(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 November 2014 (27.11.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/189354 A1

(51) International Patent Classification:
G06F 9/445 (2006.01)

(21) International Application Number:
PCT/MY2014/000062

(22) International Filing Date:
18 April 2014 (18.04.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PI 2013700821 20 May 2013 (20.05.2013) MY

(71) Applicant: **MIMOS BERHAD** [MY/MY]; Technology Park Malaysia, 57000 Kuala Lumpur (MY).

(72) Inventors: **DIN, Dahlia Binti**; c/o Mimos Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY). **WONG, Chin Wee**; c/o Mimos Berhad, Technology Park Malaysia, 57000 Kuala Lumpur (MY).

(74) Agent: **TAY, Wee Chao**; c/o Author IP, No. 2-3, Taman Arosa, Jalan Haji Jaib, 84000 Muar, Johor (MY).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

[Continued on next page]

(54) Title: METHOD AND SYSTEM FOR PERFORMING A BULK REBOOT OPERATION IN A GROUP OF RELAY ACCESS POINTS

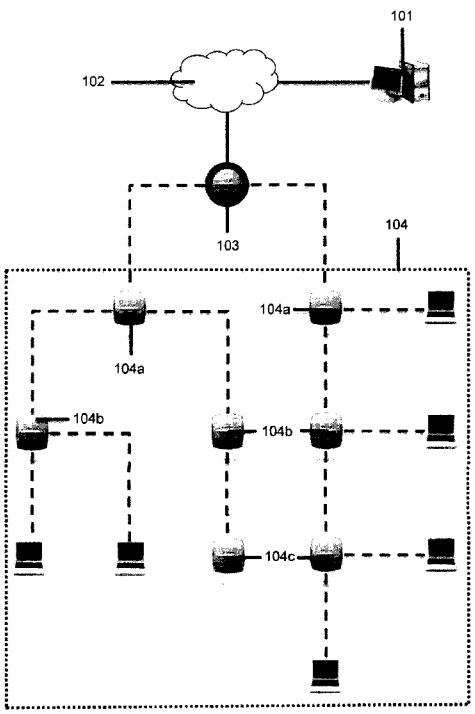

FIGURE 1

(57) Abstract: The present invention relates to a method for performing a bulk reboot operation in a group of relay access points (104a) (104b) (104c) within a wireless network environment. A relay access point (104a) upon receiving a reboot command, which is sent from a network management system residing in an operation center (101), will not immediately reboot itself. On the contrary, the relay access point (104a) ensures that low level relay access points (104b), which are wirelessly connected to and directly a level below the relay access point (104a), successfully disconnect from the relay access point (104a) and perform the reboot operation before the relay access point (104a) reboot itself. A system for carrying out the aforesaid is also described herein.

WO 2014/189354 A1

Published:

— *with international search report (Art. 21(3))*

METHOD AND SYSTEM FOR PERFORMING A BULK REBOOT OPERATION IN A GROUP OF RELAY ACCESS POINTS

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to a reboot operation, and more particularly, to a bulk reboot operation in a group of relay access points.

BACKGROUND OF THE INVENTION

A bulk reboot operation is normally performed on a group of identical or similar electronic devices such as computers, modems, routers, access points, or relay access points that are wirelessly linked to each other in a wireless network environment, which may carry out identical or similar functions. The bulk reboot operation is necessary and required to be implemented in order to effectuate changes made to the electronic devices, which may include firmware upgrade, software upgrade, restoring settings to factory default settings, changes in configurations settings, etc.

This particular document pertains to a bulk reboot operation on a group of relay access points within a wireless network environment. In general, a relay access point is an access point that relays data from a primary access point to end user devices, and is typically utilized for the purpose of expanding wireless coverage.

Usually, the bulk reboot operation is managed and initiated by a network management system that resides in an operation center. Reboot commands will be sent in a bulk manner to every relay access points within the group, instructing the relay access points to reboot themselves.

There exists an issue with the aforesaid conventional method. As the reboot commands are sent out in a bulk manner at complete or near simultaneous, the devices in the upper level will receive the reboot commands earlier than the devices in the lower level. As such, the devices in the upper level will proceed to

reboot themselves upon receiving the reboot commands, causing them to be disconnected from the devices in the lower level. Consequently, this results in failure of receiving the reboot commands by the devices in the lower level, and thus the bulk reboot operation is carried out unsuccessfully.

In view of the above, it therefore has become the aim of the present invention to solve all the aforementioned technical issue by providing a novel method and system for performing a bulk reboot operation on a group of relay access points within a wireless network environment.

SUMMARY OF THE INVENTION

A first and a second aspects of the present invention are directed to a method and a system, respectively, for performing a bulk reboot operation in a group of relay access points within a wireless network environment, which comprises a plurality of wireless clients including the group of relay access points, at least one operation center having a network management system residing within it for managing the wireless network including sending a reboot command to each relay access point within the group of relay access points, and at least one primary access point for bridging the communications between the operation center, the Internet, and the wireless clients including the group of relay access points.

The method and the system of the present invention allow and ensure all relay access points within the group of relay access points to reboot successfully upon receiving the reboot command from the network management system of the operation center, regardless of the time difference in receiving the reboot command by one relay access point and by another relay access point.

The bulk reboot operation is normally carried out to effectuate changes made to the relay access points. Those changes may include firmware upgrade, software upgrade, restoring settings to factory default settings, changes in configurations settings, etc.

The method and the system of the present invention work by allowing the relay access points to reboot in order of lowest to highest level. In other words, the relay access points at the lowest level are allowed to reboot first, follow by the relay access points that are connected to and directly a level above the lowest level relay access points, and so on, until the highest level relay access points are rebooted.

Referring now to the method of the present invention, firstly, the operation center sends out the reboot commands to every relay access points in the group of relay access points via its network management system at complete or near simultaneous. The relay access point does not proceed to reboot itself immediately when it receives the reboot command. On the contrary, the relay access point prevents itself from rebooting, and prevents new wireless clients including new relay access points from establishing new connections with it. Subsequently, the relay access point identifies low level relay access points from low level wireless clients that are connected to and directly a level below it. Thereafter, the relay access point allows the identified low level relay access points to reboot first. At that point of rebooting, the low level relay access points will be completely disconnected from the relay access point. The relay access point will continuously check and updates the status of existing connections between the relay access point and the identified low level relay access points, and when it is determined that all the existing connections have ended, the relay access point will then proceed to reboot itself. Additionally, the relay access point will also proceed to reboot itself if the existing connections have timed out.

Referring now to the system of the present invention, each relay access point within the group of relay access points comprises at least one simple network management protocol (SNMP) for managing the relay access point; at least one connection blocking module to prevent new wireless clients including new relay access points from establishing new connections with it; at least one connection checking module for identifying low level relay access points from low level wireless clients that are connected to and directly a level below the relay access

point, and checking and updating the status of existing connections between the relay access point and the identified low level relay access points; and at least one reboot module for rebooting the relay access point upon sensing all existing connections have either ended or timed out.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram illustrating the system of the present invention for performing a bulk reboot operation in a group of relay access points within a wireless network environment.

DETAILED DESCRIPTION OF THE INVENTION

The above mentioned and other features and objects of this invention will become more apparent and better understood by reference to the following detailed description. It should be understood that the detailed description made known below is not intended to be exhaustive or limit the invention to the precise disclosed form as the invention may assume various alternative forms. On the contrary, the detailed description covers all the relevant modifications and alterations made to the present invention, unless the claims expressly state otherwise.

A first core aspect and a second core aspect of the present invention relate to a method and a system, respectively, for performing a bulk reboot operation in a group of relay access points within a wireless network environment.

Referring now to Figure 1, the wireless network environment comprises a plurality of wireless clients (104) including the group of relay access points (104a) (104b) (104c), at least one operation center (101) having a network management system residing within it for managing the wireless network including sending a reboot command to each relay access point within the group of relay access points (104a) (104b) (104c), and at least one primary access point (103) for bridging the communications between the operation center (101), the Internet

(102), and the wireless clients (104) including the group of relay access points (104a) (104b) (104c).

The method and the system of the present invention allow and ensure that all the relay access points within the group of relay access points (104a) (104b) (104c) are successfully rebooted upon receiving the reboot command from the network management system of the operation center (101). In conventional method, the relay access point (104a) receives the reboot command earlier than the low level relay access point (104b) that is connected to and directly a level below the relay access point (104a), and thus, theoretically, the relay access point (104a) should carry out the reboot operation earlier than the low level relay access point (104b). This scenario is undesirable because there is a huge possibility that the low level relay access point (104b) does not receive the reboot command, hence the bulk reboot operation is performed unsuccessfully. In another words, most of the low level relay access points would not have rebooted. However, this undesirable scenario does not exist in the present invention. The time difference in receiving the reboot command by one relay access point, for example relay access point (104a), and by another relay access point, for example low level relay access point (104b), is not vital and does not affect the effectiveness of the present invention.

The method and the system of the present invention work by allowing the relay access points (104a) (104b) (104c) to reboot in order of lowest to highest level. In other words, the lower level relay access points (104c) are allowed to reboot first, follow by the low level relay access points (104b) that are connected to and directly a level above the lower level relay access points (104c), and lastly follow by the relay access points (104a) that are connected to and directly a level above the low level relay access points (104b).

The method of the present invention will now be thoroughly described with the aid of Figure 1. Firstly, the operation center (101) will send out the reboot commands in bulk to each relay access points within the group of relay access points (104a) (104b) (104c) via its network management system at complete or

near simultaneous. Once the relay access point (104a) receives the reboot command, it will not immediately reboot itself. On the contrary, it (104a) prevent itself from being rebooted, which in turn provides the low level relay access point (104b) that is connected to and directly a level below the relay access point (104a), and the lower level relay access point (104c) that is connected to and directly a level below the low level relay access point (104b) sufficient time to receive the reboot commands.

Further, the relay access point (104a) also prevents or blocks new wireless clients (not shown in Figure 1) including new relay access points (now shown in Figure 1) from establishing new connections with it (104a). The relay access point (104a) does so by detecting and saving MAC addresses of all low level wireless clients (104) including the low level relay access points (104b), wherein the low level wireless clients (104) are directly a level below the relay access point (104a), and the low level relay access points (104b) are connected to and directly a level below the relay access point (104a). With this information, the relay access point (104a) would be able to differentiate the existing low level wireless clients (104) including the existing low level relay access point (104b) from the new wireless clients (104) including the new relay access points by filtering the detected MAC addresses. In one embodiment of the present invention, the MAC addresses can be filtered by using access control list (ACL).

Subsequently, the relay access point (104a) will proceed to identify the low level relay access point (104b) from the low level wireless clients (104) that are connected to and directly a level below the relay access point (104a). The relay access point (104a) does so by extracting and obtaining information pertaining to the low level wireless clients (104) including the low level relay access points (104b). With this information, the relay access point (104a) will be able to determine which of the low level wireless clients (104) are actually the low level relay access points (104b). Apart from the above, the relay access point (104a) is also capable to identify lower level relay access point (104c) from lower level wireless clients (104), which are connected to and directly a level below the low level relay access point (104b).

Consequently, the relay access point (104a) will allow the identified low level relay access points (104b) that is connected to and directly a level below the relay access point (104a) to reboot first. At the point of rebooting, the low level relay access point (104b) will be disconnected from the relay access point (104a). The relay access point (104a) will continuously check and update all the existing connections between the relay access point (104a) and the identified low level relay access points (104b). Once it is determined and confirmed that all the existing connections have ended, the relay access point (104a) will proceed to reboot itself. In the event that the existing connections have not ended, a time out timer will be initiated. The relay access point (104a) will then proceed to reboot itself when the existing connections have timed out.

Referring now to the system of the present invention, each relay access point within the group of relay access points (104a) (104b) (104c) comprises at least one simple network management protocol (SNMP) for managing the relay access points (104a) (104b) (104c); at least one connection blocking module to prevent new wireless clients (104) including new relay access points from establishing new connections with it (104a) (104b) (104c); at least one connection checking module for identifying low level relay access points (104b) from low level wireless clients (104) that are connected to and directly a level below the relay access point (104a), and checking and updating the status of existing connections between the relay access point (104a) and the identified low level relay access points (104b); and at least one reboot module for rebooting the relay access point (104a) upon sensing all existing connections have either ended or timed out.

It should be well noted and understood that the teachings of the present invention does not limit to three levels of relay access points only. The present invention uses three levels of relay access points as an example, and for the purposes of easy understanding and conveying the teachings of the present invention to the readers. In fact, the teachings of the present invention can be used to perform bulk reboot operation in a group of relay access points within a

wireless network environment that comprises at least one level of relay access points, or more than three levels of relay access points.

5

CLAIMS

1) A method for performing a bulk reboot operation in a group of relay access points (104a) (104b) (104c) within a wireless network environment that comprises a plurality of wireless clients (104) including the group of relay access points (104a) (104b) (104c), the method comprises the steps of:

   a) receiving a reboot command by a relay access point (104a), wherein the reboot command is sent by a network management system residing in an operation center;

   b) preventing the relay access point (104a) from rebooting;

   c) blocking new wireless clients including new relay access points, by the relay access point (104a), from establishing new connections with the relay access point (104a);

   d) identifying low level relay access points (104b) from low level wireless clients (104), by the relay access point (104a), wherein the low level relay access points (104b) are connected to and directly a level below the relay access point (104a);

   e) checking and updating the status of existing connections between the relay access point (104a) and the identified low level relay access points (104b), by the relay access point (104a); and

   f) rebooting the relay access point (104a) upon detecting the following:

      i. all existing connections between the relay access point (104a) and the identified low level relay access points (104b) have ended; or

      ii. all existing connections between the relay access point (104a) and the identified low level relay access points (104b) have timed out.

2) A method in accordance with claim 1, wherein the step of blocking new wireless clients including new relay access points from establishing new connections with the relay access point (104a) further comprises the steps of:

a) detecting and saving the MAC addresses of the low level wireless clients (104) including the low level relay access points (104b), by the relay access point (104a), wherein the low level wireless clients (104) are directly a level below the relay access point (104a), and the low level relay access points (104b) are connected to and directly a level below the relay access point (104a); and

b) filtering the detected MAC addresses by the relay access point (104a).

3) A method in accordance with claim 2, wherein the step of filtering the detected MAC address is by using access control list (ACL).

4) A method in accordance with claim 1, wherein the step of identifying the low level relay access points (104b) from the low level wireless clients (104) that are connected to and directly a level below the relay access point (104a) further comprises the step of extracting and obtaining information of the low level wireless clients (104) including the low level relay access points (104b).

5) A method in accordance with claim 1 further comprises the step of identifying lower level relay access points (104c) from lower level wireless clients (104) that are connected to the identified low level relay access points (104b).

6) A system for performing a bulk reboot operation in a group of relay access points (104a) (104b) (104c) within a wireless network environment that comprises a plurality of wireless clients (104) including the group of relay access points (104a) (104b) (104c), at least one operation center (101) having a network management system for managing the wireless network including sending out a reboot command to each relay access point within the group of relay access points (104a) (104b) (104c), and at least one primary access point (103) for bridging the communications between the operation center (101), the Internet (102), and the wireless clients including the group of relay access points (104a) (104b) (104c),

characterized in that, each relay access point (104a) (104b) (104c) comprises:

a) at least one simple network management protocol (SNMP) agent for managing the relay access point (104a) (104b) (104c);

b) at least one connection blocking module for blocking new wireless clients including new relay access points from establishing new connections with the relay access point (104a) (104b) (104c);

c) at least one connection checking module for identifying low level relay access points (104b) from low level wireless clients (104) that are connected to and directly a level below the relay access point (104a), and checking and updating the status of existing connections between the relay access point (104a) and the identified low level relay access points (104b); and

d) at least one reboot module for performing the reboot operation on the relay access point (104a) upon detecting the following:

i. all existing connections between the relay access point (104a) and the identified low level relay access points (104b) have ended; or

ii. all existing connections between the relay access point (104a) and the identified low level relay access points (104b) have timed out.

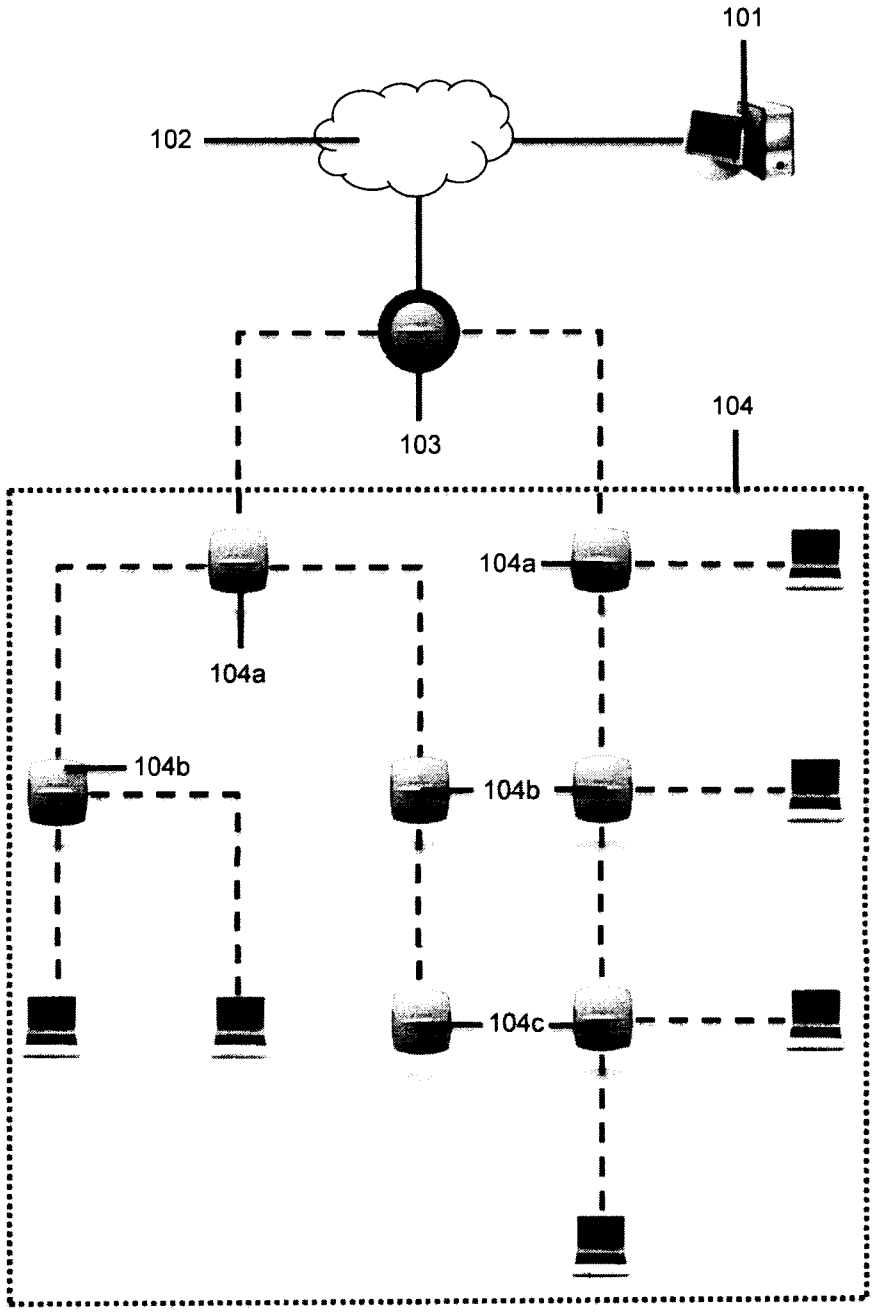

FIGURE 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2014/000062

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F9/445
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)
G06F H04B

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/072253 A1 (ERICSSON TELEFON AB L M [SE]; LEE ANTHONY [IE]; DOYLE GARRETT [IE]) 1 July 2010 (2010-07-01) page 3 - page 7; figures 1-5	1-6
A	US 8 027 637 B1 (BIMS HARRY [US]) 27 September 2011 (2011-09-27) column 30, line 64 - column 32, line 32	1-6
A	US 2004/216099 A1 (OKITA KOICHI [JP] ET AL) 28 October 2004 (2004-10-28) figures 5,6 abstract	1-6

☐ 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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 August 2014	03/09/2014

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	Bohnhoff, Peter

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/MY2014/000062

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010072253 A1	01-07-2010	EP 2370896 A1	05-10-2011
		JP 5190543 B2	24-04-2013
		JP 2012513133 A	07-06-2012
		US 2011314464 A1	22-12-2011
		WO 2010072253 A1	01-07-2010
US 8027637 B1	27-09-2011	NONE	
US 2004216099 A1	28-10-2004	CN 1540899 A	27-10-2004
		JP 3987460 B2	10-10-2007
		JP 2005010821 A	13-01-2005
		KR 20040093355 A	05-11-2004
		US 2004216099 A1	28-10-2004
		US 2006030308 A1	09-02-2006
		US 2006030325 A1	09-02-2006
		US 2008064384 A1	13-03-2008
		US 2009042554 A1	12-02-2009
		US 2009111450 A1	30-04-2009
		US 2010248705 A1	30-09-2010
		US 2011171947 A1	14-07-2011