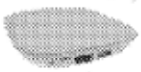
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$69.00
Amazon.com

Measuring RSSI with Wifi Cards - TomatoUSB

tomatousb.org/tut:measuring-rssi-with-wifi-cards ▾

Dec 8, 2010 - Notice that nothing has been said here about **measurement** of RF energy in dBm or mW. **RSSI** is an arbitrary integer value, defined in the 802.11 standard and ...

People also ask

- How is RSSI calculated?
- What is a good RSSI level?
- Is RSSI measured in dB or dBm?
- What is RSSI in WiFi?

Feedback

How to check RSSI value with NetSpot

https://www.netspotapp.com/what-is-rssi-level.html ▾

Jul 8, 2019 - **RSSI measurements** represent the relative quality of a received signal on a device. ... Your computer's **WiFi adapter** and NetSpot app can help you determine the ...

How to Calculate the Average RSSI for an 802.11 | It Still Works

https://itstillworks.com › Network ▾

Jan 21, 2011 - Wireless network interface cards use received signal strength indication -- or RSSI for short -- to monitor radio signal strength and ... Download a free wireless networking tool with SNR or **RSSI measurement** capabilities. ... with WI-FI enabled.

How to get RSSI values thru laptop? - Wireless Networking ...

www.dslreports.com › Forums › Broadband and Networking › Wireless Networking ▾

Sep 7, 2007 - 12 posts - 5 authors

Hi, I am a student, and I am doing this project that needs me to obtain the **rssi** of different aps thru a laptop. ... The manufacturer's utility (for the wireless card/chipset) usually will show this. ... I am really bad in the knowledge of **wifi** signal.

macos - RSSI value of wifi connection - how to interpret? - Super User

https://superuser.com/questions/21827/rssi-value-of-wifi-connection-how-to-interpret ▾

2 answers

Aug 12, 2009 - **RSSI** or received signal strength indication can go from 0 to -100 (for Apple - other vendors can measure it differently as RSSI has no stated units. ... a percentage and not a linear representation of how many dBm is actually reaching the card.

[PDF] Converting Signal Strength Percentage to dBm Values.book - MadWifi

madwifi-project.org/attachment/wiki/.../RSSI/Converting_Signal_Strength.pdf?format... ▾

Nov 15, 2002 - Granularity in **RSSI Measurements** . ..... strength with a Symbol card would convert to

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an RSSI of 16 (because their RSSI_Max = 31). Atheros, with RSSI_Max=60 ...

UserDocs/RSSI - madwifi-project.org - Trac

madwifi-project.org › Start › UserDocs

Nov 3, 2005 - RSSI is a measurement of the received radio signal strength (energy integral, not ... RSSI can be used internally in a wireless networking card to determine when ...

Received signal strength indicator and its analysis in a ... - IEEE Xplore

https://ieeexplore.ieee.org/iel7/6746315/6751208/06761255.pdf

by Y Chapre - 2013 - Cited by 53 - Related articles

Aug 15, 2008 - analysis of RSSI measurement and investigated the effect of wireless local area network (WLAN) card, time and duration of measurement, interference and ... with Intel(R) WiFi Link 5100 AGN (NDIS 6 Native WiFi) card is placed at a fixed and ...

SNR and RSSI Values. - Cisco Community

https://community.cisco.com/t5/wireless-and-mobility/snr-and-rssi.../td-.../1445580

Jul 28, 2010 - SNR is comprised of 2 values and is measured as a positive value between ... So if a client card has a 2 dbi antenna (although they are typically either 0dbi .... Any wifi analyzer application on my Android show me RSSI negative values always.

Understanding a Wi-Fi connection. | CCIE or Null!

https://ccie-or-null.net/2011/01/24/understanding-a-wi-fi-connection/

Jan 24, 2011 - RSSI is the measurement of power in an RF signal, the more power in an RF signal ... from the vendor of your client WLAN cards to see the RSSI value range.

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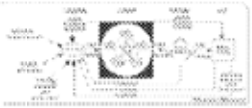
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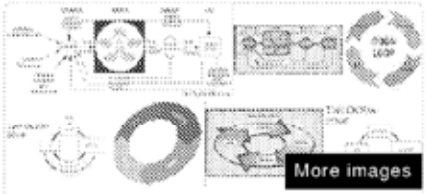
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The **OODA loop** is the cycle observe–orient–decide–act, developed by military strategist and United States Air Force Colonel John Boyd. Boyd applied the concept to the combat operations process, often at the operational level during military campaigns.



OODA loop - Wikipedia
https://en.wikipedia.org/wiki/OODA_loop

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OODA loop

The OODA loop is the cycle observe–orient–decide–act, developed by military strategist and United States Air Force Colonel John Boyd. Boyd applied the concept to the combat operations process, often at the operational level during military campaigns. Wikipedia

Feedback

OODA loop - Wikipedia
https://en.wikipedia.org/wiki/OODA_loop

The **OODA loop** is the cycle observe–orient–decide–act, developed by military strategist and United States Air Force Colonel John Boyd. Boyd applied the concept to the combat operations process, often at the operational level during military campaigns.

Overview Applicability Notes

I'm So Sick Of The OODA Loop - Task & Purpose
https://taskandpurpose.com/case-against-ooda-loop

Jul 30, 2018 - "He got inside my loop." People in the military can't shut the hell up about **OODA Loops**. In the military, the **OODA Loop** is often used as a synonym for "decision making." Some will even break down the acronym, into "Observe, Orient, Decide, Act," as if that makes it a more profound statement.

Boyd's O.O.D.A Loop and How We Use It – Tactical Response
https://www.tacticalresponse.com/.../18649427-boyd-s-o-o-d-a-loop-and-how-we-use...

The **O.O.D.A. Loop** is a process we go through hundreds if not thousands of times in a single day. It is a process that defines how we humans react to stimulus.

The Ultimate Guide To The OODA Loop (How to Turn Uncertainty into ...
https://taylorpearson.me/ooda-loop/

Aug 2, 2017 - The **OODA loop** was a tool developed by military strategist John Boyd to explain how individuals and organizations can win in uncertain and chaotic environments. It is an Acronym that explains the four steps of decision making: Observe, Orient, Decide Act.

Why is the OODA loop so ... · Going Full OODA · The Core Attributes of the ...

OODA Loop by John Boyd, a great decision making tool | ToolsHero
https://www.toolshero.com › Decision Making
Rating: 4.5 - 6 votes
This article describes the concept of the **OODA Loop**, developed by John Boyd in a practical way. After reading you will understand the basics of this powerful ...

OODA LOOP: What You Can Learn from Fighter Pilots About Making ...
https://fs.blog/2018/01/john-boyd-ooda-loop/
One strategy that I've found repeatedly effective is the **OODA loop**. Developed by strategist and U.S. Air Force Colonel John Boyd, the **OODA loop** is a practical ...

The OODA Loop: A Tool for Better Decision-Making – Personal Growth ...
https://medium.com/.../the-ooda-loop-a-tool-for-better-decision-making-that-youre-al...
Mar 11, 2017 - Preparation is key for doing well at whatever it is you're trying to do. It's why athletes practice, actors rehearse, and writers read. The reason ...

The Critical Thinker's OODA Loop -- Dr. Jamie Schwandt -- Medium
https://medium.com/@jamieschwandt/the-critical-thinkers-ooda-loop-6c69e878c153
May 17, 2018 - Essentially, the **OODA Loop** is a high-speed decision making and feedback process in four stages: Observe, Orient, Decide, and Act.[2] The ...

Retired Top Gun instructor explains the OODA Loop - Business Insider
https://www.businessinsider.com/ooda-loop-decision-making-2017-8
Aug 15, 2017 - A retired Marine and elite fighter pilot breaks down the **OODA Loop**, the military decision-making process that guides 'every single thing' in life.

OODA Loop: A Comprehensive Guide | The Art of Manliness
https://www.artofmanliness.com/articles/ooda-loop/
Sep 16, 2014 - Understanding the **OODA Loop** will make you a success in life and in business.

Searches related to ooda loop

disrupting the ooda loop	**boyd** ooda loop **book**
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grualva Lobos, Boris D.
Attorney Docket Number	20145-054US

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
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	First Named Inventor	Wonjong Rhee
	Art Unit	2446
	Examiner Name	Grualva Lobos, Boris D.
	Attorney Docket Number	20145-054US

	1	Office Action, and English translation thereof, dated 2018-11-01, in Chinese Patent Application No. 201180075399.4 (20pgs).	X
	2	Office Action dated 2018-12-07, in European Patent Application No. 11787994.0 (4pgs).	☐

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Examiner Signature	/BORIS D GRIJALVA LOBOS/	Date Considered	01/27/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grualva Lobos, Boris D.
Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2019-01-17
Name/Print	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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Page #651

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	14356581	Filing Date	2014-05-06	Docket Number (if applicable)	20145-054US	Art Unit	2446
First Named Inventor	Wonjong Rhee			Examiner Name	Boris D. Grijalva Lobos		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

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☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☐ Enclosed

☐ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 502776

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

X Patent Practitioner Signature

Applicant Signature

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

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Signature of Registered U.S. Patent Practitioner			
Signature	/Michael North/	Date (YYYY-MM-DD)	2019-01-17
Name	Michael North	Registration Number	46963

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Electronic Patent Application Fee Transmittal

Application Number:	14356581
Filing Date:	06-May-2014
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Filer:	Michael V. North/Nita Miller
Attorney Docket Number:	20145-054US

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	1820	1	1900	1900
		Total in USD ($)		**1900**

Electronic Acknowledgement Receipt

EFS ID:	34889938
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	17-JAN-2019
Filing Date:	06-MAY-2014
Time Stamp:	16:41:36
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1900
RAM confirmation Number	011819INTEFSW16423100
Deposit Account	502776
Authorized User	Nita Miller
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.17 (Patent application and reexamination processing fees) 37 CFR 1.19 (Document supply fees)	

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	054US_RCE.pdf	697598 6c608a99f127012 3a8459913f4853e818e683 9c51	no	3
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30820 7f25664288ff35291681799036f57707cc64a 2bdc	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	728418		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grualva Lobos, Boris D.
Attorney Docket Number	20145-054US

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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If you wish to add additional U.S. Published Application citation information please click the Add button. Add

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

Charter Communications, Inc.
Exhibit 1006
Page #659

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	2446
	Examiner Name	Grualva Lobos, Boris D.
	Attorney Docket Number	20145-054US

	1	Office Action, and English translation thereof, dated 2018-11-01, in Chinese Patent Application No. 201180075399.4 (20pgs).	X
	2	Office Action dated 2018-12-07, in European Patent Application No. 11787994.0 (4pgs).	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Charter Communications, Inc.
Exhibit 1006
Page #660

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	2446
	Examiner Name	Grualva Lobos, Boris D.
	Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2019-01-17
Name/Print	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	34890921
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	17-JAN-2019
Filing Date:	06-MAY-2014
Time Stamp:	17:24:41
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	054US_SIDS_Trans.pdf	29061 84c54ce8cfb3613bcade16790b791c5679ea df2b	no	3
Warnings:					

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	054US_SIDS_SB08.pdf	612043 e1a89942b58666f0f016e1fa079775fa99b36dc026	no	4
Warnings:					
Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
3	Non Patent Literature	054US_SIDS_NPL1.pdf	3614390 0f28952e6e38015be59553a840686a457fc80fe1	no	20
Warnings:					
Information:					
4	Non Patent Literature	054US_SIDS_NPL2.pdf	188577 3015ffb15d794c2e2d074c871f52dc34b45dbc01	no	4
Warnings:					
Information:					
		Total Files Size (in bytes):	4444071		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2019-01-17 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

Charter Communications, Inc.
Exhibit 1006
Page #665

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☒ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☐ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application

not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

☐ Pursuant to 37 CFR § 1.704(d), Applicant certifies that each of the references cited herein were first cited in a communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in 37 CFR § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement.

Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2019-01-17

By: /Michael V. North/
Michael V. North
Reg. No. 46963

Customer No.
146571
UNITED STATES PATENT AND TRADEMARK OFFICE

Charter Communications, Inc.
Exhibit 1006
Page #667

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	14356581	Filing Date	2014-05-06	Docket Number (if applicable)	20145-054US	Art Unit	2446
First Named Inventor	Wonjong Rhee			Examiner Name	Boris D. Grijalva Lobos		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☐ Enclosed

- ☐ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 502776

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

X Patent Practitioner Signature

Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Michael North/	Date (YYYY-MM-DD)	2019-01-17
Name	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Charter Communications, Inc.
Exhibit 1006
Page #670

Electronic Patent Application Fee Transmittal

Application Number:	14356581
Filing Date:	06-May-2014
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Filer:	Michael V. North/Nita Miller
Attorney Docket Number:	20145-054US

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	1820	1	1900	1900
		Total in USD ($)		**1900**

Electronic Acknowledgement Receipt

EFS ID:	34889668
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	17-JAN-2019
Filing Date:	06-MAY-2014
Time Stamp:	16:30:44
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	054US_RCE.pdf	697598 6c608a99f1270123a8459913c853e818e683 9c51	no	3
Warnings:					

Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30821 43607b99ccaf155b0ed7079f4ecd1ff9a52d577c	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	728419	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
14/356,581	05/06/2014	

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 01/17/2019	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $100 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $460 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
SHERRY DAVIS

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/356,581	05/06/2014	Wonjong Rhee	20145-054US	4319

146571 7590 01/04/2019
North Weber & Baugh LLP - ASSIA
3260 Hillview Avenue, 1st Floor
Palo Alto, CA 94304

EXAMINER
GRIJALVA LOBOS, BORIS D

ART UNIT	PAPER NUMBER
2446	

NOTIFICATION DATE	DELIVERY MODE
01/04/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket1@northweber.com

Charter Communications, Inc.
Exhibit 1006
Page #676

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 14/356,581	**Applicant(s)** Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	**Art Unit** 2446	**AIA Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 18 December 2018 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☑ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☑ The period for reply expires 3 months from the mailing date of the final rejection.
   b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection.The current period for reply expires ____ months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANTS FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37CFR 41.37(a).

AMENDMENTS

3. ☑ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☑ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: The amendments to the claims raise new issues that require further search and/or consideration (See 37CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicants reply has overcome the following rejection(s): _____
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☑ For purposes of appeal, the proposed amendment(s):(a)☑ will not be entered, or (b)☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☑ The request for reconsideration has been considered but does NOT place the application in concition for allowance because: The amendments to the claims raise new issues that require further search and/or consideration.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed:_____.
    Claim(s) objected to:_____.
    Claim(s) rejected:1,3-5,7-10,12-16,34,36-37 and 53-57.
    Claim(s) withdrawn from consideration:_____.

/B.D.G/ Examiner, Art Unit 2446	/Tauqir Hussain/ Primary Examiner, Art Unit 2446

Charter Communications, Inc.
Exhibit 1006
Page #677

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	14/356,581	Confirmation No.: 4319
Inventor(s)	:	Wonjong Rhee	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grijalva Lobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via EFS-Web addressed to: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Dated: 2018-12-18 By: /Nita Miller/
Nita Miller

RESPONSE TO FINAL OFFICE ACTION

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Examiner Grijalva Lobos:

This Amendment is in response to the Final Office Action mailed October 26, 2018 ("Office Action"), and having a shortened statutory response period for reply expiring January 26, 2019. Accordingly, this paper is timely filed. Applicant respectfully requests reconsideration in view of the Amendments and Remarks set forth below.

Amendments to the Claims are reflected in the complete Listing of Claims which begins at page **2** of this paper.

Remarks/Arguments begin on page **8** of this paper.

DO NOT ENTER: /B.D.G/

Charter Communications, Inc.
Exhibit 1006
Page #678

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	14/356,581	Confirmation No.: 4319
Inventor(s)	:	Wonjong Rhee	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grijalva Lobos	
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Dated: 2018-12-18 By: /Nita Miller/
Nita Miller

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Remarks/Arguments begin on page **8** of this paper.

Charter Communications, Inc.
Exhibit 1006
Page #679

Electronic Acknowledgement Receipt

EFS ID:	34624766
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	18-DEC-2018
Filing Date:	06-MAY-2014
Time Stamp:	15:50:46
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		054US_RFOA.pdf	46384 cc2903722633ed4c0718376248688694767c76ac	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	8	8
	Claims	2	7
	Response After Final Action	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	46384	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

Claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 were presented for examination. All pending claims were rejected by the Examiner in the Office Action. In response, Applicant hereby amends claims 1, 10, 15, 34, and 53 and cancels claims 7 and 55. Applicant respectfully requests reconsideration in light of the amendments to the claims and the below remarks.

Applicant thanks Examiner Grijalva Lobos for the courtesy of a telephone interview on November 6, 2018. During this interview, Applicant's representative proposed amendments that the Examiner confirmed overcome all current rejections. In light of the agreement reached during the interview, Applicant hereby amends claims 1, 10, 15, 34, and 54 to further clarify the present invention's limitation. Applicant respectfully requests that the current rejections be withdrawn, and that all pending claims, claims 1, 3-5, 8-10, 12-16, 34, 36, 37, and 53-54, and 56-57 be allowed as currently amended. Support for the claim amendments may be found, for example, in paragraphs 46 and 54.

CONCLUSION

In view of the above arguments, Applicant believes that all pending claims are allowable and respectfully request that a Notice of Allowance be issued for this application in its current state. Applicant believes that more than a sufficient number of reasons have been stated to traverse all rejections. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the Examiner is invited to contact the undersigned at telephone number (650) 353-3786. If any fees are due in connection with the filing of this amendment, the Commissioner is authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2018-12-18

By: /Ali Uyanik/
Ali Uyanik
Reg. No. 67,080

Customer No.
146571
UNITED STATES PATENT & TRADEMARK OFFICE

Charter Communications, Inc.
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Page #682

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of the Claims:

1. (Currently amended) A method for improving performance of one or more communication units, the method comprising:

receiving, by a server, from a network monitoring device, in real-time, data associated with an operation of ~~one~~ two or more communication units located in different geographical areas, the data comprising a parameter;

processing, by the server, at least one of the data and historical data;

based on the processed data, determining a policy for at least one ~~each~~ of the ~~one~~ two or more communication units; and

communicating the policy, by the server, via a network, to at least one or more communication units that, in response to ~~implementing~~ receiving the policy implemented one or more algorithms based on at least a rule or a condition to improve a performance of the one or more communication units.

2. (Cancelled)

3. (Previously presented) The method of claim 1, wherein monitoring comprises determining a received signal strength indication.

4. (Previously presented) The method of claim 1, further comprising, based on a change in the operation, updating the policy.

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5. (Previously presented) The method of claim 1, wherein determining the policy comprises selecting the policy from a set of policies.

6-7. (Cancelled)

8. (Previously presented) The method of claim 1, wherein the one or more communication units comprise at least one of:

an access point (AP);

a base station;

a wireless LAN device;

a DSLAM;

a gateway;

a performance enhancement device;

a Digital Subscriber Line (DSL) Customer Premises Equipment (CPE) modem;

an in-home powerline device;

a Home Phoneline Network Alliance (HPNA) based device;

an in-home coax distribution device;

a G.hn (Global Home Networking Standard) compatible device;

an in-home metering communication device;

an in-home appliance communicatively interfaced with the LAN;

a wireless femtocell base station;

a wireless WiFi compatible base station;

a wireless mobile device repeater;

a wireless mobile device base station;

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Page #684

a set-top box (STB)/set-top unit (STU) customer electronics device;

an Internet Protocol (IP) enabled television;

an IP enabled media player;

an IP enabled gaming console;

an Ethernet gateway;

a computing device connected to the LAN;

an Ethernet connected computer peripheral device;

an Ethernet connected router;

an Ethernet connected wireless bridge;

an Ethernet connected network bridge; or

an Ethernet connected network switch.

9. (Cancelled)

10. (Currently amended) A non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor of a server to perform a method for improving performance of one or more communication units ~~by the server~~, the method comprising:

receiving from a network monitoring device, in real-time, data associated with an operation of ~~one~~ two or more communication units located in different geographical areas, the data comprising a parameter;

processing at least one of the data and historical data;

determining by the server, a policy for each of the one or more communication units, based on the processed data; and

communicating, via a network, the policy to ~~at least one~~ two or more communication units that, in response to ~~implementing~~ receiving the policy implemented one or more algorithms based on at least a rule or a condition to improve a performance of the one or more communication units.

11. (Cancelled)

12. (Previously presented) The non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory device.

13. (Previously presented) The non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises determining a condition for communicating the policy.

14. (Previously presented) The non-transitory machine-readable storage medium of claim 10, wherein monitoring comprises determining a received signal strength.

15. (Currently amended) The non-transitory machine-readable storage medium of claim 10, ~~wherein updating the policy comprises~~ further comprising updating the parameter based on a change in the operation to update the policy.

16. (Previously presented) The non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises selecting the policy from a set of policies.

17-33. (Cancelled)

34. (Currently amended) An apparatus comprising:

a memory; and

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a processor, coupled to the memory, and operable to:

receive, from a network monitoring device, in real-time, data associated with an operation of ~~one~~ two or more communication units located in different geographical areas, the data comprising a parameter;

analyze at least one of the data and historical data;

based on the analyzed data, determine a policy for at least one ~~each~~ of the ~~one~~ two or more communication units~~, based on the analyzed data~~; and

communicate the policy, via a network that is communicatively coupled to the processor, to at least one or more communication units that, in response to ~~implementing~~ receiving the policy implemented one or more algorithms based on at least a rule or a condition to improve a performance of the one or more communication units.

35. (Cancelled)

36. (Previously presented) The apparatus of claim 34, further comprising a monitoring device coupled to the processor, the monitoring device determines a received signal strength.

37. (Previously presented) The apparatus of claim 34, wherein determining the policy comprises selecting the policy from a set of policies and updating the parameter.

38-52. (Cancelled)

53. (Currently amended) The method of claim 1, wherein processing comprises storing at least one of the data and ~~the~~ historical data in ~~the~~ a memory.

54. (Previously presented) The method of claim 4, wherein updating the policy comprises updating the parameter.

Charter Communications, Inc.
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55. (Cancelled)

56. (Previously presented) The method of claim 34, wherein processing comprises storing at least one of the data and the historical data in the memory.

57. (Previously presented) The method of claim 34, wherein determining the policy comprises determining a condition for communicating the policy.

Charter Communications, Inc.
Exhibit 1006
Page #688

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
14/356,581	05/06/2014	

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 12/18/2018	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $100 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $460 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
NICOLE NICHOLSON

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/356,581	05/06/2014	Wonjong Rhee	20145-054US	4319

146571 7590 11/13/2018
North Weber & Baugh LLP - ASSIA
3260 Hillview Avenue, 1st Floor
Palo Alto, CA 94304

EXAMINER	
GRIJALVA LOBOS, BORIS D	

ART UNIT	PAPER NUMBER
2446	

NOTIFICATION DATE	DELIVERY MODE
11/13/2018	ELECTRONIC

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docket1@northweber.com

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Applicant-Initiated Interview Summary	**Application No.** 14/356,581	**Applicant(s)** Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	**Art Unit** 2446	**AIA Status** No

All participants (applicant, applicants representative, PTO personnel):

(1) BORIS D. GRIJALVA LOBOS. (3) _____.

(2) ALI UYANIK (67080). (4) _____.

Date of Interview: 06 November 2018.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☑101 ☐112 ☑102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1,10 and 34.

Identification of prior art discussed: Malik et al. (US 2009/0147697 A1).

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Applicant's representative explained the amendments set forth in the agenda and proposed including additional subject matter to capture the idea of processing data from a plurality of devices, and based on the collective processed data communicating a policy to one of the plurality of devices. The examiner agreed that the discussed amendments overcome the applied reference. However, further search and consideration would be necessary.

Claim rejections under 35 USC 101 were also discussed. The examiner proposed incorporating subject matter from paragraph [0046] of the specification as published which would add significantly more than an abstract idea.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☑ Attachment

/B.D.G/ Examiner, Art Unit 2446	/Tauqir Hussain/ Primary Examiner, Art Unit 2446

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Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

Grijalva Lobos, Boris

From: Ali Uyanik <auyanik@northweber.com>
Sent: Thursday, November 1, 2018 3:25 PM
To: Grijalva Lobos, Boris
Cc: Nita Miller; Michael North
Subject: RE: Application No.: 14/356,581
Attachments: 054US Agenda2.pdf

Please see attached

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **Wonjong Rhee**	Examiner: **Grijalva Lobos, Boris D.**
Application No.: 14/356,581	Art Group: 2446
Filed: 06 May 2014	Confirmation No.: 4319
For: METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	Docket No.: 20145-054US

AGENDA FOR PHONE INTERVIEW

Examiner Grijalva Lobos:

This paper is an outline for our phone interview on Tuesday November 6, 2018 at 1:00 PM (EST) to discuss the following claim amendments concerning the above-mentioned patent application.

Proposed Claim Amendments

1. (Currently amended) A method for improving performance of one or more communication units, the method comprising:

receiving, by a server, from a network monitoring device, in real-time, data associated with an operation of one or more communication units, the data comprising a parameter;

processing, by the server, at least one of the data and historical data;

based on the processed data, determining a policy for ~~each of the one~~ two or more communication units located in a different geographical area; and

communicating the policy, by the server, via a network, to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units.

2. (Cancelled)

3. (Currently amended) The method of claim 1, wherein monitoring comprises determining a received signal strength indication.

4. (Currently amended) The method of claim 1, further comprising, based on a change in the operation, updating the policy.

5. (Currently amended) The method of claim 1, wherein determining the policy comprises selecting the policy from a set of policies.

6. (Cancelled)

7. (Currently amended) The method of claim 1, wherein at least one of the one or more communication units are located in a different geographical area.

8. (Currently amended) The method of claim 1, wherein the one or more communication units comprise at least one of:

an access point (AP);

a base station;

a wireless LAN device;

a DSLAM;

a gateway;

a performance enhancement device;

a Digital Subscriber Line (DSL) Customer Premises Equipment (CPE) modem;

an in-home powerline device;

a Home Phoneline Network Alliance (HPNA) based device;

an in-home coax distribution device;

a G.hn (Global Home Networking Standard) compatible device;

an in-home metering communication device;

an in-home appliance communicatively interfaced with the LAN;

a wireless femtocell base station;

a wireless WiFi compatible base station;

a wireless mobile device repeater;

a wireless mobile device base station;

a set-top box (STB)/set-top unit (STU) customer electronics device;

an Internet Protocol (IP) enabled television;

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an IP enabled media player;

an IP enabled gaming console;

an Ethernet gateway;

a computing device connected to the LAN;

an Ethernet connected computer peripheral device;

an Ethernet connected router;

an Ethernet connected wireless bridge;

an Ethernet connected network bridge; or

an Ethernet connected network switch.

9. Canceled.

10. (Currently amended) A non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor ~~of a server~~ to perform a method for improving performance of one or more communication units ~~by the server~~, the method comprising:

receiving, by the server, from a network monitoring device, in real-time, data associated with an operation of one or more communication units, the data comprising a parameter;

processing at least one of the data and historical data;

determining by the server, a policy for each of the one or more communication units, based on the processed data; and

communicating, by the server, via a network, the policy to ~~at least one~~ two or more communication units located in a different geographical area that, in response to implementing the policy improve a performance of the one or more communication units.

11. (Cancelled)

12. (Currently amended) The non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory device.

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13. (Currently amended) The non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises determining a condition for communicating the policy.

14. (Currently amended) The non-transitory machine-readable storage medium of claim 10, wherein monitoring comprises determining a received signal strength.

15. (Currently amended) The non-transitory machine-readable storage medium of claim 10, ~~wherein updating the policy comprises~~ further comprising updating the parameter based on a change in the operation to update the policy.

16. (Currently amended) The non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises selecting the policy from a set of policies.

17. – 33. (Cancelled)

34. (Currently amended) An apparatus comprising:

a memory; and

a processor, coupled to the memory, and operable to:

receive, from a network monitoring device, in real-time, data associated with an operation of one or more communication units, the data comprising a parameter;

analyze at least one of the data and historical data;

based on the analyzed data, determine a policy for ~~each of the one~~ two or more communication units located in a different geographical area~~, based on the analyzed data~~; and

communicate the policy, via a network that is communicatively coupled to the processor, to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units.

35. (Cancelled)

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36. (Currently amended) The apparatus of claim 34, further comprising a monitoring device coupled to the processor, the monitoring device determines a received signal strength.

37. (Currently amended) The apparatus of claim 34, wherein determining the policy comprises selecting the policy from a set of policies and updating the parameter.

38. – 52. (Cancelled)

53. (Currently amended) The method of claim 1, wherein processing comprises storing at least one of the data and ~~the~~ historical data in ~~the~~ a memory.

54. (Previously presented) The method of claim 4, wherein updating the policy comprises updating the parameter.

55. (Previously presented) The method of claim 34, wherein at least one of the one or more communication units are located in a different geographical area.

56. (Previously presented) The method of claim 34, wherein processing comprises storing at least one of the data and the historical data in the memory.

57. (Previously presented) The method of claim 34, wherein determining the policy comprises determining a condition for communicating the policy.

Respectfully submitted,

Date: 1 November, 2018

By: / Ali Uyanik /
Ali Uyanik
Reg. No. 67,080

NORTH WEBER & BAUGH LLP
3260 Hillview Avenue
Palo Alto, CA 94304
Tel.: (650) 353-3786
Fax: (650) 856-0542
auyanik@northweber.com

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/356,581	05/06/2014	Wonjong Rhee	20145-054US	4319

146571 7590 10/26/2018
North Weber & Baugh LLP - ASSIA
3260 Hillview Avenue, 1st Floor
Palo Alto, CA 94304

EXAMINER	
GRIJALVA LOBOS, BORIS D	

ART UNIT	PAPER NUMBER
2446	

NOTIFICATION DATE	DELIVERY MODE
10/26/2018	ELECTRONIC

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Office Action Summary	**Application No.** 14/356,581	**Applicant(s)** Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	**Art Unit** 2446	**AIA Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 03/09/2018.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☑ This action is **FINAL.** 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1,3-5,7-10,12-16,34,36-37 and 53-57 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1,3-5,7-10,12-16,34,36-37 and 53-57 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date See Continuation Sheet.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

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Continuation of Attachment(s) 2) Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date: 7/23/2015, 2/20/2018, 3/9/2018, 6/18/2018, 8/9/2018, 10/5/2018

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 7/23/2015, 02/20/2018, 03/09/2018, 06/18/2018, 08/09/2018, and 10/5/2018 are being considered by the examiner.

Response to Amendment

This Office action is in response to amendments filed on 3/9/2018. The amendments have been fully considered.

Claims 1, 3-5, 7-10, 12-16, 34, and 36-37 have been amended.

Claims 2, 6, 11, 17-33, 35, and 38-52 have been cancelled.

Claims 53-57 have been added.

Claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 are pending.

Response to Arguments

Applicant's arguments with respect to claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Claim Objections

Claims 9 and 15 are objected to because of the following informalities:

Claim 9 recites the same subject matter recited in Claim 4.

Claim 15 recites the limitation "the non-transitory machine-readable storage medium of claim 10, wherein wherein updating the policy comprises [...]". It should be - - the non-transitory machine-readable storage medium of claim 10, wherein updating the policy comprises - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

> The following is a quotation of 35 U.S.C. 112(b):
> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.
>
> The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Regarding claim 1, it recites the limitations "a method for improving performance [...] comprising: [...] communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units" (underline for emphasis). It's unclear if the recitation "improve a performance" is merely an intended result (or intended use) caused by performing all of the steps recited before the term, or if it's an actual step to be performed by the method claim. In other words, it's unclear if prior art reciting all of the limitations in the claim up to before the term at issue infringes the limitations if an actual improvement to performance is not recited. If the recitation is an actual step required by the claim, then the claim amounts to "a method for improving performance" comprising a step of improving performance, which is indefinite because it would be unclear how to actually improve the performance.

Regarding claims 3-5, 7-9, and 53-54 the limitations invoke, by reference, all of the limitations of claim 1. Therefore, claims 3-5 and 7-9 are rejected for the same reasons set forth in claim 1, above.

Claim 3 further recites the limitation "wherein monitoring comprises determining a received signal strength indication". There is insufficient antecedent basis for the term "monitoring" in the claim.

The examiner notes a "network monitoring device" in claim 1, however, the claim does not recite a monitoring step associated with the network monitoring device or even that the monitoring is performed by the network monitoring device. For examination purposes, the examiner has interpreted the monitoring of claim 3 as a step performed by the network monitoring device of claim 1.

Regarding claim 10, it recites limitations similar in scope to those of claim 1. Therefore, claim 10 is rejected for the same reasons set forth in claim 1, above.

Regarding claims 12-16, the limitations invoke, by reference, all of the limitations of claim 10. Therefore, claims 12-16 are rejected for the same reasons set forth in claim 10, above.

Regarding claims 34, it recites limitations similar in scope to those of claim 1. Therefore, claim 10 is rejected for the same reasons set forth in claim 1, above.

Regarding claims 36-37 and 56-57, the limitations invoke, by reference, all of the limitations of claim 34. Therefore, claims 36-37 and 56-57 are rejected for the same reasons set forth in claim 1, above.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 are rejected under 35 U.S.C. 101 because the claimed invention is directed to a judicial exception (i.e., a law of nature, a natural phenomenon, or an abstract idea) without significantly more.

The following is the Principles of Law:

A patent may be obtained for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof'.

The Supreme Court has "long held that this provision contains an important implicit exception [:] Laws of nature, natural phenomena, and abstract ideas are not patentable".

Under the now familiar two-part test described by the Supreme Court in Alice, "[W]e must first determine whether the claims at issue are directed to a patent-ineligible concept", such as an abstract idea. Alice Corp. Pty. Ltd. v. CLS Bank Int'l, 134 S. Ct. 2347, 2355 (2014). If so, we must then "consider the elements of each claim both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application. Id. (quoting Mayo, 132 S. Ct. at 1298, 1297). For the reasons set forth below, we find that the claims are directed to the abstract idea of classifying and storing digital images in an organized manner and fail to add an inventive concept sufficient to confer patent eligibility.

The examiner is bound by and applies the framework as set forth by the Court in Mayo and reaffirmed by the Court in Alice for determining whether the claims are directed to patent-eligible subject matter.

Step one: Are the claims at issue directed to a process, machine, manufacture, or composition of matter?

The examiner concludes that claims 1, 3-5, 7-9, and 53-54, are directed to a process. Claims 10, 12-16, 34, 36-37, and 53-57 are directed to a machine.

Step two: Are the claims directed to a law of nature, a natural phenomenon, or an abstract idea?

The examiner concludes that claims 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 are directed to an abstract idea.

Regarding claim 1, the claimed invention is directed to non-statutory subject matter because the claim(s) as a whole, considering all claim elements both individually and in combination, do not amount to significantly more than an abstract idea.

The claim(s) is/are directed to the abstract idea of "An Idea 'Of Itself'".

Regarding claim 1, the limitations recite:

A method for improving performance of one or more communication units, the method comprising:

receiving from a network monitoring device, in real-time, data associated with an operation of one or more communication units, the data comprising a parameter;

processing at least one of the data and historical data;

based on the processed data, determining a policy for each of the one or more communication units communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units.

The idea clearly boils down to receiving data and based on the data determining actions to be performed. Concepts relating to data comparisons that can be performed mentally or are analogous to human mental work have been deemed by the courts as being directed to ineligible subject matter (see, for example, Smartgene - Comparing new and stored information and using rules to identify options).

Furthermore, the idea of collecting data so as to identify options is a well-established and known practice derived from human nature (see, for example, Dietrich - Decision Making - Inquiries Journal - 2010).

Claim 1 contains additional subject matter to perform the abstract idea, namely implementing the idea by computer devices communicating over a computer network, however, simply performing abstract ideas on computer devices and using networks to communicate information does not amount to significantly more than the abstract idea on itself.

Therefore, claim 1 is directed to an abstract idea.

Regarding claim 3, it simple sets forth what is being monitored in the abstract idea but the nature of the abstract idea does not change by defining what is being monitored, as observations could include anything. Therefore, claim 3 does not amount to more than the abstract idea.

Regarding claim 4, it recites the limitation *the method of claim 1, further comprising, based on a change in the operation, updating the policy*. The limitations are similar to the idea of claim 1 in which a policy is selected based on observation, with the difference that the policy is an updated policy. In other words, it amounts to no more than performing the abstract idea over and over again.

Regarding claim 5, it recites the limitation *the method of claim 1, wherein determining the policy comprises selecting the policy from a set of policies*. The limitations are similar to the idea of claim 1 in which a policy is selected based on observation, with the difference that there is a limited amount of options. Having a set of options does not amount to more than the abstract idea.

Regarding claim 7, it recites *the method of claim 1, wherein at least one of the one or more communication units are located in a different geographical area*. In other words, it sets forth that the computer devices may not be located at the same location. Nevertheless, placing computer devices at different locations does not amount to significantly more than the abstract idea.

Regarding claim 8, it recites the limitation *the method of claim 1, wherein the one or more communication units comprise at least one of: an access point (AP); a base station; a wireless LAN device; a DSLAM; a gateway; a performance enhancement device; a Digital Subscriber Line (DSL) Customer Premises Equipment (CPE) modem; an in-home powerline device; a Home Phoneline Network Alliance (HPNA) based device; an in-home coax distribution device; a G.hn (Global Home Networking Standard) compatible device; an in-home metering communication device; an in-home appliance communicatively interfaced with the LAN; a wireless femtocell base station; a wireless WiFi compatible base station; a wireless mobile device repeater; a wireless mobile device base station; a set-top box (STB)/set-top unit (STU) customer electronics device; an Internet Protocol (IP) enabled television; an IP*

enabled media player; an IP enabled gaming console; an Ethernet gateway; a computing device connected to the LAN; an Ethernet connected computer peripheral device; an Ethernet connected router; an Ethernet connected wireless bridge; an Ethernet connected network bridge; or an Ethernet connected network switch. In other words, the claims defines what the computer devices are, but defining what computer devices are does not change the nature of the computer devices which do not amount to significantly more than the abstract idea.

Regarding claim 9, it recites the same limitations as claim 4. Therefore, claim 9 is rejected for the same reasons set forth in claim 4, above.

Regarding claim 10, it recites limitations similar in scope to those of claim 1. Therefore, claim 10 is rejected for the same reasons as set forth in claim 1, above.

Regarding claim 12, it recites the limitation *the non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory of the device*. The use of memories to store data to be processed is inherent of computer devices. Therefore, if a computer device does not amount to significantly more than the abstract idea it performs, a memory of the computer storing data also does not amount to significantly more than the abstract idea.

Regarding claim 13, it recites the limitation *the non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises determining a condition for communicating the policy*. The idea is analogous to that of claim 10, in which it boils down to receiving data and based on the data determining actions to be performed. Therefore, claim 13 is rejected for the same reasons as set forth in claim 10.

Regarding claim 14, it recites limitations similar in scope to those of claim 3. Therefore, claim 14 is rejected for the same reasons as set forth in claim 3.

Regarding claim 15, it recites limitations similar in scope to those of claim 4. Therefore, claim 14 is rejected for the same reasons as set forth in claim 4.

Regarding claim 16, it recites limitations similar in scope to those of claim 5. Therefore, claim 14 is rejected for the same reasons as set forth in claim 5.

Regarding claim 34, it recites limitations similar in scope to those of claim 1, with additional elements such as memories and processors. Memory devices and processors are inherent parts of computer devices. Computer devices do not amount to significantly more than abstract ideas. Therefore, claim 34 is rejected for the same reasons as set forth in claim 1, above.

Regarding claim 36, it recites limitations similar in scope to those of claim 3. Therefore, claim 36 is rejected for the same reasons as set forth in claim 3.

Regarding claim 37, it recites limitations similar in scope to those of claim 5. Therefore, claim 37 is rejected for the same reasons as set forth in claim 5.

Regarding claim 53, it recites limitations similar in scope to those of claim 12. Therefore, claim 53 is rejected for the same reasons as set forth in claim 12.

Regarding claim 54, it recites limitations similar in scope to those of claim 4. Therefore, claim 54 is rejected for the same reasons as set forth in claim 4.

Regarding claim 55, it recites limitations similar in scope to those of claim 7. Therefore, claim 55 is rejected for the same reasons as set forth in claim 7.

Regarding claim 56, it recites limitations similar in scope to those of claim 53. Therefore, claim 56 is rejected for the same reasons as set forth in claim 53.

Regarding claim 57, it recites limitations similar in scope to those of claim 13. Therefore, claim 57 is rejected for the same reasons as set forth in claim 13.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim(s) 1, 3-5, 7-10, 12-16, 34, 36-37, and 53-57 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Malik et al. (US 2009/0147697 A1, hereinafter Malik).

Regarding claim 1, Malik discloses a method for improving performance of one or more communication units **(Fig. 3 discloses a method for improving performance of communication units (see ¶[0047]))**, the method comprising:

receiving from a network monitoring device, in real-time, data associated with an operation of one or more communication units **(paragraph [0025] discloses a first network element receiving from a second network element performance data related to communications between the second network element and a third network element of a plurality of elements (see paragraph [0018]); paragraph [0028] discloses that the received performance data of the third element is current performance data of the third network element)**,

the data comprising a parameter **(paragraphs [0029]-[0030] discloses that the performance metrics may include measured values)**;

processing at least one of the data and historical data **(paragraphs [0029]-[0030] discloses that the first network element processes the received data)**;

based on the processed data, determining a policy for each of the one or more communication units **(paragraph [0046] discloses determining an action to be performed by the third network element)**

communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units **(paragraph [0047] discloses transmitting from the first network element to the third network element the determined action and suggests that by implementing the method performance is improved)**.

Regarding claim 3, Malik discloses the method of claim 1, wherein monitoring comprises determining a received signal strength indication **(paragraph [0030] discloses that monitored parameters include received signal strength indicators)**.

Regarding claim 4, Malik discloses the method of claim 1, further comprising, based on a change in the operation, updating the policy **(Fig. 3 discloses that the method is performed on a continuous basis)**.

Regarding claim 5, Malik discloses the method of claim 1, wherein determining the policy comprises selecting the policy from a set of policies **(paragraphs [0045]-[0046] discloses that there may be a plurality of actions that the first network element may select)**.

Regarding claim 7, Malik discloses the method of claim 1, wherein at least one of the one or more communication units are located in a different geographical area **(paragraph [0018] discloses that some of the plurality of elements may be mobile; paragraph [0019] discloses that at least some of the users may be on one area served by an access point, and that there may be multiple access points)**.

Regarding claim 8, Malik discloses the method of claim 1, wherein the one or more communication units comprise at least one of: an access point (AP); a base station; a wireless LAN device; a DSLAM; a gateway; a performance enhancement device; a Digital Subscriber Line (DSL) Customer Premises Equipment (CPE) modem; an in-home powerline device; a Home Phoneline Network Alliance (HPNA) based device; an in-home coax distribution device; a G.hn (Global Home Networking Standard) compatible device; an in-home metering communication device; an in-home appliance communicatively interfaced with the LAN; a wireless femtocell base station; a wireless WiFi compatible

base station; a wireless mobile device repeater; a wireless mobile device base station; a set-top box (STB)/set-top unit (STU) customer electronics device; an Internet Protocol (IP) enabled television; an IP enabled media player; an IP enabled gaming console; an Ethernet gateway; a computing device connected to the LAN; an Ethernet connected computer peripheral device; an Ethernet connected router; an Ethernet connected wireless bridge; an Ethernet connected network bridge; or an Ethernet connected network switch **(paragraph [0018] discloses that the plurality of devices may be any one of a plurality of wireless devices)**.

Regarding claim 9, Malik discloses the method of claim 1, further comprising, based on a change in the operation, updating the policy **(Fig. 3 discloses that the method is performed on a continuous basis)**.

Regarding claim 10, Malik discloses a non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor to perform a method for improving performance of one or more communication units **(paragraph [0025] discloses a first network element which may be a computing device - computing devices adapted to perform functions inherently comprise processing devices and instructions stored to be performed by the processing devices; Fig. 3 discloses a method performed by the first network element for improving performance of communication units (see ¶[0047]))**, the method comprising:

receiving, from a network monitoring device, in real time, data associated with an operation of one or more communication units **(paragraph [0025] discloses the first network element receiving from a second network element performance data related to communications between the second network element and a third network element of a plurality of elements (see paragraph [0018]); paragraph [0028] discloses that the received performance data of the third element is current performance data of the third element)**,

the data comprising a parameter **(paragraphs [0029]-[0030] discloses that the performance metrics may include measured values)**;

processing at least one of the data and historical data **(paragraphs [0029]-[0030] discloses that the first network element processes the received data)**;

determining a policy for each of the one or more communication units **(paragraph [0046] discloses determining an action to be performed by the third network element)**,

based on the processed data, communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units **(paragraph [0047] discloses transmitting from the first network element to the third network element the determined action and suggests that by implementing the method performance is improved)**.

Regarding claim 12, Malik discloses the non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory of the device **(storing data to be processed is inherent for computer devices)**.

Regarding claim 13, Malik discloses the non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises determining a condition for communicating the policy **(paragraphs [0044]-[0046], to determine so as to later transmit the policy comprises determining a condition)**.

Regarding claim 14, Malik discloses the non-transitory machine-readable storage medium of claim 10, wherein monitoring comprises determining a received signal strength **(paragraph [0030] discloses that monitored parameters include received signal strength indicators)**.

Regarding claim 15, Malik discloses the non-transitory machine-readable storage medium of claim 10, wherein wherein updating the policy comprises the parameter based on a change in the

operation **(Fig. 3 discloses that the parameters are updated continuously and may change due to a change in the operation (e.g. element 320))**.

Regarding claim 16, Malik discloses the non-transitory machine-readable storage medium of claim 10, wherein determining the policy comprises selecting the policy from a set of policies **(paragraphs [0045]-[0046] discloses that there may be a plurality of actions that the first network element may select)**.

Regarding claim 34, Malik discloses an apparatus comprising:

a memory; and a processor, coupled to the memory **(paragraph [0025] discloses a first network element which may be a computing device - computing devices adapted to perform functions inherently comprise processing devices and instructions stored to be performed by the processing devices; Fig. 3 discloses a method performed by the first network element for improving performance of communication units (see ¶[0047]))**, and operable to:

receive, from a network monitoring device, in real-time, data associated with an operation of one or more communication units **(paragraph [0025] discloses the first network element receiving from a second network element performance data related to communications between the second network element and a third network element of a plurality of elements (see paragraph [0018]); paragraph [0028] discloses that the received performance data of the third element is current performance data of the third element)**,

the data comprising a parameter **(paragraphs [0029]-[0030] discloses that the performance metrics may include measured values)**;

analyze at least one of the data and historical data **(paragraphs [0029]-[0030] discloses that the first network element processes the received data)**;

determine a policy for each of the one or more communication units, based on the analyzed data **(paragraph [0046] discloses determining an action to be performed by the third network element)**; and

communicate the policy, via a network that is communicatively coupled to the processor, to at least one or more communication units that in response to implementing the policy improve a performance of the one or more communication units **(paragraph [0047] discloses transmitting from the first network element to the third network element the determined action and suggests that by implementing the method performance is improved)**.

Regarding claim 36, Malik discloses the apparatus of claim 34, further comprising a monitoring device coupled to the processor, the monitoring device determines a received signal strength **(paragraph [0030] discloses that monitored parameters include received signal strength indicators)**.

Regarding claim 37, Malik discloses the apparatus of claim 34, wherein determining the policy comprises selecting the policy from a set of policies and updating the parameter **(paragraphs [0045]-[0046] discloses that there may be a plurality of actions that the first network element may select)**.

Regarding claim 53, Malik discloses the method of claim 1, wherein processing comprises storing at least one of the data and the historical data in the memory **(storing data to be processed is inherent for computer devices)**.

Regarding claim 54, Malik discloses the method of claim 4, wherein updating the policy comprises updating the parameter **(Fig. 3 discloses that the parameters are updated continuously and may change due to a change in the operation (e.g. element 320))**.

Regarding claim 55, Malik discloses the method of claim 34, wherein at least one of the one or more communication units are located in a different geographical area **(paragraph [0018] discloses that some of the plurality of elements may be mobile; paragraph [0019] discloses that at least some of the users may be on one area served by an access point, and that there may be multiple access points)**.

Regarding claim 56, Malik discloses the method of claim 34, wherein processing comprises storing at least one of the data and the historical data in the memory **(storing data to be processed is inherent for computer devices)**.

Regarding claim 57, Malik discloses the method of claim 34, wherein determining the policy comprises determining a condition for communicating the policy **(paragraphs [0044]-[0046], to determine so as to later transmit the policy comprises determining a condition)**.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for

applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1, 10, 12, 34, 53, and 56 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of copending Application No. 13995901 (reference application). Although the claims at issue are not identical, they are not patentably distinct from each other because:

Regarding claim 1, Patent Application No. 13995901 discloses the limitations as follows:

14356581		13995901	
Claims	Description	Claims	Description
1	A method for improving performance of one or more communication units, the method comprising:		A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
	receiving from a network monitoring device, in real-time, data associated with an operation of one or more communication units,		a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
	the data comprising a parameter; processing at least one of the data and historical data; based on the processed data, determining a policy for each of the one or more communication units		an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
	communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units.		a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.

Regarding claim 10, Patent Application No. 13995901 discloses the limitations as follows:

A non-transitory machine-readable storage medium having computer executable instructions stored thereon that when executed cause a processor to perform a method for improving performance of one or more communication units, the method comprising:			A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
receiving, from a network monitoring device, in real time, data associated with an operation of one or more communication units,			a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
the data comprising a parameter; processing at least one of the data and historical data; determining a policy for each of the one or more communication units,			an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
based on the processed data, communicating the policy to at least one or more communication units that, in response to implementing the policy improve a performance of the one or more communication units.			a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.

Regarding claim 12, Patent Application No. 13995901 discloses the non-transitory machine-readable storage medium of claim 10, wherein processing comprises storing at least one of the data and the historical data in a memory of the device **(claim 1, storing data to be processed is inherent for computer devices)**.

Regarding claim 34, Patent Application No. 13995901 discloses the limitations as follows:

An apparatus comprising: a memory; and a processor, coupled to the memory, and operable to:			A Digital Subscriber Line (DSL) customer premises equipment (CPE) Management Center (CMC) coupled to a Broadband network, the CMC comprising:
receive, from a network monitoring device, in real-time, data associated with an operation of one or more communication units, the data comprising a parameter;			a data collection module, communicatively coupled to at least one DSL CPE device, to receive information from the CPE device regarding operation of the at least one DSL CPE device, wherein the information is to be received on a: periodic basis, on-demand basis, or in real-time basis;
analyze at least one of the data and historical data; determine a policy for each of the one or more communication units, based on the analyzed data; and			an analysis module coupled to the data collection module to analyze the received information, wherein the CMC is to determine one or more line parameter values associated with a central office imposed (CO-imposed) line constraint, and wherein the analysis module is to determine to what extent range of the one or more parameter values can be changed within the CO-imposed line constraints; and
communicate the policy, via a network that is communicatively coupled to the processor, to at least one or more communication units that in response to implementing the policy improve a performance of the one or more communication units.			a command signal generation module coupled to the analysis module to receive analysis results and to generate a corresponding command signal for transmission to the at least one DSL CPE device to modify the at least one DSL CPE device operation within the CO-imposed line constraints based on the analysis, wherein the CMC is able to modify an operation of the at least one DSL CPE device independent of management on a CO side of the Broadband network, and wherein the CMC is capable to be afforded for collecting operational data without control over operation of a digital subscriber line access multiplexer (DSLAM) coupled to the at least one DSL CPE device.

Regarding claim 53, Patent Application No. 13995901 discloses the method of claim 1, wherein processing comprises storing at least one of the data and the historical data in the memory **(claim 1, storing data to be processed is inherent for computer devices)**.

Regarding claim 56, Patent Application No. 13995901 discloses the method of claim 34, wherein processing comprises storing at least one of the data and the historical data in the memory **(claim 1, storing data to be processed is inherent for computer devices)**.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Method and apparatus for monitoring a network and locating a node using signal strength calculations; US 5198805 A; Whiteside et al.

Monitoring quality of service in packet-based communications; US 7796524 B1; O'Connell et al.

Adaptive rate control based on battery life; US 8503297 B1; Vargantwar.

See PTO-892 for complete list.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BORIS D GRIJALVA LOBOS whose telephone number is (571)272-0767. The examiner can normally be reached on M-F 10:30AM to 6:30PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Gillis can be reached on 571-272-7952. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B.D.G/
Examiner, Art Unit 2446

/Tauqir Hussain/
Primary Examiner, Art Unit 2446

Notice of References Cited	Application/Control No. 14/356,581	Applicant(s)/Patent Under Reexamination Rhee, Wonjong	
	Examiner BORIS D GRIJALVA LOBOS	Art Unit 2446	Page 1 of 1

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*	A	US-5970064-A	10-1999	Clark; Timothy Ian James	H04L41/0813	370/242
*	B	US-8880666-B2	11-2014	Aaron; Jeffrey A.	H04L67/1008	709/219
*	C	US-20050055579-A1	03-2005	Kanda, Mitsuru	H04L63/20	726/4
*	D	US-5974106-A	10-1999	Dupont; Pierre B.	H04L1/0002	375/377
*	E	US-20060187885-A1	08-2006	Roy; Vincent	H04L1/0015	370/332
*	F	US-8520586-B1	08-2013	Husted; Paul J.	H04W74/08	370/318
*	G	US-20120151540-A1	06-2012	Stanwood; Kenneth	H04L65/00	725/109
*	H	US-20130122910-A1	05-2013	Singh; Bik	H04W36/18	455/437
	I					
	J					
	K					
	L					
	M					

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Dietrich (Decision Making - Inquiries Journal - 2010)
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Charter Communications, Inc.
Exhibit 1006
Page #723

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/21/2015	11/16/2016	12/20/2017	10/21/2018					
	1	✓	✓	✓	✓					
	2	✓	-	-	-					
	3	✓	✓	✓	✓					
	4	✓	✓	✓	✓					
	5	✓	✓	✓	✓					
	6	✓	-	-	-					
	7	✓	✓	✓	✓					
	8	✓	✓	✓	✓					
	9	✓	✓	✓	✓					
	10	✓	✓	✓	✓					
	11	✓	-	-	-					
	12	✓	✓	✓	✓					
	13	✓	✓	✓	✓					
	14	✓	✓	✓	✓					
	15	✓	✓	✓	✓					
	16	✓	✓	✓	✓					
	17	-	-	-	-					
	18	-	-	-	-					
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

CLAIM		DATE								
Final	Original	12/21/2015	11/16/2016	12/20/2017	10/21/2018					
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	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

CPC - Searched*		
Symbol	Date	Examiner
H04L7/00,0004	12/21/2015	BGL
H04L12/00,14,16,24,2414,2415,2417-2419,2424-2426,2428-2433,2439,244-2442,2447,2464,2465,2468-247,2472,2473,2476,2478,26,2602,2618,2634-2642,2668-2678,2692	12/21/2015	BGL
H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038	12/21/2015	BGL
H04L43/00,04,08-0817,0876-10,16	12/21/2015	BGL
H04L47/00,10,11,12,28,29,32	12/21/2015	BGL
H04L7/00,0004 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32	10/21/2018	BGL

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/356,581	Rhee, Wonjong
	Examiner	Art Unit
	BORIS D GRIJALVA LOBOS	2446

Search Notes		
Search Notes	**Date**	**Examiner**
EAST Inventor Name Search Performed	12/21/2015	BGL
EAST Text Limited Classification Search Performed (see attached search notes)	12/21/2015	BGL
EAST Text Search Performed (see attached search notes)	12/21/2015	BGL
EAST Inventor Name Search Performed	11/16/2016	BGL
EAST Text Search Performed	11/16/2016	BGL
Updated EAST Text Search (see attached search notes)	12/20/2017	BGL
Updated EAST Inventor Name Search (see attached search notes)	12/20/2017	BGL
Updated EAST Inventor Name Search (see attached search notes)	10/21/2018	BGL
Updated EAST Text Limited Classification Search (see attached search notes)	10/21/2018	BGL
Updated EAST Text Search (see attached search notes)	10/21/2018	BGL
GOOGLE Search Performed	10/21/2018	BGL

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

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	2	Bagnulo, Marcelo, "MPTCP threats," MPTCP WG - IETF79, URL: https://www.ietf.org/proceedings/79/slides/mptcp-7/mptcp-7.htm (3pgs).	
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EXAMINER SIGNATURE

Examiner Signature	/BORIS D GRIJALVA LOBOS/	Date Considered	10/20/2018

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

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See attached certification statement.

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☒ A certification statement is not submitted herewith.

SIGNATURE

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Signature	/Michael North/	Date (YYYY-MM-DD)	2018-10-05
Name/Print	Michael North	Registration Number	46963

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Substitute for form 1449A/PTO	Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	**Application Number**	14/356,581
	Filing Date	November 10, 2011
	First Named Inventor	Wonjong Rhee
	Group Art Unit	~~2446~~ 2447
	Examiner Name	~~Hwang, Joon H.~~ Grijalva Lobos, Boris
Sheet 1 of 1	Attorney Docket No: 8241P054	

US PATENT DOCUMENTS					
Examiner Initial *	Cite No [1]	USP Document Number	Publication or Issue Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-2005-0055466[1]	03/10/2005	MATSUNO et al.	

[1]English language equivalent of JP-2005-86628

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Examiner Initials*	Cite No [1]	Foreign Patent Document Country Code/Number/Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[2]
		JP-2001-168913*	06/22/2001	HITACHI LTD.		
		JP-2002-111729*	04/12/2002	KDDI CORP.		
		JP-2002-64561*	02/28/2002	HITACHI LTD.		
		JP-2003-110605*	04/11/2003	MITSUBISHI ELECTRIC CORP.		
		JP-2004-236030*	08/19/2004	FUJITSU LTD.		
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		JP-2005-86628*	03/31/2005	NEC CORP.		
		WO-2008/072606*	06/19/2008	NEC CORP.		

*English abstract provided.

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
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		Non-Final Office Action for Japanese Patent Application No. 2014-541020 (Attorney Docket No. 8241P054JP), mailed 4/22/2015.	☒
		Notice of Allowance for European Patent Application No. 11787994.0 (Attorney Docket No. 8241P054EP), mailed 4/24/2015.	☐

EXAMINER /BORIS D GRIJALVA LOBOS/ **DATE CONSIDERED** 10/21/2018

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
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Application Number	14/356,581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Boris D. Grualvalobos
Attorney Docket Number	20145-054US

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	1	Examination Report dated 2018-04-06, in Australian Patent Application No. 2017202588 (5pgs).	

Examiner Signature	/BORIS D GRIJALVA LOBOS/	Date Considered	10/20/2018

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First Named Inventor	Wonjong Rhee
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Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

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	Application Number	14356581
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	First Named Inventor	Wonjong Rhee
	Art Unit	2446
	Examiner Name	Grijalva Lobos, Boris
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Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2018-10-05
Name/Print	Michael North	Registration Number	46963

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

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	1	6469982	B1	2002-10-22	Michel Andre Robert Henrion et al.	
	2	6618356	B1	2003-09-09	Olivier Bonaventure	
	3	6678247	B1	2004-01-13	Olivier Bonaventure	
	4	6680907	B1	2004-01-20	Olivier Bonaventure	
	5	7864669	B2	2011-01-04	Cisco Technology, Inc.	

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	1	20160315976	A1	2016-10-27	Gregory Detal et al.	

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	2	20180248984	A1	2018-08-30	Olivier Bonaventure et al.	

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	1	2013023989	WO	A1	2013-02-21	Gregory Detal et al.		
	2	3151504	EP	A1	2017-04-05	Olivier Bonaventure et al.		
	3	3255845	EP	A1	2017-12-13	Olivier Bonaventure et al.		

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	1	Handley, M. et al., "Outgoing Packet Routing with MP-TCP, draft-handley-mptcp-routing-00.txt," 2009-10-19 (14pgs).	
	2	Sarolahti, P., "Multi-address Interface in the Socket API, draft-sarolahti-mptcp-af-multipath-01.txt," 2010-03-04 (13pgs).	
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	4	Singh, A. et al., "PayLoad Multi-connection Transport using Multiple Addresses, draft-singh-mptcp-plml-00.txt," 2010-08-06 (33pgs).	
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	7	Bagnulo, M., "Threat Analysis for TCP Extensions for Multipath Operation with Multiple Addresses," 2011-03, RFC: 6181, ISSN: 2070-1721, MPTCP Threat Analysis (17pgs).	
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	19	de Foy, X. et al., "Considerations for MPTCP operation in 5G, draft-defoy-mptcp-considerations-for-5g-01," 2018-06-22, Internet-Draft (14pgs).	
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	26	Purkayastha, D. et al., "Considerations for MPTCP operation in 5G, draft-purkayastha-mptcp-considerations-for-nextgen-00," 2017-10-29 (4pgs).	
	27	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols," draft-ietf-mptcp-congestion-02, 2011-03-14 (13pgs).	
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	30	M. Scharf et al., "MPTCP Application Interface Considerations, draft-ietf-mptcp-api-03," 2011-11-30 (28pgs).	
	31	A. Ford et al., "TCP Extensions for Multipath Operation with Multiple Addresses," ISSN: 2070-1721 (65pgs).	
	32	A. Ford et al., "TCP Extensions for Multipath Operation with Multiple Addresses, draft-ietf-mptcp-multiaddressed-12," 2013-04-25 (64pgs).	
	33	MPTCP Recent articles and software, "Experimenting with MPTCP using raw sockets (2018/04/18/mobil_tracebox.html)," 2018-04-18 (19pgs).	
	34	A. Ford et al., "Architectural Guidelines for Multipath TCP Development, draft-ietf-mptcp-architecture-00," 2010-02-28 (26pgs).	
	35	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols," ISSN: 2070-1721, 2011-10 (12pgs).	
	36	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols," ISSN: 2070-1721, 2011-10 (13pgs).	

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	37	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols, draft-ietf-mptcp-congestion-07," 2011-07-29 (14pgs).	
	38	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols, draft-ietf-mptcp-congestion-06," 2011-07-25 (13pgs).	
	39	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols, draft-ietf-mptcp-congestion-05," 2011-06-16 (13pgs).	
	40	C. Raiciu et al., "Coupled Congestion Control for Multipath Transport Protocols, draft-ietf-mptcp-congestion-04," 2011-06-15 (13pgs).	
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	42	A. Ford et al., "Architectural Guidelines for Multipath TCP Development, draft-ietf-mptcp-architecture-01," 2010-06-22 (28pgs).	
	43	Bagnulo, M., "Threat Analysis for TCP Extensions for Multi-path Operation with Multiple Addresses, draft-ieft-mptcp-threat-08," 2011-01-26, URL: https://tools.ietf.org/html/draft-ietf-mptcp-threat-08 (17pgs).	
	44	Bagnulo, M., "Threat Analysis for TCP Extensions for Multi-path Operation with Multiple Addresses draft-ietf-mptcp-threat-07," 2011-01-11, URL: https://tools.ietf.org/html/draft-ietf-mptcp-threat-07 (17pgs).	
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Name/Print	Michael North	Registration Number	46963

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Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

	1	Deng, L. et al., "MPTCP Proxy for Mobile Networks, draft-deng-mptcp-mobile-network-proxy-00," 2014-02-14, URL: https://tools.ietf.org/html/draft-deng-mptcp-mobile-network-proxy-00 (8pgs)	
	2	Bagnulo, M., "Secure MPTCP, draft-bagnulo-mptcp-secure-00," 2014-02-12, URL: https://tools.ietf.org/html/draft-bagnulo-mptcp-secure-00 (8pgs).	
	3	Paasch, C. et al., "A generic control stream for Multipath TCP, draft-paasch-mptcp-control-stream-00," 2014-02-11, URL: https://tools.ietf.org/html/draft-paasch-mptcp-control-stream-00 (11pgs).	
	4	Deng, Zhenjie, "Non-Renegable Selective Acknowledgements (NR-SACKs) for MPTCP, draft-deng-mptcp-nrsack-00.txt," 2013-12-02, URL: https://tools.ietf.org/html/draft-deng-mptcp-nrsack-00 (10pgs).	
	5	Wing, D. et al., "Multipath TCP (MPTCP) Path Selection using PCP, draft-wing-mptcp-pcp-00," 2013-10-07, URL: https://tools.ietf.org/html/draft-wing-mptcp-pcp-00 (10pgs).	
	6	Bagnulo, M. et al., "Analysis of MPTCP residual threats and possible fixes, draft-bagnulo-mptcp-attacks-01," 2013-10-01, URL: https://tools.ietf.org/html/draft-bagnulo-mptcp-attacks-01 (25pgs).	
	7	Coene, Y. et al., " Conformance tests for Multipath TCP, draft-coene-mptcp-conformance-00," 2013-07-15, URL: https://tools.ietf.org/html/draft-coene-mptcp-conformance-00 (10pgs).	
	8	Eardley, P., "Survey of MPTCP Implementations, draft-eardley-mptcp-implementations-survey-02," 2013-07-12, URL: https://tools.ietf.org/html/draft-eardley-mptcp-implementations-survey-02 (38pgs).	
	9	Xue, K. et al., "TMPP for Both Two MPTCP-unaware Hosts, draft-xue-mptcp-tmpp-unware-hosts-02,"2013-06-20, URL: https://tools.ietf.org/html/draft-xue-mptcp-tmpp-unware-hosts-02 (15pgs).	
	10	Scharf, M. et al., "MPTCP Application Interface Considerations, draft-ietf-mptcp-api-07," 2013-01-19, URL: https://tools.ietf.org/html/draft-ietf-mptcp-api-07 (34pgs).	
	11	Ford, A. et al., "TCP Extensions for Multipath Operation with Multiple Addresses, draft-ietf-mptcp-multiaddressed-12," 2012-10-22, URL: https://tools.ietf.org/html/draft-ietf-mptcp-multiaddressed-12 (63pgs).	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.D.G/

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	12	Paasch, C., Ed. et al., "Securing the MultiPath TCP handshake with external keys, draft-paasch-mptcp-ssl-00," 2012-10-15, URL: https://tools.ietf.org/html/draft-paasch-mptcp-ssl-00 (8pgs).	
	13	Paasch, C., Ed. et al., "MultiPath TCP Low Overhead, draft-paasch-mptcp-lowoverhead-00," 2012-10-15, URL: https://tools.ietf.org/html/draft-paasch-mptcp-lowoverhead-00 (9pgs).	
	14	Hampel, G. et al., "MPTCP Proxies and Anchors, draft-hampel-mptcp-proxies-anchors-00," 2012-02-08, URL: https://tools.ietf.org/html/draft-hampel-mptcp-proxies-anchors-00 (30pgs).	
	15	Raiciu, C. et al., "Coupled Congestion Control for Multipath Transport Protocols, draft-ietf-mptcp-congestion-07," 2011-07-29, URL: https://tools.ietf.org/html/draft-ietf-mptcp-congestion-07 (13pgs).	
	16	Hampel, G. et al., "Enhancements to Improve the Applicability of Multipath TCP to Wireless Access Networks, draft-hampel-mptcp-applicability-wireless-networks-00," 2011-06-15, URL: https://tools.ietf.org/html/draft-hampel-mptcp-applicability-wireless-networks-00 (25pgs).	
	17	Barre, S. et al., "MultiPath TCP - Guidelines for implementers, draft-barre-mptcp-impl-00," 2011-03-07, URL: https://tools.ietf.org/html/draft-barre-mptcp-impl-00 (41pgs).	
	18	Bagnulo, M., "Threat Analysis for TCP Extensions for Multi-path Operation with Multiple Addresses, draft-ietf-mptcp-threat-08," 2011-01-26, URL: https://tools.ietf.org/html/draft-ietf-mptcp-threat-08 (17pgs).	
	19	Ford, A. et al., "Architectural Guidelines for Multipath TCP Development, draft-ietf-mptcp-architecture-05," 2011-01-21, URL: https://tools.ietf.org/html/draft-ietf-mptcp-architecture-05 (29pgs).	
	20	Scharf, M. et al., "MPTCP Application Interface Considerations, draft-scharf-mptcp-api-04," 2010-11-22, URL: https://tools.ietf.org/html/draft-scharf-mptcp-api-04 (26pgs).	
	21	Singh, A. et al., "PayLoad Multi-connection Transport using Multiple Addresses, draft-singh-mptcp-plml-00.txt," 2010-08-06, URL: https://tools.ietf.org/html/draft-singh-mptcp-plmt-00 (33pgs).	
	22	Scharf, M., "Multi-Connection TCP (MCTCP) Transport, draft-scharf-mptcp-mctcp-01," 2010-07-12, URL: https://tools.ietf.org/html/draft-scharf-mptcp-mctcp-01 (35pgs).	

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	Examiner Name	Grijalva Lobos, Boris
	Attorney Docket Number	20145-054US

	23	Ford, A. et al., "TCP Extensions for Multipath Operation with Multiple Addresses, draft-ford-mptcp-multiaddressed-03," 2010-03-08, URL: https://tools.ietf.org/html/draft-ford-mptcp-multiaddressed-03 (35pgs).	
	24	Raiciu, C. et al., "Coupled Multipath-Aware Congestion Control, draft-raiciu-mptcp-congestion-01," 2010-03-08, URL: https://tools.ietf.org/html/draft-raiciu-mptcp-congestion-01 (11pgs).	
	25	Sarolahti, P., "Multi-address Interface in the Socket API, draft-sarolahti-mptcp-af-multipath-01.txt," 2010-03-04, URL: https://tools.ietf.org/html/draft-sarolahti-mptcp-af-multipath-01 (13pgs).	
	26	Bagnulo, M., "Threat Analysis for Multi-addressed/Multi-path TCP, draft-bagnulo-mptcp-threat-01," 2010-02-08, URL: https://tools.ietf.org/html/draft-bagnulo-mptcp-threat-01 (13pgs).	
	27	Ford, A., Ed., et al., "Architectural Guidelines for Multipath TCP Development, draft-ford-mptcp-architecture-01," 2010-02-03, URL: https://tools.ietf.org/html/draft-ford-mptcp-architecture-01 (24pgs).	
	28	Handley, M., et al., "Outgoing Packet Routing with MP-TCP, draft-handley-mptcp-routing-00.txt," 2009-10-19, URL: https://tools.ietf.org/html/draft-handley-mptcp-routing-00 (14pgs).	
	29	Office Action dated 2018-08-10, in Canadian Patent Application No. 2,855,461 (3pgs).	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/BORIS D GRIJALVA LOBOS/	Date Considered	10/20/2018

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.D.G/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

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Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2018-10-05
Name/Print	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Charter Communications, Inc.
Exhibit 1006
Page #760

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	20	("20030031180" | "20030076784" | "20050261915" | "20060126613" | "20060187885" | "20070153807" | "20080186873" | "20090055900" | "20100290465" | "20110013529" | "20110110359" | "20110182182" | "20110273979" | "20120294310" | "5970064" | "5974106" | "6430612" | "7840220" | "8520586" | "8880666").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/20 23:05
L7	1	("20120151540").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/20 23:23
L8	7	("20160315976" | "20180248984" | "6469982" | "6618356" | "6678247" | "6680907" | "7864669").PN.	US-PGPUB; USPAT	OR	OFF	2018/10/21 00:11
S1	1026	((access near1 point) (base near1 station) (wireless near1 LAN near1 device) (DSLAM) (gateway) (performance near1 device) DSL CPE (customer near1 premises near1 equipment) modem (in-home near1 powerline) (in-home coax) (HPNA) (metering near1 device) (LAN near3 appliance) (femtocell) (wifi near1 base) (repeater) STB STU (IP near2 TV) (IP near2 media near1 device) (gam$3 near1 console) gateway device computer router bridge switch) with ((transmit$4 send$3 forward$3 receiv$3) near5 policy) with operation	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 12:31
S2	84	((access near1 point) (base near1 station) (wireless near1 LAN near1 device) (DSLAM) (gateway) (performance near1 device) DSL CPE (customer near1 premises near1 equipment) modem (in-home near1 powerline) (in-home coax) (HPNA) (metering near1 device) (LAN near3 appliance) (femtocell) (wifi near1 base) (repeater) STB STU (IP near2 TV) (IP near2 media near1 device) (gam$3 near1 console) gateway device computer router bridge switch) with ((transmit$4 send$3 forward$3 receiv$3) near5 policy) with operation with (location time)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 12:48
S3	26692	RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:31
S4	1040	monitor$3 near3 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:32

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S6	0	(monitor$3 near3 RSSI) with (adjust$3 near3 rate)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:32
S7	8	((transmit$3 send$3 receiv$3 forward$3 monitor$3) near3 RSSI) with (adjust$3 near3 rate)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/16 15:33
S8	26	((send$3 transmit$4 receiv$3 forward$3) near5 conditions near3 operation) with ((access near1 point) AP)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:26
S9	4998	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:58
S10	3	(adaptation near1 algorithm) with ((real near1 time) real-time) with historical	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 18:58
S11	1	"14356581"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:14
S12	0	((send$3 transmit$4 forward$3 receiv$3) near3 policy) near20 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S13	0	((send$3 transmit$4 forward$3 receiv$3) near3 policy) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S14	31	((send$3 transmit$4 forward$3 receiv$3) near7 policy) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:39
S15	1	(policy near1 server) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:59
S16	26	(policy near1 server) same2 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/17 20:59
S17	0	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) with RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19

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S18	178	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19
S19	1	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:19
S20	2	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) with AP	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:20
S21	7	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and (((access near1 point) AP) with server)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/18 18:20
S22	109	rhee near1 wonjong	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 13:24
S23	10	(rhee near1 wonjong) and policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 13:30
S24	58484	(H04L7/00,0004 H04L12/00,14,16,24,2414,2415,2417-2419,2424-2426,2428-2433,2439,244-2442,2447,2464,2465,2468-247,2472,2473,2476,2478,26,2602,2618,2634-2642,2668-2678,2692 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869,50-5016,5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32).cpc.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:17
S25	25	((transmit$3 send$3 receiv$3 forward$3) near5 policy near5 algorithms) and S24	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:17
S26	41	(rhee near1 wonjong) and S24	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 15:18
S27	1	"7840220".pn.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2015/12/21 16:50
S28	1672280	adaptation algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:55
S29	5390	adaptation near1 algorithm	US-	OR	ON	2016/11/14

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			PGPUB; USPAT; EPO; JPO			19:55
S30	394	(creat$3 generat$3 comput$3 calculat$3) near5 (adaptation near1 algorithm)	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:56
S31	0	((creat$3 generat$3 comput$3 calculat$3) near5 (adaptation near1 algorithm)) with policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:56
S32	5	((creat$3 generat$3 comput$3 calculat$3) near5 (adaptation near1 algorithm)) same2 policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/14 19:56
S33	13	(rhee near1 wonjong) and policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:17
S34	2862	(generat$3 creat$3 develop$3) near10 RSSI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:18
S35	361	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state))	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:19
S36	0	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state)) with policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:19
S37	4	((generat$3 creat$3 develop$3) near10 RSSI) with ((observ$3 collect$3 obtain$3 receiv$3 detect$3) near5 (data status information state)) same2 policy	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S38	5394	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S39	2	S35 and S38	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/11/16 17:20
S40	5784	adaptation near1 algorithm	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 14:02
S41	451	(transmit$4 send$3 receiv$3 forward$3	US-	OR	ON	2017/12/20

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		push$3) near5 (adaptation near1 algorithm)	PGPUB; USPAT; EPO; JPO			14:03
S42	4	"7840220".pn. "2007136337"	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 15:43
S43	46	(policy near7 algorithm) and (communication near5 algorithm) and WIFI	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 21:13
S44	0	S43 and S41	US-PGPUB; USPAT; EPO; JPO	OR	ON	2017/12/20 21:13
S51	33	("2006/0187885").URPN.	USPAT	OR	OFF	2018/10/19 20:09
S52	10158	monitor$3 near7 (signal near1 strength)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:07
S53	86958	(H04L7/00,0004 H04L41/00,06,08-0806,0813-0836,085-0859,0866-0869.50-5016.5035,5038 H04L43/00,04,08-0817,0876-10,16 H04L47/00,10,11,12,28,29,32).cpc.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2018/10/19 23:08
S54	335	S52 and S53	US-PGPUB; USPAT; EPO; JPO	OR	ON	2018/10/19 23:08
S55	38	("4161628" | "4229734" | "4279032" | "4430788" | "4558358" | "4694453" | "4730302" | "4799211" | "4816825" | "4860001" | "4890278" | "4896315" | "4926162" | "5048009" | "5115199").PN. OR ("5198805").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/10/19 23:11
S56	316	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 adapt$3)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:27
S57	58	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 adapt$5) not S56	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/19 23:33
S58	5	("2009/0059872").URPN.	USPAT	OR	OFF	2018/10/19 23:51
S59	1	("2012/0077533").URPN.	USPAT	OR	OFF	2018/10/19 23:54
S60	839	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 (adapt$5 chang$3 modif$3)) not (S56 S57)	US-PGPUB; USPAT;	OR	OFF	2018/10/19 23:57

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			EPO; JPO			
S61	433	(monitor$3 near7 (signal near1 strength)) and (dynamic$4 near5 (adapt$5 chang$3 modif$3)) and @AD<="20111110" not (S56 S57)	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/20 00:04
S62	15	("2004/0223470").URPN.	USPAT	OR	OFF	2018/10/20 00:09
S63	31	remote$2 near3 manag$5 near3 QOS	USPAT	OR	OFF	2018/10/20 00:15
S64	6276	S52 and @AD<="20111110"	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/20 00:20
S65	1349	RSSI and S64	US-PGPUB; USPAT; EPO; JPO	OR	OFF	2018/10/20 00:21
S66	15	("2004/0223470").URPN.	USPAT	OR	OFF	2018/10/20 00:33
S67	89	("2007/0082677").URPN.	USPAT	OR	OFF	2018/10/20 00:40

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S45	100	rhee near1 wonjong	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S46	889	(policy with algorithm).clm.	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S47	1	S45 and S46	US-PGPUB; USPAT	OR	ON	2017/12/20 20:54
S48	42097	((transmission near1 control$4) (communication near1 algorithm)).clm.	US-PGPUB; USPAT	OR	ON	2017/12/20 20:55
S49	13	S46 and S48	US-PGPUB; USPAT	OR	ON	2017/12/20 20:55
S50	5	S48 and S45	US-PGPUB; USPAT	OR	ON	2017/12/20 20:56
S68	104	rhee near1 wonjong	US-PGPUB; USPAT	OR	ON	2018/10/20 02:52
S69	106792	((transmission near1 control$4) (communication near1 algorithm) policy).clm.	US-PGPUB; USPAT	OR	ON	2018/10/20 02:53
S70	7	S68 and S69	US-PGPUB; USPAT	OR	ON	2018/10/20 02:53

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

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	Attorney Docket Number	20145-054US

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Attorney Docket Number	20145-054US

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Attorney Docket Number	20145-054US

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Application Number	14/356,581
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First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Boris D. Grualvalobos
Attorney Docket Number	20145-054US

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 1

	Complete if Known
Application Number	14/356,581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Boris D. Grualva Lobos
Attorney Docket Number	20145-054US

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Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	1	Office Action dated 2018-08-10, in Canadian Patent Application No. 2,855,461 (3pgs).	

Examiner Signature	/BORIS D GRIJALVA LOBOS/	Date Considered	10/20/2018

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Art Unit	2446
Examiner Name	Boris D. Grualvalobos
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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5970064	A	1999-10-19	Timothy Ian James Clark et al.	
	2	6430612	B1	2002-08-06	Yoshio Iizuka	
	3	7840220	B1	2010-11-23	James P. Mitchell	
	4	5974106	A	1999-10-26	Pierre B. Dupont et al.	
	5	8520586	B1	2013-08-27	Paul J. Husted	
	6	8880666	B2	2014-11-04	Jeffrey A. Aaron et al.	

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	Examiner Name	Boris D. Grualvalobos
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	1	20030076784	A1	2003-04-24	D.C. John Ta et al.	
	2	20050261915	A1	2005-11-24	Yasuomi Ooki et al.	
	3	20060187885	A1	2006-04-24	Vincent Roy et al.	
	4	20070153807	A1	2007-07-05	Rene L. Cruz et al.	
	5	20080186873	A1	2008-08-07	Nicolas Pujet et al.	
	6	20090055900	A1	2009-02-26	Bhanu Gopalasetty et al.	
	7	20110013529	A1	2011-01-20	Fanxiang Bin et al.	
	8	20110110359	A1	2011-05-12	Stephen P. Cooke et al.	
	9	20120294310	A1	2012-11-22	Chia-Wei Yen et al.	

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	1	2112781	EP	A1	2009-10-28	Koninkl KPN NV [NL]		
	2	2004173170	JP	A	2004-06-17	NEC Infrontia Corp		
	3	2007116411	WO	A1	2007-10-18	Link Fusion Ltd.		
	4	2007136337	WO	A2	2007-11-29	Telefonaktiebolaget LM Ericsson (Publ)		
	5	2011079612	WO	A1	2011-07-07	ZTE Corp.		
	6	2426983	EP	A1	2012-03-07	ZTE Corp.		
	7	101156458	CN	A	2008-04-02	Vincent Roy et al.		

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	1	International Search Report and Written Opnion dated 2012-02-15, for International Patent Application No. PCT/US2011/063326, filed 2011-12-05 (Docket No. 20145-055PC) (11pgs).	
	2	International Search Report and Written Opinion dated 2012-06-21, for International PCT Patent Application No. PCT/US2011/060265, filed 2011-11-10 (Docket No. 20145-054PC) (14pgs).	

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	3	International Preliminary Report on Patentability dated 2014-05-13, for International PCT Patent Application No. PCT/US2011/060265, filed 2011-11-10 (Docket No. 20145-054PC) (11pgs).	
	4	International Preliminary Report on Patentability dated 2014-06-19, for International PCT Patent Application No. PCT/US2011/063326, filed 2011-12-05 (Docket No. 20145-055PC) (6pgs).	
	5	Office Action mailed 2015-08-05, in Japanese Patent Application No. 2014-545862 (Docket No. 20145-055JP) (6pgs).	
	6	Office Action mailed 2015-09-28, in Canadian Patent Application No. 2858162 (Docket No. 20145-055CA) (5pgs).	
	7	Non-Final Office Action mailed 2016-01-11, in US Patent Application No. 14/356,581, filed 2014-05-06 (Docket No. 20145-054US) (25pgs).	
	8	Examination Report dated 2016-04-20, in Australian Patent Application No. 2011380909 (Docket No. 20145-054AU) (4pgs).	
	9	Response to Non-Final Office Action mailed 2016-05-11, in US Patent Application 14/356,581, filed 2014-05-06 (Docket No. 20145-054US) (17pgs).	
	10	English translation of Office Action mailed 2016-11-09, in Chinese Patent Application No. 201611040117875O (Docket No. 20145-054CN) (4pgs).	X
	11	Final Office Action mailed 2016-11-25, in US Patent Application No. 14/356,581, filed 2014-05-06 (Docket No. 20145-054US) (18pgs).	☐
	12	Response to Final Office Action filed 2017-02-23, in US Patent Application No. 14/356,581, filed 2014-05-06 (Docket No. 20145-054US) (18pgs).	☐
	13	Response filed 2017-03-24, in Canadian Patent Application No. 2858162 (Docket No. 20145-055CA) (22pgs).	☐

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	14	Response filed 2017-08-15, and English translation of claims, in Chinese Patent Application No. 201180075399.4 (Docket No. 20145-054CN) (19pgs).	☒
	15	Response filed 2017-09-26, in Australian Patent Application No. 2016200393 (Docket No. 20145-055AUD) (44pgs).	☐
	16	Office Action mailed 2017-08-25, in Canadian Patent Application No. 2,858,162 (Docket No. 20145-055CA) (4pgs).	☐
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	18	Notice of Acceptance dated 2017-10-26, in Australian Patent Application No. 2016200393 (Docket No. 20145-055AUD) (3pgs).	☐
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	20	Non-Final Office Action mailed 2017-12-29, in US Patent Application No. 14/356,581, filed 2014-05-06 (Docket No. 20145-054US) (20pgs).	☐
	21	Response filed 2018-01-23, in Canadian Patent Application No. 2,858,162 (Docket No. 20145-055CA) (19pgs).	☐
	22	Examination Report mailed 2015-01-22, in Australian Patent Application No. 2011382612 (Docket No. 20145-055AU) (3pgs).	☐
	23	Office Action dated 2017-02-21, in Australian Patent Application No. 2016200393 (Docket No. 20145-055AUD) (5pgs).	☐
	24	Bees, Duncan, "Flexible Bandwidth Services with DSL Bonding," Internet citation, 2002-08-01, XP002495657, Retrieved from the Internet: URL: http://www.pmc-sierra.com/cgi-bin/document.pl?docnum=2021395 (24pgs).	☐

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Examiner Name	Boris D. Grualvalobos
Attorney Docket Number	20145-054US

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

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Signature	/Michael North/	Date (YYYY-MM-DD)	2018-03-09
Name/Print	Michael North	Registration Number	46963

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	1	20120151540	A1	2012-06-01	Kenneth Stanwood	

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	2	Response filed 2018-02-09, and English translation of claims, in Chinese Patent Application No. 201180075399.4 (20pgs).	X
	3	Office Action dated 2018-05-31, and English translation thereof, in Chinese Patent Application No. 201180075399.4 (22pgs).	☒
	4	Preliminary Amendments made 2018-04-12, in Australian Patent Application No. 2018200888 (32pgs).	☐
	5	Notice of Allowance dated 2018-03-09, in European Patent Application No. 118028265 (7pgs).	☐
	6	Office Action dated 2017-02-10, in Australian Patent Application No. 2016200291 (4pgs).	☐
	7	Response filed 2017-05-24, in Australian Patent Application No. 2016200291 (36pgs).	☐
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	2446
Examiner Name	Boris Grijalva Lobos
Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2018-08-09
Name/Print	Michael North	Registration Number	46963

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Art Unit	2446
Examiner Name	Grijalva Lobos, Boris
Attorney Docket Number	20145-054US

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	1	6430612	B1	2002-08-06	Yoshio Iizuka	

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	1	20030031180	A1	2003-02-13	Sanchalta Datta et al.	
	2	20050261915	A1	2005-11-24	Yasuomi Ooki et al.	
	3	20060126613	A1	2006-06-15	Jonathan Marcus Zweig	
	4	20070153807	A1	2007-07-05	Rene L. Cruz et al.	
	5	20080186873	A1	2008-08-07	Nicolas Pujet et al.	

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	6	20100290465	A1	2010-11-18	Shashi H. Ankaiah et al.	
	7	20110013529	A1	2011-01-20	Fanxiang Bin et al.	
	8	20110182182	A1	2011-07-28	Kai-Yu Yang et al.	
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	1	2004173170	JP		2004-06-17			
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	1	International Search Report and Written Opinion dated 2012-08-06, in International Patent Application No. PCT/US2011/063327 (12pgs).	

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	2	International Preliminary Report on Patentability dated 2014-06-10, in International Patent Application No. PCT/US2011/063327 (9pgs).	
	3	Office Action dated 2015-01-19, in Australian Patent Application No. 2011382613 (3pgs).	
	4	Office Action dated 2015-08-20, in Canadian Patent Application No. 2858030 (2pgs).	
	5	English translation of Office Action dated 2015-07-28, in Japanese Patent Application No. 2014545863 (5pgs).	X
	6	First Office Action dated 2017-02-10, in Australian Patent Application No. 2016200291 (4pgs).	☐
	7	Response filed 2017-05-24, in Australian Patent Application No. 2016200291 (36pgs).	☐
	8	Second Office Action dated 2017-06-19, in Australian Patent Application No. 2016200291 (3pgs).	☐
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Name/Print	Michael North	Registration Number	46963

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Oct 21, 2006 - This occurs through observing others (particularly those close to them), hearing about and discussing values, and having opportunities to make decisions and ...
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[PDF] Understanding the dynamics of decision-making ... - University of York
https://www.york.ac.uk/inst/spru/pubs/pdf/decisionmaking.pdf
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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6469982	B1	2002-10-22	Michel Andre Robert Henrion et al.	
	2	6618356	B1	2003-09-09	Olivier Bonaventure	
	3	6678247	B1	2004-01-13	Olivier Bonaventure	
	4	6680907	B1	2004-01-20	Olivier Bonaventure	
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	1	20160315976	A1	2016-10-27	Gregory Detal et al.	

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	2	20180248984	A1	2018-08-30	Olivier Bonaventure et al.	

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	1	2013023989	WO	A1	2013-02-21	Gregory Detal et al.		
	2	3151504	EP	A1	2017-04-05	Olivier Bonaventure et al.		
	3	3255845	EP	A1	2017-12-13	Olivier Bonaventure et al.		

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	1	Handley, M. et al., "Outgoing Packet Routing with MP-TCP, draft-handley-mptcp-routing-00.txt," 2009-10-19 (14pgs).	
	2	Sarolahti, P., "Multi-address Interface in the Socket API, draft-sarolahti-mptcp-af-multipath-01.txt," 2010-03-04 (13pgs).	
	3	Scharf, M., "Multi-Connection TCP (MCTCP) Transport, draft-scharf-mptcp-mctcp-01," 2010-07-12 (35pgs).	

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	4	Singh, A. et al., "PayLoad Multi-connection Transport using Multiple Addresses, draft-singh-mptcp-plmt-00.txt," 2010-08-06 (33pgs).	
	5	Barre, S. et al., "MultiPath TCP - Guidelines for implementers, draft-barre-mptcp-impl-00," 2011-03-07 (42pgs).	
	6	Hampel, G. et al., "Enhancements to Improve the Applicability of Multipath TCP to Wireless Access Networks, draft-hampel-mptcp-applicability-wireless-networks-00," 2011-06-15 (25pgs).	
	7	Bagnulo, M., "Threat Analysis for TCP Extensions for Multipath Operation with Multiple Addresses," 2011-03, RFC: 6181, ISSN: 2070-1721, MPTCP Threat Analysis (17pgs).	
	8	Ford, A. et al., "Architectural Guidelines for Multipath TCP Development," 2011-03, RFC: 6182, ISSN: 2070-1721, MPTCP Architecture (28pgs).	
	9	Raiciu, C. et al., "Coupled Congestion Control for Multipath Transport Protocols," 2011-10, RFC: 6356, ISSN: 2070-1721, MPTCP Congestion Control (12pgs).	
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(71) Applicant *(for all designated States except US)*: **UNIVERSITE CATHOLIQUE DE LOUVAIN** [BE/BE]; Place de l'Université 1, B-1348 Louvain-La-Neuve (BE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **DETAL, Gregory** [BE/BE]; Clos des Violeneux 10/001, B-1348 Louvain-La-Neuve (BE). **BONAVENTURE, Olivier** [BE/BE]; Avenue des Floralies 17, B-5030 Gembloux (BE). **VAN DER LINDEN, Simon** [BE/BE]; Avenue de Balbrire 5, B-1340 Ottignies (BE). **AVOINE, Gildas** [BE/BE]; Quai au foin 15, B-1000 Brussels (BE).

(74) Agents: **PECHER, Nicolas** et al.; Pecher & de Groote SPRL, Centre Monnet, avenue Jean Monnet 1, B-1348 Louvain-La-Neuve (BE).

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(54) **Title**: METHOD AND DEVICE FOR SELECTING NEXT HOP IN A DATA NETWORK

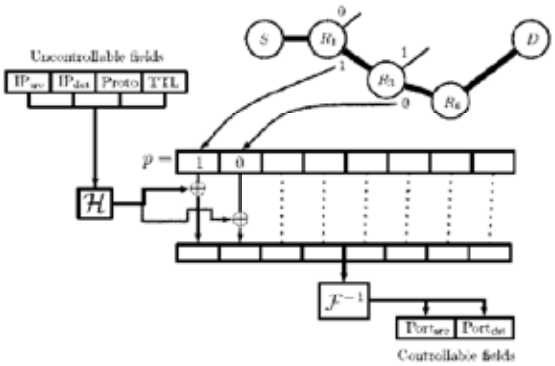


Fig. 2

(57) **Abstract**: A method for sending a packet, said packet comprising a header, from a sender to a receiver in a data communication network comprising one or more routers having two or more available next hops leading to said receiver. An invertible function F encoding a sequence of X bits into another sequence of X bits is selected. The sender performs the steps of selecting a preferred next hop for each of said one or more routers; grouping each of said preferred next hops in a path selector, said path selector having a length X in bits; selecting a function F encoding a sequence of X bits into another sequence of X bits, said function being invertible; applying the inverse of said function to said path selector and storing the result in a first subset of said header; sending said packet across said data communication network. One router performs the steps of applying said function F to said first subset of said header for obtaining the original path selector; extracting from said path selector the preferred next hop selected by the sender for said one router; sending said packet through said preferred next hop.

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METHOD AND DEVICE FOR SELECTING NEXT HOP IN A DATA NETWORK

TECHNICAL FIELD

[0001] The present invention relates generally to the field of data communications network. More particularly, the invention relates to a method for sending a packet from a sender to a receiver in a data communication network comprising one or more routers, a least one router having two or more available next hops and to devices for sending and routing packets in said data communication network.

DESCRIPTION OF RELATED ART

[0002] Load balancing plays a key role in enterprise, datacenter and ISP networks. It allows to improve the performance and the scalability of the Internet by distributing the load evenly across network links, servers, or other resources. Load balancing allows to maximize the throughput, achieve redundant connectivity or reduce congestion . Different forms of load balancing are deployed at various layers of the protocol stack. At the datalink layer, frames can be distributed over parallel links between two devices. At the application layer, requests can be spread on a pool of servers. At the network layer, the most common technique, Equal-Cost Multi-Path (ECMP) , allows routers to forward packets over multiple equally-good paths. ECMP may both increase the network capacity and improve the reaction of the control plane to failures. Current ECMP-enabled routers proportionally balance flows across a set of equal next hops on the path to the destination.

[0003] Various methods to select a next hop are known. The most deployed next-hop selection method is solely based upon a hash computed over several fields of the regular packet headers. Using a hash function ensures a somewhat fair distribution of the next-hop selection (See e.g. Z. Cao, Z. Wang, and E. Zegura "Performance of Hashing-Based Schemes for

Internet Load Balancing" In Proc. IEEE INFOCOM, 2000). Most implementations include as input to the hash computation the transport-level port numbers allowing to improve the load spreading while still maintaining the same path for a given transport level flow.

[0004] However, using the transport header to perform the network layer forwarding breaks the layered architecture, enabling the transport layer to influence the path being followed by packets. Although some topology discovery applications exploit this principle, it remains difficult for end hosts to accurately control forwarding decisions or even be aware of the path diversity that is available in the network. Multipath-aware transport protocols such as SCTP-CMT or MultiPath TCP would clearly benefit from being able to select network paths that are as independent as possible to avoid congestion . Unfortunately, this is not possible with the existing hash-based load-balancing techniques. Source routing techniques could enable end hosts to choose the paths their packets follow. Unfortunately, standard IP source routing does not scale well and has well-known security problems. Better alternatives that let end hosts leverage on the path diversity have been proposed. However, these solutions rely on specific shim headers that follow the IP header. Experience shows that it is very difficult to incrementally deploy such a new header in a network.

[0005] For performing load balancing at the network layer it is known to use Equal-Cost Multi-Path (ECMP). ECMP is discussed in C. Hopps "Analysis of an Equal-Cost Multi-Path Algorithm" RFC 2992, IETF, November 2000. ECMP is a packet forwarding strategy that uses paths that tie for the best path selection. When such strategies are being used, routers need to balance packets over multiple next hops. Various next-hop selection methods exist to balance packets over load-balanced paths. They should meet the following requirements:

- Minimal disruption: Packets from the same TCP flow should always follow the same path in order to avoid packet reordering.
- Transparency: Load balancing operates on normal network packets. It does not require any additional fields in packet header.

- Operate at Line Rate: The additional computation required to balance the packets should be marginal.

Load balancing should also fairly share the load over the next hops. Since flows vary widely in terms of number of packets and volume, this is not that easy. Most load-balancing methods that meet these requirements are based on a hash function. They compute a hash over the fields that identify the flow in the packet headers. These fields are usually the source and destination IP addresses, the protocol number and the source and destination ports. In the present description, we call these fields the 5-tuple. The computed hash can then be used in various ways to select a next hop. The simplest and most deployed method is called Modulo-N. If there are N available next hops, the remainder of dividing the hash by N is used as an identifier of the next hop to use. Because of the roughly uniform distribution of the hashes, this method results in a uniform distribution in terms of number of packets.

PRIOR ART DISCUSSION

[0006] An example of a hashing-based network load balancing method is disclosed by document **US 6,888,797** wherein a router 2 determines an output link 12, 13, 14,15 or 16 based on a hash value computed from header data comprising source address, destination address, source port, destination port, and protocol id, and from network load directions. This method allows the router to distribute the stream of packets to the output links according to a desired load distribution. However, this method does not allow the sender to predetermine the link to be selected for specific packets.

[0007] Another example of a hashing-base network load balancing method is disclosed in **US 7,233,575**. This document addresses the situation where at least routers in the network have the same number of valid next hops. In such a situation, the known hashing methods will assign all packet of a given flow, i.e. having same source and destination address to the same output next-hop in successive routers of the network. Load balancing of packets at different routers is highly correlated. This phenomenon is called

polarization. This leads to systematic unbalanced load distribution. This problem is solved by assigning different hashing parameters to each of the routers, in such a way that the next-hop selections for each router are uncorrelated. However, this document also does not address the selection of specific paths.

[0008] The following references all either do not allow the control of the specific path, or require additional data in the header, and thereby do not meet the transparency requirement:

1. P. B. Godfrey, I. Ganichev, S. Shenker, and I. Stoica. "Pathlet Routing". In Proc. ACM SIGCOMM, August 2009.
2. H T. Kaur et al. BANANAS: "An Evolutionary Framework for Explicit and Multipath Routing in the Internet" In Proc. ACM SIGCOMM FDNA Workshop, 2003.
3. M. Motiwala, M. Elmore, N. Feamster, andS. Vempala. "Path Splicing" In Proc. ACM SIGCOMM, October 2008.
4. X. Yang and D. Wetherall. "Source Selectable Path Diversity via Routing Deflections" In Proc. ACM SIGCOMM, August 2006.

[0009] A method for adaptive routing of messages in a computer network is known from US5721820. The method provides adaptive source routing by generating at a source node a routing message describing a plurality of allowable paths via which data message can reach a desired destination. The data message and the routing message are sent by the source to a first switch, and the routing message is evaluated by control logic to determine if an available, allowable path exists. If so, the data message and routing message are sent via that path to the destination. The need of these routing messages generates additional overhead and makes this method non-transparent.

[0010] A method for transmitting a packet via a sequence of nodes in a network is known from US5353283. The transmitted-packet contains a sequence of one or more identifiers in a sequence of fields and a pointer pointing to a particular identifier in the sequence of identifiers in a field of a routing section of a header in the packet. A node of the sequence of nodes at

which the packet is located selects a forwarding table from a set of forwarding tables maintained in a memory at that node. The node then retrieves an entry from the selected forwarding table indexed by the identifier in the sequence of identifiers pointed to by the pointer. The node then transmits the packet to the next node of the sequence of nodes indicated by the retrieved forwarding table entry. The need for these additional fields in the packet header makes this method also non-transparent.

[0011] The present invention aims at providing a method and device that overcomes the above-discussed drawbacks of the prior art.

[0012] In particular, it is an object of the present invention to provide a method for sending a packet from a sender to a receiver in a data communication network, wherein the sender can select the actual next hop out of a router in the network for specific packets, in the case where a router has more than one available next hops. Preferably, when the sender does not wish to select the actual next hop, the router having more than one available next hop should select the next hop in a load-balanced way, i.e. using each of the next hops evenly.

[0013] Another object of the present invention is to provide a sender and a router adapted for performing this method. Such a method and devices may be used for example for testing the operation of specific links and for monitoring the network. This feature may also be used for improving performance of the network

SUMMARY OF THE INVENTION

[0014] According to a first aspect, the present invention relates to a method for sending a packet, said packet comprising a header, from a sender to a receiver in a data communication network comprising one or more routers, one or more routers having two or more available next hops leading to said receiver. In the method, a function F encoding a sequence of X bits into another sequence of X bits is selected, said function being invertible. The sender performs the steps of selecting a preferred next hop for each of said

one or more routers; grouping each of said preferred next hops in a path selector, said path selector having a length X in bits ; applying the inverse of said function F to said path selector and storing the result in a first subset of said header; sending said packet across said data communication network. At least one of the routers performs the steps of applying said function F to said first subset of said header for obtaining the original path selector; extracting from said path selector the preferred next hop selected by the sender for said one router; sending said packet through said preferred next hop. Thereby, the sender can specify the path for the packet across the network, or "steer" the packets. The first subset of the header is the "controllable fields" discussed in the examples.

[0015] Said function F is advantageously selected among the functions where at least 40% or preferably 50% of the output bits change wherever a single bit in the input is changed. As a result of this choice, packets that have not been processed by a sender for being steered along a specific path are processed by a router of the network in a load-balanced way.

[0016] In a preferred embodiment of the invention, when the sender initiates a counter TTL and stores said counter in a second subset of said packet header and each successive router in the network receiving a packet decrements said counter TTL, a router having two or more available next hops uses said counter for extracting from said path selector the preferred next hop selected by the sender for said one router.

[0017] In a preferred embodiment, the grouping of each next hops in a path selector is performed by a lossless compression method. Thereby, an optimal use of the available space in the packet header is made for coding a maximum number of paths.

[0018] The function may advantageously be a block cipher selected from a group comprising Skip32 and RC5.

[0019] The first subset of header, where the path selector is stored, may comprise the source port and/or the destination port. It may also comprise the source address or a subset thereof, the destination address or a subset thereof, a flow label and an MPLS label.

[0020] In a preferred embodiment, the sender further computes a hash function based on a third subset of said header and adds said hash function to each of said preferred next hops grouped in said path selector, and the router further computes the same hash function based on said third subset of said header and adds said hash function to each of said preferred next hops extracted from said path selector. Thereby, the phenomenon of polarization discussed above is avoided. The third subset of the header is the "uncontrollable fields" discussed in the examples.

[0021] According to a second aspect, the invention relates to the use of the method of the invention in an MultiPath TCP-enabled network.

[0022] According to a third aspect, the invention relates to a sender for sending a packet to a receiver in a data communication network comprising means for performing the steps performed by the sender in the method of the invention. These means may be implemented e.g. in electronics or in software.

[0023] According to a fourth aspect, the invention relates to a router for routing a packet to a receiver in a data communication network comprising means for performing the steps performed by the router in the method of the invention. These means may be implemented e.g. in electronics or in software.

[0024] According to a fifth aspect, the invention relates to a network comprising one or more senders according to the invention and/or one or more routers according to the invention.

[0025] According to a sixth aspect, the invention relates to a software comprising means for performing the steps performed by the sender in the invention and/or for performing the steps performed by the router in the invention.

BRIEF DESCRIPTION OF THE DRAWING

[0026] **Fig.1** a schematic view of an example network wherein the invention may be deployed.

[0027] **Fig.2** illustrates schematically the steps of the method of the invention performed in a sender.

[0028] **Fig.3** illustrates schematically the steps of the method of the invention performed in a router.

[0029] **Fig.4** illustrates deviations from an optimal distribution amongst two possible next-hops.

DETAILED DESCRIPTION OF THE INVENTION

[0030] A schematic representation of all possible paths between a sender S and a destination D in an exemplary network is shown in Fig. 1. A set of routers according to the invention R1, R2, ...R8 may transport data packets along possible hops from a router to a next one shown as arrows. Routers R1 and R3 have two available next hops, and therefore these routers may select two possible next hops for an incoming data packet. Similarly, router R4 has three available next hops. In this example there exist five different load-balanced paths between nodes S and D.

[0031] In an example embodiment, the method of the invention is decomposed in four separate operations. First, the desired path is specified as a sequence of next-hop selections by the sender, that we call a path selector. This path selector is then encoded inside selected header fields of the packets. We call these header fields controllable fields. Third, each router recovers from these fields the encoded path selector and, finally, the load-balanced next-hop selection it needs to apply on this packet. These four operations allow senders according to the invention to steer their packets inside the network. In this example, we focus on IPv4 and use the source and destination ports as controllable fields, i.e., they are used to encode the path selector. We also define uncontrollable fields that are used to add

randomness in the forwarding process of packets from senders not according to the invention. With IPv4, these uncontrollable fields may include the source and destination IP addresses and the protocol number. The example embodiment starts from two assumptions. First, the same encoding function is used on all devices (senders or routers) inside the network. Second, the network topology is available to the sender, either directly or through a network information such as ALTO . From this network topology, it is possible to compute all the load-balanced paths for a given sender-destination pair. In the following, we first describe how the method represents a path as a path selector and how a router retrieves from a path selector the next-hop selection it needs to apply. Second, we discuss how to encode the path selector inside the packet header. Then, we discuss the load-balancing distribution of packets passing through routers and how the invention avoids polarization. Finally, we summarize the complete operations of the invention.

[0032] The path selector is encoded in the controllable field of the header. Designating the length in bits of this controllable field by X, a simple embodiment of the invention divides these X bits in a number L of subfields of equal length. However, in order to maximize the number of next hops selections that can be encoded inside a path selector having a limited length X in bits, a preferred embodiment of the invention encodes the path selector using a lossless compression. An example of an applicable lossless compression is as follows:

[0033] The following definitions are used in the description of this preferred embodiment:

B	The radix of the path selector, i.e., the numeral base to encode the path selector.
n_i	The next-hop selection of the i^{th} router.
L	The length of the path selector, i.e., number of next-hop selections that can be encoded in it.
N_r	The number of next hops available for a router r that needs to forward a packet.
$N_r(d)$	The number of load-balanced next hops N_r on router r for the

destination prefix d.

F(x)	An invertible function applied on x.
H(x)	A Hash function applied on x.
u_f	The uncontrollable fields used.
$E_i(n_i)$	A function applied on a next-hop selection. It allows to add randomness using u_f to the next-hop selection.
$D_i(p)$	A function that performs the inverse of E_i, i.e., $x = D_i(E_i(x)) \ \forall x \in [0,B[$.
A||B	The concatenation of A and B.

[0034] A load-balanced path in a network can be described as a set of successive routers and their next-hop selections. For instance, the load balanced path highlighted in bold in Fig. 1 can be expressed as the following sequence: {R1 → R2,R4 → R7}, where Ri → Rj means that Ri forwards the packet to Rj . There is no need to represent the next-hop selection of router R7 towards D as R7 only has one possible next hop. By knowing the number N_r of available next hops towards a destination for each router r in the network, next-hop selections can be mapped to a number $n \in [0,N_r[$, where n indicates the index of the next hop which should be selected. By using this representation, the highlighted path in Fig. 1 can therefore be expressed as the following sequence of next-hop selections: {1 → 0, 3 → 2}, where i → j specifies that the i^{th} router on the path selects the j^{th} next hop. We define this sequence of next-hop selections to be a path selector.

Path Selector Representation.

[0035] To force a packet to follow a specific load-balanced path, the sender encodes the path selector inside the source and destination ports of the packet headers. The sender may store a path selector as a positional base-B unsigned integer, where B is known as the radix and shared by all the nodes in the network. This allows maximizing the number of next-hop selections that can be encoded inside the path selector, while minimizing the

number of bits used. For a specific load-balanced path in the network, the path selector p can be generalized as:

$$p = \sum_{i=0}^{L-1} n_i \times B^i \qquad (1)$$

where n_i is an unsigned integer in base B that represents the next-hop selections of the i^{th} router on the path. For the moment, we assume that each router is able to determine its position in the path selector. Only routers having multiple load-balanced next hops to forward a packet must retrieve the path selector. In this case, the router first extracts the path selector p from the packet's header fields and then retrieves the next-hop selection.

A path selector p can be inverted on the i^{th} router on the path to find the next-hop selection n_i it needs to 4 apply on a packet by applying Eq. 2:

$$n_i = \left\lfloor \frac{p}{B^i} \right\rfloor \mod B \qquad (2)$$

wherein the ⌊ and ⌋ represent the integer division. The integer division by B_i removes all load-balanced next-hop selections of upstream routers while the modulo operation removes all load-balanced next-hop selections of downstream routers.

Path Selector Length.

[0036] The fixed size of the packet header fields used to encode the path selector limits the number of encodable next hop selections to:

$$L = \lfloor \log_B(2^X) \rfloor \qquad (3)$$

where X is the size in bits of the header fields used to encode the path selector. With IPv4, X = 32 since the ports are used to convey the path selector. Increasing B decreases L, thus the number of load balanced next-

hop selections that can be encoded inside the path selector. As the potential value of n_i is limited by the radix B, one should choose a B value so that it is the maximum degree in every possible network (for each possible destination prefix). It can be expressed as:

$$B = max(N_r(d)) \qquad \forall\ r, d \qquad (4)$$

It is possible to represent for any router r in the network a next-hop selection n with a value which is lower than the maximum number of available next hops at any router in the network. In practice, most routers have a hardcoded upper bound on the number of next hops they can use for a destination, most of them use a maximum of 16 next hops .

Using a radix which is equal to the maximum number of next hops N_r for all routers might end up in an inefficient usage of the available bits in the packet header. Relaxing the problem by allowing routers to use more that one position inside the path selector would give more flexibility on the load-balanced next-hop selection values that can be encoded at the source. For instance, if a router uses 3 positions of the path selector, then a sender can use $n \in [0, 3 \times B[$ to represent the next-hop selection of this router.

Position Inside the Path Selector.

[0037] Up to now, we assumed that each router knows its position inside the path selector. However, in a real world scenario it is impossible for a router to identify the sequence of upstream routers thus making impossible to know its position inside the path selector. To still enable a sender to construct a path selector and for routers to extract corresponding next-hop selections, the method may use the Time-to-Live (TTL) of the packet to identify each router's position inside the path selector. As the TTL is decremented by each router and as the path selector is bounded by L, we can define the position of each routerto be

$$i := ttl_i \bmod L,$$

where ttl_i is the TTL value of the packet received at the i^{th} router. The sender can, by knowing the initial TTL of the packets, encode the next-hop selection of each router on the path at the corresponding position inside the path selector. As previously mentioned, to allow a router to use more than one position inside the path selector, the router must decrement the TTL of the packets it forwards more than one time.

One Load-Balanced Path – Multiple Path Selectors.

[0038] When multiple connections between the same pair of hosts want their packets to follow the same load balanced path, using the same path selector generates a collision as each connection will use the same port numbers. To overcome this issue, the method may allow to generate multiple path selectors to describe the same load balanced path using two solutions that can be combined. First, the unused positions inside the path selector can be filled with random values. Second, by changing the initial TTL, the position of each router in the path selector changes and thus the pair of ports used to force a specific load-balanced path. This ensures that the 5-tuple used by the hosts varies from one connection to another.

Example.

[0039] Let us now illustrate how the method works in the simple network shown in Fig. 1. First, based on Eq. 3, we can deduce that the radix B must be 3. Using this radix, from Eq. 3, we can encode 20 load-balanced next-hop selections inside a path selector. Let us assume that the sender uses an initial TTL of 64 and wants this packet to follow the highlighted path in Fig. 1. The positions of the next-hop selections of routers R1 and R4 inside the path selector are respectively 4 (64 mod 20) and 2 (62 mod 20). The path selector computed by the sender based on Eq. 1 can therefore be expressed as:

$$p = \{4 \rightarrow 0, 2 \rightarrow 2\} = 0 \times 3^4 + 2 \times 3^2 = 18$$

Note that this implies encoding a next-hop selection of 0 for all other positions

inside the path selector. This value is then encoded inside the packet header. R1 retrieves from the packet header the same path selector and the TTL value to compute its position inside the path selector, i.e., 4. It then computes the next-hop selection it needs to apply on the packet based on Eq. 2:

$$n_4 = \left\lfloor \frac{18}{3^4} \right\rfloor \mod 3 = 0$$

R1 decrements the TTL of the packet and forwards it to the next hop labeled 0, i.e., R2. R2 does not have load-balanced next hops. It forwards the packet to R4 and decrements the TTL. R4 applies the same operation as R1. R4 computes:

$$n_2 = \left\lfloor \frac{18}{3^2} \right\rfloor \mod 3 = 2$$

The packet is therefore forwarded to R7 and then to D as R7 only has one possible next hop to forward the packet.

Invertible Function

[0040] According to the method of the invention, the path selector is encoded inside the packet header using an invertible function F. This invertible function should meet two properties:

- Bijection:

  F should be bijective such that there is a one-to-one correspondence between its domain and image which must be a sequence of bits of length X, $\{0, 1\}^X$, where X is the length in bits of the controllable fields. F must also be invertible, i.e.,

  $\exists F^{-1}$ that is the inverse of F such that: $F^{-1}(F(x)) = x \ \forall x \in \{0, 1\}^X$

- Avalanche effect:

  F must exhibit the avalanche effect . Indeed, a simple bijective function might end up in a poor distribution of the traffic . For instance, if only the port numbers are used as controllable fields, we do not want that all web traffic goes through the same next

hop. Therefore, we require that the invertible function exhibits the avalanche effect, that is for a small variation of the input (different source-ports) a large variation of the output is observed. A large number of output bits (40% or even 50%) should change for a single input bit change.

Based on these two requirements, block ciphers such as Skip32 or RC5 are good candidates to implement this invertible function when 32 bits are controllable. Skip32 is a 32 bit block cipher based on SKIPJACK and available from http://www.qualcomm.com.au/PublicationsDocs/skip32.c. RC5 is another block cipher described in R. L. Rivest "The RC5 Encryption Algorithm" Proc. FSE, volume 1008, pages 86–96, 1994. Using such functions to encode the path selector enables a router to apply the inverse of this function on the controllable fields of the packet header to retrieve the path selector.

[0041] **Fig.2** illustrates schematically the steps of the method of the invention performed in the sender. The identities of the different paths to be selected are grouped in the path selector p. Optionally, a hash function H is applied to the "uncontrollable fields", which are, in the example shown, the IP source, the IP destination, the protocol and the TTL (Time-to-live counter) The inverse of the function F is applied to the result and stored in the "controllable fields" of the header (the source port and destination port fields in the example shown)

[0042] **Fig.3** illustrates schematically the steps of the method of the invention performed in a router. The function F is applied to the "controllable fields" (source port and destination port in the example shown) and provides the path selector p. The TTL may be used as an index in the path selector for retrieving the applicable next hop. Optionally, the same hash function H is applied to the same "uncontrollable fields" (in the example shown, the IP source, the IP destination, the protocol and the TTL). Te result thereof is added to the applicable element of the path selector for obtaining the applicable next hop.

[0043] The pseudocode showing the operations performed by a router that has multiple paths available to forward a packet is as follows:

Network-wide constant: X = The number of bits of the controllable fields in the packet header.
Input: pckt = The packet to forward.
Output: The next-hop selection to apply on pckt.
H is a hash function

1: $L \leftarrow \llcorner \log B(2^X) \lrcorner$
2: $c_f \leftarrow$ ExtractControllableFields(pckt)
3: $u_f \leftarrow$ ExtractUncontrollableFields(pckt)
4: ttl $\leftarrow$ ExtractTTL(pckt)
5: $p \leftarrow F^{-1}(cb)$
6: $n_i \leftarrow \llcorner p / B^{(ttl \bmod L)} \lrcorner - H(u_f \,||\, ttl) \bmod L$
7: if $n_i < Ni$ then
8: return n_i
9: else
10: return $H(u_f \,||\, c_f \,||\, ttl) \bmod N_i$
11: end if

[0044] The Pseudocode showing the path selector Construction:

Input: path = A set (ttl_i, n_i), where ttl_i is the TTL of the packet when received by router i on the path and ni the next-hop selection that should be undertaken by router i.
Input: u_f = The uncontrollable fields the source needs to use to send a packet.
Output: The path selector to use to force a packet to follow the path using the uncontrollable fields u_f .
H is a hash function

1: $L \leftarrow \llcorner \log B(2^X) \lrcorner$

2: $p \leftarrow 0$

3: for $(ttl_i, n_i) \in$ path do

4: $p \leftarrow p + (n_i + H(u_f \,||\, ttl_i) \bmod B) \times B^{(ttl \bmod L)}$

5: end for

6: return p

[0045] Fig.4 shows the results obtained by the applicant when performing simulations comparing methods according the inventions and known methods. The graph shows the cumulative distribution function CDF [%] in function of the load repartition [% packets] for deviations from an optimal distribution 50%/50% amongst two possible next-hops. The two first curves starting from the left of the graph are for methods according to the invention (Controllable per-Flow Load Balancing CFLB) using block ciphers Skip32 and RC5 respectively. The third and fourth curves represent the results obtained with known hash-based load balancers MD5 and CRC16 respectively. Each method was simulated using realistic traces and evaluated the fraction of packets forwarded to each next hop. The simulations were based on the CAIDA passive traces collected in July 2008 at an Equinix data center in San Jose, CA (SHANNON, C., ABEN, E., CLAFFY, K., AND ANDERSEN, D. The CAIDA Anonymized 2008 Internet Traces – 2008-07-17 12:59:07 - 2008-07-1714:01:00. http://www.caida.org/data/passive/passive_2008_dataset.xml) To analyze how the method of the invention balances the non-controlled traffic compared to hash-based techniques, 10 million packets (extracted from the CAIDA traces) were forwarded through one load balancer performing a distribution among N = 2 next hops using either methods according to the invention or classical hash functions . Fig. 4 shows the result of this simulation (computed every second). There are three observations resulting from Fig. 4. First, using CRC16 as a hash-based load balancer gives a rather poor distribution of packets. Second, as the maximum deviation value never goes up to 4% of packets, the load distribution among the two output links is close to an equal 50/50 % repartition of traffic for all evaluated techniques except CRC16. Third,

the methods according to the invention,(CFLB-Skip32 and CFLB-RC5) whatever the block cipher used, achieve an equivalent load distribution as a hash-based load balancer using MD5. The applicant did not observe a significant impact on the quality of the load distribution according to the B (radix of the path selector) value used. In conclusion, it was shown that the method according to the invention allows obtaining a good load balancing in a controllable way.

[0046] It has been experienced that the invention can be used advantageously in a MultiPath TCP-enabled network. MultiPath TCP (MPTCP) is an extension to TCP that splits a data stream over multiple TCP subflows while still presenting a standard TCP socket API to applications (FORD, A., RAICIU, C., HANDLEY, M., AND BONAVENTURE, O. TCP Extensions for Multipath Operation with Multiple Addresses. Internet draft, draft-ietf-mptcp-multiaddressed-09, IETF, June 2012.). MultiPath TCP associates each TCP subflow (identified by its 5-tuple) to its MPTCP-session identified by a token which is exchanged within the first subflow establishment. The token enables the use of any arbitrary port number in subsequent new TCP subflows, as the token uniquely associates the TCP subflow to its corresponding MPTCP session and not the 5-tuple. If MultiPath TCP is used, the source and destination port of the TCP header can thus be used as controllable bits in the method of the invention allowing the latter to encode more next-hop selections within the path selector.

[0047] The terms and descriptions used herein are set forth by way of illustration only and are not meant as limitations. Those skilled in the art will recognize that many variations are possible within the spirit and scope of the invention as defined in the following claims, and their equivalents, in which all terms are to be understood in their broadest possible sense unless otherwise indicated. More specifically, the examples above are given in the context of an IPv4, but the invention applies as well to IPv6 networks, MPLS networks, and TRILL networks. As a consequence, all modifications and alterations will occur to others upon reading and understanding the previous description of the invention. In particular, dimensions, materials, and other parameters, given in

the above description may vary depending on the needs of the application.

[0048] The work leading to this invention has received funding from the European Union Seventh Framework Programme (FP7) under grant agreement n° 257422.

CLAIMS

1. A method for sending a packet, said packet comprising a header, from a sender to a receiver in a data communication network comprising one or more routers, one or more routers having two or more available next hops leading to said receiver,
characterized in that :
- a function F encoding a sequence of X bits into another sequence of X bits is selected, said function being invertible;
- the sender performs the steps of
    - selecting a preferred next hop for each of said one or more routers;
    - grouping each of said preferred next hops in a path selector, said path selector having a length X in bits ;
    - applying the inverse of said function F to said path selector and storing the result in a first subset of said header;
    - sending said packet across said data communication network;
- one router of the one or more routers performs the steps of
    - applying said function F to said first subset of said header for obtaining the original path selector;
    - extracting from said path selector the preferred next hop selected by the sender for said one router;
    - sending said packet through said preferred next hop.

2. The method of claim 1 characterized in that said function F is selected among the functions where at least 40% of the output bits change wherever a single bit in the input is changed.

3. The method according to any of preceding claims characterized in that said function F is selected among the functions where at least 50% of the output bits change wherever a single bit in the input is changed.

4. The method according to any of preceding claims wherein

- the sender initiates a counter TTL and stores said counter in a second subset of said packet header;
- each successive router in the network receiving a packet decrements said counter TTL;

characterized in that

- a router having two or more available next hops uses said counter for extracting from said path selector the preferred next hop selected by the sender for said one router.

5. The method according to any of preceding claims characterized in that said grouping of each of said preferred next hops in a path selector is performed by a lossless compression method.

6. The method according to any of preceding claims characterized in that said function is a block cipher selected from a group comprising Skip32 and RC5.

7. The method according to any of preceding claims characterized in that said first subset of said header is selected among the group comprising the source port and the destination port.

8. The method according claim 7 characterized in that the group further comprises the source address or a subset thereof, the destination address or a subset thereof, a flow label and an MPLS label.

9. The method according to any of preceding claims characterized in that

- the sender further computes a hash function based on a third subset of said header and adds said hash function to each of

said preferred next hops grouped in said path selector;

- the router further computes the same hash function based on said third subset of said header and adds said hash function to each of said preferred next hops extracted from said path selector.

10. Use of the method of any of claims 1 to 9 in an MultiPath TCP-enabled network.

11. A sender for sending a packet to a receiver in a data communication network characterized in that it comprises means for performing the steps performed by the sender in the method of any of claims 1 to 9.

12. A router for routing a packet to a receiver in a data communication network characterized in that it comprises means for performing the steps performed by the router in the method of any of claims 1 to 9.

13. A network comprising one or more senders according to claim 11 and/or one or more routers according to claim 12.

14. A software comprising means for performing the steps performed by the sender in the method of any of claims 1 to 9 and/or for performing the steps performed by the router in the method of any of claims 1 to 9.

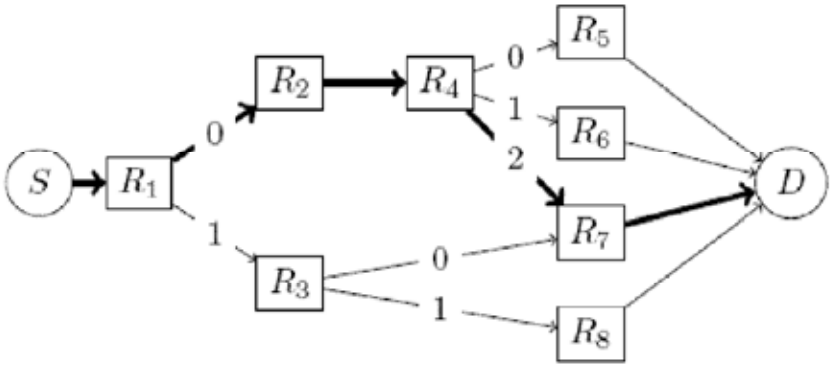


Fig. 1

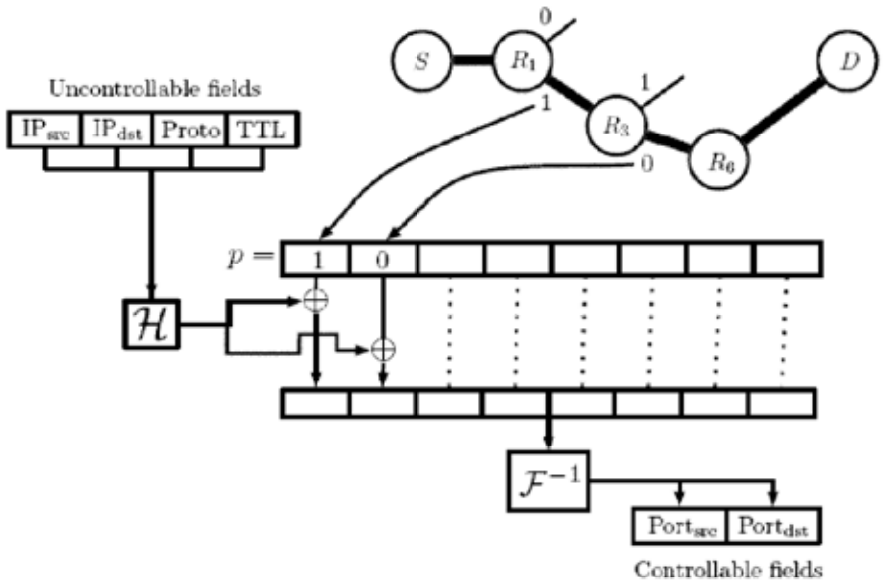

0
S
R_1
D
1
1
R_3
0
R_6
Uncontrollable fields
IP_{src}
IP_{dst}
Proto
TTL
$p =$
1
0
$\mathcal{H}$
$\mathcal{F}^{-1}$
$Port_{src}$
$Port_{dst}$
Controllable fields

Fig. 2

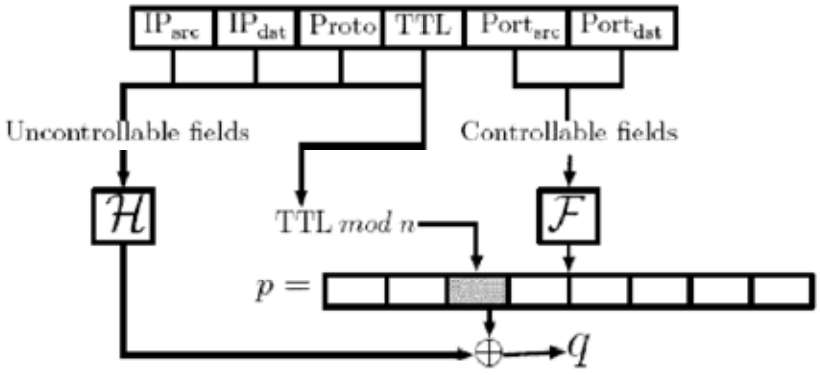

IP_{src}
IP_{dst}
Proto
TTL
$Port_{src}$
$Port_{dst}$
Uncontrollable fields
Controllable fields
$\mathcal{H}$
TTL *mod* n
$\mathcal{F}$
$p =$
q

Fig. 3

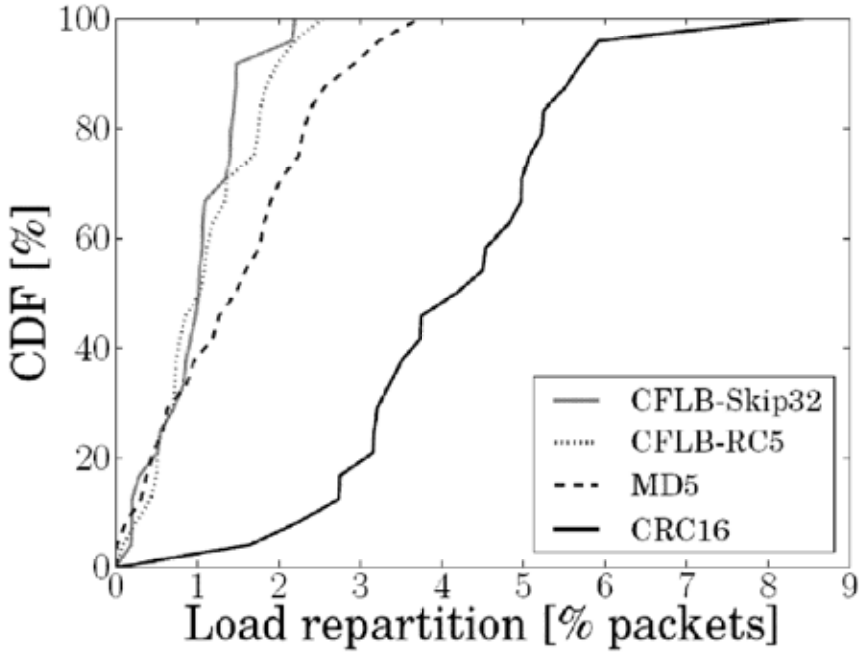

CDF [%]
Load repartition [% packets]
CFLB-Skip32
CFLB-RC5
MD5
CRC16
0
20
40
60
80
100
0
1
2
3
4
5
6
7
8
9

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/065601

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/56
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 721 820 A (ABALI BULENT [US] ET AL) 24 February 1998 (1998-02-24) cited in the application column 1, line 14 - column 5, line 56 -----	1-14
A	US 5 353 283 A (TSUCHIYA PAUL F [US]) 4 October 1994 (1994-10-04) cited in the application column 3, line 49 - column 11, line 8 -----	1-14
A	HOPPS C: "RFC 2992 - Analysis of an Equal-Cost Multi-Path Algorithm", INTERNET CITATION, November 2000 (2000-11), XP002267341, Retrieved from the Internet: URL:http://www.watersprings.org/pub/rfc/rfc2992.txt [retrieved on 2004-01-20] the whole document -----	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ciurel, Cristian

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5721820 A	24-02-1998	NONE	
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(71) Applicants:
- **Tessares SA**
  1348 Louvain-la-Neuve (BE)
- **Université Catholique de Louvain**
  1348 Louvain-La-Neuve (BE)

(72) Inventors:
- **BONAVENTURE, Olivier**
  5030 Gembloux (BE)
- **DETAL, Gregory**
  1360 Thorembais-Saint-Trond (BE)
- **BARRÉ, Sébastien**
  5573 Martouzin-Neuville (BE)

(74) Representative: **Plas, Axel Ivo Michel**
IP HILLS NV
Hubert Frère-Orbanlaan 329
9000 Gent (BE)

(54) METHOD AND DEVICE FOR ESTABLISHING MULTIPATH NETWORK CONNECTIONS

(57) According to an embodiment a method is disclosed for establishing a Multipath TCP (MPTCP) connection comprising a first and second TCP connection between a client and a server. The client performs the steps of: sending a synchronization segment to the server indicative for a request to establish the first and second TCP connection, receiving a synchronization and acknowledgement segment from the server, establishing the first and second TCP connections, sending an acknowledgment segment to the server in order for the server to establish the first and second TCP connection.

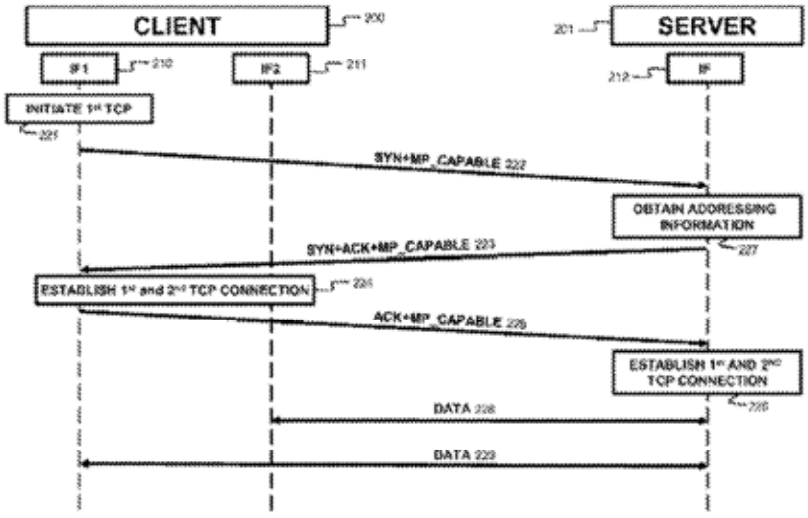


Fig. 2

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Description

Field of the Invention

[0001] The present invention generally relates to field of Multipath network connections. More particular, it relates to the field of establishing Multipath network connections that operate under the Multipath TCP or MPTCP protocol. A version of the protocol is published by the IETF in RFC 6824.

[0002] When a client or initiating node has initiated and established a Multipath TCP connection with a server node, at least two different networking paths exist between the client and server. For a client application running on the client node and communicating with a server application running on the server node, the Multipath TCP connection appears to these applications as a single connection with a single remote networking interface.

Background of the Invention

[0003] The Multipath TCP protocol specification further outlines how a Multipath TCP connection can be established. According to this protocol, first, a single TCP connection between the client and server is established by a handshaking mechanism. During this handshaking mechanism, information on the capabilities and support for the Multipath TCP are exchanged. If one or both of the networking nodes do not support the MPTCP protocol, the connection is maintained as a single TCP connection. If both networking nodes support MPTCP, the client node may initialise a second handshaking mechanism for establishing a second TCP connection, i.e., a TCP subflow or auxiliary TCP connection.

[0004] A problem with establishing an MPTCP connection according to the above protocol is the time delay for establishing the subflows. For example, at least two 3-way handshakes must be performed for respectively establishing the first TCP connection and then the auxiliary TCP connection. That means that at least six messages are exchanged before the MPTCP connection is fully operable and thus before the full bandwidth of the two connections can be used to transfer data. This is especially disadvantageous in situations where connections have a limited lifetime within which data must be transferred as fast as possible. This is for example the case for browsing applications and the connections established with web services by such applications.

Summary of the Invention

[0005] It is an object of the present invention to overcome the above mentioned shortcomings and to provide a way to establish a MPTCP connection within a shorter time span.

[0006] This object is achieved, according to a first aspect, by a method for establishing a Multipath TCP or shortly a MPTCP connection between a client networking node and a server networking node; wherein the Multipath TCP connection comprises a first and one or more auxiliary TCP connections. The method comprises the following steps performed by the client networking node:

- sending a synchronization (SYN) segment to the server indicative for a request to establish the first and the one or more auxiliary TCP connections;
- subsequently receiving a synchronization and acknowledgement (SYN+ACK) segment from the server;
- subsequently establishing the first and the one or more auxiliary TCP connections;
- sending an acknowledgment segment (ACK) to the server in order for the server to establish the first and one or more auxiliary TCP connections.

[0007] Along this disclosure, a client networking node is to be understood as the networking node that initiates or requests a Multipath TCP or MPTCP connection. The server networking node is to be understood as the networking node that receives or serves the request. The client and server networking nodes are not necessarily the endpoints of a communication path. The MPTCP connection may also be established along a section of a communication path, for example between proxy servers or gateways.

[0008] The full MPTCP connection comprising the different subflows is thus established at the client side after the exchange of two messages, i.e., the initial synchronization segment and then the reception of the corresponding acknowledgment from the server. In other words, the client establishes the first and the one or more auxiliary TCP connections based on the synchronization segment and the received acknowledgment. There is thus no further need for additional handshaking messages to be exchanged.

[0009] At the server side, the full MPTCP connection is established after the exchange of the three messages, i.e., the initial synchronization segment, the acknowledgment together with synchronization segment from the server and then the acknowledgment from the client.

[0010] It is thus an advantage of the present invention that a Multipath TCP connection can be established by a single three-way handshake. The number of segments exchanged and the establishment delay is thus independent of the amount of auxiliary TCP connections.

[0011] Furthermore, the exchanged messages may be backward compatible with segments used in the current MPTCP protocol, i.e., respectively the SYN+MP_CAPABLE segment, the SYN+ACK+MP_CAPABLE segment and the ACK+MP_CAPABLE segment. While the message may be the same, the interpretation given to them by the client and server is different, and, therefore, the Multipath TCP connection (and its associated subflows) are established by just a single three-way handshake.

[0012] In the publication "A Measurement-based

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Study of Multipath TCP Performance over Wireless Networks" by Yung-Chih Che et al. In IMC '13 Proceedings of the 2013 conference on Internet measurement conference, page 455-468 another solution is suggested to the problem of the time delay in the MPTCP protocol. In section 4.1.2 of this publication, it is proposed to modify the current MPTCP implementation to allow a client to send SYN segments, that are part of the handshaking mechanism, simultaneously over each of its available communication paths to the server. This solution is different from the proposed method as there is still an exchange of messages over all communication paths before establishing the connections. There is thus still a three-way handshake performed per connection of the Multipath connection. Therefore, the amount of exchanged messages is higher and increases with the amount of auxiliary MPTCP connections. Furthermore, if one network path is slower than the others, it cannot be used to transmit data before the end of the handshake over this path.

[0013] Advantageously, the client comprises a first and one or more second networking interfaces. The first TCP connection is then established over the first networking interface and the one or more auxiliary TCP connections are then established over the respectively one or more second networking interfaces.

[0014] This is the most typical case where Multipath TCP connections are used. By establishing a connection to the server over several interfaces, several communication paths are obtained. These interfaces may correspond to physical networking interfaces, but also to virtual interfaces. The first connection may then for example use the IPv4 IP protocol and an auxiliary connection the IPv6 IP protocol.

[0015] According to an embodiment, the sending and receiving is then performed over the first networking interface.

[0016] In other words, the setup of the MPTCP connection is performed by only exchanging messages over the first networking interface. In this case, the auxiliary connections are setup without exchange of messages over the second interfaces. This is especially advantageous if the first connection is performed over a stable path, for example over a wired interface. This way the connection is established in a fast way. This is also especially advantageous when the performance of the other connections is already known. This is typically the case when other connections have already been established before such that the performance of the connection is already known and further exchange of messages is not necessary in order to estimate the performance.

[0017] Alternatively, the sending of a synchronization segment is performed over the first networking interface and the receiving of a synchronization and acknowledgement segment is performed over the one or more second networking interfaces. Other combinations are also possible. For the exchange of the three-way handshake messages, more than one interface is thus used. This is especially advantageous when the performance of one of the connections is not known. By sending one of the handshake messages over such an interface, an indication of the performance can already be made which is useful for the later MPTCP connection.

[0018] The first TCP connection may further be characterized by first addressing information of the client and of the server and the one or more auxiliary TCP connections may be characterized by second addressing information of the client and of the server.

[0019] As common for TCP, the addressing information may then comprise an IP network address and port number.

[0020] According to an embodiment of the invention, the synchronization segment from the client to the server comprises the first and second addressing information of the client.

[0021] In order for the server to establish the auxiliary TCP connections, it should know the addressing information used at the client side. According to this embodiment, this information is provided along with the synchronization segment from the client. This has the advantage than there is no real restriction on the second address information as it is fully communicated to the server.

[0022] According to an alternative embodiment, the method comprises the further step of sending the second addressing information of the client to the server over an out-of-band communication channel with the server.

[0023] In this case, the server does not receive the second addressing information in the handshake messages of the first or auxiliary TCP connection, but over a separate or alternative channel. For example, there may be a dedicated out-of-band connection between the client and server for exchanging the second addressing information. Such a connection may for example be a part of a management application running on both client and server. This is especially advantageous in the case where many MPTCP connections are setup between the client and the server.

[0024] According to another alternative embodiment, there is a predefined logical relationship for deriving the second addressing information.

[0025] In other words, the server may derive the second addressing information based on an agreement or rule on how to derive the second addressing information. For example, a mathematical relationship may exist between the first and second addressing information. Or, according to another example, the second addressing information may be derived from previous connections where the same second addressing information for identical first addressing information.

[0026] According to an embodiment the server corresponds to an Access Gateway and the client corresponds to a multi-homed Customer Premises Equipment (CPE). Both the Access Gateway and Customer Premises Equipment then reside within an access network.

[0027] In such a case, the CPE is typically referred to

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as multi-homed equipment because of the different networking interfaces and thus the different possibilities to connect to an access network. The Access Gateway provides wide area or internet access to devices within the access network, i.e., devices in the access network can access outside networks through the Access Gateway.

[0028] It is a further advantage to perform the above method in order to provide network access to multi-homed CPE because in such environment, where a lot of MPTCP communication sessions will be established between the CPE and the Access Gateway. By using the method according to the invention in such an access network the overall delay in establishing the connections and the amount of messages exchanged is heavily reduced.

[0029] In such an access network, the first Multipath TCP connection may for example be established over a wired subscriber line providing network connectivity between the CPE and the Access Gateway. Examples of wired subscriber line technologies are DSL or Digital Subscriber Lines such as ADSL and VDSL, cable lines and optical fibre. The auxiliary connections may then be established over wireless communication interface. This way, an auxiliary MPTCP connection is established over this wireless interface. The wireless interface may for example use a mobile data communication technology such as for example GSM, CDMA, GPRS, EDGE and LTE in order to establish the connection with the server node, i.e., with the Access Gateway.

[0030] According to a second aspect, the invention relates to a corresponding method for establishing a Multipath TCP connection between a client networking node and a server networking node. The Multipath TCP connection comprises a first and one or more auxiliary TCP connections; the method comprising the following steps performed by the server networking node:

- receiving a synchronization segment from the client indicative for a request to establish the first and the one or more auxiliary TCP connections;
- retrieving first addressing information for the first TCP connection from the synchronization segment;
- obtaining second addressing information for the one or more auxiliary TCP connections;
- sending a synchronization and acknowledgement segment to the client in order for the client to establish the first and the one or more auxiliary TCP connections;
- receiving an acknowledgment segment from the client;
- subsequently establishing the first and the one or more auxiliary TCP connections based on the first and second addressing information.

[0031] According to an embodiment, the synchronization segment from the client to the server comprises the second addressing information of the client and the obtaining step further comprises retrieving the second addressing information from the synchronization segment.

[0032] According to an alternative embodiment, the obtaining comprises receiving the second addressing information from the client over an out-of-band communication channel with the client.

[0033] According to a third aspect, the invention relates to a client networking node configured to perform the method according to the first aspect.

[0034] According to a fourth aspect, the invention relates to a server networking node configured to perform the method according to the second aspect.

[0035] According to a fifth aspect, the invention relates to a network comprising the client networking node according to the third aspect and a server networking node according to the fourth aspect.

[0036] According to a sixth aspect, the invention relates to a computer program product comprising computer-executable instructions for performing the method according to the first and/or second aspect when the program is run on a computer.

[0037] According to a seventh aspect, the invention relates to a computer readable storage medium comprising the computer program product according to the sixth aspect.

[0038] According to an eighth aspect, the invention relates to a data processing system programmed for carrying out the method according to first or second aspect.

Brief Description of the Drawings

[0039]

Fig. 1 illustrates a multiple 3-way handshaking mechanism for establishing a Multipath TCP connection according to the state of the art;

Fig. 2 illustrates a single 3-way handshaking mechanism for establishing a Multipath TCP connection according to a first embodiment of the invention; and

Fig. 3 illustrates a single 3-way handshaking mechanism for establishing a Multipath TCP connection according to a second embodiment of the invention; and

Fig. 4 illustrates an access network for providing network access comprising a client and server according to an embodiment of the invention.

Fig. 5 illustrates a suitable computing system 500 as a further embodiment of the client and/or server according to Fig. 2, 3 and 4.

Detailed Description of Embodiments

[0040] The present invention relates to the establishment of Multipath TCP connections. TCP is a connection-oriented transport protocol defined in RFC793. In TCP,

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a connection is created by exchanging three segments:

- a SYN or synchronization segment from the client to the server;
- a SYN+ACK segment or synchronization with acknowledgment from the server to the client;
- an ACK segment or acknowledgment from the client to the server.

[0041] With this three-way handshake, key information is negotiated about the TCP connection such as the utilisation of certain options and the initial sequence numbers. Once established, the connection is identified by the following information:

- the network address of the client;
- the network address of the server;
- the source port on the client;
- the destination port on the server.

[0042] Multipath TCP is an extension to TCP defined in RFC6824. Multipath TCP allows a TCP connection to exchange data between client and server over multiple network paths by exchanging data over multiple TCP connections that appear to an application as a single TCP connection. A typical example of its application is a smartphone that is connected over both a WiFi and a 3G interface. To establish a Multipath TCP connection, several 3-way handshakes are used, i.e., one handshake per connection. This process is illustrated in Fig. 1 for a Multipath TCP connection comprising of a first and auxiliary TCP connection:

- An application on the client 100 opens a TCP socket. Upon creation of the socket, the networking stack initiates in step 121 the setup of a first TCP connection by its first networking interface 100.
- The client 100 sends a synchronization segment 122 in which it indicates that it has Multipath capabilities, shortly referred to as a SYN+MP_CAPABLE segment 122.
- The server 101 receives the segment 122 over its networking interface 112 and now knows the addressing information of the client, i.e., the address and port number of the client for this first TCP connection.
- The server acknowledges the segment 122 by returning a SYN+ACK+MP_CAPABLE segment 123. This segment also indicates that the server 101 supports Multipath TCP and comprises the addressing information of the server for the first TCP connection.
- Upon reception of the segment 123, the client 100 establishes the first TCP connection.
- Thereupon, the client 100 acknowledges the segment 123 by returning the ACK+MP_CAPABLE segment 125.
- Upon reception of segment 125, server 101 establishes the first TCP connection.
- Then, at some point in time, the client 100, i.e., the networking stack of the client 100, decides to initiate in step 131 the second or auxiliary TCP connection over a second communication path, i.e., over the second networking interface 111 of the client.
- It does this by sending a SYN+MP_JOIN segment 132 to the server 101. This segment comprises the addressing information of the client for the auxiliary connection and also identifies that the auxiliary connection is part of the Multipath TCP connection.
- In return, the server 101 sends a SYN+ACK+MP_JOIN segment 133 to the client's second networking interface 111.
- Upon reception, the client now has the addressing information of the server for the auxiliary connection and establishes in step 134 the second or auxiliary TCP connection.
- Thereupon, the client 100 acknowledges the establishment 134 by the ACK+MP_JOIN segment 135 to the server 101.
- Upon reception of this segment 135, the server also establishes in step 136 the second or auxiliary TCP connection.

[0043] Fig. 2 illustrates the establishment of a Multipath TCP connection between a client 200 and a server 201 according to an embodiment of the invention. The client 200 comprises two networking interfaces 210 and 211 for establishing the subflows of the Multipath TCP connection, i.e., the first TCP connection and the auxiliary TCP connection. At some point in time, an application running on the client 200 needs a TCP connection with server 201 and therefore opens a TCP socket with the server between the first networking interface 210 and the networking interface 212 of the server.

[0044] Upon the opening of the socket, the networking stack of the client 200 initiates in step 221 the first TCP connection of the Multipath TCP connection. In order to do so, the client sends an SYN+MP_CAPABLE segment 222 to the server's networking interface 212. The server then receives the segment 222 and retrieves the addressing information of the client from the segment 222, i.e., the network address and port of the networking interface 210. The server then also obtains under step 227 the addressing information of the client 200 of the auxiliary TCP connection of the Multipath TCP connection, i.e., the network address and port number of the second networking interface 211. There are different possibilities for doing so as further outlined below.

[0045] The reception of segment 222 is interpreted by the server as a request to setup the Multipath TCP connection, i.e., to setup both the first and auxiliary TCP connections. It is thus not only an indication that the client 200 supports Multipath TCP as is the case in the solution shown in Fig. 1. The request may be directly included in the first segment 222, for example by including it in segment 222. Alternatively, the request may also be done indirectly, for example by a predefined setting in the serv-

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er that segments 222 should always be considered as such a request. This is particularly useful in controlled network environments where connecting clients and servers are known beforehand. The client 200 may also alter or set such a setting through an out-of-band connection or channel between the client and the server as set out further below.

[0046] When the request is included in segment 222, this may be done in several ways. One way is to define a new TCP option that includes such a request. Another possibility is to place the request inside the payload of the SYN segment. Yet another possibility is to place the request inside an option in the network packet, i.e., as an IP option. This is especially advantageous in IPv6 where there is no strict limit on the length of such an option and thus on the length of the request.

[0047] The server then replies with a SYN+ACK+MP_CAPABLE segment 223. This segment 223 acknowledges the reception of the first segment 222. As it originates form the server, it also comprises the addressing information from the server for the first TCP connection, i.e., the network address and port number. At that moment, the client 200 has thus a confirmation that the server 201 is ready for the Multipath TCP connection and that the server has all the information, i.e., the addressing information of the client for the first and auxiliary connections. Therefore, under step 224, the client 200 established both the first and auxiliary TCP connection.

[0048] Thereafter, the client 200 confirms the establishment with the ACK+MP_CAPABLE segment 225 to the server. Upon reception, the server has confirmation that the client 200 is ready for the Multipath TCP connection and also establishes the first and auxiliary TCP connections under step 226. Once the Multipath TCP connection has been setup on both client and server, data packets 228,229 may be exchanged between client 200 and server over both networking interface 210 and 211 and thus over both the first and auxiliary TCP connections.

[0049] According to the method illustrated in Fig. 2, the server 201 performs the step 227 for obtaining the addressing information of the client. According to embodiments of the invention, the obtaining the addressing information of the client for the auxiliary TCP connection may be performed in several ways as described below.

[0050] In a first way of performing the obtaining step 227, the addressing information is comprised in the SYN+MP_CAPABLE segment 222 and the server then retrieves this information from the segment. According to a first example a new TCP option is defined that includes this addressing information. According to a second example the addressing information is embedded as payload data in the SYN segment. According to a third example, the addressing information is embedded as an option in the network packet, i.e., as an IP option. This is especially advantageous in IPv6 where there is no strict limit on the length of such an option and thus on the length of the addressing information. The embedding of the addressing information may further be combined with the embedding of the request as outlined above. Preferably the addressing information is provided such that backwards compatibility with the MPTCP protocol is guaranteed.

[0051] In a second way of performing the obtaining step 227, the addressing information is provided by the client 200 to the server 201 by an out-of-band communication mechanism or channel, i.e., by communication between the server 201 and client 200 outside of the Multipath TCP connection or of the handshaking performed for establishing the Multipath TCP connection. For example, a separate connection may exist between client and server to exchange further information about the Multipath TCP connection. Such a connection may be used by management applications running on both the client 200 and server 201 that manage the establishment of the Multipath TCP connections.

[0052] In a third way of performing the obtaining step 227, the addressing information is independently derived by the server 201 by a predefined logical relationship for deriving the addressing information, i.e., according to a predefined rule indicating how the addressing information can be derived. Some examples of such a rules are:

- There is a mathematical relationship between de network address and/or port of the client for the two connections. For example, the network address and/or port for the auxiliary connection may be obtained by incrementing the network address and/or port for the first connection.
- The addressing information is identical as used for previous connections that used the same addressing information of the client for the first connection.

[0053] In any of proposed ways, If the client 200 sends the data packets 228, 229 to the server, the server is able identify the Multipath TCP connections to which the data packets belong by inspecting the address and port information in the data packets.

[0054] Fig. 3 illustrates the establishment of a Multipath TCP connection between a client 300 and a server 301 according to an embodiment of the invention. The performed steps and exchanged segments are identical to the ones of Fig. 2. Only the differences between the two embodiments will now be described. According to this embodiment, the server 301 acknowledges the SYN+MP_CAPABLE segment 322 by the SYN+ACK+MP_CAPABLE segment 323. However, this segment 323 is now sent to the second networking interface 311, i.e., over the communication path for the auxiliary TCP connection. In order to do so, the server uses the addressing information for the auxiliary TCP connection that was obtained in the obtaining step 327. After the establishment 324 of the first and auxiliary connection, the client 300 then acknowledges the segment 323 by the ACK+MP_CAPABLE segment 325. This segment

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325 is again sent over the second networking interface 311 to the server. Alternatively, segment 325 may be sent over the first networking interface 310. An advantage of this embodiment is that both the client and server may use the fastest path during the setup, i.e., during the 3-way handshake. The fastest path may further be different for client and server. This is typically the case if the links are asymmetric, for example when an asymmetric DSL link with a slow upstream is combined with a symmetric but expensive LTE network. Another advantage is that the client directly obtains the addressing information of the server 301 for the auxiliary connection.

[0055] According to further embodiments, the segments may also be redundantly exchanged over both connections at the same time. This improves stability because if one of the segments is dropped, the other redundant segment may still arrive. Furthermore, if the segment 222 or 322 is sent redundantly to the server in this way, the server directly obtains the addressing information of the client for both the first and auxiliary connection. This way, the obtaining steps 227 or 327 may be performed by just retrieving the addressing information from respectively each of the redundant segments.

[0056] According to a further embodiment, the server may further comprise more than one networking interface. In this case, the first TCP connection is setup between the first networking interface 210 or 310 of the client and a first networking interface of the server. Similarly, the auxiliary TCP connection is then setup between the second networking interface 211 or 311 of the client and a second networking interface of the server.

[0057] According to a further embodiment, the client 200 or 300 and server 300 or 301 are further part of an access network for providing network access and thus internet access to customers. This is further illustrated in Fig. 4. The client 200 or 300 then corresponds to a Customer Premises Equipment 400 or shortly CPE. By the CPE 400, a network operator provides network access to a subscriber by the access network 402 to an outside network 403 such as for example the internet. The CPE 400 connects client devices 404 to the network 403 by more than one network interface, for example by a wired interface 406 and wireless interface 407. The server 201 or 301 further corresponds to an Access Gateway 401 or shortly AG that connects the outside network 403 with the access network 402.

[0058] By using the access network, a client device 404 may then setup a network connection with the server application 405. In order to increase the network bandwidth and reliability, a Multipath TCP connection is setup between the CPE 400 and the AG 401 according to the embodiments described above. As only one three-way handshake is needed to setup the Multipath TCP connection, the delay for doing so will be the same as for a normal single TCP connection. This way, the client device 404 will benefit from the increased bandwidth offered by the auxiliary connection without suffering from an increased delay for this bandwidth to become available.

[0059] According to yet another embodiment, the client device may correspond to a mobile communication device comprising a plurality of wireless network interfaces such as for example a WiFi interface and an interface for cellular data communication. A MPTCP connection may then be established over both these interfaces.

[0060] Fig. 5 shows a suitable computing system 500 as a further embodiment of the client 200, 300, 400 or server 201, 301, 401. Computing system 500 may in general be formed as a suitable general purpose computer and comprise a bus 510, a processor 502, a local memory 504, one or more optional output interfaces 516, a communication interface 512, a storage element interface 506 and one or more storage elements 508. Bus 510 may comprise one or more conductors that permit communication among the components of the computing system 500. Processor 502 may include any type of conventional processor or microprocessor that interprets and executes programming instructions. Local memory 504 may include a random access memory (RAM) or another type of dynamic storage device that stores information and instructions for execution by processor 502 and/or a read only memory (ROM) or another type of static storage device that stores static information and instructions for use by processor 502. Storage element interface 506 may comprise a storage interface such as for example a Serial Advanced Technology Attachment (SATA) interface or a Small Computer System Interface (SCSI) for connecting bus 510 to one or more storage elements 508, such as one or more local disks, for example SATA disk drives, and control the reading and writing of data to and/or from these storage elements 508. Although the storage elements 508 above is described as a local disk, in general any other suitable computer-readable media such as a solid state drive or flash memory cards could be used. The system 500 described above can also run as a Virtual Machine above the physical hardware. The steps performed on the client and server devices according to the above embodiment may be partly or completely implemented as programming instructions to be run on processor 502. Communication interface 512 may further correspond to the client's or server's networking interfaces 210, 211, 212, 310, 311, 312, 406, 407. For example, when the system 500 is embodied as a client 200 or 300, it may communicate with server 501 over networking interface 512. The client will then comprise a plurality of such interfaces 512 for establishing the TCP connections.

[0061] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by

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the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element, such as a computer system, a processor, or another integrated unit may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. Method for establishing a Multipath TCP connection between a client networking node (200, 300, 400) and a server networking node (201, 301, 401); wherein the Multipath TCP connection comprises a first and one or more auxiliary TCP connections; the method comprising the following steps performed by the client networking node:

   - sending a synchronization segment (222, 322) to the server indicative for a request to establish the first and the one or more auxiliary TCP connections;
   - subsequently receiving a synchronization and acknowledgement segment (223, 323) from the server;
   - subsequently establishing (224, 324) the first and the one or more auxiliary TCP connections;
   - sending an acknowledgment segment (225, 325) to the server in order for the server to establish (226, 326) the first and one or more auxiliary TCP connections.

2. Method according to claim 1 wherein the client comprises a first (210, 310, 406) and one or more second networking interfaces (211, 311, 407); and wherein the first TCP connection is established over the first networking interface and wherein the one or more auxiliary TCP connections is established over the respectively one or more auxiliary networking interfaces.

3. Method according to claim 2 wherein the sending and receiving is performed over the first networking interface (210).

4. Method according to claim 2 wherein the sending a synchronization segment (322) is performed over the first networking interface (310) and the receiving a synchronization and acknowledgement segment (323) is performed over the one or more second networking interfaces (311).

5. Method according to any one of the preceding claims wherein the first TCP connection is **characterized by** first addressing information of the client and of the server; and wherein the one or more auxiliary TCP connections are **characterized by** second addressing information of the client and of the server.

6. Method according to claim 5 wherein the synchronization segment from the client to the server comprises the first and second addressing information of the client.

7. Method according to claim 5 further comprising the step of sending the second addressing information of the client to the server over an out-of-band communication channel with the server.

8. Method according to claim 5 wherein there is a predefined logical relationship for deriving the second addressing information.

9. Method according to anyone of the preceding claims wherein the server corresponds to an Access Gateway (401) and the client corresponds to a multi-homing Customer Premises Equipment (400); and wherein the Access Gateway and Customer Premises Equipment are within an access network (402).

10. Method for establishing a Multipath TCP connection between a client networking node (200, 300, 400) and a server networking node (201, 301, 401); wherein the Multipath TCP connection comprises a first and one or more auxiliary TCP connections; the method comprising the following steps performed by the server networking node:

    - receiving a synchronization segment (222, 322) from the client indicative for a request to establish the first and the one or more auxiliary TCP connections;
    - retrieving first addressing information for the first TCP connection from the synchronization

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segment;
- obtaining (227, 327) second addressing information for the one or more auxiliary TCP connections;
- sending a synchronization and acknowledgement segment (223, 323) to the client in order for the client to establish (224, 324) the first and the one or more auxiliary TCP connections;
- receiving an acknowledgment segment (225, 325) from the client;
- subsequently establishing (226, 326) the first and the one or more auxiliary TCP connections based on the first and second addressing information.

11. Method according to claim 10 wherein the synchronization segment from the client to the server comprises the second addressing information of the client; and wherein the obtaining step comprises retrieving the second addressing information from the synchronization segment.

12. Method according to claim 10 wherein the obtaining comprises receiving the second addressing information from the client over an out-of-band communication channel with the client.

13. Client networking node (200, 300, 400) configured to perform the method according to any one of claims 1 to 9.

14. Server networking node (201, 301, 401) configured to perform the method according to any one of claims 10 to 12.

15. System (402) comprising the client networking node (400) according to claim 13 and a server networking node (401) according to claim 14.

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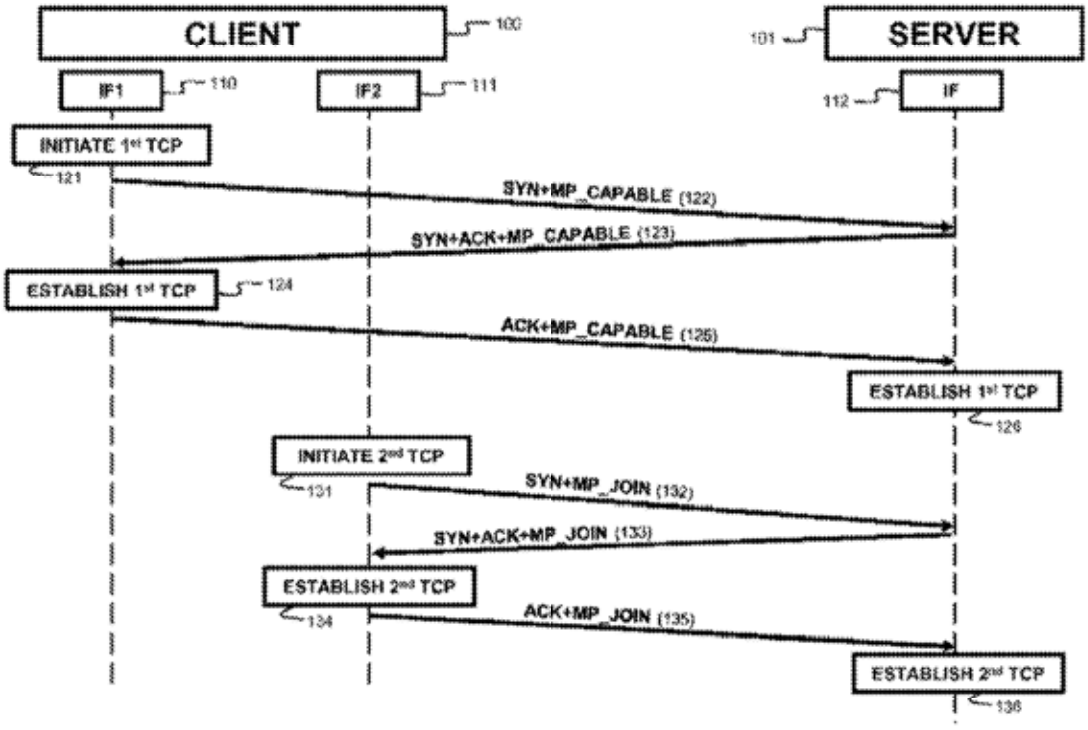


Fig. 1 – PRIOR ART

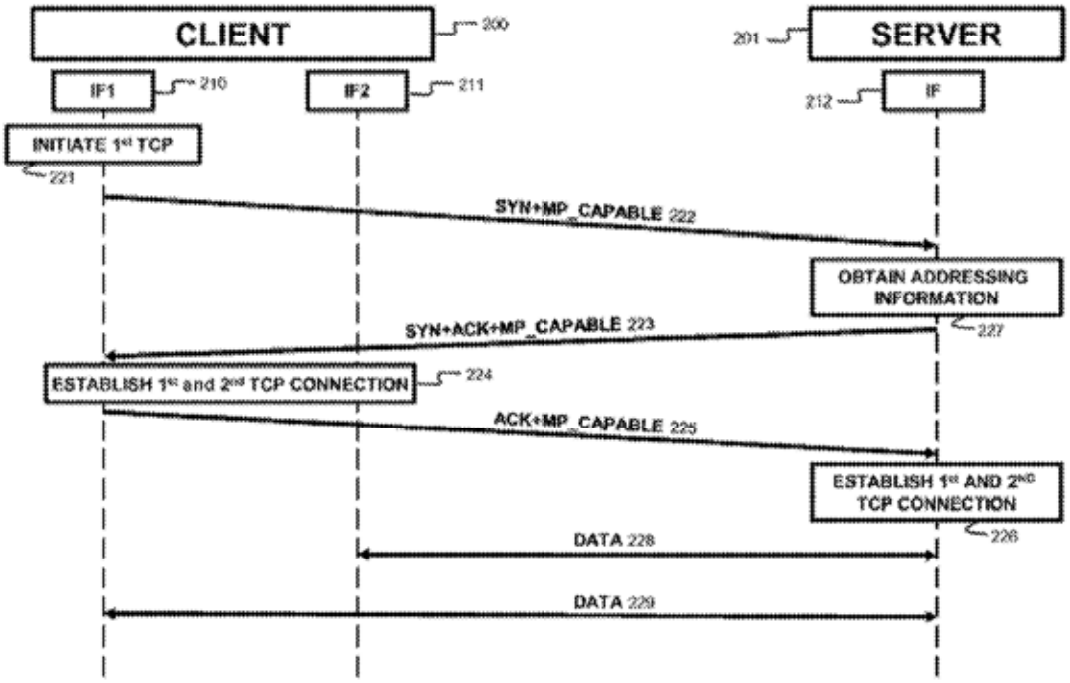

CLIENT
200
SERVER
201
IF1
210
IF2
211
212
IF
INITIATE 1st TCP
221
SYN+MP_CAPABLE 222
OBTAIN ADDRESSING INFORMATION
227
SYN+ACK+MP_CAPABLE 223
ESTABLISH 1st and 2nd TCP CONNECTION
224
ACK+MP_CAPABLE 225
ESTABLISH 1st AND 2ND TCP CONNECTION
226
DATA 228
DATA 229

Fig. 2

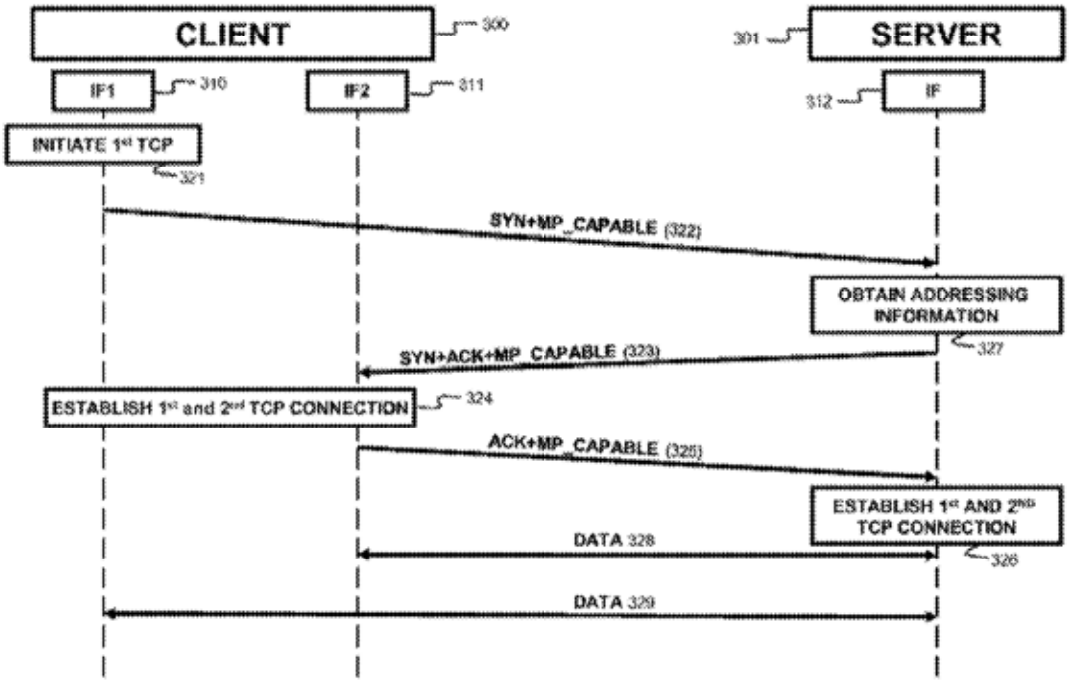

CLIENT
300
SERVER
301
IF1
310
IF2
311
IF
312
INITIATE 1st TCP
321
SYN+MP_CAPABLE (322)
OBTAIN ADDRESSING INFORMATION
327
SYN+ACK+MP_CAPABLE (323)
ESTABLISH 1st and 2nd TCP CONNECTION
324
ACK+MP_CAPABLE (325)
ESTABLISH 1ST AND 2ND TCP CONNECTION
326
DATA 328
DATA 329

Fig. 3

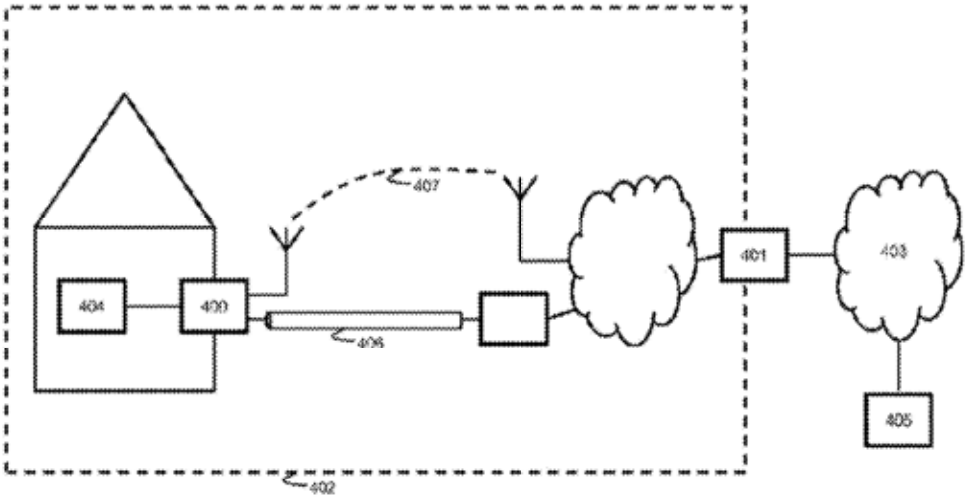


Fig. 4

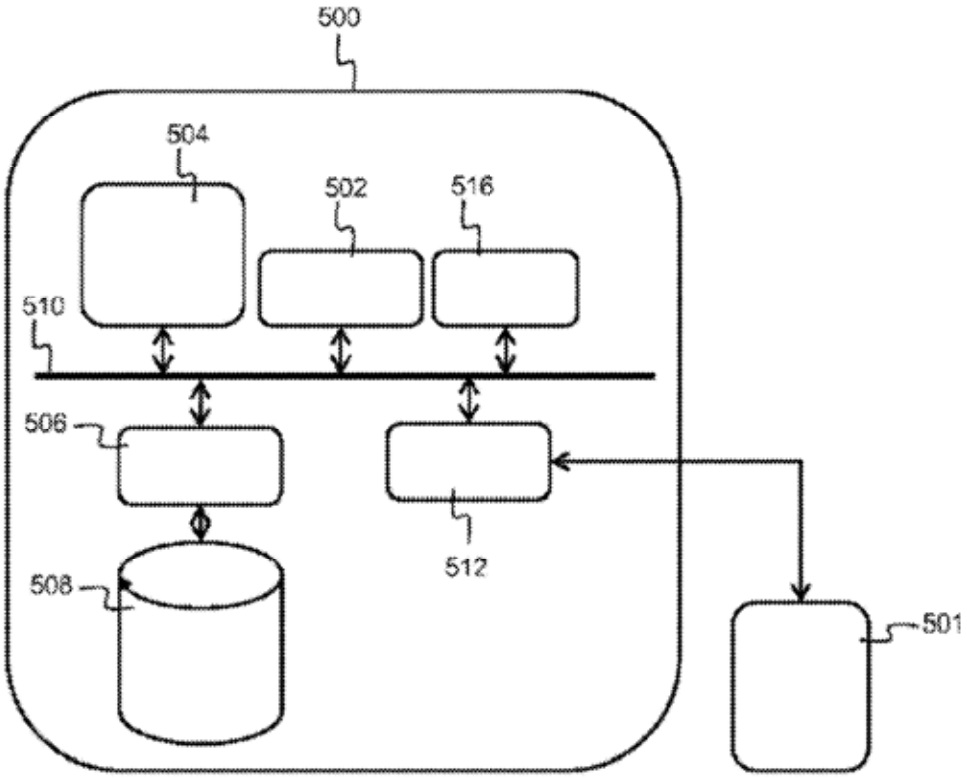


Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 7769

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	YUNG-CHIH CHEN ET AL: "A measurement-based study of MultiPath TCP performance over wireless networks", PROCEEDINGS OF THE 2013 CONFERENCE ON INTERNET MEASUREMENT CONFERENCE, IMC '13, 1 January 2013 (2013-01-01), pages 455-468, XP055256395, New York, New York, USA DOI: 10.1145/2504730.2504751 ISBN: 978-1-4503-1953-9 * abstract * * page 1 - page 4 * * page 8 - page 9 * -----	1-15	INV. H04L29/06
Y	WO 2015/094043 A1 (ERICSSON TELEFON AB L M [SE]) 25 June 2015 (2015-06-25) * figures 2,3,5a * * page 2, line 19 - page 2, line 26 * * page 9, line 11 - page 12, line 27 * -----	1-15	
A	US 2015/215345 A1 (AGARWAL KANAK B [US]) 30 July 2015 (2015-07-30) * figure 4 * * paragraph [0065] - paragraph [0081] * ----- -/--	1-15	TECHNICAL FIELDS SEARCHED (IPC) H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 March 2016	Gutiérrez García, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EUROPEAN SEARCH REPORT

Application Number
EP 15 18 7769

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FORD CISCO C RAICIU U POLITECHNICA OF BUCHAREST M HANDLEY U COLLEGE LONDON O BONAVENTURE U CATHOLIQUE DE LOUVAIN A: "TCP Extensions for Multipath Operation with Multiple Addresses; rfc6824.txt", TCP EXTENSIONS FOR MULTIPATH OPERATION WITH MULTIPLE ADDRESSES; RFC6824.TXT, INTERNET ENGINEERING TASK FORCE, IETF; STANDARD, INTERNET SOCIETY (ISOC) 4, RUE DES FALAISES CH- 1205 GENEVA, SWITZERLAND, 17 January 2013 (2013-01-17), pages 1-64, XP015086539, [retrieved on 2013-01-17] * page 14 - page 35 *	1-15	
A	US 2013/195004 A1 (HAMPEL KARL GEORG [US]) 1 August 2013 (2013-08-01) * paragraph [0069] - paragraph [0071] *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 March 2016	Gutiérrez García, J

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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 18 7769

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-03-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2015215345 A1	30-07-2015	NONE	
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REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- RFC 6824. IETF **[0001]**
- **YUNG-CHIH CHE et al.** A Measurement-based Study of Multipath TCP Performance over Wireless Networks. *IMC '13 Proceedings of the 2013 conference on Internet measurement conference,* 2013, 455-468 **[0012]**

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Office européen des brevets

(11) EP 3 255 845 A1

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(71) Applicant: **Tessares SA**
1348 Louvain-la-Neuve (BE)

(72) Inventors:
- **BONAVENTURE, Olivier**
  5030 Gembloux (BE)
- **DETAL, Gregory**
  1360 Thorembais-Saint-Trond (BE)
- **BARRÉ, Sébastien**
  5573 Martouzin-Neuville (BE)
- **PEIRENS, Bart**
  1030 Brussel (BE)

(74) Representative: **Plas, Axel Ivo Michel**
IP HILLS NV
Hubert Frère-Orbanlaan 329
9000 Gent (BE)

(54) MULTIPATH TCP IN HYBRID ACCESS NETWORKS

(57) A method is disclosed for exchanging data over a TCP connection (234) between a client node (100) and a networking node (103). The TCP connection comprises a primary MPTCP subflow (122) between a customer premises equipment, a HCPE (101), and a hybrid access gateway, a HAG (102). The method comprises, by the HCPE, converting (410, 413) first TCP segments (401, 406) to first MPTCP segments (402, 405) of the primary MPTCP subflow and vice versa, and using destination address information of the first TCP segments as destination address information of the first MPTCP segments, and using source address information of the first MPTCP segment as source address information of the first TCP segments. The method further comprises, by the HAG, converting (411, 412) second TCP segments (403, 404) to second MPTCP segments (402, 405) of the primary subflow and vice versa while preserving source and destination address information.

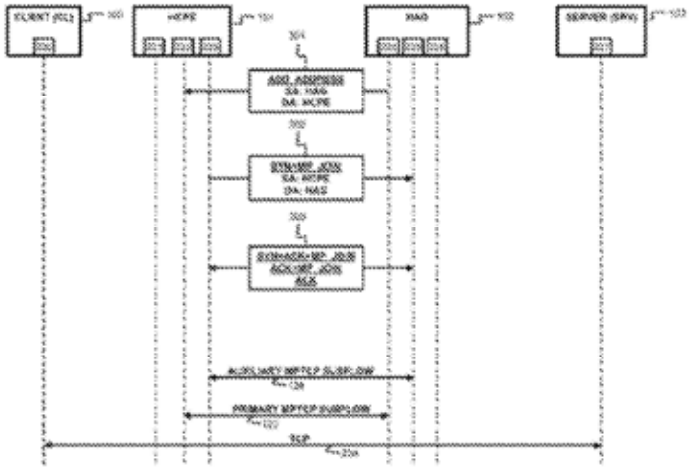


Fig. 3

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Description

Field of the Invention

[0001] The present invention generally relates to field of network connectivity provided to clients by a hybrid access network. In such a hybrid access network, a client can access a server in an outside network such as the Internet by a Hybrid Customer Premises Equipment or HCPE that connects to a Hybrid Access Gateway or HAG over more than one access network.

[0002] More particularly, the invention relates to providing Multipath TCP capabilities between such a HCPE and HAG within a single path TCP connection between the client and server.

Background of the Invention

[0003] A Customer Premises Equipment connects clients or local networks to an access network of an Internet Service Provider or ISP. The ISP then provides internet access to the clients by connecting the access network with the Internet through a gateway over the core network of the provider.

[0004] With the higher bandwidths provided by the latest wireless technologies such as for example LTE, Hybrid Customer Premises Equipments or HCPEs have been introduced providing network access over both wired and wireless technologies. In order to further boost the bandwidth for the user, ways of simultaneously using several access networks have been introduced. One of them is the use of the Multipath TCP (MPTCP) protocol that is specified by the IETF in RFC 6824. The protocol allows to establish a TCP connection between a client and server node. The connection then comprises several subflows, MPTCP subflows, over which the data is transferred.

[0005] However, a shortcoming of the protocol is that both endpoints, i.e., client and server must support MPTCP in order to make full use of it. Therefore, the protocol does not support the establishment of different subflows between intermediary nodes of a TCP connection, such as between the HCPE and the gateway over the different access networks.

[0006] In EP2882148 a solution is provided to tackle the above shortcoming and, thus, to provide multipath capabilities between a HCPE and a gateway. Both the HCPE and the gateway serve as an intermediate proxy between a client connecting to a server. When the client connects to the server, the HCPE will convert the TCP synchronization segment of the client to a MPTCP synchronization segment and address it to the gateway with the address of the server included in an optional field of the segment. The gateway on its turn converts the MPTCP segment back to a TCP segment and addresses it to the server. This way, a three way handshake is performed and a TCP connection between the client and the server is established.

[0007] A disadvantage of the above solution is that the server sees the gateway as the source of the connection and not the client or HCPE. The utilisation of the HAG and the HCPE is thus not transparent to the server. A further disadvantage is that the HCPE has to provide the address of the server as an optional field. This increases the size of the time critical synchronization segments and is further not optimal because the optional fields are limited in size. A further disadvantage is that traffic within the access network and core network of the ISP is addressed to the gateway and not to the server. This is problematic for legal reasons because ISPs can be obliged to keep track of the network activity and thus of the servers that a customer and thus a client is trying to reach. In order to do so, the ISP will have to link the intercepted traffic with information from the gateway. This is complex and thus costly.

[0008] It is an object of the present invention to overcome the above disadvantages and to provide a way to provide a transparent end-to-end TCP connection between a client and server while using multipath capabilities between the HCPE and a gateway.

Summary of the Invention

[0009] This object is achieved, according to a first aspect, by a method for exchanging data over a TCP connection between a client node and a networking node. The TCP connection comprises a primary MPTCP subflow over a first access network between a hybrid customer premises equipment, an HCPE, serving as a first proxy node and a Hybrid Access Gateway, a HAG, serving as a second proxy node. The method comprises the following steps:

- converting, by the HCPE, first TCP segments to first MPTCP segments of the primary MPTCP subflow and vice versa; and
- using, by the HCPE, destination address information of the first TCP segments as destination address information of the first MPTCP segments; and
- using, by the HCPE, source address information of the first MPTCP segment as source address information of the first TCP segments; and
- converting, by the HAG, second TCP segments to second MPTCP segments of the primary subflow and vice versa while preserving source and destination address information.

[0010] The client is thus connected to the networking node, for example a server, through the HCPE and HAG. The HCPE provides the client access to more than one access network, for example a DSL and LTE network. The HAG on its turn serves as a gateway between the access networks and an outside network such as the Internet in which the networking node is located. In other words, the HAG sits in between the outside network and the HCPE. The TCP connection comprises a first single

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path portion between the client and HCPE, then a multipath portion between the HCPE and HAG and then again a single path portion between the HAG and the server. The multipath portion comprises the primary MPTCP subflow, i.e., the subflow that was setup first when establishing the MPTCP connection. The multipath portion may comprise one or more additional or auxiliary subflows between the HCPE and HAG established over other access networks. The TCP connection may be initiated from the client node or from the networking node.

[0011] TCP segments sent from the client to the networking node are intercepted by the HCPE that converts them to MPTCP segments. If the HCPE decides to send a segment over the primary subflow, it does not alter the destination address in the segment. Depending on whether the HCPE applies network address translation (NAT) or not, it may alter the source address information in the segment. Subsequently, the HAG will intercept the segment since all traffic towards the HCPE will pass by the HAG. The HAG then converts the MPTCP segment back to a TCP segment without altering the source or destination address information. This way the HAG and MPTCP portion is transparent to the networking node and the networking node believes that it receives single path TCP segments from the client or HCPE. The other way around, segments sent by the networking node to the client are intercepted by the HAG and converted to MPTCP segments. Again, if the HAG decides to send the segments over the primary MPTCP subflow, it does not alter the source or destination address of the segments. At the HCPE, the segment is converted to a TCP segment while preserving the source address and forwarded to the client. Depending on the NAT function at the HCPE the destination address may be translated to that of the client.

[0012] In other words, both the client and the networking node experience a single path TCP connection while multipath is supported for the connection between the HCPE and HAG. It is thus an advantage that the usage of multipath is transparent to both client and networking node. This also implies that network logging for legal purpose can be performed at any place before or after the HAG. Transparency is also advantageous for traffic engineering for IP sources and destinations, for Class of Service (CoS) marking, for traffic reporting by for example the Internet Protocol Flow Information Export (IPFIX) protocol or the sampled flow (sflow) protocol and for security applications such as for example Intrusion detection system (IDS) and Internet Provider Security (IPS) tags.Furthermore, it is an advantage that the address of the server can be provided in the destination field of the MPTCP segments and does not need to be provided in an optional field thereby enhancing protocol compatibility and reducing the size of the segments.

[0013] As the HCPE and the HAG maintain an MPTCP connection state, the TCP connection may further comprise an auxiliary MPTCP subflow over a second access network between the HCPE and the HAG. The method then further comprises:

- at the HCPE, converting third TCP segments to third MPTCP segments of the auxiliary MPTCP subflow and vice versa; and
- at the HAG, converting fourth TCP segments to fourth MPTCP segments of the auxiliary subflow and vice versa.

[0014] As provided by the MPTCP protocol, the HCPE or the HAG can then decide over which subflow to send the MPTCP segment based on current network performance or network policies. Similar to the primary subflow, both the HCPE and HAG perform a conversion between the TCP and MPTCP states and vice versa.

[0015] According to an embodiment, the converting then further comprises:

- by the HCPE, using destination address information of the HAG for the third MPTCP segments; and
- by the HAG, using destination address information of the networking node for the fourth segments sent to the networking node.

[0016] In order to route the segments differently for the auxiliary subflow, the HCPE now sends a MPTCP segment with the data of the TCP segment to the network address of the HAG in the second access network. This way the segments are routed over the auxiliary subflow to the HAG. At the HAG, the destination address is again replaced with that of the networking node.

[0017] Because all segments on the auxiliary subflow need to address the HAG directly, the network operator may use policies that prohibit the client or the HCPE to use the second access network to access the networking device directly. This way, the use of the second access network can be controlled in an easy and straightforward manner.

[0018] According to an embodiment, the method further comprises, in order to establish the auxiliary MPTCP subflow:

- sending, by the HAG for establishing the auxiliary MPTCP subflow, a segment comprising an address of the HAG in the second access network over the primary MPTCP subflow.

[0019] The HAG thus announces its address for establishing the auxiliary MPTCP subflow to the HCPE. This has the advantage that the HAG can, at any given time, determine when the HCPE, and thus the client, can use the auxiliary MPTCP subflow.

[0020] The HCPE may initiate the auxiliary subflow by sending a segment comprising a request to establish the second MPTCP subflow to the HAG. Alternatively, the HAG may initiate the auxiliary subflow by sending a segment comprising the request to establish the second MPTCP subflow to the HCPE. In this case it is not nec-

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essary to send the address of the HAG in the second access network over the primary MPTCP subflow if the HAG knows the alternate address of the HCPE.

[0021] Alternatively, both the primary and auxiliary MPTCP subflow may be established by:

- by the HAG, receiving a synchronization segment from the HCPE indicative for a request to establish the primary and auxiliary MPTCP subflows; and
- subsequently, by the HCPE, receiving a synchronization and acknowledgement segment from the HAG; and
- establishing, by the HCPE, the primary and the auxiliary MPTCP subflows; and
- receiving, by the HAG, an acknowledgment segment from the HCPE; and
- subsequently, by the HAG, establishing the primary and the auxiliary MPTCP subflows.

[0022] The primary and auxiliary MPTCP subflows are thus established at the HCPE side after the exchange of two messages, i.e., the initial synchronization segment and then the reception of the corresponding acknowledgment from the HAG. In other words, the HCPE establishes the primary and auxiliary TCP subflows based on the synchronization segment and the received acknowledgment. There is thus no further need for additional handshaking messages.

[0023] At the HAG side, the subflows are established after the exchange of the three messages, i.e., the initial synchronization segment, the acknowledgment together with synchronization segment from the HAG and then the acknowledgment from the HCPE.

[0024] It is thus an advantage that the two subflows can be established by a single three-way handshake. The number of segments exchanged and the establishment delay is thus independent of the number of auxiliary subflows. Furthermore, the same amount of TCP segments and MPTCP segments are exchanged. Both HCPE and HAG thus perform a one-to-one conversion of the segments during the establishment of the TCP connection.

[0025] Furthermore, the exchanged messages may be made backward compatible with segments used in the current MPTCP protocol, i.e., respectively the SYN segment with the MP_CAPABLE option, the SYN+ACK segment with the MP_CAPABLE option and the ACK segment containing the MP_CAPABLE option. While the message may be the same, the interpretation given to them by the client and server is different, and, therefore, the subflows are established by just a single three-way handshake.

[0026] According to a further embodiment the HAG comprises a plurality of gateway servers each acting as gateway between the first access network and the networking node; and wherein the method further comprises:

- by the HAG, load balancing the primary MPTCP subflow to one of the gateway servers.

[0027] As the HAG is a bottleneck to the outside network, the primary MPTCP subflows are load balanced over the different servers, i.e., all segments of a certain TCP connection are assigned to the same gateway server. As the auxiliary subflow is assigned a separate address, the load balancing of the auxiliary subflow may then be done by providing the HCPE with the network address of the gateway server to which the primary subflow is assigned.

[0028] According to a second aspect, the invention relates to a method for exchanging data over a TCP connection between a client node and a networking node; wherein the TCP connection comprises a primary MPTCP subflow over a first access network between a customer premises equipment, a HCPE, serving as a first proxy node and a hybrid access gateway, a HAG, serving as a second proxy node; the method comprising:

- by the HCPE:
    - o converting first TCP segments to first MPTCP segments of the primary MPTCP subflow and vice versa; and
    - o using destination address information of the first TCP segments as destination address information of the first MPTCP segments; and
    - o using source address information of the first MPTCP segment as source address information of the first TCP segments.

[0029] According to a third aspect, the invention relates to a method for exchanging data over a TCP connection between a client node and a networking node; wherein the TCP connection comprises a primary MPTCP subflow over a first access network between a customer premises equipment, a HCPE, serving as a first proxy node and a hybrid access gateway, a HAG, serving as a second proxy node; the method comprising:

- by the HAG:
    - o converting second TCP segments to second MPTCP segments of the primary subflow and vice versa while preserving source and destination address information.

[0030] According to a fourth aspect, the invention relates to a Hybrid Customer Premises Equipment, HCPE, configured to perform the steps performed by the HCPE according to the first and second aspect.

[0031] According to a fifth aspect, the invention relates to a Hybrid Access Gateway configured to perform the steps performed by the HAG according to the third aspect.

[0032] According to a sixth aspect, the invention re-

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lates to a system comprising the HCPE according to second aspect and the HAG according to the third aspect.

Brief Description of the Drawings

[0033]

Fig. 1 illustrates a client, a Hybrid Customer Premises Equipment, a Hybrid Access Gateway and a Server used for establishing a TCP connection according to an embodiment of the invention; and

Fig. 2 illustrates segments exchanged in order to establish a Multipath TCP connection according to an embodiment of the invention; and

Fig. 3 illustrates segments exchanged to establish an auxiliary subflow according to an embodiment of the invention; and

Fig. 4 illustrates segments exchanged over both the primary and auxiliary subflow of a Multipath TCP connection according to an embodiment of the invention; and

Fig. 5 illustrates a Hybrid Access Gateway according to an embodiment of the invention.

Fig. 6 illustrates a suitable computing system as a further embodiment of an Hybrid Customer Premises Equipment and/or an Hybrid Access Gateway according to an embodiment of the invention.

Detailed Description of Embodiments

[0034] Fig. 1 illustrates a system for exchanging data over a TCP connection between a client 100 and a networking node 103 according to an embodiment of the invention. The TCP connection may be initiated by the client 100 in which case the node 103 acts as a server or vice versa. For the remainder of this description, the networking node 103 will be referred to as the server. The system further comprises a Hybrid Customer Premises Equipment 101, further referred to as HCPE. The HCPE 101 serves as a gateway for the client 100 and any other networking device within the local network 113. HCPE 101 provides the client access to the access networks 110, 111 of an Internet Service Provider (ISP). The system further comprises a Hybrid Access Gateway 102 allowing communication between the access networks 110, 111 and an outside network 112 such as for example the Internet. The server 103 resides in this outside network 112. Both the HCPE 101 and the HAG 102 are annotated as 'hybrid' because they are able to communicate with each other over more than one access network. An access network may be a wired access network such as for example an ADSL, ADSL2, VDSL, VDSL2, fibre or cable access network. In such a case the HCPE will have a wired communication interface. An access network may also be a wireless access network such as for example an LTE, Wi-Fi, satellite or any other wireless access network. In such a case, the HCPE will also comprise a wireless interface.

[0035] As will be described in the embodiments below, the client 100 can establish a TCP connection with the server 103, i.e., a connection wherein both the client 100 and the server 103 maintain TCP state information in order to maintain a reliable connection. When sending data over the TCP connection to the server, the client sends the TCP segments to the HCPE 101. The HCPE maintains both a TCP state and a Multipath TCP, MPTCP, connection state. The MPTCP protocol is an extension of the TCP protocol. A version of the protocol is published by the IETF in RFC 6824. The HCPE then converts the TCP segments to MPTCP segments and sends them over one of the access networks 110, 111 to the HAG 102. In order to do so, the HCPE maintains a primary MPTCP subflow 122 over the first access network 110 with the HAG 102 and an auxiliary MPTCP subflow 124 over the second access network 111 with the HAG 102. This way, the TCP connection may benefit from the aggregated bandwidth of the access networks 110 and 111. Also the HAG 102 maintains both a TCP and a MPTCP connection state. When the HAG receives the MPTCP segments from the HCPE, it converts the segments back to TCP segments and forwards them to the server 103. TCP segments from the server are sent in a similar way to the client 100.

[0036] For the addressing, the TCP port numbering scheme may be combined with the Internet Protocol, IP, addressing scheme which is commonly referred to as TCP/IP. The IP protocol may for example be IPv4 or the newer IPv6.

[0037] Fig. 2 illustrates the establishment of the TCP connection 234 between client 100 and server 103 according to an embodiment of the invention. In the example, the client initiates the connection, but the establishment may also be done by the node 103 in which case the client 100 acts as a serving node. The establishment is done by the exchange of TCP segments 201 to 209. In each segment in Fig. 2 to 4, the type of the segment is underlined followed by the source address denoted by 'SA' and the destination address denoted by 'DA'. For the addresses in the segments, 'CL' indicates the address of the client 100, 'SRV' indicates the address of the server 103, 'HCPE' indicates an address of the HCPE 101 and 'HAG' indicates an address of the HAG 102.

[0038] In a first step, the client transmits a TCP synchronization segment 201 or shortly SYN segment over its networking interface 220 to the server 103 by adding the network address assigned to the networking interface 227 of the server in the destination address field of the synchronization segment 201. As the HCPE serves as a gateway for the client 100, the segment will be received at the networking interface 221 of the HCPE 101.

[0039] The HCPE comprises two outside network in-

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terfaces 222 and 223 connecting the HCPE to respectively the first and second access network 110 and 111. Then, in step 210, the HCPE 101 converts the received SYN segment 201 to a SYN segment 202 that indicates Multipath capabilities, i.e., a SYN segment containing the MP_CAPABLE option. Depending whether the HCPE implements network address translation, NAT, the HCPE may replace the source address of the segment 201 with the address of the HCPE, i.e., with the address assigned to interface 222. NAT may for example be performed when using IPv4 while it is normally not necessary when using IPv6. In either case, the HCPE 101 does not alter the destination address during the conversion step 210.

[0040] In a next step, the HCPE 101 then transmits the segment 202 over its first networking interface 222 and thus over the primary subflow 122 to the server. As the HAG acts as a gateway for the first access network to the network in which the server resides, the segment 202 will be routed towards the network interface 224 of the HAG and thus received by the HAG 102. Then, in step 211, the HAG converts the MPTCP segment 202 back to a TCP segment 203 by removing the MP_CAPABLE option. During the conversion, the HAG does not alter the source or destination address of the segment. The HAG then forwards the converted segment.

[0041] When the server 103 receives the SYN segment, it appears as if the client 100 or HCPE 101 attempts to establish a single path TCP connection with the server. If there is no NAT applied, both the HCPE 101 and the HAG 102 remain completely transparent to the server. In return, the server 103 replies to the client 100 or HCPE 101 by a synchronization and acknowledgment segment 204, a SYN+ACK.

[0042] This segment 204 is again intercepted by the HAG 102 serving as gateway towards the HCPE 101 and the client 100. In step 212, the HAG performs a similar conversion of the segment 204 as in step 211, but now adds the multipath capability option, commonly referred to as MP_CAPABLE. Again, both source and destination addresses remain unchanged.

[0043] As the HCPE serves as a gateway to the client for segments from the HAG, the converted segment 205 will be received at the HCPE 101. In step 213, the HCPE removes the MP_CAPABLE option and thus converts the MPTCP segment 205 to a TCP segment 206. Dependent on whether NAT is performed, the source address may be changed to that of the client 100.

[0044] In a similar way as for the SYN segments 201-203, the client now acknowledges the TCP connection by segment 207. This segment is again converted 214 by the HCPE to an ACK+MP_CAPABLE segment 208 and converted 215 back to a regular ACK segment 209 by the HAG 102. When ACK segment 209 is received by the server 103, the TCP connection 234 is considered established at both the client 100 and the server 103 by the three-way handshake. Between the HCPE and HAG, the connection will be treated as the primary subflow 122 of a MPTCP connection.

[0045] Together with the establishment of the TCP connection 234 or any time thereafter, a second subflow may be established between the HCPE 101 and the HAG 102

[0046] Fig. 3 illustrates steps performed by the HCPE and HAG to establish the second subflow 124 according to an embodiment of the invention. The steps performed are in line with the MPTCP protocol for establishing an auxiliary subflow. After the establishment of the first subflow 122, the HA sends an MPTCP segment 301 containing the ADD_ADDRESS option to the CPE wherein the network address of interface 225 of the HAG over the second access network 111 is announced. Thereafter, the HCPE and HAG exchange further segments such as the SYN+MP_JOIN segment 302 and SYN+ACK+MP_JOIN segment 303 in order to establish the second MPTCP subflow 124. For the exchange of MPTCP segments the HCPE will use the second network interface 223 and thus the second access network.

[0047] In order to exchange data over the two subflows 122, 124, both the HCPE 101 and HAG 102 keep track of the MPTCP state, i.e., manage the MPTCP Data Sequence Numbers, DSNs, as defined by the MPTCP protocol.

[0048] According to an alternative embodiment, the second subflow 124 may also be established implicitly during the establishment of the first subflow. This way the extra network traffic and time delay caused by the exchange of segments 301-303 can be avoided. This implicit establishing is possible because the HCPE 101 is known to the HAG 102 as they are both part of the same subscriber network, e.g. the same ISP. The alternative embodiment will now be described with reference to Fig. 2.

[0049] When the HAG has received the first SYN+MP_CAPABLE segment 202, the HAG will also obtain the addressing information of the HCPE's second networking interface 223. How this address information may be obtained is explained further below.

[0050] The reception of segment 202 is interpreted by the HAG 102 as a request to setup both the first and auxiliary MPTCP subflows 122 and 124. It is thus not only an indication that the HCPE 101 supports Multipath TCP. This request may be directly included in the first segment 202. Alternatively, the request may also be done indirectly, for example by a predefined setting in the server that segments 202 should always be considered as such a request. This way, no further information must be present in the segment 202. The HCPE 101 may also alter or set such a setting through an out-of-band connection or channel between the HCPE 101 and the HAG 102.

[0051] When the request is included in segment 202, this may be done in several ways. One way is to define a new TCP option that includes such a request. Another possibility is to place the request inside the payload of the SYN segment 202. Yet another possibility is to place the request inside an option in the network packet, i.e.,

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as an IP option. This is especially advantageous in IPv6 where there is no strict limit on the length of such an option and thus on the length of the request.

[0052] When the HCPE receives the SYN+ACK+MP_CAPABLE segment 205, it interprets it as a confirmation that the HAG 102 is ready for communication over the two subflows 122 and 124.

[0053] Thereafter, the HCPE 101 confirms the establishment of the first and second subflow with the ACK+MP_CAPABLE segment 208 to the HAG. Upon reception, the HAG 102 has confirmation that the HCPE 101 has established both subflows 122, 124 and also establishes the first and auxiliary subflows 122, 124.

[0054] Obtaining the address information of the HCPE 101 for the second subflow by the HAG 102 may be performed in several ways as described below.

[0055] In a first way of performing the addressing information is comprised in the SYN+MP_CAPABLE segment 202 and the HAG 102 then retrieves this information from segment 202. According to a first example a new TCP option is defined that includes this addressing information. According to a second example the addressing information is embedded as payload data in the SYN segment 202. According to a third example, the addressing information is embedded as an option in the network packet, i.e., as an IP option. This is especially advantageous in IPv6 where there is no strict limit on the length of such an option and thus on the length of the addressing information. The embedding of the addressing information may further be combined with the embedding of the request as outlined above. Preferably the addressing information is provided such that backwards compatibility with the MPTCP protocol is guaranteed.

[0056] In a second way for obtaining the addressing information is by using an out-of-band communication mechanism or channel, i.e., by communication between the HCPE 101 and HAG 102 outside of the MPTCP subflows. For example, a separate connection may exist between HCPE 101 and HAG 102 to exchange further information about the subflows. Such a connection may be used by management applications running on both the HCPE 101 and HAG 102 that manage the establishment of the multipath subflows.

[0057] In a third way, the addressing information is independently derived by the HAG 102 by a predefined logical relationship, i.e., according to a predefined rule indicating how the addressing information can be derived. Some examples of such a rules are:

- There is a mathematical relationship between the network address and/or port of the HCPE 101 for the two subflows. For example, the network address and/or port for the auxiliary subflow may be obtained by incrementing the network address and/or port used for the first subflow.
- The addressing information is identical as used for previous subflows established with the HCPE.
- The HAG has access to a database that lists all the addresses of all the HCPEs.

[0058] The HAG 102 and HCPE 101 may also support connection establishment coming from the outside network, i.e., when server 103 initiates the establishment of TCP connection 234 with client 100.

[0059] When the TCP connection 234 is established according to one of the above embodiments, data segments may be exchanged between client 100 and server 103. Fig. 4 illustrates how segments 401 to 408 are converted by the HCPE 101 and the HAG 102 in order to use the two subflows 122, 124 while preserving transparency to both client 100 and server 103.

[0060] When a TCP segment 401 is sent from client 100 to server 103 along the primary subflow 122, the segment 401 will be intercepted at the HCPE, and transmitted as an MPTCP segment 402 over the first or primary subflow to the server 103. During this conversion step 410, the destination address information is preserved. The source address information may be changed to that of the interface 222 when NAT is applied by the HCPE. The MPTCP segment 402 will on its turn be intercepted by the HAG and converted back the TCP data segment 403. During the conversion step 411, source and destination address information is preserved by the HAG. Finally, segment 403 will arrive at the server 103 as a single path TCP segment originating from the client 100 or HCPE 101.

[0061] The conversion in the opposite direction from server 103 to client 100 over the first MPTCP subflow 122 is performed in a similar fashion. A TCP segment 404 originating from the server 103 will be intercepted by the HAG 102 and converted to MPTCP segment 405. During the conversion step 412 source and destination address information is preserved. Segment 405 will on its turn be received or intercepted by the HCPE. At the HCPE, the segment 405 is converted to TCP segment 406. During this conversion step 413 the source address information is preserved. The destination address information may be changed depending on whether NAT is applied by the HCPE. The client 100 then receives the single path TCP segment 406 in a transparent way, i.e., as if it was coming from server 103.

[0062] When the TCP segment 401 is sent from client 100 to server 103 along the auxiliary subflow 124, the segment 401 will again be intercepted at the HCPE 101 and transmitted as MPTCP segment 407 over the second or auxiliary subflow to the server 103. During this conversion step 410, the destination address information is replaced by the address information of the HAG 102, i.e., the address assigned to the network interface 225 of the HAG. During the same step 410, the source address information is changed to that of the interface 223. The segment 407 is then forwarded over the second access network 111 to the HAG. As the MPTCP segment 407 is addressed to the HAG, the segment 407 will be routed to the HAG's network interface 225. As the auxiliary subflow 124 is linked with the primary subflow 122, the HAG

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will identify the segment 407 as belonging to the TCP connection 234. Therefore, the HAG converts the segment, during conversion step 411 to TCP segment 403 and replaces the destination address with that of the server. If NAT is not applied at the HCPE, the source address is replaced with that of the client 100, otherwise with the address assigned to the interface 222 of the HCPE, i.e., the interface used for the primary subflow 122.

[0063] The conversion in the opposite direction from server 103 to client 100 over the auxiliary MPTCP subflow 124 is performed in a similar fashion. TCP segment 404 originating from the server 103 will be intercepted by the HAG 102 and converted to MPTCP segment 408, i.e., a MPTCP segment for the auxiliary MPTCP subflow 124. During the conversion step 412 the source address of the server is replaced with the source address of the HAG, i.e., the address assigned to network interface 224 of the HAG. The destination address is replaced with that of the HCPE 101, i.e., the network address of the HCPE's network interface 223 on the second access network 111.

[0064] The segment will then be routed along the second access network 111 to the HCPE 101. At the HCPE 101, the segment 408 at interface 223. As the HCPE keeps an MPTCP state, it derives that segment 408 belongs to TCP connection 234. Therefore, subsequently, during conversion step 413 segment 408 is converted to segment 406. In step 413 the source address of the HAG is replaced with the address of the server and the destination address is replaced with the address of the client. Finally, the segment 406 arrives at the client 100.

[0065] Fig. 5 illustrates the layout of the HAG according to an embodiment of the invention. The HAG 102 comprises a server 501 comprising proxy logic 505 to perform the conversion steps as explained with respect to the previous embodiments. Segments received over the primary MPTCP subflow 122 and auxiliary MPTCP subflow 124 are converted by the proxy logic 505 to TCP segments and vice versa.

[0066] Also other data packets 510 may be received at networking interface 224 such as for example packets according to the other networking protocols including UDP or ICMP. These packets will not be converted by the proxy logic, but are directly forwarded to the outside network over networking interface 226. This way, the MPTCP functionality in the HCPE and HAG 102 remains also completely transparent to other protocols.

[0067] The HAG 102 may further comprise a plurality of HAG servers 501 to 503 in order to load balance the data traffic. To this respect the HAG 102 also comprises load balancers 520 and 521. Load balancer 520 balances the packets coming from different HCPEs to one of the HAG servers 501-503. Load balancer 521 balances the packets coming from the outside network to one of the HAG servers 501-503. Several policies may be implemented in the load balancer such as for example:

- Load balance per MPTCP flow, i.e., per newly established TCP connection between a client and server.
- Load balance per HCPE, i.e., every HCPE is assigned a single HAG server for all its connections. This may be performed by checking the source IP address of the packets received over the primary interface 224.
- Load balancing per source prefix. This way a cluster of HCPEs is assigned to a single HAG server.

The above load-balancing mechanisms ensure that both HCPE-side and outside network-side load-balancers 520 and 521 consistently route packets of a given flow to the same proxy. This also ensures that the load balancing decision is not changed for an ongoing flow, i.e., for an ongoing TCP connection between client and server.

[0068] During operation, i.e., when Multipath TCP operates over both the primary and auxiliary subflows, the situation may arise that the networking address assigned to network interface 222 for the primary MPTCP subflow 122 becomes unavailable, e.g. by an interface reset, while the existing auxiliary subflow 124 is still in place. In such a case the HCPE 101 may advertise a REMOVE_ADDR option in a segment to the HAG 102 over the still active slave subflow 124, i.e., it advertises that the used networking address is no longer valid. This then triggers a clean-up of the MPTCP state at the HAG 102 for any subflow attached to this address. This closing of connections that lose their primary subflow is necessary because the address could become assigned to another HCPE during the lifetime of the MPTCP session. The common address could then be used simultaneously by two different users which may result in errors on the network.

[0069] Therefore, the HAG 102 may terminate the TCP connection 234 if the network address used for the primary subflow is lost, and, subsequently, release all associated resources. This may be done by the following steps:

- The HAG receives a segment from the HCPE 101 with the REMOVE_ADDR option indicative that the networking address used for the primary subflow is lost.
- Thereupon, the HAG 102 resets the HAG resets the TCP connection 234 to the server.
- The HAG 102 sends a segment with the TCP option MP_FASTCLOSE to the HCPE 101.
- Upon reception, the HCPE 101 resets the TCP connection 234 towards the client 100.

[0070] Fig. 6 shows a suitable computing system 600 as a further embodiment of the HCPE 101 or HAG 102. Computing system 600 may in general be formed as a suitable general purpose computer and comprise a bus 610, a processor 602, a local memory 604, one or more optional output interfaces 616, a communication interface 612, a storage element interface 606 and one or more storage elements 608. Bus 610 may comprise one

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or more conductors that permit communication among the components of the computing system 600. Processor 602 may include any type of conventional processor or microprocessor that interprets and executes programming instructions. Local memory 604 may include a random access memory (RAM) or another type of dynamic storage device that stores information and instructions for execution by processor 602 and/or a read only memory (ROM) or another type of static storage device that stores static information and instructions for use by processor 602. Storage element interface 606 may comprise a storage interface such as for example a Serial Advanced Technology Attachment (SATA) interface or a Small Computer System Interface (SCSI) for connecting bus 610 to one or more storage elements 608, such as one or more local disks, for example SATA disk drives, and control the reading and writing of data to and/or from these storage elements 608. Although the storage elements 608 above is described as a local disk, in general any other suitable computer-readable media such as a solid state drive or flash memory cards could be used. The system 600 described above can also run as a Virtual Machine above the physical hardware. The steps performed on the HCPE and HAG devices according to the above embodiments may be partly or completely implemented as programming instructions to be run on processor 602. Communication interface 612 may further correspond to the HCPE's or HAG's networking interfaces 221, 222, 223, 224, 225, 266..

[0071] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element, such as a computer system, a processor, or another integrated unit may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one(s) described or illustrated above.

Claims

1. Method for exchanging data over a TCP connection (234) between a client node (100) and a networking node (103); wherein the TCP connection comprises a primary MPTCP subflow (122) over a first access network (110) between a customer premises equipment, a HCPE (101), serving as a first proxy node and a hybrid access gateway, a HAG (102), serving as a second proxy node; the method comprising:

   - by the HCPE:

     o converting (210, 213, 214) first TCP segments (201, 206, 207) to first MPTCP segments (202, 205, 208) of the primary MPTCP subflow and vice versa; and
     o using destination address information of the first TCP segments (201, 207) as destination address information of the first MPTCP segments (202, 208); and
     o using source address information of the first MPTCP segment as source address information of the first TCP segments; and

   - by the HAG:

     o converting (211, 212, 215, 217) second TCP segments to second MPTCP segments of the primary subflow and vice versa while preserving source and destination address information.

2. Method according to claim 1 wherein the TCP connection (234) comprises an auxiliary MPTCP subflow over a second access network between the HCPE (101) and the HAG (102); the method further comprising:

   - at the HCPE, converting third TCP segments to third MPTCP segments of the auxiliary MPTCP subflow and vice versa; and
   - at the HAG, converting fourth TCP segments to fourth MPTCP segments of the auxiliary subflow and vice versa.

3. Method according to claim 2 further comprising:

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- by the HCPE, using destination address information of the HAG for the third MPTCP segments; and
- by the HAG, using destination address information of the networking node for the fourth segments sent to the networking node.

4. Method according to claim 2 or 3 further comprising, for establishing the auxiliary MPTCP subflow:

   - sending, by the HAG for establishing the auxiliary MPTCP subflow, a segment comprising an address of the HAG in the second access network over the primary MPTCP subflow.

5. Method according to any one of claims 2 to 4 further comprising:

   - sending, by the HCPE, a segment comprising a request to establish the second MPTCP subflow to the HAG.

6. Method according to any one of claims 2 to 4 further comprising:

   - sending, by the HAG, a segment comprising a request to establish the second MPTCP subflow to the HCPE.

7. Method according to claim 2 or 3 comprising, for establishing the primary and auxiliary MPTCP subflow:

   - by the HAG, receiving a synchronization segment from the HCPE indicative for a request to establish the primary and auxiliary MPTCP subflows; and
   - subsequently, by the HCPE, receiving a synchronization and acknowledgement segment from the HAG; and
   - establishing, by the HCPE, the primary and the auxiliary MPTCP subflows; and
   - receiving, by the HAG, an acknowledgment segment from the HCPE; and
   - subsequently, by the HAG, establishing the primary and the auxiliary MPTCP subflows.

8. Method according to any one of the preceding claims wherein the HAG comprises a plurality of gateway servers each acting as gateway between the first access network and the networking node; and wherein the method further comprises:

   - by the HAG, load balancing the primary MPTCP subflow to one of the gateway servers.

9. Method for exchanging data over a TCP connection (234) between a client node (100) and a networking node (103); wherein the TCP connection comprises a primary MPTCP subflow (122) over a first access network (110) between a customer premises equipment, a HCPE (101), serving as a first proxy node and a hybrid access gateway, a HAG (102), serving as a second proxy node; the method comprising:

   - by the HCPE:

     o converting (210, 213, 214) first TCP segments (201, 206, 207) to first MPTCP segments (202, 205, 208) of the primary MPTCP subflow and vice versa; and
     o using destination address information of the first TCP segments (201, 207) as destination address information of the first MPTCP segments (202, 208); and
     o using source address information of the first MPTCP segment as source address information of the first TCP segments.

10. Method for exchanging data over a TCP connection (234) between a client node (100) and a networking node (103); wherein the TCP connection comprises a primary MPTCP subflow (122) over a first access network (110) between a customer premises equipment, a HCPE (101), serving as a first proxy node and a hybrid access gateway, a HAG (102), serving as a second proxy node; the method comprising:

    - by the HAG:

      o converting (211, 212, 215, 217) second TCP segments to second MPTCP segments of the primary subflow and vice versa while preserving source and destination address information.

11. Hybrid Customer Premises Equipment, HCPE (101), configured to perform the steps performed by the HCPE according to any one of the claims 1 to 9.

12. Hybrid Access Gateway (102) configured to perform the steps performed by the HAG (102) according to any one of the claims 1 to 8 or 10.

13. System comprising the HCPE (101) according to claim 11 and the HAG (102) according to claim 12.

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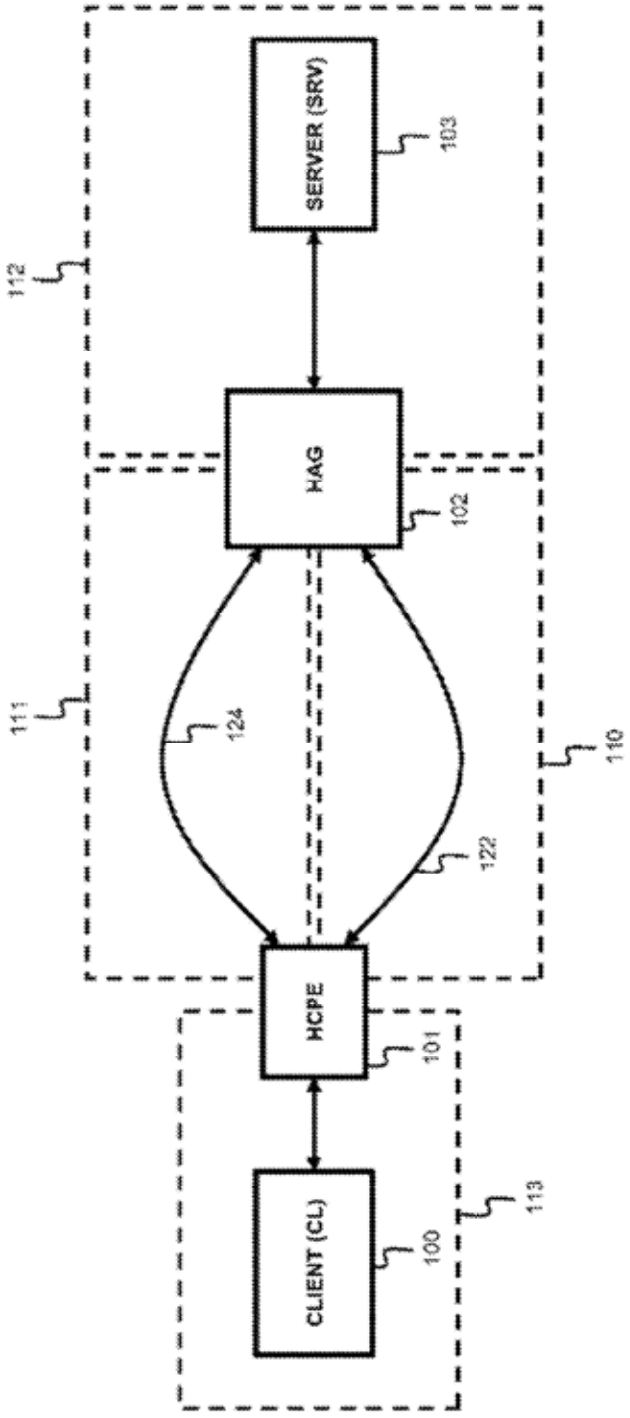

SERVER (SRV)
103
112
HAG
102
111
124
110
122
HCPE
101
CLIENT (CL)
100
113

Fig. 1

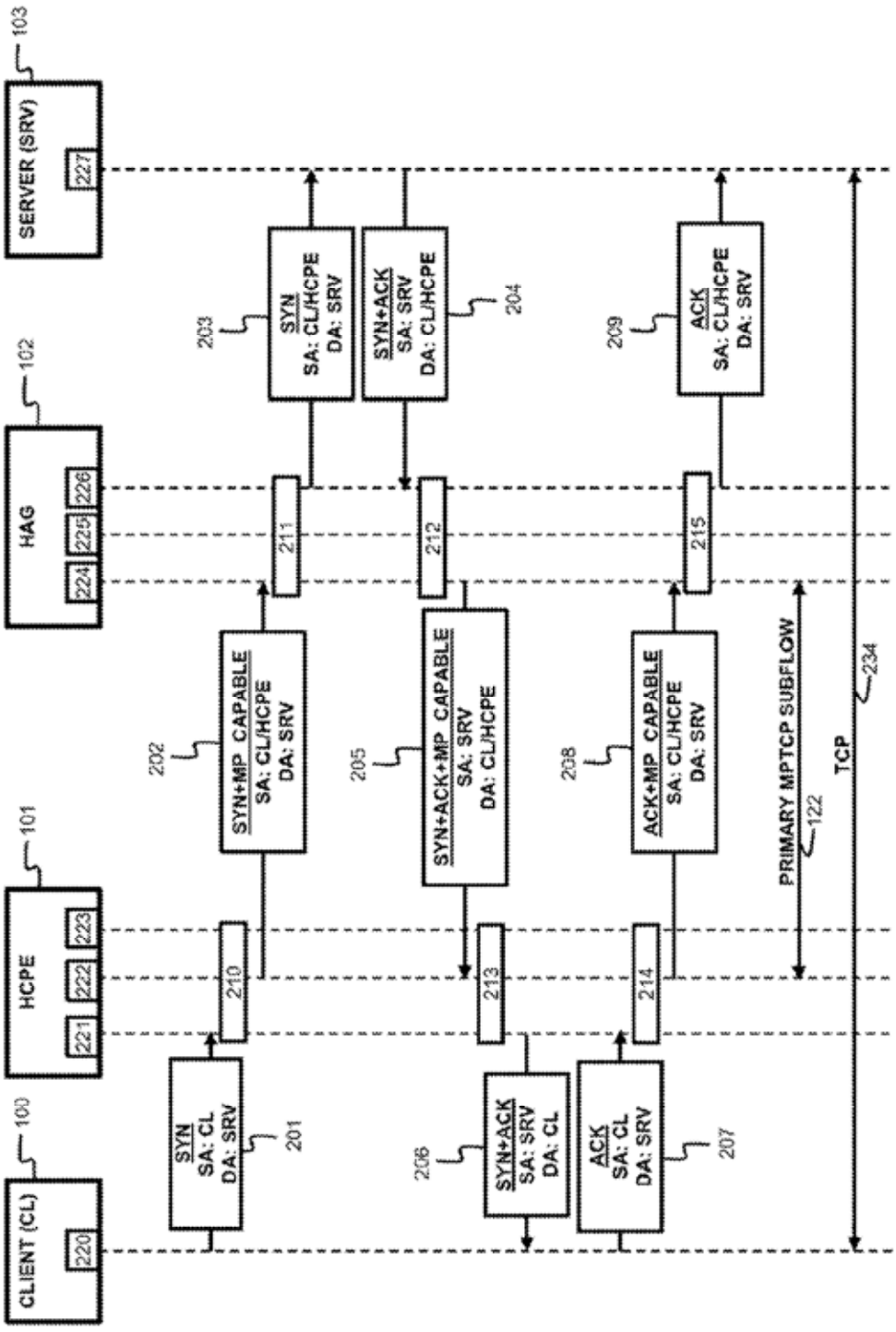

CLIENT (CL)
100
220
HCPE
101
221
222
223
HAG
102
224
225
226
SERVER (SRV)
103
227
SYN
SA: CL
DA: SRV
201
210
SYN+MP CAPABLE
SA: CL/HCPE
DA: SRV
202
211
SYN
SA: CL/HCPE
DA: SRV
203
SYN+ACK
SA: SRV
DA: CL/HCPE
204
212
SYN+ACK+MP CAPABLE
SA: SRV
DA: CL/HCPE
205
213
SYN+ACK
SA: SRV
DA: CL
206
ACK
SA: CL
DA: SRV
207
214
ACK+MP CAPABLE
SA: CL/HCPE
DA: SRV
208
215
ACK
SA: CL/HCPE
DA: SRV
209
PRIMARY MPTCP SUBFLOW
122
TCP
234

Fig. 2

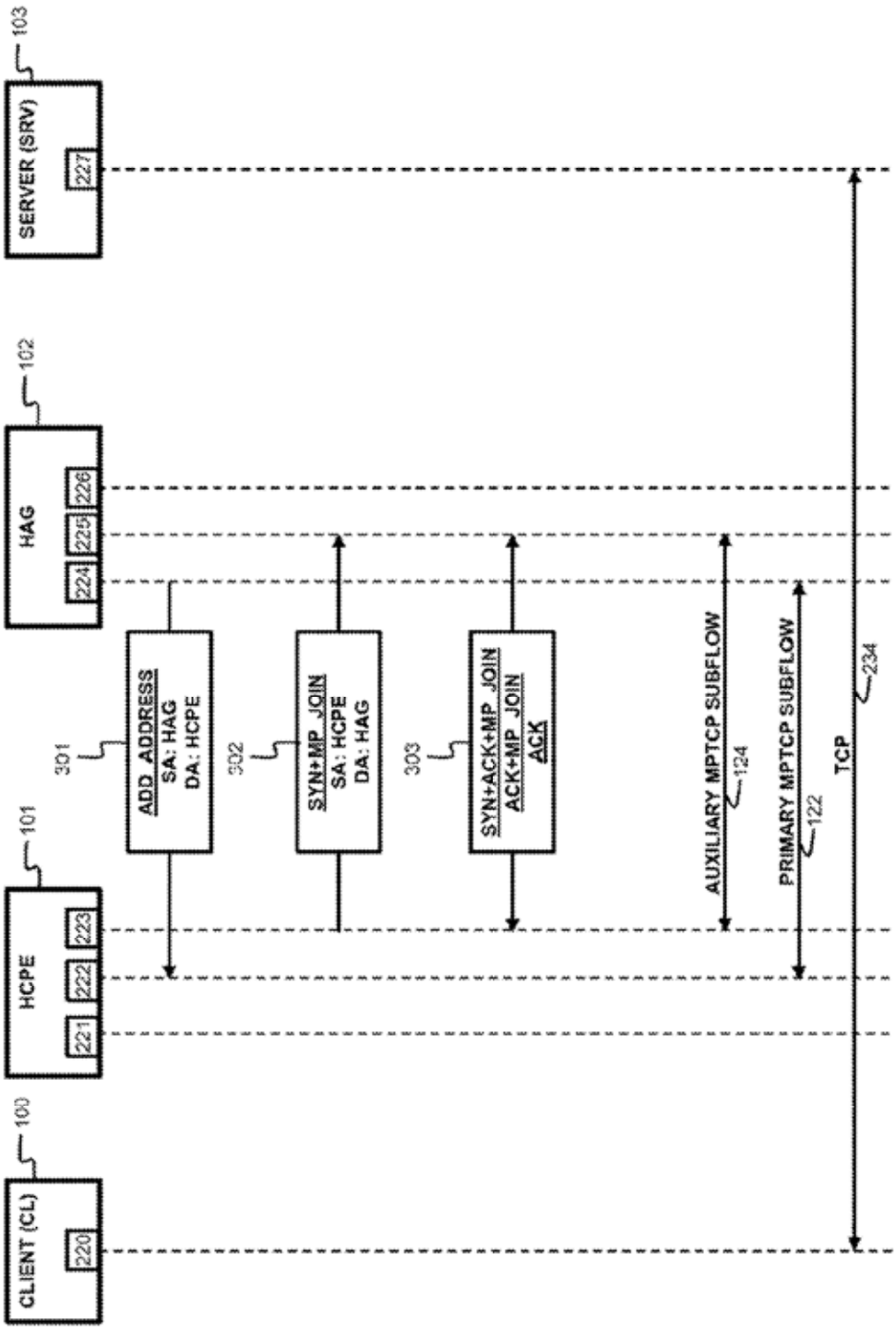

CLIENT (CL)
220
100
HCPE
221
222
223
101
HAG
224
225
226
102
SERVER (SRV)
227
103
301
ADD_ADDRESS
SA: HAG
DA: HCPE
302
SYN+MP_JOIN
SA: HCPE
DA: HAG
303
SYN+ACK+MP_JOIN
ACK+MP_JOIN
ACK
AUXILIARY MPTCP SUBFLOW
124
PRIMARY MPTCP SUBFLOW
122
TCP
234

Fig. 3

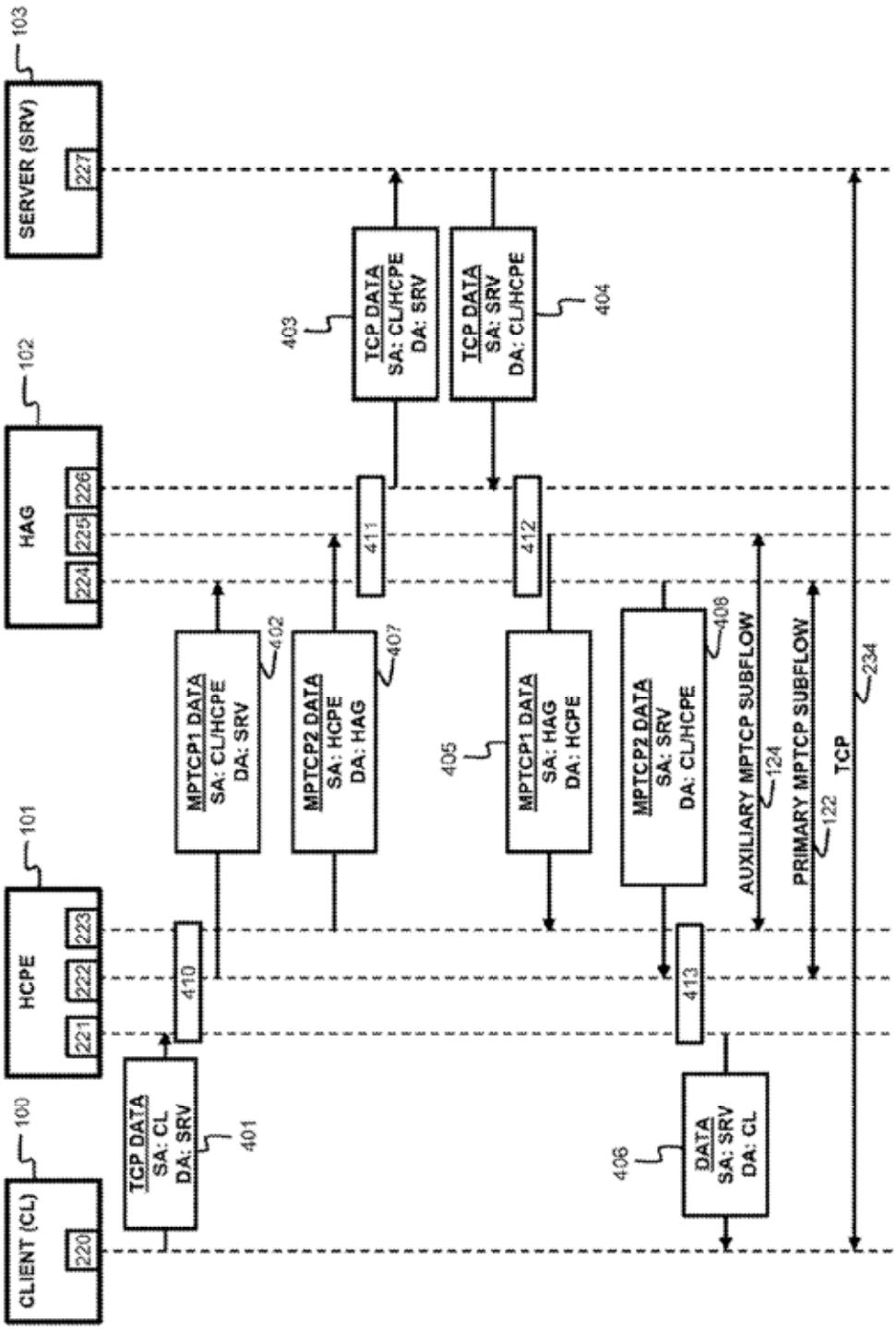

CLIENT (CL)
100
220
HCPE
101
221
222
223
HAG
102
224
225
226
SERVER (SRV)
103
227
TCP DATA
SA: CL
DA: SRV
401
410
MPTCP1 DATA
SA: CL/HCPE
DA: SRV
402
MPTCP2 DATA
SA: HCPE
DA: HAG
407
411
TCP DATA
SA: CL/HCPE
DA: SRV
403
TCP DATA
SA: SRV
DA: CL/HCPE
404
412
MPTCP1 DATA
SA: HAG
DA: HCPE
405
MPTCP2 DATA
SA: SRV
DA: CL/HCPE
408
413
DATA
SA: SRV
DA: CL
406
AUXILIARY MPTCP SUBFLOW
124
PRIMARY MPTCP SUBFLOW
122
TCP
234

Fig. 4

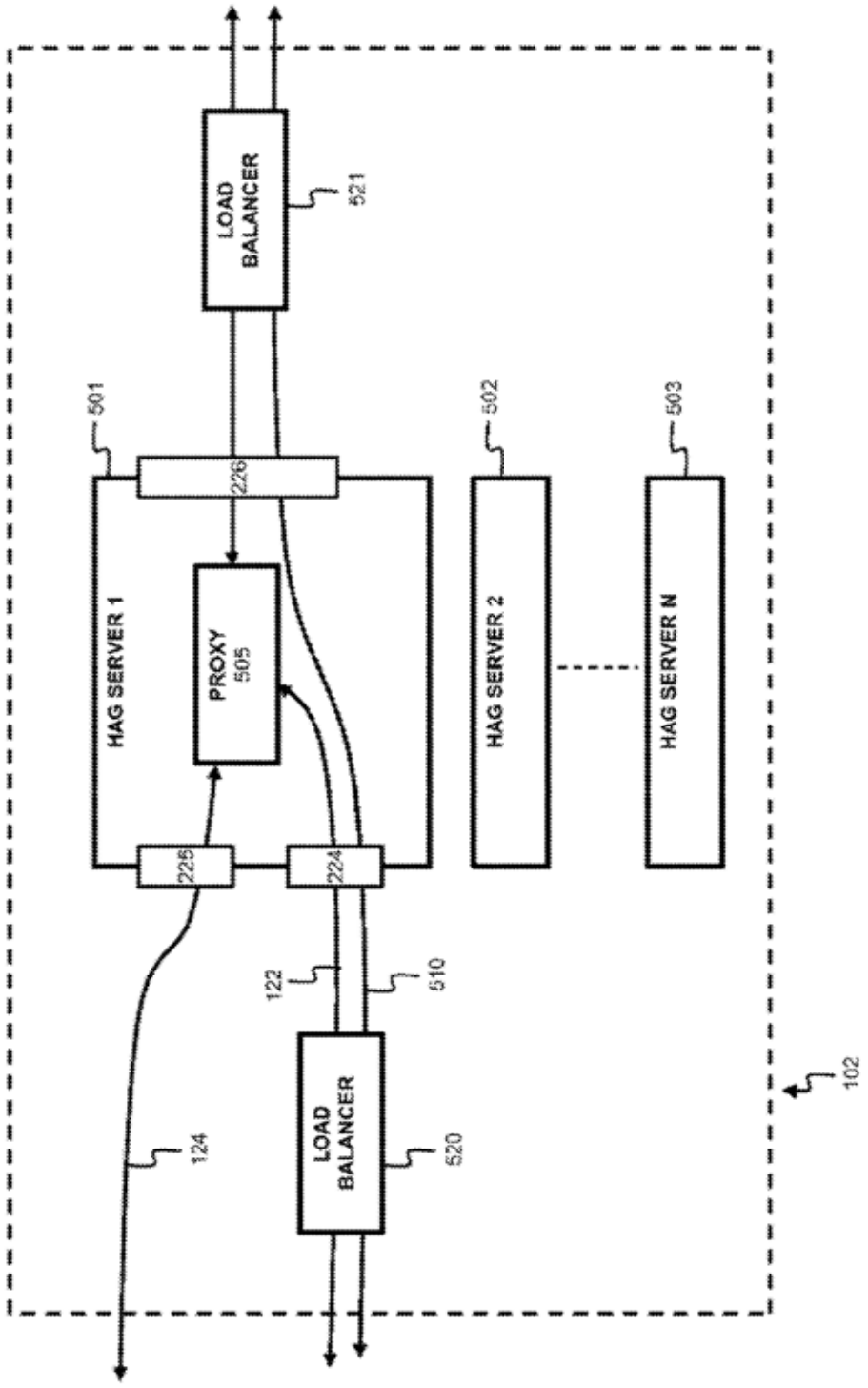

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Fig. 5

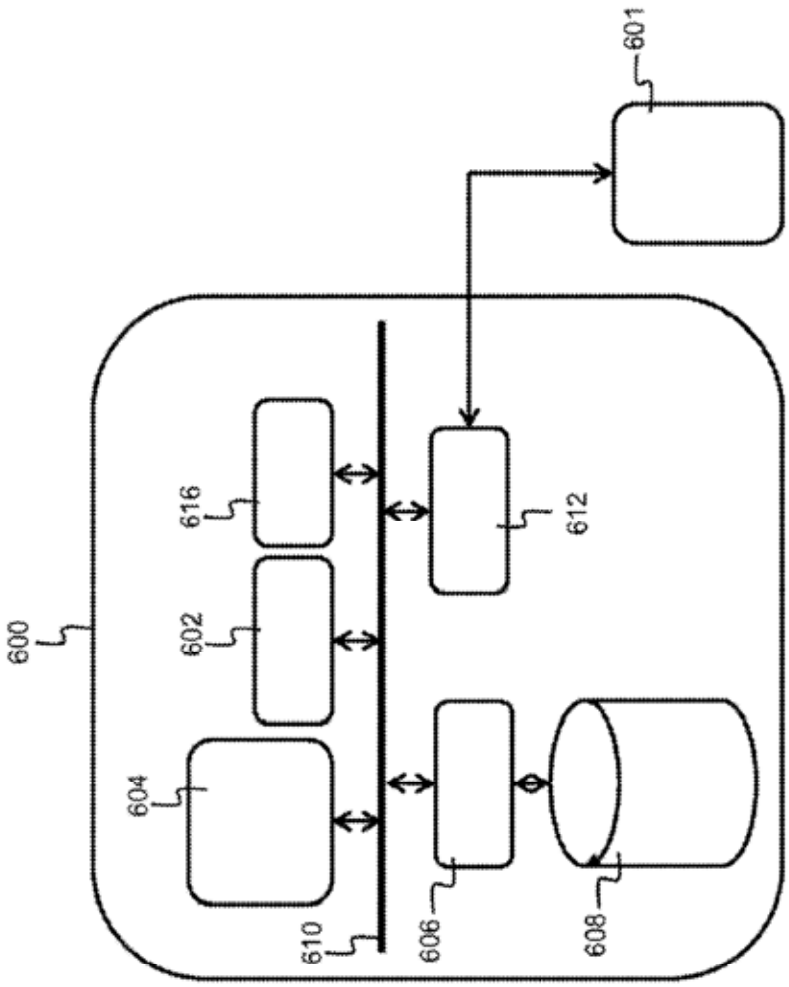


Fig. 6

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 3990

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2016/049609 A1 (HUGHES NETWORK SYSTEMS LLC [US]) 31 March 2016 (2016-03-31) * paragraph [0047] - paragraph [0058] *	1-13	INV. H04L12/707 H04L29/06
X	BOUCADAIR C JACQUENET ORANGE D BEHAGHEL ONEACCESS S SECCI UPMC W HENDERICKX NOKIA/ALCATEL-LUCENT R SKOG ERICSSON O BONAVENTURE TES: "An MPTCP Option for Network-Assisted MPTCP Deployments: Plain Transport Mode; draft-boucadair-mptcp-plain-mode-07.txt", AN MPTCP OPTION FOR NETWORK-ASSISTED MPTCP DEPLOYMENTS: PLAIN TRANSPORT MODE; DRAFT-BOUCADAIR-MPTCP-PLAIN-MODE-07.TXT, INTERNET ENGINEERING TASK FORCE, IETF; STANDARDWORKINGDRAFT, INTERNET SOCIETY (ISOC) 4, RUE DES FALAISES CH- 1205 GENEVA, SWITZERLA, 19 May 2016 (2016-05-19), pages 1-31, XP015113139, [retrieved on 2016-05-19] * page 8, paragraph 4 - page 10, paragraph 4.3; figures 2, 3 * * page 13, line 1 - page 14, line 3 *	1-13	
A,D	EP 2 882 148 A1 (UNIVERSITÉ CATHOLIQUE DE LOUVAIN [BE]) 10 June 2015 (2015-06-10) * abstract * * paragraph [0035] - paragraph [0057] *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)
H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 November 2016	Stergiou, Christos

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 17 3990

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2016049609 A1	31-03-2016	US 2016094467 A1	31-03-2016
		WO 2016049609 A1	31-03-2016
EP 2882148 A1	10-06-2015	AU 2014363687 A1	02-06-2016
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		EP 3080957 A1	19-10-2016
		US 2016315976 A1	27-10-2016
		WO 2015086543 A1	18-06-2015

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Page #872

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2882148 A **[0006]**

Electronic Patent Application Fee Transmittal

Application Number:	14356581
Filing Date:	06-May-2014
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Filer:	Michael V. North/Nita Miller
Attorney Docket Number:	20145-054US

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt

EFS ID:	33933870
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	05-OCT-2018
Filing Date:	06-MAY-2014
Time Stamp:	16:03:28
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	100918INTEFSW16044000
Deposit Account	502776
Authorized User	Nita Miller
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37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.492 (National application filing, search, and examination fees)

37 CFR 1.492(a) (Basic national fee only)

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2018-10-05 By: /Nita Miller/
Nita Miller

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Commissioner for Patents
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Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

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☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

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☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application

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☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

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Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2018-10-05

By: /Michael V. North/
Michael V. North
Reg. No. 46963

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146571
UNITED STATES PATENT AND TRADEMARK OFFICE

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Exhibit 1006
Page #888

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	
Examiner Name	
Attorney Docket Number	20145-054US

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

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	Attorney Docket Number	20145-054US

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Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
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32	Non Patent Literature	055USC_IDS_NPL080.pdf	148689 d3752a9c6ea34bd952848db68238255632e 98dbb8	no	30
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33	Non Patent Literature	055USC_IDS_NPL081.pdf	148498 cc04e16783998c91ae85ed13178a296e7b2 6b2d6	no	30
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34	Non Patent Literature	055USC_IDS_NPL082.pdf	144951 85193d7ec8c4bbc8870a0115aa08e6ea38f 6973b	no	29
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35	Non Patent Literature	055USC_IDS_NPL083.pdf	139177 2dcf97677d74a027f3b3e1710d9587503dac 2b1ea	no	28
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36	Non Patent Literature	055USC_IDS_NPL084.pdf	139505 909ff57e7b7c5e21eaaf26917d37c664a9bc6a33	no	28
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37	Non Patent Literature	055USC_IDS_NPL085.pdf	136092 6aed3a2b9329431f97fd86ccb04ff8a326fd6aa724	no	27
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38	Non Patent Literature	055USC_IDS_NPL086.pdf	131107 d0adc4873157910e1e3e1a85e76fbc82bf4ab641	no	26
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39	Non Patent Literature	055USC_IDS_NPL087.pdf	113042 119ab4224c608f6fe9bef746868d41ab0ab197cd	no	3
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40	Non Patent Literature	055USC_IDS_NPL088.pdf	113708 45a1c82eef3f60a8afeafcac0420ee12a0ec31	no	3
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41	Non Patent Literature	055USC_IDS_NPL089.pdf	142168 4ad0cbff2cba9517b06508ac51eadcff1cca4b5f	no	3
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42	Non Patent Literature	055USC_IDS_NPL090.pdf	25834 a1c746c52f18b6cb150bfece0b1e4d329a27dc6c	no	7
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43	Non Patent Literature	055USC_IDS_NPL091.pdf	412898 5cdbaa07183652b7b47e6f3c4191039b5984 52217	no	19
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44	Non Patent Literature	055USC_IDS_NPL092.pdf	113788 dd40460e007bc3b396edc2c6fa7b026feb49 2a9c	no	3
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45	Non Patent Literature	055USC_IDS_NPL093.pdf	393961 56eb8b06380a3a3a41e25853f2892ee910666ae7	no	7
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46	Non Patent Literature	055USC_IDS_NPL094.pdf	510567 31e33745a87b226edd37a69babdd2761617e9a	no	8
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47	Non Patent Literature	055USC_IDS_NPL095.pdf	23478 b877293be434c972060152228cad2ee0ace607af	no	7
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48	Non Patent Literature	055USC_IDS_NPL096.pdf	453257 0aaa8bf4370a5a8c39d52c73d42813df792b33e9	no	17
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49	Non Patent Literature	055USC_IDS_NPL097.pdf	294567 aa93eaded3bc5b269f36424b91a10227112b98c28	no	14
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50	Non Patent Literature	055USC_IDS_NPL098.pdf	998649 241f881e09576acb2a659b306b91c941e9a6be38	no	11
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52	Non Patent Literature	055USC_IDS_NPL100.pdf	716030 00d133fb0ea74f1671310f0157f1a0bec54d81b0	no	4
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2018-10-05 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

Charter Communications, Inc.
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Page #906

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application

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OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

☐ Pursuant to 37 CFR § 1.704(d), Applicant certifies that each of the references cited herein were first cited in a communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in 37 CFR § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement.

Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2018-10-05

By: /Michael V. North/
Michael V. North
Reg. No. 46963

Customer No.
146571
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Exhibit 1006
Page #908

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	
Examiner Name	
Attorney Docket Number	20145-054US

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	Examiner Name	
	Attorney Docket Number	20145-054US

	1	IETF 79 Proceedings, "Multipath TCP (pmtcp) (WG)," URL: https://www.ietf.org/proceedings/79/mptcp.html (3pgs).	
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	Attorney Docket Number	20145-054US

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	Attorney Docket Number	20145-054US

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
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	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

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	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2018-10-05
Name/Print	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	33934812
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	05-OCT-2018
Filing Date:	06-MAY-2014
Time Stamp:	16:44:03
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	054US_SIDS_Trans.pdf	29080 30:b50a4d43b1dcc56d9d8cc4b3ded96b3927b26	no	3

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	054US_SIDS_SB08-3.pdf	614529 a1540ce728cc8d53a4428642527806e3c98ea558	no	8
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Information:					
A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.					
3	Non Patent Literature	055USC_IDS_NPL101.pdf	113815 23108a513c0af43585074bc6e3130474be467d59	no	3
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8	Non Patent Literature	055USC_IDS_NPL106.pdf	3250021 a799f4236bbea3088c62f85436cd1371779f0f7	no	7
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Warnings:					
Information:					
		Total Files Size (in bytes):	22892884		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2018-10-05 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

Charter Communications, Inc.
Exhibit 1006
Page #926

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application

not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

☐ Pursuant to 37 CFR § 1.704(d), Applicant certifies that each of the references cited herein were first cited in a communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in 37 CFR § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement.

Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2018-10-05

By: /Michael V. North/
Michael V. North
Reg. No. 46963

Customer No.
146571
UNITED STATES PATENT AND TRADEMARK OFFICE

Charter Communications, Inc.
Exhibit 1006
Page #928

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14356581
Filing Date	2014-05-06
First Named Inventor	Wonjong Rhee
Art Unit	
Examiner Name	
Attorney Docket Number	20145-054US

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Charter Communications, Inc.
Exhibit 1006
Page #929

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

	1	Wang, F. et al., "A Proactive Approach to Avoid Performance Degradation of MPTCP, draft-zuo-mptcp-degradation-00," 2017-10-30, URL: https://tools.ietf.org/html/draft-zuo-mptcp-degradation-00 (9pgs).	
	2	Purkayastha, D. et al., "Considerations for MPTCP operation in 5G, draft-purkayastha-mptcp-considerations-for-nextgen-00," 2017-10-29, URL: https://tools.ietf.org/html/draft-purkayastha-mptcp-considerations-for-nextgen-00 (7pgs).	
	3	Bonaventure, O. et al., "O-RTT TCP Converter, draft-bonaventure-mptcp-converters-02," 2017-10-30, URL: https://tools.ietf.org/html/draft-bonaventure-mptcp-converters-02 (32pgs).	
	4	Boucadair, M. et al., "RADIUS Extensions for Network-assisted Multipath TCP (MPTCP), draft-boucadair-mptcp-radius-05," 2017-10-08, URL: https://tools.ietf.org/html/draft-boucadair-mptcp-radius-05 (11pgs).	
	5	Boucadair, M. et al., "DHCP Options for Network-Assisted Multipath TCP (MPTCP), draft-boucadair-mptcp-dhc-08," 2017-10-08, URL: https://tools.ietf.org/html/draft-boucadair-mptcp-dhc-08 (13pgs).	
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	First Named Inventor	Wonjong Rhee
	Art Unit	
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International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
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34	Non Patent Literature	055USC_IDS_NPL182.pdf	63780 8935e65943294a47f4d11a34dd6456fde48802ce	no	11
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35	Non Patent Literature	055USC_IDS_NPL183.pdf	55363 ffb16ed991cee41943119f837a1acf525f7b5421f	no	9
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36	Non Patent Literature	055USC_IDS_NPL184.pdf	64255 f2ad76a352d12e50ea394d8a1b071dc97a...99733	no	11
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37	Non Patent Literature	055USC_IDS_NPL185.pdf	44079 8c95a1d66f97f8c82a562991c5a9e85be77...04d9d	no	6
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38	Non Patent Literature	055USC_IDS_NPL186.pdf	60912 9b3a969a8c911ee7e27dbbb4279f2640d84...02371	no	11
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39	Non Patent Literature	055USC_IDS_NPL187.pdf	37150 c7c8f061941209ed8d28e3b9a2f8e9972fa8...3c78	no	5
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40	Non Patent Literature	055USC_IDS_NPL188.pdf	38049 8cddcc770cd8b82405af7ccccf556459629...ae3a0	no	5
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41	Non Patent Literature	055USC_IDS_NPL189.pdf	50356 025370140dd877a28caa2358a902da09575...aeef1	no	8
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42	Non Patent Literature	055USC_IDS_NPL190.pdf	56359 63b523522413b9849538ef9705eaee876eb5...7038	no	10
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43	Non Patent Literature	055USC_IDS_NPL191.pdf	93378 eeb582d9b06949cec9d7dfb6a64a176b658 05589	no	18
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44	Non Patent Literature	055USC_IDS_NPL192.pdf	46055 17680d4c509b642ff07f66661c7da4cb2dbc1 c8b6	no	7
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45	Non Patent Literature	055USC_IDS_NPL193.pdf	52110 e394ee3a8d667dacd85b46da0659044e1c 4a02c	no	9
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46	Non Patent Literature	055USC_IDS_NPL194.pdf	53941 b77a4fc708f033813226c347d246b8bdc75d2 8a4c	no	8
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47	Non Patent Literature	055USC_IDS_NPL195.pdf	111016 82a58dc095ada92a26e6d0e821c6e63c5ff4 2fa0	no	21
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48	Non Patent Literature	055USC_IDS_NPL196.pdf	94306 420588dcf0ed5492402d16eb68425cf54be 4f427a	no	18
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49	Non Patent Literature	055USC_IDS_NPL197.pdf	62823 3c2c55c1be8fa492a259493f80613e45e56e b691	no	11
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50	Non Patent Literature	055USC_IDS_NPL198.pdf	92716 378410c66008cafcd26530189273aaf7fdu90ebck	no	17
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51	Non Patent Literature	055USC_IDS_NPL199.pdf	68478 d380f39b866eb9e6101c0270bb523788c5bcd3735	no	12
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52	Non Patent Literature	055USC_IDS_NPL200.pdf	104317 67c9e4fcc8960999f868d5d4318f1a3025614676	no	19
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2018-10-05 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

Charter Communications, Inc.
Exhibit 1006
Page #946

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application

not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☒ Applicant submits that the enclosed Information Disclosure Statement is timely; therefore, no fee is required.

☒ Except as provided for under 37 CFR § 1.98(a)(2), Applicant has enclosed a copy of each listed reference.

☐ The above referenced application relies upon Application No. _____, filed _____, for an earlier effective filing date under 35 U.S.C. 120. Although, pursuant to 37 CFR § 1.98(d), the references submitted herein are not required to be submitted for the Examiner to consider them, Applicant submits the references herein so that the information will be printed on the patent issuing from this application.

☐ Pursuant to 37 CFR § 1.704(d), Applicant certifies that each of the references cited herein were first cited in a communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in 37 CFR § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement.

Consideration of the listed references and favorable action are requested. If any additional fees are due in connection with the filing of this Information Disclosure Statement, the Commissioner is hereby authorized to charge such fees to Deposit Account 50-2776.

Respectfully submitted,

Date: 2018-10-05

By: /Michael V. North/
Michael V. North
Reg. No. 46963

Customer No.
146571
UNITED STATES PATENT AND TRADEMARK OFFICE

Charter Communications, Inc.
Exhibit 1006
Page #948

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

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	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

	1	Deng, L. et al., "MPTCP Proxy for Mobile Networks, draft-deng-mptcp-mobile-network-proxy-00," 2014-02-14, URL: https://tools.ietf.org/html/draft-deng-mptcp-mobile-network-proxy-00 (8pgs)	
	2	Bagnulo, M., "Secure MPTCP, draft-bagnulo-mptcp-secure-00," 2014-02-12, URL: https://tools.ietf.org/html/draft-bagnulo-mptcp-secure-00 (8pgs).	
	3	Paasch, C. et al., "A generic control stream for Multipath TCP, draft-paasch-mptcp-control-stream-00," 2014-02-11, URL: https://tools.ietf.org/html/draft-paasch-mptcp-control-stream-00 (11pgs).	
	4	Deng, Zhenjie, "Non-Renegable Selective Acknowledgements (NR-SACKs) for MPTCP, draft-deng-mptcp-nrsack-00.txt," 2013-12-02, URL: https://tools.ietf.org/html/draft-deng-mptcp-nrsack-00 (10pgs).	
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	9	Xue, K. et al., "TMPP for Both Two MPTCP-unaware Hosts, draft-xue-mptcp-tmpp-unware-hosts-02,"2013-06-20, URL: https://tools.ietf.org/html/draft-xue-mptcp-tmpp-unware-hosts-02 (15pgs).	
	10	Scharf, M. et al., "MPTCP Application Interface Considerations, draft-ietf-mptcp-api-07," 2013-01-19, URL: https://tools.ietf.org/html/draft-ietf-mptcp-api-07 (34pgs).	
	11	Ford, A. et al., "TCP Extensions for Multipath Operation with Multiple Addresses, draft-ietf-mptcp-multiaddressed-12," 2012-10-22, URL: https://tools.ietf.org/html/draft-ietf-mptcp-multiaddressed-12 (63pgs).	

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	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

	12	Paasch, C., Ed. et al., "Securing the MultiPath TCP handshake with external keys, draft-paasch-mptcp-ssl-00," 2012-10-15, URL: https://tools.ietf.org/html/draft-paasch-mptcp-ssl-00 (8pgs).	
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	17	Barre, S. et al., "MultiPath TCP - Guidelines for implementers, draft-barre-mptcp-impl-00," 2011-03-07, URL: https://tools.ietf.org/html/draft-barre-mptcp-impl-00 (41pgs).	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

	23	Ford, A. et al., "TCP Extensions for Multipath Operation with Multiple Addresses, draft-ford-mptcp-multiaddressed-03," 2010-03-08, URL: https://tools.ietf.org/html/draft-ford-mptcp-multiaddressed-03 (35pgs).	
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	25	Sarolahti, P., "Multi-address Interface in the Socket API, draft-sarolahti-mptcp-af-multipath-01.txt," 2010-03-04, URL: https://tools.ietf.org/html/draft-sarolahti-mptcp-af-multipath-01 (13pgs).	
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	29	Office Action dated 2018-08-10, in Canadian Patent Application No. 2,855,461 (3pgs).	

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14356581
	Filing Date	2014-05-06
	First Named Inventor	Wonjong Rhee
	Art Unit	
	Examiner Name	
	Attorney Docket Number	20145-054US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael North/	Date (YYYY-MM-DD)	2018-10-05
Name/Print	Michael North	Registration Number	46963

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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EFS ID:	33935688
Application Number:	14356581
International Application Number:	
Confirmation Number:	4319
Title of Invention:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER
First Named Inventor/Applicant Name:	Wonjong Rhee
Customer Number:	146571
Filer:	Michael V. North/Nita Miller
Filer Authorized By:	Michael V. North
Attorney Docket Number:	20145-054US
Receipt Date:	05-OCT-2018
Filing Date:	06-MAY-2014
Time Stamp:	17:26:23
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

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2	Information Disclosure Statement (IDS) Form (SB08)	054US_SIDS_SB08-5.pdf	613797 60e169b673f6bc6e1fc457371c44e93e0f5e87807	no	6
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3	Non Patent Literature	055USC_IDS_NPL201.pdf	45848 5e7e06412cfb19e09e86bca9f6b66e4282bcc7bc0	no	8
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4	Non Patent Literature	055USC_IDS_NPL202.pdf	52213 428130e9a894427f39d422d8dc3fe264c9ca137	no	8
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5	Non Patent Literature	055USC_IDS_NPL203.pdf	64357 f352b891ecc8d281de712e72a14866064cae7c57	no	11
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6	Non Patent Literature	055USC_IDS_NPL204.pdf	44079 37d52b4d8f3bff7c6cb0e402d19f72e796853 5b41	no	10
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7	Non Patent Literature	055USC_IDS_NPL205.pdf	58539 e69fa5720e589d0e5d5adbc15a2164c00f93 93a9	no	10
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8	Non Patent Literature	055USC_IDS_NPL206.pdf	103086 2fc9d988d419ab611c0fdf8b89a8c57a16ec0da6b	no	25
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9	Non Patent Literature	055USC_IDS_NPL207.pdf	58028 639eae77c4c172525c2d16c0ade0f311027ebeef3	no	10
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10	Non Patent Literature	055USC_IDS_NPL208.pdf	182002 b0e2dc0ac6b399ce6460f274dc8b0f5c6f5ca16f	no	38
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11	Non Patent Literature	055USC_IDS_NPL209.pdf	74576 c472b8a8f6773e7981abf56e17eab8ebcd2472692d	no	15
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12	Non Patent Literature	055USC_IDS_NPL210.pdf	164321 8cc90da204dee58c1f4620b2ae93e106886fccab	no	34
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13	Non Patent Literature	055USC_IDS_NPL211.pdf	299657 1d3c8ecc4ff54d42236390d51505c450266b954f	no	63
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14	Non Patent Literature	055USC_IDS_NPL212.pdf	47551 8eff5b3cbda59f58f4958ff1e8c7f3fda758bf394	no	8
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15	Non Patent Literature	055USC_IDS_NPL213.pdf	51278 880834826d6995fa377969053c43416f79c2ba3f	no	9
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16	Non Patent Literature	055USC_IDS_NPL214.pdf	127669 c4731e5d6f5a6c6a682822f6f50a1d30f762be61b49	no	30
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17	Non Patent Literature	055USC_IDS_NPL215.pdf	72210 3e0983a3e8967d21dced24ec2ce9e7ac98dc88d3	no	13
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23	Non Patent Literature	055USC_IDS_NPL221.pdf	148750 52935c380e59246f5c685b98e7f2d7837a4cfe59	no	33
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24	Non Patent Literature	055USC_IDS_NPL222.pdf	170413 349e25741b52da92b27de353ce1ef82b1450da1d	no	35
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25	Non Patent Literature	055USC_IDS_NPL223.pdf	169749 8797de7121c517795456ab5cdd9e7d78ccc10172	no	35
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31	Non Patent Literature	055USC_IDS_NPL229.pdf	3431508 1a9c075906bf0534a704670ee3871c6b14534ae	no	3
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Wonjong Rhee	Confirmation No.: 4319
Appl. No.	:	14/356,581	
Filing Date	:	2014-05-06	
Title	:	METHOD, APPARATUS, AND SYSTEM FOR OPTIMIZING PERFORMANCE OF A COMMUNICATION UNIT BY A REMOTE SERVER	
Art Unit	:	2446	
Examiner	:	Boris D. Grualvalobos	
Docket No.	:	20145-054US	

CERTIFICATE OF MAILING (37 CFR §1.8)

I hereby certify, pursuant to 37 CFR §1.8, that this correspondence is being electronically transmitted via EFS-Web addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

Date: 2018-10-05 By: /Nita Miller/
Nita Miller

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SIR or MADAM:

Filed herewith, in accordance with the provisions of 37 CFR §§ 1.56 and 1.97–1.98, listing various references for consideration by the Examiner, is an Information Disclosure Statement ("IDS").

The filing of this IDS shall not be construed as a representation that a search has been made, or regarding the completeness of the list of references, or that no other material information exists. Furthermore, the filing of this IDS shall not be construed as a representation that inclusion of a reference in this list is an admission that it is prior art or is pertinent to this application, or as an admission that the information listed is, or may be considered to be, material to the patentability of the above referenced application. The filing of this IDS shall not be construed in any manner as an admission against interest.

This IDS is being filed:

Charter Communications, Inc.
Exhibit 1006
Page #961

☐ within three months of the filing date of a national application, other than a continued prosecution application under § 1.53(d);

☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application;

☐ before the mailing of a first Office Action on the merits;

☐ before the mailing of a first Office Action after the filing of a request for continued examination under § 1.114;

☒ after three months of the filing date or entry into the national stage or after the mailing of a first Office action on the merits, but before the mailing date of any final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☒ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

OR

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this information disclosure statement;

OR

☐ That no item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing this certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in § 1.56(c) more than three months prior to the filing of this information disclosure statement.

☐ on or before the payment of the issue fee but after the mailing of a final action under § 1.113, a notice of allowance under §1.311, or an action that otherwise closes prosecution in the application;

AND

☐ enclosed herein is the fee set forth in 37 CFR § 1.17(p);

AND

☐ Applicant certifies pursuant to 37 CFR § 1.97(e):

☐ That each item of information contained in the information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application