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- (71) **Applicant (for all designated States except US):** SILVER SPRING NETWORKS, INC. [US/US]; 575 Broadway Street, Redwood City, CA 94063 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** VASWANI, Raj [US/US]; 190 Trinity Lane, Portola Valley, CA 94028 (US). HUGHES, Sterling [US/US]; 338 South Fremont Street, Apt. 216, San Mateo, CA 94401 (US). VAN GREUNEN, Jana [US/US]; C/o Silver Spring Networks,

Inc., 575 Broadway Street, Redwood City, CA 94611 (US). SAN FILIPPO, William, S. III [US/US]; 13761 La Paloma Road, Los Altos Hills, CA 94022 (US). FLAMMER, George III [US/US]; 10549 San Felipe Road, Cupertino, CA 95014 (US).

(74) **Agent:** LABARRE, James, A.; Buchanan Ingersoll & Rooney PC, P. O. Box 1404, Alexandria, VA 22313-1404 (US).

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[Continued on next page]

(54) **Title:** ROUTE AND LINK EVALUATION IN WIRELESS MESH COMMUNICATIONS NETWORKS

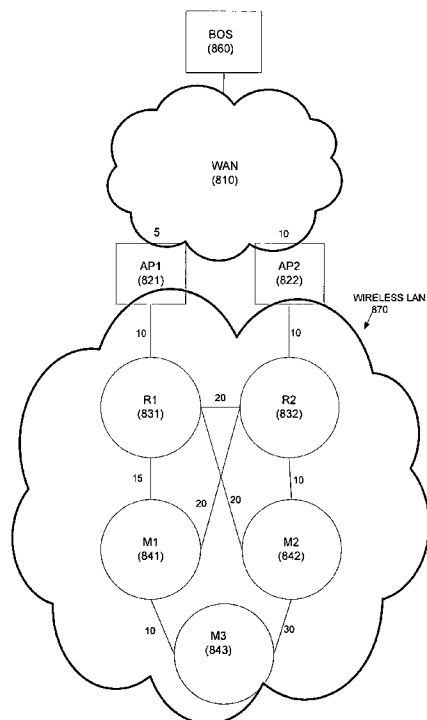


FIGURE 8

(57) **Abstract:** Methods and systems for providing a network and routing protocol for utility services are disclosed. A method includes discovering a utility network. Neighboring nodes are discovered and the node listens for advertised routes for networks from the neighbors. The node is then registered with one or more utility networks, receiving a unique address for each network registration. Each upstream node can independently make forwarding decisions on both upstream and downstream packets, i.e., choose the next hop according to the best information available to it. The node can sense transient link problems, outage problems and traffic characteristics. Information is used to find the best route out of and within each network. Each network node maintains multi-egress, multi-ingress network routing options both for itself and the node(s) associated with it. The node is capable of several route maintenance functions utilizing the basic routing protocol and algorithms.



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GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (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, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Declarations under Rule 4.17:

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

(88) Date of publication of the international search report:

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/003713

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H04L12/56 H04W40/24

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 practical, 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.
X	YARVIS M D ET AL: "Real-world experiences with an interactive ad hoc sensor network" PARALLEL PROCESSING WORKSHOPS, 2002. PROCEEDINGS. INTERNATIONAL CONFERENCE ON 18-21 AUGUST 2002, PISCATAWAY, NJ, USA, IEEE, 18 August 2002 (2002-08-18), pages 143-151, XP010608442 ISBN: 978-0-7695-1680-6	1-9, 21
Y	sections 4,4.1,4.2	14-20
X	WO 2004/109474 A (MESHNETWORKS INC [US]; JOSHI AVINASH [US]; STRUTT GUENAE T [US]) 16 December 2004 (2004-12-16)	1-9, 21
Y	paragraphs [0027], [0028]; figure 1	14-20
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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	"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
"E" earlier document but published on or after the international filing date	"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
"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)	"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.
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Itani, Maged
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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/003713

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>BHARGHAVAN V ET AL: "MACAW: A MEDIA ACCESS PROTOCOL FOR WIRELESS LAN'S" COMPUTER COMMUNICATION REVIEW, ACM, NEW YORK, NY, US, vol. 24, no. 4, 1 October 1994 (1994-10-01), pages 212-225, XP000477053 ISSN: 0146-4833 sections 2.3,3.1,3.3.1,3.4 abstract; tables 4,5</p>	10-13
Y	<p>BANERJEE S ET AL: "Minimum energy paths for reliable communication in multi-hop wireless networks" INTERNATIONAL SYMPOSIUM ON MOBILE AD HOC NETWORKING & COMPUTING, [Online] 9 June 2002 (2002-06-09), - 11 June 2002 (2002-06-11) pages 146-156, XP002559865 ISBN: 1-58113-501-7 Retrieved from the Internet: URL:http://doi.acm.org/10.1145/513800.513818 18> [retrieved on 2009-12-10] sections 1,4,4.1,4.2</p>	14-20
A	<p>KARBASCHI G ET AL: "A link-quality and congestion-aware cross layer metric for multi-hop wireless routing" MOBILE ADHOC AND SENSOR SYSTEMS CONFERENCE, 2005. IEEE INTERNATIONAL CONFERENCE ON NOV. 7, 2005, PISCATAWAY, NJ, USA, IEEE, 7 November 2005 (2005-11-07), pages 649-655, XP010859007 ISBN: 978-0-7803-9465-0 sections II,IV,V</p>	1-21
A	<p>DOUGLAS S J DE COUTO ET AL: "a high-throughput path metric for multi-hop wireless routing" WIRELESS NETWORKS ; THE JOURNAL OF MOBILE COMMUNICATION, COMPUTATION AND INFORMATION, KLUWER ACADEMIC PUBLISHERS, DO, vol. 11, no. 4, 1 July 2005 (2005-07-01), pages 419-434, XP019216752 ISSN: 1572-8196 sections 3,3.1 abstract</p>	1-21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/003713

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9,21

A method for route evaluation in a wireless network

2. claims: 10-20

A method for polling nodes in a wireless network

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/003713

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004109474 A	16-12-2004	EP 1631915 A2	08-03-2006
		EP 1631916 A1	08-03-2006
		JP 2006527524 T	30-11-2006
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		WO 2004109536 A1	16-12-2004
