An Energy Efficency Parameter For Mobile Ad- Hoc Network

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***Abstract-*A software library that aids in the design of mobile ad hoc networks (MANET). The OMAN design engine works by taking a specification of network requirements and objectives, and allocates resources which satisfy the input constraints and maximize the communication performance objective. The tool is used to explore networking design options and challenges, including: power control, adaptive modulation, flow control, scheduling, mobility, uncertainty in channel models, and cross-layer design.**

The unaddressed niche which OMAN seeks to fill is the general framework for optimization of any network resource, under arbitrary constraints, and with any selection of multiple objectives. While simulation is an important part of measuring the effectiveness of implemented optimization techniques, the novelty and focus of OMAN is on proposing novel network design algorithms, aggregating existing approaches, and providing a general framework for a network designer to test out new proposed resource allocation methods. In this paper, present a high-level view of the OMAN architecture, review specific mathematical models used in the network representation, and show how OMAN is used to evaluate tradeoffs in MANET design. Specifically, cover three case studies of optimization. The first case is robust power control under uncertain channel information for a single physical layer snapshot. The second case is scheduling with the availability of directional radiation patterns. The third case is optimizing topology through movement planning of relay nodes.

***Keyword*-cross-layer design, OMAN, adaptive modulation, power control**

I.INTRODUCTION

Network design, like other broad optimization fields, is often treated as a collection of distinct problems with significant effort focused on finding solutions to each of those individual problems. In developing the Optimization for Ad hoc Networks (OMAN) system, the main goal is to bring together network resource allocation problems and the methods for solving them into a cohesive, extendable.

A.Problem statement

Object-oriented software package with a standard application programming interface (API) and graphical user interface (GUI) for software developers and network design engineers, respectively. In OMAN, network design is approached as a process of optimizing variables in a well-defined scenario across time, space, and the communication network stack. The high-level data flow in OMAN.

Inputs are the scenario specification and optimization variables and objectives, as well as an extensive set of parameters defining every aspect of the network model, simulation, and optimization. In other words, the system input is the definition of the design problem and a list of directives on how OMAN should find a good solution to this problem. The output of the system is a set of optimal or locally optimal resource allocations and an estimate of the performance expected when the network operates under those design decisions. OMAN defines a portfolio of objectives which include, among others, power, capacity, connectivity, survivability, delay, fairness, load balancing, throughput, and redundancy.

B.Solution for problem

The problems addressed in this paper are how to support coordination by enabling applications to

- Conserve energy and
- Transparently adapt to changing network topologies.

Prior to expanding on these, the system model is described. The system consists of a WSN in which there are many types of nodes. Some are more energy efficient. Others are line-powered and not energy constrained. They also differ in their computational and sensing abilities. Regardless of these differences, they all communicate over the same low-power wireless networking technology like IEEE 802.15.4.

The result is a heterogeneous and dynamic environment in which devices differ both in terms of hardware capabilities and energy efficiencies.

The WSN runs a SOA in which each device may host one or more service consumers and/or providers. Consumers are typically platform-independent and contain application logic. Platform-specific functionalities are accessed through services that are bound to consumers. Providers are dynamically discovered, bound to, and invoked by, consumers. A consumer and its providers may reside on the same node or on different nodes. Due to variations in network link quality over time, the set of providers that are within range of a consumer is dynamic.

The service discovery, matching, and binding process is automatic and done based on service-specifications published by both the consumer and provider. The service specification includes both functional and non-functional properties of the service.

For example, a functional property of the sensing service may be the sensor type and its accuracy, while its non-functional property may be its location. By comparing the properties required by the consumer to the ones provided by the provider, a match can be made. The matching process ensures that all matching services are functionally interchangeable from the consumer's perspective and will satisfy the application requirements.

WSNs are not general-purpose computing platforms and, as such, exhibit certain common characteristics that are reacted by the SOA. For example, many WSN applications like habitat monitoring operate periodically, each time performing the same set of operations like sensing and data delivery. Other applications remain idle until a particular event like the detection of a phenomenon occurs.

To account for these operational characteristics, the SOA has three forms of service invocations,

1.On-demand

2.Periodic, and

3.Event-based

On-demand is what is traditionally provided by most SOAs in which an invocation is similar to a remote procedure call. That is, the consumer initiates a service invocation by sending the provider a message, and waits for the provider to respond with results. Periodic and event-based invocations involve the provider automatically invoking the service periodically. They differ in that periodic invocations send every result whereas event-based invocations only send interesting results, as defined by the provider, back to the consumer. Both of the latter forms of invocations are more energy efficient than on-demand, assuming the same invocation period, since they do not require the consumer to send the provider a message each time the service is executed.

The optimization of network parameters in OMAN is a feedback process of optimization and performance estimation through simulation. The first step is to find an optimization method most appropriate to the set of control variables and objectives provided as input. If no specialized algorithm is available in OMAN for the specified problem, then the problem is formulated as a mathematical program in the AMPL modeling language. An appropriate generic solver is then used to solve the program, depending on whether objectives and constraints are linear or nonlinear, the variables are discrete or continuous.

The power control problem of minimizing power under a signal-to-noise-interference constraint is an example of a linear program which is optimized using this generic solver approach. If a specialized method is available for the problem, OMAN automatically uses it to find a solution. An example of a specialized method is a heuristic packing procedure which schedules a set of concurrent transmissions that maximize sum-rate capacity and ensures a chance for every node to transmit at least once.

II.LITERATURE REVIEW

Kai Chen, Klara Nahrstedt(2005) proposed an Effective Location-Guided Tree Construction Algorithms for Small Group Multicast in MANET. Mobile ad hoc network (MANET) consists of many mobile hosts connected by wireless links. Each node operates not only as an end-system, but also as a router to forward packets. In MANET, the network topology may change frequently due to the nodes movements. A good routing protocol should always forward packets along or close to the shortest path from source to destination, and be able to adapt quickly to topology changes. A number of unicast routing protocols have been proposed in the mobile ad hoc environment. Multicast has become increasingly important in MANET because of the need for collaborative applications among a group of mobile users. Most of the current multicast routing protocols for MANET follow the same multicast group model as in the Internet.

M. Wang, L. Lamont,P. Mason, M. Gorlatova(2005) proposed an effective intrusion detection approach for olsr manet protocol,Mobile Ad hoc Networks (MANETs) are autonomous systems of mobile nodes interconnected by wireless links. Any node in a MANET acts as a router to support connectivity to other mobile nodes that are out of range. The nodes are free to move randomly and organize themselves arbitrarily. The inherent flexibility offered by these networks, originally conceived for mostly military purposes such as battlefield communication and battlefield sensor monitoring network, allows for ease of deployment and appeals to various commercial applications such as convention meetings, electronic classrooms, search-and-rescue efforts, disaster relief, and law enforcement. A side effect of this flexibility is the ease with which a node can join or leave a MANET. Lack of any fixed physical and, sometimes, administrative infrastructure in these networks makes the task of securing them extremely challenging.

Carlos A.S. Oliveira , Panos M. Pardalos (2005) proposed an Optimization Approach for Cooperative Communication in Ad Hoc Networks. Mobile ad hoc networks (MANETs) are a useful organizational technique for providing communication infrastructure to wireless devices. They consist of loosely coupled units, that communicate locally only to accessible neighbors. Routing of data among non accessible units in a MANET is made possible through multi-hop retransmission. There are many applications of MANETs, including coordination of rescue groups and other military applications such as UAVs (Unmanned Air Vehicles). The problem of determining an optimal route for a group of ad hoc users, such that the total connection time among nodes in the resulting MANET is maximized, subject to a limit on the maximum distance traveled by unit. This problem is called the cooperative communication problem in ad hoc networks (CCPMANET). A model for the problem using integer linear programming is developed. A formulation based on graph theory. A heuristic local search algorithm is used to find solutions with good quality for the CCPMANET.

Radu Grosu, Oliviero Riganelli, et all(2005) proposed an Power Optimization in Fault-Tolerant MANETs. MANETs are intrinsically decentralized, meaning that all network activities, including discovering the topology and delivering messages, must be executed by the nodes themselves. Nodes running out of battery power not only lose their own individual capabilities, but also impact the entire network by changing, for example, routing functionality. In addition, connectivity is strongly influenced by frequently changes in topology due to node mobility. A power-aware approach for increasing the robustness of MANETs.

Jim Dowling, Eoin Curran, Raymond Cunningham(2005), proposed an Using Feedback in Collaborative Reinforcement Learning to Adaptively Optimize MANET Routing**.** Designers face many system optimization problems when building distributed systems. Traditionally, designers have relied on optimization techniques that require either prior knowledge or centrally managed runtime knowledge of the system's environment, but such techniques are not viable in dynamic networks where topology, resource, and node availability are subject to frequent and unpredictable change.

Joon-Sang Park, Giovanni Pau, Mario Gerla, et all(2007) proposed an Efficient Peer-to-peer File Sharing using Network Coding in MANET. Mobile peer-to-peer systems have recently got in the limelight of the research community that is striving to build efficient and effective mobile content addressable networks. The line of research, a new peer-to-peer (P2P) file sharing protocol suited to mobile ad hoc networks (MANET).The main ingredients of our protocol are network coding and mobility assisted data propagation, i.e., single-hop communication.

The network coding in combination with single hop communication allows P2P file sharing systems in MANET to operate in a more efficient manner and helps the systems to deal with typical MANET issues such as dynamic topology and intermittent connectivity as well as various other issues that have been disregarded in MANET P2P researches such as addressing, node/user density, non-cooperativeness, and unreliable channel. The P2P protocol based on network coding and single-hop communication allows shorter file downloading delays compared to an existing MANET P2P protocol.

Cornelius Helga, Thomas Stock hammer, Thomas Wiegand,et all(2007) proposed an Distributed Rate-Distortion Optimization For Rate less Coded Scalable Video In Mobile Ad Hoc Networks. Mantes are attractive due to low infrastructure costs, especially in areas with high user density. The coverage area for mobile services can generally be extended through cooperation with neighboring nodes. In MANETs, user terminals in a mobile network are conceptually not assumed to be receivers only, but can also be used as routing nodes in order to build a dynamic network infrastructure. User nodes building a MANET are assumed to be highly mobile, which results in the dynamic characteristics of this network type. Thus a topology built upon a MANET cannot be truly robust against network separation as well as against route or path loss. Therefore, clients typically experience loss of connection to serving nodes.

Alex Fridman, Richard Primerano, Steven Weber, Moshe Kam(2008),proposed an Cooperative Surveillance In Video Sensor Networks In the energy-constrained medium of video sensor networks, the objective of much research has been to statistically minimize the number of nodes that will achieve the number of nodes beyond the threshold of full coverage, and cooperatively filtering out the high level of redundant data in the video streams to minimize pernode capacity requirements.

The scenario study is that of a swarm of robots, all with wireless communication capabilities. Some of the robots are equipped with video cameras and are thus considered sensors. A few select robots have sufficient battery and computational power to perform machine vision processing of the video stream.

Elhadi E. Shakshuki, Hafiz M. Asif, et all(2008) proposed an Power Consumption Optimization and Delay Minimization in MANET. The performance of wireless networks under video traffic is subjected to two-fold constraints. Both power minimization and other QoS requirements such delay, delay jitter etc need to be taken care of properly. Mobile Ad Hoc Networks (MANETs) are more sensitive to these issues where each mobile device acts like a router and thus, routing delay adds significantly to overall end-to- end delay.

The performance of the Warning Energy Aware Cluster head/Virtual Base Station-On demand (WEAC/VBS-O) protocol, proposed earlier by one of the terms of average delay, multi hop communication and power minimization aspects subject to video traffic. The H.263 standard is utilized to model video traffic in our simulation design. Primarily, To establish a single hop communication between nodes.

Cristian Borcea, Gang Xu, Liviu Iftode(2011), proposed an A Policy Enforcing Mechanism for Trusted Ad Hoc Networks. To ensure fair and secure communication in Mobile Ad hoc Networks (MANETs), the applications running in these networks must be regulated by proper communication policies. An enforcing policies in MANETs is challenging because they lack the infrastructure and trusted entities encountered in traditional distributed systems. The design and implementation of a policy enforcing mechanism based on a kernel-level trusted execution monitor built on top of the Trusted Platform Module. Under this mechanism, each application or protocol has an associated policy. Two instances of an application running on different nodes may engage in communication only if these nodes enforce the same set of policies for both the application and the underlying protocols used by the application

III.SYSTEM MODEL

The resource efficiency using wireless sensor can be done using the following system models.

A.Oman Based Application Selection

In OMAN, efficiency in resource allocation will be discussed. In order to show the efficiency we will be considering the location monitoring system. it uses resources like sensors and servers. In this, the sensor nodes report the exact location information of the monitored persons to the server; thus using identity sensors immediately poses a major privacy breach. To tackle such a privacy breach, the concept of aggregate location information, that is, a collection of location data relating to a group or category of persons from which individual identities have been removed , has been suggested as an effective approach to preserve location privacy . Although the counting sensors by nature provide aggregate location information, they would also pose privacy breaches.

B. Aggregate Locations Module

To design two in-network location anonymization algorithms, namely, resource- and quality- aware algorithms that preserve personal location privacy, while enabling the system to provide location monitoring services. Both algorithms rely on the well established k-anonymity privacy concept that requires a person is indistinguishable among k persons. In our system, sensor nodes execute our location anonymization algorithms to provide k- anonymous aggregate locations, in which each aggregate location is a cloaked area A.

C.Mapped Location Monitoring Module

Each sensor node is responsible for determining the number of objects in its sensing area, blurring its sensing area into a cloaked area A, which includes at least k objects, and reporting A with the number of objects located in A as aggregate location information to the server. To do not have any assumption about the network topology, as our system only requires a communication path from each sensor node to the server through a distributed tree. Each sensor node is also aware of its location and sensing area.

Resource Efficiency In Server

The server is responsible for collecting the aggregate locations reported from the sensor nodes, using a spatial histogram to estimate the distribution of the monitored objects, and answering range queries based on the estimated object distribution. Furthermore, the administrator can change the anonymized level k of the system at anytime by disseminating a message with a new value of k to all the sensor nodes.

System Users

Authenticated administrators and users can issue range queries to our system through either the server or the sensor nodes, as depicted in Above System Architecture figure. The server uses the spatial histogram to answer their queries.

D.Minimum Bounding Rectangle (MBR)

To find the minimum bounding rectangle (MBR) of the sensing area of A. It is important to note that the sensing area can be in any polygon or irregular shape.

IV.RESULT AND DISCUSSION

One of the goals of OMAN as a network design tool is to provide a mechanism for comparing network technologies, i.e., radios, MAC protocols, routing protocols, and battery models. Each such model or algorithm is implemented in OMAN in a modular way such that it can be swapped out for any number of alternatives.

The GUI provides a streamlined way of configuring multiple alternatives, and comparing them through concurrent simulation and optimization. An “internal developer” can extend OMAN by providing an implementation of a new alternative model or algorithm. The API supports such an extension without needing to be modified. The developer only has to add a set of control parameters associated with the new extension. These parameters are then automatically added to the GUI through active generative programming.

V.CONCLUSION

The detail three representative case studies of network design which showcase the tradeoffs and optimization approaches implemented in the OMAN library. The first case covers a method for finding a robust power allocation which solves the bi objective power control problem. The second case builds on the PHY layer framework of the first case, and solves the scheduling problem with the addition of unidirectional radiation patterns. The third case builds on the first two and optimizes the throughput of the network by treating the movement of some of the nodes as decision variables. These cases serve as examples of using OMAN to study cross-layer optimization problems in network design

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