ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

Optimization of Wi-Fi Usage with Cluster Head Rotation of Motes and Client, Band Steering Technology

Dhanenjjeyan.K[1], Lalitha.R[2]

MSc Student, Dept. of CT, Sri Krishna Arts and Science College, Coimbatore, India[1]

Assistant Professor, Dept. of CT, Sri Krishna Arts and Science College, Coimbatore, India[2]

ABSTRACT: The use of Wi-Fi technology has been increasing in past few years and yet to grow further more efficiently. This paper describes the LEACH protocol and proposed technology that helps us to optimize the Wi-Fi usage. This mechanism also ensures that all the clients connected to the wireless network gets service to the maximum. Proposedtechnology is a standards-based RF management technology that puts the WLAN infrastructure in control of client connectivity and roaming. LEACH provides a balancing of energy usage by random rotation of cluster heads. The algorithm is also organized in such a manner that data-fusion can be used to reduce the amount of data transmission.

KEYWORDS: Mote, LEACH, AP, Clients,Radio,Packets

I. Introduction

Over the last few years the interest over the use of wireless sensor networks has been potentially increased, in various fields like disaster management, battle field surveillance, and border security surveillance. In such applications, a large number of motes are deployed, which are often unattended and work autonomously, which is due to energy depletion over the motes. Sensor nodes are referred to as motes. Cluster head selection is a key technique used to extend the lifetime of a sensor network by reducing energy depletion over the motes. It can also increase network scalability. Initially motes are deployed in the network. Then the motes are clustered. After which based on the Leach protocol cluster head is selected and it is rotated within the cluster. A wireless sensor network of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity.

The wireless sensor network is built of motes from a few to several hundreds or even thousands, where each mote is connected to one (or sometimes several) sensors. Each such sensor network mote has typically several parts: a radiotransceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting.

Proposed method allows devices to more easily shift from one access point to another as required, maintaining the best available signal for the device. Traditionally, a device will connect to an access point and will not release from that access point as long as there is some amount of signal left. It will automatically shift devices to a new access point in order to keep the most healthy, active connection available for the device.

II. Related work

In [1] authors analyzed a statistical characteristics of Wi-Fi RSSI difference from heterogeneous devices and proposed its normal distributed model for cancelling the effect of the diversity of devices on Wi-Fi AP's RSSI measurements. To evaluate the accuracy enhancement of Wi-Fi AP position through Wi-Fi RSSI difference correction, four devices with different Wi-Fi chipsets were used to collect measurements in a small-scale test bed. As a result, the correction would

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

normalize Wi-Fi RSSI measurements from heterogeneous devices into Wi-Fi RSSI measurements from a reference device so that the quick and accurate survey is achievable by using multiple devices in wide indoor area. Furthermore, user generated contribution, which uses heterogeneous devices, can be easily applied to the Wi-Fi AP position estimation by using that correction. In [3] A first method is provided wherein access points monitor and keep track of their states on each resource block (frequency channel and antenna pattern) associated therewith and dynamically select the resource blocks that increase network throughput based on the instantaneous states of the access points. A second method is provided comprising employing Q-learning to determine one or more modifications of operating parameters of a network node based on observed throughput of the network and implementing the one or more modifications at the node. A third method is also provided which combines the first and second methods so as to increase network throughput. In [7] the approach proposed performs channel allocation, choosing the best set of access points (APs) to be used, including their activation or deactivation to meet a required quality of service (QoS). The CINDOOR software tool and a stochastic binary PSO algorithm is used to meet the following requirements altogether: minimize the interference, maximize the signal-to-interference ratio (SIR) and activate as few APs as possible to maximize the coverage area and reduce interferences. In [8] a method comprised determining, by an apparatus, a pattern of frequency band capabilities of wireless client devices relative to respective wireless Media Access Control (MAC) addresses of the wireless client devices, the determining based on a machine-based classification of the wireless client device capabilities relative to the respective MAC addresses; classifying a new wireless client device based on classifying the corresponding MAC address of the new client device relative to the pattern; and steering the new wireless client device to an available wireless band based on the classifying of the new wireless client device. In[10] WM (Wireless virtualization with Multipath TCP) a cross-layer approach that aims to improve performance of mobile Wi-Fi users is used. The demonstration showed that a Wi-Fi client equipped WM can keep multiple concurrent connections to APs by using wireless virtualization. Moreover, WM enhances the aggregated bandwidth and achieves seamless handover by adopting Multipath TCP.

Clients impact on a WLAN

Client behaviour has a significant impact on WLAN performance. Key issues include

Client-based decision-making: Clients are typically in control of connectivity decisions, such as which access point to associate with, what speed they send and receive data, and when to change access points as they roam. Unfortunately, clients do not have a system-level view of the network and often make poor connectivity decisions, such as connecting to the first access point they hear, regardless of whether it matches their needs.

For example, a dual band 2.4- and 5-GHz-capable smartphone may attach itself to the 2.4-GHz band, even if it is crowded, reducing the client's throughput by half despite the availability of a 5-GHz-capable access point within that client's range. These poor decisions reduce both client and overall network performance. Likewise, since the WLAN is a shared medium and only one client can talk on a channel at a time, one slow client can significantly degrade performance as other clients wait for access to that channel.

Unpredictable performance = User dissatisfaction

Because clients have a narrow perspective on the network and different clients behave differently, WLAN performance can be unpredictable. Consequently, users will face performance problems, which increases help desk and support costs, and can lead to unnecessary spending on WLAN and wired gear in an attempt to improve service. Users should have predictable WLAN performance no matter what type of client they use. However, information technology is in no position to micro-manage client capabilities such as band selection, client distance from an access point, access point load, and other parameters needed to match a given client to the right access point. Client-based software solutions are also problematic as they may not be available for all operating systems or compatible with all client hardware, and can be very difficult to install in BYOD, education, and other highly dynamic environments. IN addition, client-based software requires vigilant version control, which is virtually impossible to manage in today's diverse and rapidly changing client environments.

Poor roaming algorithms and sticky clients

Once attached to an access point, clients tend to stay attached – even when users begin to roam and the WLAN signal weakens. As a result of this stickiness, performance for mobile users and clients often degrades, dragging down overall

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

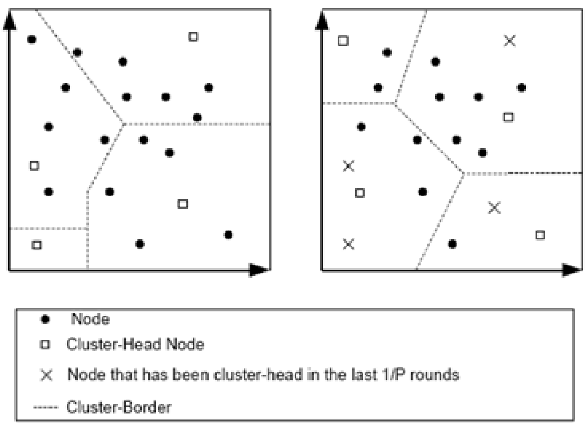
network throughput. Even a client capable of fast data rates must drop back to a slower rate if its user moves far from the access point serving that client. Increasing client diversity: The number and type of smartphones, tablets, laptops and other clients that connect to WLANs continues to rise as new generations of clients hit the market. These clients are quite diverse, with different operating systems and WLAN chipsets, resulting in a variety of connection speeds (ranging from 11 Mbps to 1.3 Gbps), roaming behaviours, band preferences (2.4 vs. 5 GHz) and other capabilities. This diversity impacts WLAN performance because slow clients, like slow cars on a highway, require everyone to slow down. So if an 802.11ac client connects to an access point with a weak signal, its performance will be slow, forcing other clients to wait before they can send or receive data.

III. PROPOSED ALGORITHM

Leach

- The reason we need network protocol such as LEACH is due to the fact that a node in the network is no longer useful when its battery dies
- This protocol allows us to space out the lifespan of the nodes, allowing it to do only the minimum work it needs to transmit data
- The LEACH Network is made up of nodes, some of which are called *cluster-heads*
  - The job of the cluster-head is to collect data from their surrounding nodes and pass it on to the base station
  - LEACH is dynamic because the job of cluster-head rotates
- The LEACH network has two phases: the set-up phase and the steady-state
  - The Set-Up Phase
    - Where cluster-heads are chosen
  - The Steady-State
    - The cluster-head is maintained
    - When data is transmitted between nodes

The algorithm is designed such a way that each node becomes a cluster-head at least once Fig2.1 shows the Leach implementation-cluster head rotation



Control over client behaviour of proposed method

Proposed method monitors each client's capabilities and connection on a WLAN, matching every client to the best radio on the best access point. By consistently monitoring each client, Proposed method can react to client behaviour at the time of connection and as client and network conditions change. For example, if a client moves into another access point's coverage area or interference causes performance to drop, Proposed method will automatically move the client to an access point or channel that can deliver better performance. Proposed method leverages industry standards to accomplish its monitoring and control functions, including the 802.11k and the 802.11v standards. As a result, IT is

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

assured of interoperability with no additional overhead. By taking a system-level approach to client connectivity, Proposed method can:

Create a holistic view of each client by leveraging all of the access points on a network to dynamically gather information on a client's capabilities and behaviour, such as signal strength and channel utilization; Aggregate and share client information across access points; and coordinate access points to consistently connect each client to the access points that best meets its needs. Many WLAN vendors offer limited client control, in which access points that are overloaded, for example, can actively discourage clients from attaching. In contrast, Proposed method is aware of every client connected to every access points and directs each one to a specific access point based on its connection needs. To illustrate, a client might not know that it is connected to an access point that's very busy while a lightly loaded access point is only 15 feet away, or that a nearby access point has a stronger signal. Proposed method is aware of all these characteristics and automatically moves a client to the optimal access point, adjusting dynamically to deliver consistent, predictable performance to everyone on the network.

a. Band steering

If a dual-band capable client attempts to connect to a 2.4-GHz radio on an Access Point with a 20-MHz channel, Proposed technique will steer the client to an available 5-GHz radio with a 40-MHz channel and good signal strength, taking advantage of the client's capabilities to double its throughput.

b. Client steering

When a client attempts to connect to an access point that provide sub-optimal performance, Proposed technique uses client steering to direct that client to a better access point. For example, if a client connects to an access point with a week signal, it will steer that client to an access point with a stronger signal. Likewise, if a user begins to roam, it will move that client to another access point to maintain optimal performance ,it focuses on optimizing the lowest performing clients. For example unhealthy clients are moved, such as a user experiencing interruptions on a call due to dropped packets.

IV. PSEUDO CODE

Band steering

Step 1: get clients band capability
Step 2: get connected radio capability
Step 3: check if client's radio capability >radio's then
Step 4: search for , equal or maximum within range capable radio
Step 5: if found then
Step 6: Shift client connect to found radio
Step 7: end
Step 10: end

Client steering

Step1: get AP's data transfer speed
Step2: if found < optimal level
Step3: then
Step4: call band steering upon concurrent connections
Step5:loop for number of connections
begin
check if data transfer speed< optimal
then

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

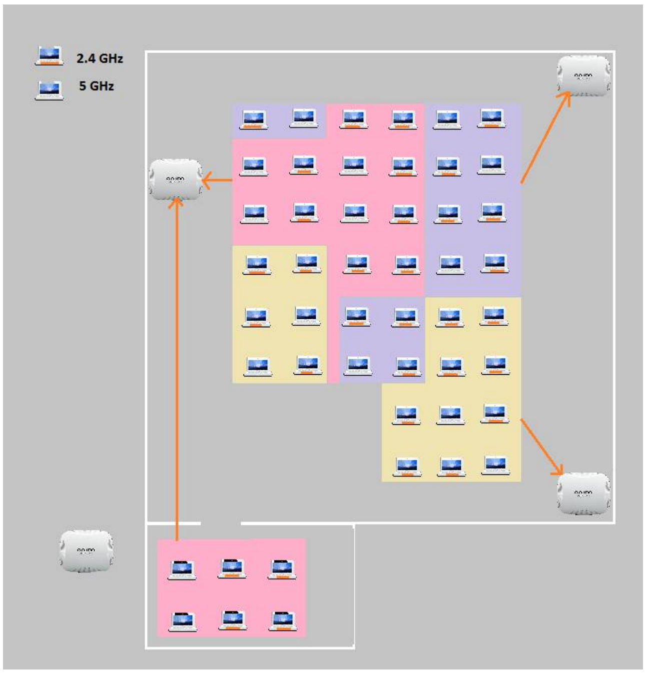
(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

check if transfer rate variation of the connection> optimal value
then
shift client connect to nearest strong signaled AP
end
end
check if data transfer rate< specified low limit
then
disconnect client
end
Step 6: end loop
Step 7: end
Step 8: end

V. SIMULATION RESULTS

In [A] a dynamic environment of students, Clients connect where they want without taking network conditions into account.Often prefer 2.4 GHz which is slower and interference prone.Clients connect to the strongest RF signal causing some APs to be overwhelmed.APs are not evenly loaded by client count or throughput



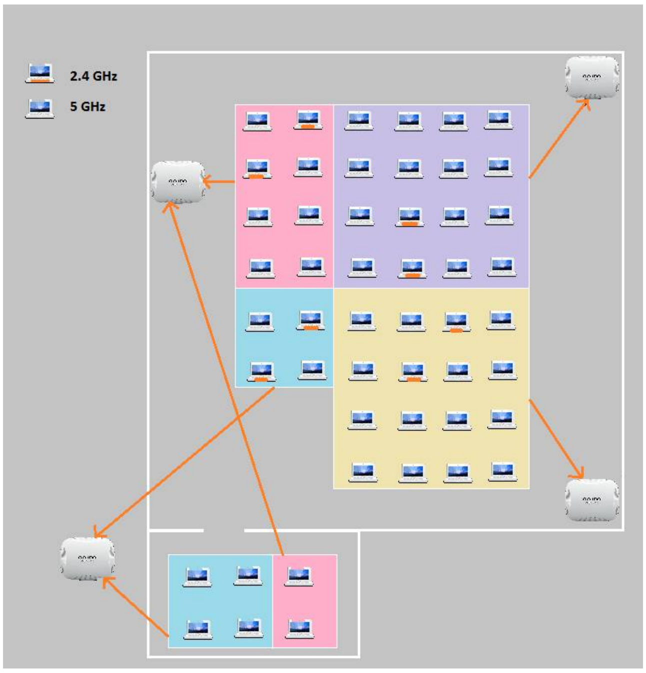
[A]

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016



[B]

In [B] a dynamic environment of students with proposed methodology,More clients on 5 GHz for better throughput and performance.RF utilization and client to AP signal taken into account when balancing.No more slow clients bringing down the network.High utilization clients are balanced across APs to limit bottlenecks.

VI. CONCLUSION AND FUTURE WORK

The simulation results showed that the proposed methodology performs better with optimizing the wifi usage. Just a handful of poorly behaved clients can have a significant negative impact on WLAN performance. By optimizing client connections, steering band and client delivers numerous benefits, including:

- Faster network connections for individual clients, which translates to better overall performance for everyone;
- Vastly improved performance for roaming smartphones, tablets, and laptops;
- A standards-based solution that works with all client types, including 802.11abg, 802.11n and 802.11ac clients; there's no need to purchase new clients or install new software;
- Operates automatically, so there's nothing for IT to configure, monitor, or manage;
- The network continuously optimizes client connections so overall network capacity and performance remains consistent; and
- Dramatically reduced help desk calls due to a better user experience

A wireless sensor network is an interesting area. Clustering is a good technique to reduce the network traffic and provides stability to the wireless sensor networks. By using Leach protocol cluster head selection can be done efficiently.

At the end we come to the conclusion that by employing the Leach protocol and client/band steering technology together, which periodically rotates the cluster heads within the cluster, and maintaining the best available signal for the device , the Wi-Fi is optimized for an efficient usage .

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2016

REFERENCES

1. Y Cho, M Ji, Y Lee, S Park - WiFi AP position estimation using contribution from heterogeneous mobile devices
2. Position Location and Navigation, ieeexplore.ieee.org, 2012.
3. MD Aime, G Calandriello, ALioy - Dependability in wireless networks: Can we rely on WiFi?
4. IEEE Security & Privacy, ieeexplore.ieee.org, 2007.
5. SUN Jiatong, VKN Lau - Cross-layer optimization for next-generation WiFi systems
6. US Patent 9,113,371, - Google Patents, 2015.
7. H Liu, G Li - [BOOK] OFDM-based broadband wireless networks: design and optimization
8. Books.google.com-2005.
9. F Granelli, D Kliazovich, J Hui… - Performance optimization of single-cell voice over WiFi communications using quantitative cross-layering analysis, Traffic Performance in …– Springer, 2007.
10. [BOOK] Mohammad Matin, “Wireless sensor networks – technology and applications”, Publisher: InTech,
11. Chapters published July 18, 2012 under CC BY 3.0 license.
12. J Moreno, M Domingo, L Valle, JR Pérez, Automatic channel and Aps allocation in WiFi networks using ray tracing techniques and particle swarm - ieeexplore.ieee.org , 2010.
13. H Liu, J Zhou, J Zhu, TMF Pang ,HIGH-DENSITY WIRELESS BAND STEERING BASED ON WIRELESS DEVICE ADDRESS- US Patent 20,160,044,673- freepatentsonline.com, 2016.
14. V Veran, K Mazali, JF Kuc -Method for steering a handset's user on preferred networks while roaming
15. US Patent App. 13/877,325, - Google Patents, 2011.
16. K Nguyen, Y Ji, S Yamada Improving WiFi networking with concurrent connections and multipath TCP…, - ieeexplore.ieee.org, 2013.
17. U Paul, R Crepaldi, J Lee, SJ Lee… Characterizing WiFi link performance in open outdoor network- ieeexplore.ieee.org, 2011.
18. BH Jung, NO Song, DK Sung A network-assisted user-centric WiFi-offloading model for maximizing per-user throughput in a heterogeneous network - IEEE Transactions on Vehicular-eeexplore.ieee.org 2014.

BIOGRAPHY

Dhanenjjeyan.K is a MSc Student in Computer Technology,Sri Krishna Arts and Science College, Coimbatore, Tamilnadu, India.

Mrs Lalitha.R is working as Assistant Professor at Department of CT, Sri Krishna Arts and Science College, Coimbatore, Tamilnadu, India.