



US007027418B2

(12) **United States Patent**  
**Gan et al.**

(10) **Patent No.:** **US 7,027,418 B2**  
(45) **Date of Patent:** **Apr. 11, 2006**

(54) **APPROACH FOR SELECTING COMMUNICATIONS CHANNELS BASED ON PERFORMANCE**

(75) Inventors: **Hongbing Gan**, Carlton North (AU); **Bijan Treister**, Kew (AU); **Efstratios Skafidas**, Coburg (AU)

(73) Assignee: **Bandspeed, Inc.**, Austin, TX (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 768 days.

5,726,978 A *	3/1998	Frodigh et al. ....	370/252
5,774,808 A	6/1998	Särkioja et al.	
5,781,861 A	7/1998	Kang et al.	
5,844,522 A	12/1998	Sheffer et al.	
5,873,036 A	2/1999	Vucetic	
5,898,928 A	4/1999	Karlsson et al.	
5,956,642 A	9/1999	Larsson et al.	
6,009,332 A	12/1999	Haartsen	
6,169,761 B1	1/2001	Marcoccia et al.	
6,240,126 B1 *	5/2001	Ohashi et al. ....	375/132
6,549,784 B1 *	4/2003	Kostic et al. ....	455/501
6,650,872 B1	11/2003	Karlsson	
6,687,239 B1 *	2/2004	Koprivica .....	370/341

(Continued)

(21) Appl. No.: **09/948,488**

(22) Filed: **Sep. 6, 2001**

(65) **Prior Publication Data**

US 2002/0136268 A1 Sep. 26, 2002

**Related U.S. Application Data**

(60) Provisional application No. 60/264,594, filed on Jan. 25, 2001.

(51) **Int. Cl.**  
**H04Q 7/00** (2006.01)

(52) **U.S. Cl.** ..... **370/329**; 375/132; 455/450

(58) **Field of Classification Search** ..... 370/328-334, 370/431, 436, 437, 464, 465; 375/132-136; 450/450, 451, 452.1, 452.2

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,716,573 A	12/1987	Bergstrom et al.	
4,780,885 A *	10/1988	Paul et al. ....	375/267
5,323,447 A	6/1994	Gillis et al.	
5,394,433 A *	2/1995	Bantz et al. ....	375/132
5,418,839 A	5/1995	Knuth et al.	
5,541,954 A	7/1996	Emi	
5,574,979 A	11/1996	West	
5,649,291 A	7/1997	Tayloe	

**OTHER PUBLICATIONS**

Johnsson, HiperLAN/2-The Broadband Radio Transmission Technology Operating in the 5 GHz Frequency Band, pp. 1-22, 1999.\*

(Continued)

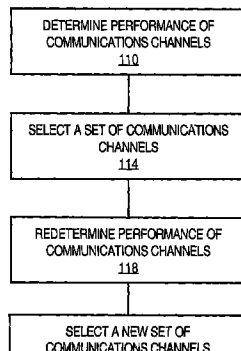
*Primary Examiner*—Frank Duong

(74) *Attorney, Agent, or Firm*—Hickman Palermo Truong & Becker, LLP

(57) **ABSTRACT**

An approach for selecting sets of communications channels involves determining the performance of communications channels. A set of channels is selected based on the results of performance testing and specified criteria. The participant generates data that identifies the selected set of channels and provides that data to other participants of the communications network. The participants communicate over the set of channels, such as by using a frequency hopping protocol. When a specified time expires or monitoring of the performance of the channel set identifies poor performance of the set of channels, the participant selects another set of channels for use in communications based on additional performance testing. By selecting channels based on the initial performance testing and performance monitoring, the communications network adaptively avoids channels with poor performance.

**128 Claims, 11 Drawing Sheets**



U.S. PATENT DOCUMENTS

6,694,147	B1 *	2/2004	Viswanath et al. ....	455/517
6,700,875	B1	3/2004	Schroeder et al.	
6,704,346	B1 *	3/2004	Mansfield .....	375/136
6,745,034	B1	6/2004	Wang et al.	
6,760,317	B1	7/2004	Honkanen et al.	
2002/0122462	A1 *	9/2002	Batra et al. ....	375/132

OTHER PUBLICATIONS

Zander, Adaptive Frequency Hopping in HF communications, IEEE, pp. 99-105, 1995.\*

Lawrey et al.n Adaptive Frequency Hopping for Multiuser OFDM, pp. 1-5, ICICS'99.\*

Gan et al, Adaptive Frequency Hopping Implementation Proposals for IEEE 802.15.1/2 WPAN, pp. 1-28, Nov. 2000, downloaded at [http://grouper.ieee.org/groups/802/15/pub/2000/Nov00/00367r0P802-15\\_TG2-Adaptive-Frequency-Hopping.ppt](http://grouper.ieee.org/groups/802/15/pub/2000/Nov00/00367r0P802-15_TG2-Adaptive-Frequency-Hopping.ppt).\*

Walter L. Davis, "A MAC Layer submission for the High Rate 802.15.3 Standard," Project: IEEE P802.15 Working

Group for Wireless Personal Area Networks (WPANs), Sep. 2000, XP 002220853, pp. 1-57.

Jeyhan Karaoguz, "Multi-Rate QAM Physical Layer (8-40 Mbps) Proposal for High Rate WPAN," Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs), Oct. 20, 2000, XP002220854, pp. 1-39. IEE Proc.-Commun., vol. 142, No. 2, Apr. 1995, entitled "Adaptive frequency hopping in HF communications", by J. Zander, PhD and G. Malmgren, MSc, (pp. 99-105).

Fifth International Symposium on Signal Processing and its Applications, ISSPA '99 Brisbane, Australia, Aug. 22-25, 1999, entitled "Multiuser OFDM", by E. Lawrey, (pp. 761-764).

European Patent Office, "Communication pursuant to Article 96(2) EPC," Jun. 22, 2004, 5 pages.

"Clean Version of Amended Claims for Response to Official Comm. From Patent Examiner," EPO Patent Application No. 02709170.1, pp. 1-15.

\* cited by examiner

100  
↙

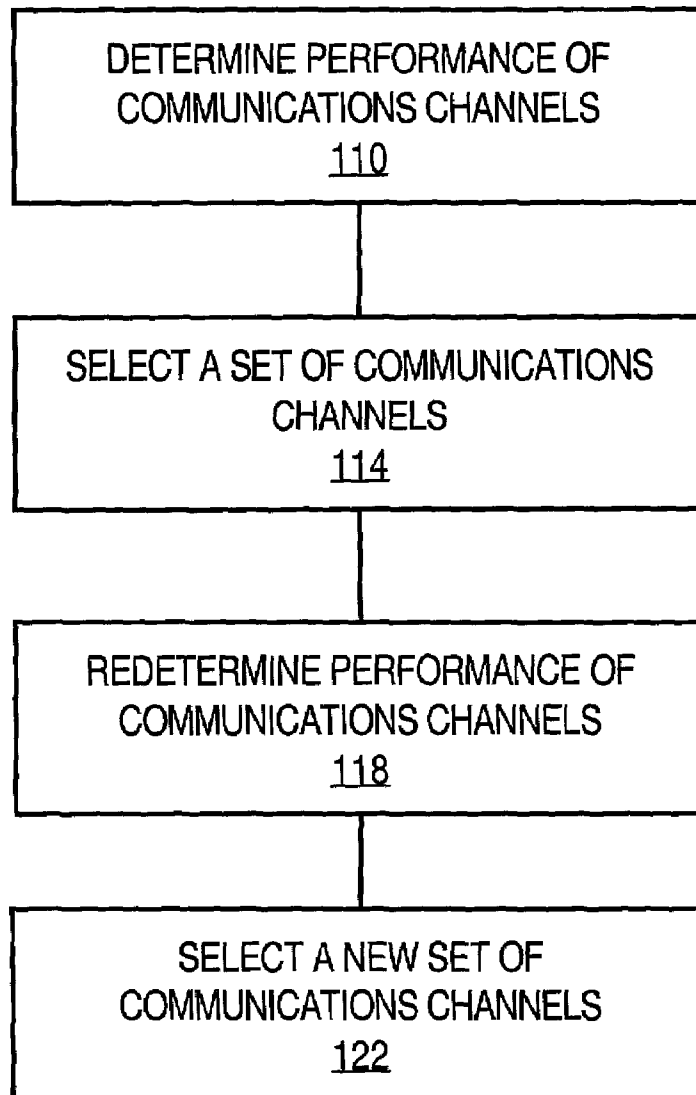


FIG. 1A

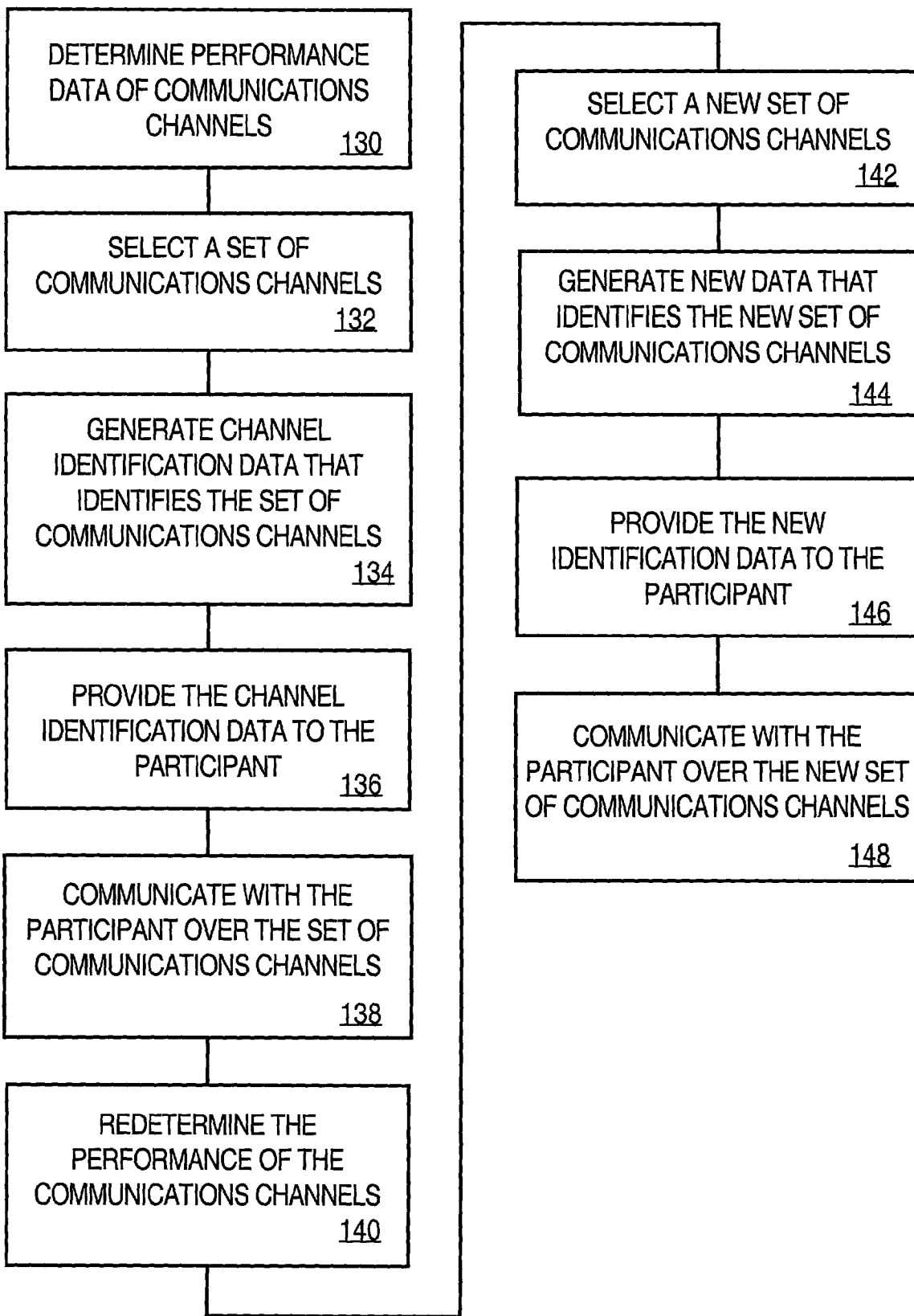


FIG. 1B

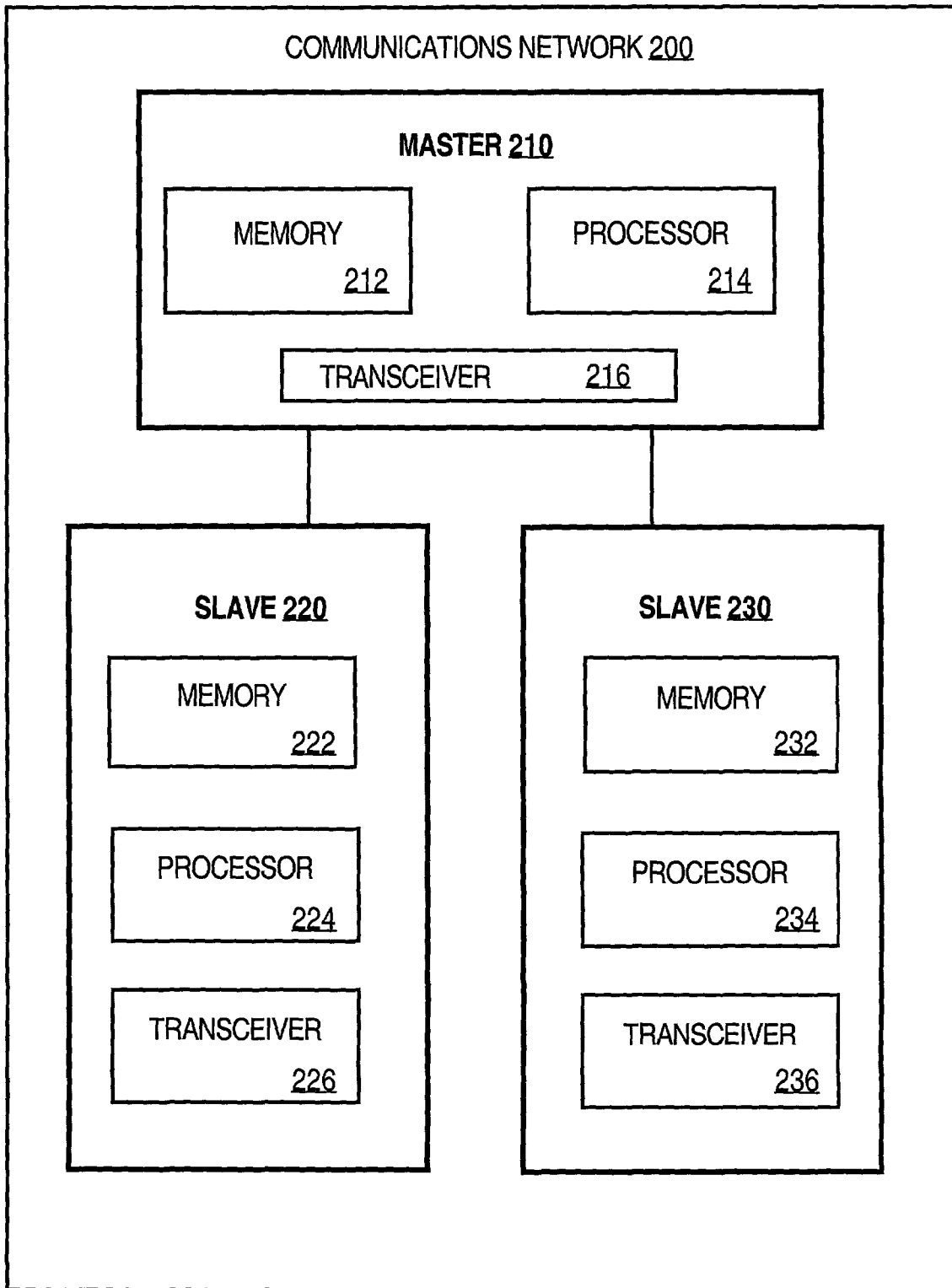


FIG. 2

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.