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Monitoring and minimizing the Total Energy consumption in Mobile Nodes at the end-to-end Quality of Service

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Abstract

In general mobile networks are highly unpredictable at the end-to-end quality-of-service (QoS) and the scale of the individual node. Due to its high requirement and complicated security issues researchers concentrated on the issue of its energy consumption and consistency. This work given an novel idea and demonstrated how energy maps can be utilized by an application to minimize a node's total energy consumption over its near-future trajectory.

Key words- Mobile adhoc Network, Virtual Path, Quality of Service.

Introduction

The mobile nodes cannot “sample” the end-to-end energy potential because an end-to-end measurement from each mobile node i to BS would be needed. Such measurements, even if initiated, can only be collected by BS. However, the nodes themselves would need these measurements to construct the energy potential. Our main idea is to have each node measure the energy field in, which is a locally determinable quantity, and exchange these measurements such that each node can estimate the energy field accurately, from which it can construct the parts of the energy potential that it needs. The particular method by which the energy field is locally measured by each node depends on the global topological properties of the deployment region.

Hence, Assume that this method has been chosen and has been fixed. As a preliminary step, assume that the local measurements of the energy field were exchanged instantaneously with all of the nodes in the network. Then, from these local estimates of the energy field, each node could construct the energy potential on demand, via the Path Integration Algorithm, The conceptual steps of the Path Integration Algorithm are idea is that if a node had access to the database of all of the local measurements of the energy field made by all of the nodes, then, for every, it could estimate as follows: Starting at location, the node looks up the estimate of the energy field at from the database. Based on this estimate, it constructs the first hop of a “virtual path” by hopping to the tip of the estimate of the energy field vector. After this first hop on this virtual path, we arrive at a point We repeat the procedure by following the energy field, until the virtual path ends at the base station.

2. Objectives of the work

We show that even though mobile networks are highly unpredictable when viewed at the individual node scale, the end-to-end quality-of-service (QoS) metrics can be stationary when the mobile network is viewed in the aggregate. Finally, we show how energy maps can be utilized by an application that aims to minimize a node's total energy consumption over its near-future trajectory.

2.1 Existing system:

Energy planning and optimization constitutes one of the most significant challenges for high-mobility networks. A novel framework to share, retain and refine end- to-end energy metrics in the joint memory of the nodes, over time scales over which this information can be spread to the network and utilized for energy planning decisions. We construct maps of end-to-end energy metrics that enable energy optimization in high-mobility networks. We show how to (1) compute the spatial derivatives of energy potentials in high-mobility networks, distribute, share, fuse, and refine energy maps over time by information exchange during encounters, (2) allow the nodes to use energy maps for energy planning and optimization in delay- tolerant, high-mobility networks.

2.2 Proposed system:

We define the coherence time as the maximum duration for which the end-to-end QoS metric remains roughly constant, and the spreading period as the minimum duration required to spread QoS information to all the nodes. We show that if the coherence time is greater than the spreading period, the end-to-end QoS metric can be tracked. We focus on the energy consumption as the end-to-end QoS metric, and describe a novel method by which an energy map can be constructed and refined in the joint memory of the mobile nodes.

3. Problem Statement

Energy potential is exhibited with a limiting distribution. Further, the observation interval is long enough such that the potential can be observed in its stationary regime. When energy is the QoS metric, any mobility model that has a limiting distribution for the node density has an energy potential with a limiting distribution In order to exhibit an example, we choose the Random Waypoint (RWP) Model whose limiting distribution was derived in and shown to be independent of node velocity.

In each node moves with a velocity of 10 m/s in each travel interval, and the pause time is 0 seconds. We choose a “sampling interval” Ts of 5 seconds, with which each node samples the energy field. Since the cell size is 50 m _ 50 m, on average, a node will have moved to a new cell before it makes a new measurement. Throughout our simulations, we assume that the transmit energy is dominant over receiver energy and that the path loss exponent is q = 2. The transmission range of each node is 120 meters.^2

Local measurement packet that contains:

1. the source node’s node ID;
2. the position at which this minimum Joules-per-bit meter measurement was initiated;
3. the time at which the measurement was initiated (the “generation time stamp”);
4. the channel gain measurement; and
5. the “transmission vector,” which is the vector from the position of the source to the position of The source is able to compute this transmission vector from its own position which it knows, and position which appeared in the ACK packet from Next, Node I computes its best estimate of the energy field, for each cell, as follows: It vectorially averages the transmission vectors, and it performs a scalar average of the (minimum Joulesper- bit-meter) channel gain samples. The average energy field computed this way, over 50,000 seconds, assuming instantaneous exchange of local measurements among the nodes Next, each node constructs its best estimate of the energy potential by the Path Integration Algorithm. shows the virtual paths constructed in this simulation via this algorithm.

The virtual paths are smoother and more directed toward the base station than the actual paths because the vector average of the transmission vectors removes most of the variation in the tangential direction. However, since the channel gains are scalar, the magnitudes of energy consumption in the transmission are still preserved. Third, we use the dissemination algorithm to spread the local measurements of the energy field.

It can be shows the percentage error of this distributed construction against the centralized construction, as a function of the absolute time in seconds, parameterized by the window size W, which is discrete-time steps at each sampling interval of 5 seconds. This plot is the average over all of the nodes. As W increases from 0 to 5, the minimum duration required to achieve a target percentage error decreases. The performance is not much improved beyond W = 5. In the graph, initially, the percentage error is 100 percent or above because none of the nodes have any measurements of the energy potential. However, for W = 5, when the nodes report the measurements with generation times five time steps into the past, the percentage error decreases quickly to 20 percent in 65 seconds and to about 10 percent in 100 seconds. In 65 seconds, each node in this RWP model moves about 1.3 average lengths from a point to its next point in the RWP model. Whether this minimum duration required for an accurate construction is long or short depends on the application requirements, which we shall treat in Section 7. The error floor of 10 percent arises from 1) the non adaptive uniform cell resolution, 2) the heuristic Joules-per-bit-meter method used for energy field estimation, and 3) the path integration method itself, which is also a heuristic.

The analysis phase involves gathering requirements for the system. At this stage, business needs are studied with the intention of making business processes more efficient. The system analysis phase focuses on what the system will do in an effort that views all stakeholders, as viable sources of information. In the analysis phase, a significant amount of time is spent talking with stakeholders and reviewing the stakeholder's input. Common stakeholders for IT projects are:

- Architecture office
- Testing & certification office
- Records management team
- Application support group

Once stakeholders have been recognized, the gathering and analysis of the requirements can begin. Requirement gathering must be related to business needs or opportunities. Requirement analysis involves capturing requirements and analyzing requirements. Capturing requirements is communicating with stakeholders to agree on what the requirements are. Analyzing requirements is using standard tools to produce a baseline of the requirements. Once the stakeholders concur on the requirements, the baseline is created and becomes the formal requirement source.

Within this analysis phase, the analyst is discovering and fact finding. Along with meeting with stake holders, the analyst must meet with end users to understand what the user's needs are and to learn about problems that affect the current system in order to assist with designing a new and more efficient system. There are several activities that must occur within the analysis phase:

- Gather Information
- Define the new system's requirements
- Build prototypes for the new system
- Prioritize requirements
- Evaluate alternatives
- Meet with management to discuss new options

4. SYSTEM DESIGN

The purpose of the design phase is to plan a solution of the problem specified by the requirement document. This phase is the first step in moving from the problem domain to the solution domain. In other words, starting with what is needed design takes us toward how to satisfy the needs. The design of a system is perhaps the most critical factor affection the quality of the software; it has a major impact on the later phase, particularly testing, maintenance. The output of this phase is the design document. This document is similar to a blueprint for the solution and is used later during implementation, testing and maintenance. The design activity is often divided into two separate phases System Design and Detailed Design.

System Design also called top-level design aims to identify the modules that should be in the system, the specifications of these modules, and how they interact with each other to produce the desired results. At the end of the system design all the major data structures, file formats, output formats, and the major modules in the system and their specifications are decided.

During, Detailed Design, the internal logic of each of the modules specified in system design is decided. During this phase, the details of the data of a module are usually specified in a high-level design description language, which is independent of the target language in which the software will eventually be implemented.

In system design the focus is on identifying the modules, whereas during detailed design the focus is on designing the logic for each of the modules. In other works, in system design the attention is on what components are needed, while in detailed design how the components can be implemented in software is the issue.

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis.

Architectural Design

The architectural design of a system emphasizes on the design of the systems architecture which describes the structure, behavior, and more views of that system.

Logical Design

The logical design of a system pertains to an abstract representation of the data flows, inputs and outputs of the system. This is often conducted via modeling, using an over-abstract (and sometimes graphical) model of the actual system. In the context of systems design are included. Logical design includes ER Diagrams i.e. Entity Relationship Diagrams.

Physical Design

The physical design relates to the actual input and output processes of the system. This is laid down in terms of how data is input into a system, how it is verified/authenticated, how it is processed, and how it is displayed as In Physical design, the following requirements about the system are decided.

1.Input requirement
2.Output requirements
3.Storage requirements
4.Processing Requirements
5.System control and backup or recovery.

Put another way, the physical portion of systems design can generally be broken down into three sub-tasks:

1.User Interface Design
2.Data Design
3.Process Design

User Interface Design is concerned with how users add information to the system and with how the system presents information back to them. Data Design is concerned with how the data is represented and stored within the system. Finally, Process Design is concerned with how data moves through the system, and with how and where it is validated, secured and/or transformed as it flows into, through and out of the system. At the end of the systems design phase, documentation describing the three sub-tasks is produced and made available for use in the next phase.

Physical design, in this context, does not refer to the tangible physical design of an information system. To use an analogy, a personal computer's physical design involves input via a keyboard, processing within the CPU, and output via a monitor, printer, etc. It would not concern the actual layout of the tangible hardware, which for a PC would be a monitor, CPU, motherboard, hard drive, modems, video/graphics cards, USB slots, etc. It involves a detailed design of a user and a product database structure processor and a control processor. The H/S personal specification is developed for the proposed system.

5. Implementation

Modules:

- Networking Module.
- Dynamic Random Module.
- Connectivity Period Module

Network Module:

Client-server computing or networking is a distributed application architecture that partitions tasks or workloads between service providers (servers) and service requesters, called clients. Often clients 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 clients. A client also shares any of its resources; Clients therefore initiate communication sessions with servers which await (listen to) incoming requests.

Dynamic Random Module:

We choose the Random Waypoint (RWP) Model whose limiting distribution was derived in and shown to be independent of node velocity. Each node moves with a velocity of 10 m/s in each travel interval, and the pause time is 0 seconds "sampling interval" Ts of 5 seconds, with which each node samples the energy field. Since the cell size is 50 m * 50 m, on average, a node will have moved to a new cell before it makes a new measurement. We assume that the transmit energy is dominant over receiver energy and that the path loss exponent is $q = 2$. The transmission range of each node is 120 meters.

Connectivity Period Module:

This energy map will remain stationary for durations that are much longer than those we observe on the individual node mobility scale. We define the "coherence time" of this map as the maximum duration for which the map remains roughly constant. . If the nodes can jointly construct this energy map and spread it among themselves within this coherence time, then the energy map can be used to give each node, per-packet end to-end energy consumption guarantees that are valid. We define the "spreading period" as the minimum duration required to jointly construct and spread the energy map to all of the nodes.

Dissemination algorithm

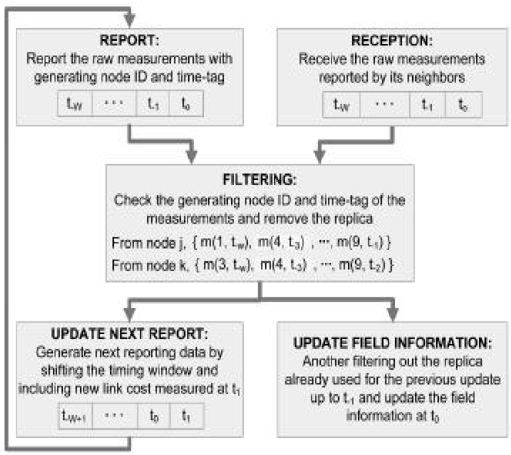

Figure.1 Dissemination Algorithm

In this fig.4.4.1we assumed that the local measurements of the energy field were instantaneously available to all of the nodes. In practice, the local measurements of the energy field can be exchanged only via local encounters with the other nodes. Given that the local measurement method of the energy field has been fixed, the “dissemination method” that does not lose any information would be to have each node i tell, every other node j it encounters, the entire set of local measurements that node i has made and heard from others.

When a node j hears a set of local measurements from another node i, it first checks whether any of these is a replica of a measurement that it already knows. If so, it is filtered out. Hence, the overhead per encounter also grows, and at some point, will dominate the data transfers. However, this overhead can be easily avoided as follows: If the spreading period exists and is bounded, then after a bounded time interval, we expect every node to have heard the old measurements.

As shown on the upper left-hand side of this figure, each node I reports to all of its neighbors, all of the samples of the energy field that it knows of and that have generation time stamps of the last W seconds. (Here, we show W as a discrete-time step, assuming a fixed sampling interval of 1 second.) At the same time, node i receives from each of its neighbors j, the samples of the energy field that its neighbor knows of and that were generated in the last seconds. In the Filtering block, these received samples are filtered; that is, any replicas that node i already knows are removed. Fig 2 shows the over all data received in each node.

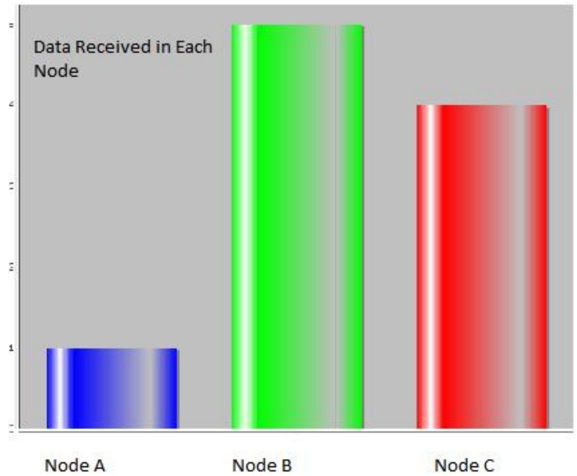

Fig- 2 Bar chart of data receiving at different nodes

6. CONCLUSION

We presented a novel framework by which network mobility can be viewed in the aggregate from the perspective of end-to-end QoS metrics. The concepts of coherence time and spreading period, which we defined, are applicable not only to energy but also to other QoS metrics such as end-to-end delay. Forming delay maps must take into account congestion and interference, which can be done by forming congestion, interference, and delay maps over the spatial domain. In our future work, we plan to pursue this approach, explore the scaling of this methodology as a function of the number of nodes, and investigate the coherence time and spreading period under increasingly realistic mobility models.

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