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Effective Energy Preserved Data Transmission Scheme over Wireless Sensor Network Environment

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ABSTRACT: The main objective of this system is to design the Wireless Network, which provides failure free communication between sending and receiving entities with proper time and speed. To enhance the lifetime of the network scenario using successful node placements and communication strategies. This system investigates the problem of energy consumption in wireless sensor networks. Wireless sensor nodes deployed in harsh environment where the conditions change drastically suffer from sudden changes in link quality and node status. The end-to-end delay of each sensor node varies due to the variation of link quality and node status, on the other hand, the sensor nodes are supplied with limited energy and it is a great concern to extend the network lifetime. To cope with those problems, this system proposes a novel and simple routing metric, predicted remaining deliveries (PRD), combining parameters, including the residual energy, link quality, end-to-end delay, and distance together to achieve better network performance. PRD assigns weights to individual links as well as end-to-end delay, so as to reflect the node status in the long run of the network.

KEYWORDS: Link-delay aware, routing metric, energy efficient, wireless sensor networks

I. INTRODUCTION

WWireless sensor networks have attracted great attention due to their various potential applications in the area of forest fire detection, transportation, and industrial automation, etc. Generally, sensor nodes are deployed in a specific region and cannot move after deployed. The main task of the sensor nodes is to periodically sense the environment and transmit the information to the data center known as the sink. Sensor nodes are usually battery-powered, and it is difficult to replace or recharge the battery. Due to the limited energy, sensor nodes drain their energy quickly, leading to the sensing area uncovered. Therefore, energy conservation becomes a critical concern in WSNs. In recent years, many energy-efficient techniques for wireless sensor networks have been developed to extend the network lifetime, including duty-cycle scheduling, medium access control techniques and compressive sensing. Previous studies demonstrate that the communication consumes most of the energy, and transmitting information takes about two thirds of its total energy consumption, while the count of transmissions depends to a great extent on the routing strategy. In other words, an energy efficient routing protocol helps extraordinarily to save energy and extend the network lifetime.

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On the other hand, many applications such as WSNs used in the fire alarm systems are delay sensitive. Thus it is necessary to design a routing metric that is aware of the residual energy of each sensor node as well as end-to-end delay.

Many routing protocols have been applied for WSNs. Tree based routing has become a popular protocol for WSNs. In a routing tree, each sensor node chooses a parent to forward the data, and eventually all data are sent to a single collection point, i.e. the sink. One significant issue in tree based routing is how to design a viable metric used for a sensor node to determine its parent node. ETX and ETT are widely used in real WSNs. ETX reflects the expected transmission counts including retransmissions needed for a packet to reach its destination, whereas ETT is the expected transmission time of a packet over the link related to the bandwidth and the packet length. Basically, ETX captures the link quality of a routing path and helps to choose a path with the best link quality, whereas ETT captures the end-to-end delay of a routing path and serves to select a path with the shortest end-to-end delay. Nevertheless, neither ETX nor ETT take the residual energy of each sensor node into account, leading to the quick death of sensor nodes with low energy level.

To strike a balance between energy efficiency and delay, it is necessary to combine both link quality and end-to-end delay together for routing metric design. This system focuses on the routing metric design for the applications of WSNs where the environment changes drastically, e.g. the intertidal environment. Our experiments of a WSN system deployed in the intertidal environment exhibit long end-to-end delay and unbalanced energy consumption among sensor nodes, which will be described in detail in the next section. Yet, designing such a routing metric poses several challenges. The first challenge is how to overcome the environment variations and reflect the status of the sensor nodes. In the harsh environment such as the intertidal area, the status of sensor nodes deployed for monitoring temperature and sea creatures are impacted by the tide, sea waves and the sea wind. Sensor nodes may change between above water and under water due to the change of the tidal level, bringing about variations in link quality and end-to-end delay. The second challenge is how to combine several factors together into the metric so as to achieve a better performance. Generally, a good routing metric should help to select the next hop which is with the best link quality, the shortest end-to-end delay and the highest residual energy. The last challenge is to balance the energy consumption among the sensor nodes so as to prolong the lifetime of each sensor node. Sensor nodes with low energy die quickly if the energy consumption is unbalanced, leading to a short lifetime and poor network performance.

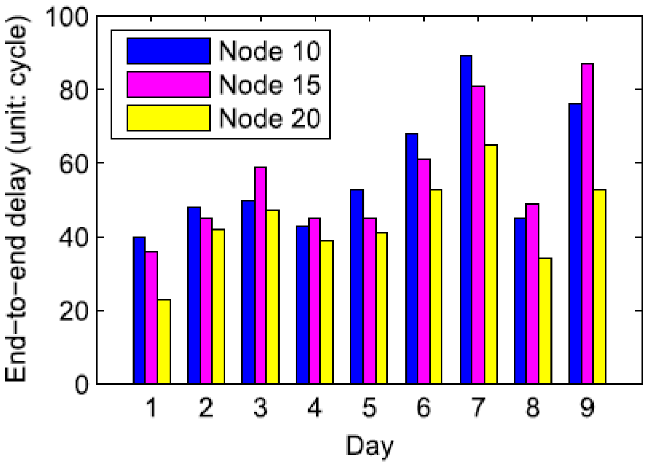

Fig. 1. The average end-to-end delay of three nodes in the experiments in 9 days

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II. SYSTEM IMPLEMENTATION

A. WIRELESS NETWORK ROUTING

Source-Server Computing or Networking is a distributed application architecture that partitions tasks or workloads between service providers (servers) and service requesters, called Sources. Often Sources and servers operate over a computer network on separate hardware. A server machine is a high-performance host that is running one or more server programs which share its resources with Sources. A Source also shares any of its resources; Sources therefore initiate communication sessions with servers which await (listen to) incoming requests.

B. STATUS IDENTIFICATION

In this Status Identification Module, user can identify the Source and Server is weather live or not. In this process we easily identify the status of the Server and also easily identify the path failure.

Message Transmission

Change status

Update status

This process just transfers the data packets to the destination or intermediate nodes.

The intermediate node just forwards the data packets to destination.

The receiver receives the data packets and sends the Acknowledgement.

Change/Update Status

This process updates the status of the server and source nodes with proper acknowledgements. Then only the user can identify whether the server machine is live or not.

C. FAST DATA PROCESSING

A Fast Data Processing optimization and wireless network routing method is proposed and the framework based on a primal dual interior-point approach with a simple step-size control strategy, such that the resultant scheme is well-suited for implementation in practice. Our primal-dual approach exposes a deep connection between observable network state information and the primal-dual interior-point optimization theory, which itself is an active research field in operations research today.

D. UTILITY OPTIMIZATION AND QUEUE STABILITY

The utility-optimality and queue-stability is established of the proposed second-order framework. Our theoretical analysis unveils the fundamental reason behind the fast convergence in the proposed second-order framework. Interestingly, our analytical results naturally lead to a utility-optimality and queue-length tradeoff relationship governed by the barrier parameter of the interior-point method. We compare this tradeoff relationship to those in first-order methods and contrast their similarities and differences, thus further advancing our understanding of both first-and-second-order methods in network optimization theory. We suggest several approaches to implement the proposed second-order method in a distributed fashion. In particular, for the distributed dual Newton direction computation (the most challenging part in our second-order method), we propose a new Sherman-Morrison-Woodbury (SMW) based iterative approach. We show that, on a -link network, the SMW-based approach obtains the precise solution in iterations, rather than asymptotically.

E. DATA PACKETS OPTIMIZATION

Data Processing functions are scalar functions that may be used to prove the stability of a balance of an ODE (Ordinary Differential Equations). For many classes of ODEs; the existence of Lyapunov functions is a necessary and sufficient condition for stability. Whereas there is no general technique for constructing Lyapunov functions for ODEs, in many

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specific cases, the construction of Lyapunov functions is known. For instance, quadratic functions suffice for systems with one state; the solution of a particular linear matrix inequality provides Lyapunov functions for linear systems; and conservation laws can often be used to construct Lyapunov functions for physical systems. Informally, a Lyapunov function is a function that takes positive values everywhere except at the stability in question, and decreases (or is non-increasing) along every trajectory of the ODE. The principal merit of Lyapunov function-based stability analysis of ODEs is that the actual solution (whether analytical or numerical) of the ODE is not required.

III. LITERATURE SURVEY

Observing Home Wireless Experience Through WiFi APs - A. Patro, S. Govindan, and S. Banerjee - 2013. [1] We present a measurement study of wireless experience in a diverse set of home environments by deploying an infrastructure, we call WiSe. Our infrastructure consists of OpenWrt-based Access Points (APs) that have been given away to residents for free to be installed as their primary wireless access mechanism. These APs are configured with our specialized measurement and monitoring software that communicates with our measurement controller through an open API. We have collected wireless performance traces from 30 homes for a period in excess of 6 months. To analyze the characteristics of these home wireless environments, we have also developed a simple metric that estimates the likely TCP throughput different clients can expect based on current channel and environmental conditions. With this infrastructure, we provide multiple quantitative observations, some of which are anecdotally understood in our community. For example, while a majority of links performed well most of the time, we observed cases of poor client experience about 2.1% of the total time.

Understanding the effect of access point density on wireless lan performance - M. A. Ergin, K. Ramachandran, and M. Gruteser - 2017. [2] In this system, we present a systematic experimental study of the effect of inter-cell interference on IEEE 802.11 performance. With increasing penetration of WiFi into residential areas and usage in ad hoc conference settings, chaotic unplanned deployments are becoming the norm rather than an exception. These networks often operate many nearby access points and stations on the same channel, either due to lack of coordination or insufficient available channels. Thus, inter-cell interference is common but not well-understood. According to conventional wisdom, the efficiency of an 802.11 network is determined by the number of active clients. Surprisingly, we find that with a typical TCP-dominant workload, cumulative system throughput is characterized by the number of interfering access points rather than the number of clients. We find that due to TCP flow control, the number of backlogged stations in such a network equals twice the number of access points. Thus, a single access point network proved very robust even with over one hundred clients. Multiple interfering access points, however, lead to an increase in collisions that reduces throughput and affects volume of traffic in the network.

Interference mitigation through power control in high density 802.11 wlans - V. Mhatre, K. Papagiannaki, and F. Baccelli - 2012. [3] Mobile data traffic is going through an explosive growth recently as mobile smart devices become more and more ubiquitous, causing huge pressure on cellular network. Taking advantage of its low cost and easy-to-deploy feature, wireless local-area networks (WLAN) becomes increasingly popular to offload data streams from cellular network, followed by higher and higher density of its deployment. However, the high density of WLAN will cause more interference, which results in degradation of its performance. Therefore, in order to enhance the performance of the network, we aim to minimize the interference caused by high density of WLAN. In this paper, we propose a novel power control scheme to achieve the above aim. We use the quality of experience (QoE) evaluation to coordinate the power of each access point (AP) and finally realize the optimization of the entire network. According to the simulation results, our scheme improves the performance of the network significantly in many aspects, including throughput and QoE.

Understanding and mitigating the impact of rf interference on 802.11 networks - R. Gummadi, D. Wetherall, B. Greenstein, and S. Seshan - 2013. [4] We study the impact on 802.11 networks of RF interference from devices such as Zigbee and cordless phones that increasingly crowd the 2.4GHz ISM band, and from devices such as wireless camera jammers and non-compliant 802.11 devices that seek to disrupt 802.11 operation. Our experiments show that

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commodity 802.11 equipment is surprisingly vulnerable to certain patterns of weak or narrow-band interference. This enables us to disrupt a link with an interfering signal whose power is 1000 times weaker than the victim's 802.11 signals, or to shut down a multiple AP, multiple channel managed network at a location with a single radio interferer. We identify several factors that lead to these vulnerabilities, ranging from MAC layer driver implementation strategies to PHY layer radio frequency implementation strategies. Our results further show that these factors are not overcome by simply changing 802.11 operational parameters (such as CCA threshold) with frequency shifts. This leads us to explore rapid channel hopping as a strategy to withstand RF interference. We prototype a channel hopping design using PRISM NICs, and find that it can sustain throughput at levels of RF interference well above that needed to disrupt unmodified links, and at a reasonable cost in terms of switching overheads.

Optimization of ap placement and channel assignment in wireless lans - Y. Lee, K. Kim, and Y. Choi - 2014. [5] The design of a wireless local area network (WLAN)has an important issue of determining the optimal placement ofaccess points (APs) and assignment of channels to them. WLANservices in the outdoor as well as indoor environments should bedesigned in order to achieve the maximum coverage and throughput.To provide the maximum coverage for WLAN service areas,APs should be installed such that the sum of signal measured ateach traffic demand point is maximized. However, as users connectedto an AP share wireless channel bandwidth with others inthe same AP, AP placement should be carefully decided to maximizethe throughput by considering load balancing among APsand channel interference for the user traffic demand. In this paper,therefore, we propose an approach of optimizing AP placementand channel assignment in WLANs by formulating an optimalinteger linear programming (ILP) problem. The optimizationmethod finds the optimal AP placement and channels whichminimize the maximum of channel utilization.objective is to minimize the maximum of channel utilization,which qualitatively represents congestion at the hot spot in WLANservice areas. It is seen from the simulation results that the proposedIndex Terms-- Network Design, WLAN, IEEE 802.11b, loadbalancing, ILP, Optimization.

CENTAUR: Realizing the Full Potential of Centralized Wlans Through a Hybrid Data Path - V. Shrivastava, N. Ahmed, S. Rayanchu, S. Banerjee, S. Keshav, K. Papagiannaki, and A. Mishra - 2014. [6] Enterprise WLANs have made a dramatic shift towards centralized architectures in the recent past. The reasons for such a change have been ease of management and better design of various control and security functions. The data path of WLANs, however, continues to use the distributed, random-access model, as defined by the popular DCF mechanism of the 802.11 standard. While theoretical results indicate that a centrally scheduled data path can achieve higher efficiency than its distributed counterpart, the likely complexity of such a solution has inhibited practical consideration. In this paper, we take a fresh, implementation and deployment oriented, view in understanding data path choices in enterprise WLANs. We perform extensive measurements to characterize the impact of various design choices, like scheduling granularity on the performance of a centralized scheduler, and identify regions where such a centralized scheduler can provide the best gains. Our detailed evaluation with scheduling prototypes deployed on two different wireless testbeds indicates that DCF is quite robust in many scenarios, but centralization can play a unique role in 1) mitigating hidden terminals - scenarios which may occur infrequently, but become pain points when they do and 2) exploiting exposed terminals - scenarios which occur more frequently, and limit the potential of successful concurrent transmissions. Motivated by these results, we design and implement CENTAUR - a hybrid data path for enterprise WLANs that combines the simplicity and ease of DCF with a limited amount of centralized scheduling from a unique vantage point. Our mechanisms do not require client cooperation and can support legacy 802.11 clients.

IV. SYSTEM ANALYSIS

A. Existing System

In the past approaches a large body of research work has focused on reducing interference level to improve stations' throughput. In earlier cases, it is seen as a channel allocation problem, and several graph coloring algorithms are explored as well as dynamic transmission range control is attempted. However, the heavy deployment of WSN still creates various interference situations and makes those approaches less effective. Consequently, some approaches explore centralized traffic scheduling in order to fundamentally minimize the degree of interference. However,

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centralized scheduling in general entails high scheduling complexity. Existing solutions therefore trade scheduling granularity for reduced complexity. For instance, Centaur, one of the state-of-the-art approaches, performs centralized scheduling only for traffic of hidden and exposed nodes whereas it delegates the scheduling of traffic for non-hidden/non-exposed nodes to Distributed Coordination Function (DCF) of CSMA/CA. Thus, contentions can hurt throughput for traffic destined to the non-hidden/non-exposed nodes. Worse, in the presence of automatic rate adaptation contentions may force selection of lower rates more often, which may further exacerbate performance.

DISADVANTAGES OF EXISTING SYSTEM
(a) Poor processing speed
(b) Resource or data allocation process is more time taken and reducing the overall process while processing
(c) Performance is poor in case of speed and accessibility.

B. Proposed System

The proposed system considers the problem of scheduling for maximum throughput utility and congestion control in a queuing network with random packet arrivals and time varying channel reliability with the powerful algorithm called Routing Mechanism with Predicted Remaining Deliveries (PRD). The system considers on hop technique, where each packet requires transmission over a single link. At every slot the network controller assesses the condition of its channels and selects a set of links for transmission. The current system derives average delay bounds for one-hop wireless networks that use maximal scheduling subject to a general set of interference constraints. In particular, when arrival processes are modulated by independent Markov processes, we show that average delay grows at most logarithmically in the number of nodes in the network.

Existing work provides explicitly computable and order-optimal delay bounds for time-correlated arrivals. Our work addresses the issues of general interference constraints and time-correlated heavy traffic simultaneously. We treat the general interference model use the concept of queue grouping to derive the order-optimal delay results. Queue grouping techniques have been used in to reduce scheduling complexity in switches and wireless networks.

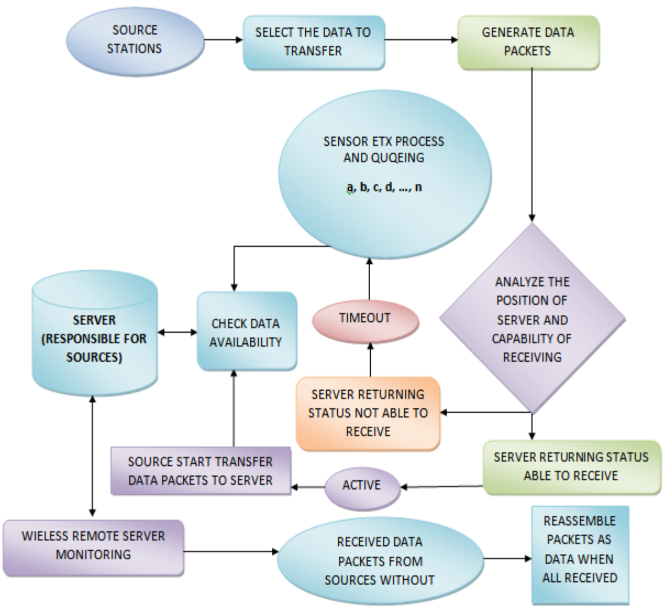

Fig.2 Proposed System Architecture Design

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ADVANTAGES OF PROPOSED SYSTEM

(a) Simple Access Checking and Authentication Facilities
(b) The proposed scheme is more efficient and less time consumption.
(c) Routing Mechanism with Predicted Remaining Deliveries (PRD) is implemented over the Wireless Sensor Network environment to achieve more speed and high accuracy in terms of transmission.

V. RESULTS AND DISCUSSION

In this section, we provided the simulated results of entire project with its practical proofs. The following figure shows the Routing Mechanism with PRD Scenario.

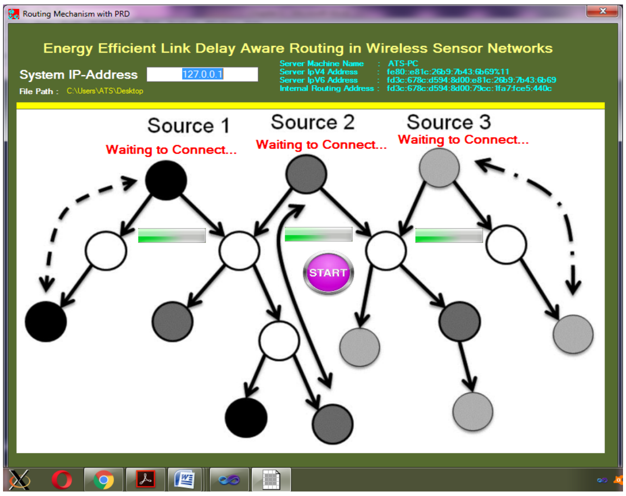

Fig.3 Routing Mechanism with PRD

The following figure illustrates the Wireless Sensor Network Monitoring view of the proposed system.

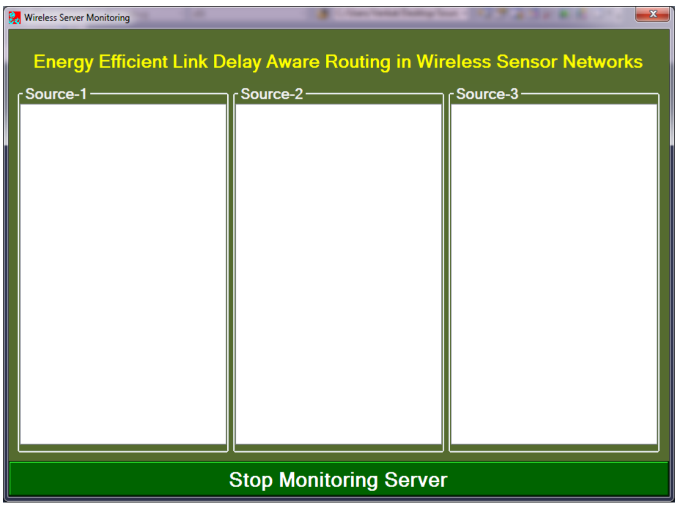

Fig.4 Wireless Sensor Network Monitoring

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VI. CONCLUSION

This system proposes a novel link-delay aware energy efficient routing metric called PRD for the routing path selection tailored for WSNs deployed in harsh environments, where the networks are exposed to extremely long end-to-end delay and unbalanced energy consumption among sensor nodes. PRD captures the predicted remaining deliveries within one unit of delay, which reflects the ability of each sensor node to forward packets and PRD also takes the end-to-end delay into consideration. The main purposes of PRD are to balance the energy consumption of the sensor nodes and extend the network lifetime, as well as controlling the end-to-end delay. Large-scale simulations are conducted to evaluate the performance of PRD. Therefore we can conclude that the proposed PRD metric can be an effective and efficient solution to choose appropriate routing paths for WSNs deployed in harsh environments.

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