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END-TO-END PER-PACKET DELAY IN MULTI-HOP WIRELESS AD-HOC NETWORKS TOMOGRAPHY

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ABSTRACT:

In end-to-end per packet delay, we study the issues of decomposing the per-hop delay for each packet, in multi-hop wireless ad hoc networks. Data on the per-hop per-packet delay can greatly increase the network visualness and promote network measurement and management. We introduce DOMO, a inactive, slight-weight, and perfect delay tomography method to decomposing the packet end-to-end delay into each hop. We have a tendency to initially draft the per packet delay tomography complication into a set of optimization issues by carefully considering the constraints among numerous timing quantities. At the network part, DOMO attaches a tiny overhead to each packet for constructing constraints of the optimization issues. By resolving these optimization issues by semi-definite relaxation at the computer side, DOMO is in a position to calculate the per-hop delays with larger accuracy as well as provides a upper bound and lower bound for every unknown per-hop delay. We implement DOMO and work out its performance extensively using both trace-driven studies and large-scale simulations. The results shows that the DOMO considerably outperforms two existing strategies; nearly multiplying the accuracy of the progressive.

INTRODUCTION:

WIRELESS ad-hoc networks have been successfully applied in many application scenarios such as ecosystem management structural protection and urban CO2 monitoring. In these applications, data packets are usually delivered to a central sink through a multi-hop wireless network. Packet delivery delay is one of the most important performance metrics for many time-sensitive applications. While a lot of research efforts have been spent on measuring and optimizing the end-to-end (i.e., node to sink) delay (or path delay) there usually lack accurate and lightweight methods for decomposing the path delay into the per-hop delay (or node delay). This decomposition is called delay tomography in previous literature.

Knowledge on the per-hop delay provides paramount benefits for network measurement and management. Without the fine-grained per-hop delay information, packet delivery behaviors inside the network are invisible to network managers. This lack of network visibility poses great difficulties for the network designers to further optimize various network performances. The end-to-end delay distribution of a deployed network at time. A larger dot represents a longer end-to-end delay. We can see that end-to-end delays from different nodes can be very different. It is, however, difficult to pinpoint the problematic nodes with only the end-to-end delay information. In contrast, per-hop delay information enables efficient detection of the problematic nodes, as well as other detailed network analysis.

LITERATURE SURVEY:

Monitoring heritage buildings with wireless sensor networks

Wireless sensor networks are untethered infrastructures that are easy to deploy and have limited visual impact - a key asset in monitoring heritage buildings of artistic interest. This paper describes one such system deployed in Torre Aquila, a medieval tower in Trento (Italy). Our contributions range from the hardware to the graphical front-end. Customized hardware deals efficiently with high-volume vibration data, and specially-designed sensors acquire the building's deformation. Dedicated software services provide: i) data collection, to efficiently reconcile the diverse data rates and reliability needs of heterogeneous sensors; ii) data dissemination, to spread configuration changes and enable remote tasking; iii) time synchronization, with low memory demands. Unlike most deployments, built directly on the operating system, our entire software layer sits atop our TeenyLIME middleware. Based on 4 months of operation, we show that our system is an effective tool for assessing the tower's stability, as it delivers data reliably (with loss ratios <0.01%) and has an estimated lifetime beyond one year.

Reliable clinical monitoring using wireless sensor networks

An intravenous infusion monitoring and alarm system based on wireless transmission technology is presented. And it can real-time monitor infusion process. Alarm signal is given when the infusion is blocked or at the end of the infusion, which will solve the inconvenience of clinical intravenous infusion, and increase the security and efficiency. In this system, the photoelectric sensor technology and signal processing technology are applied to acquire the reliable detection of the infusion drops signal. And Single Chip Microcomputer (SCM) and digital display technology are used to count, display and monitor the quantity and velocity of the liquid, and alarm when there has no liquid or a block. Using wireless communication technology to realize information network and infusion status of every ward are real-time monitored in nurse station. Experimental results show that the system meet the design requirements and is safe and reliable.

Applications, challenges, and prospective in emerging body area networking technologies

Advances in wireless technology and supporting infrastructure provide unprecedented opportunity for ubiquitous real-time healthcare and fitness monitoring without constraining the activities of the user. Wirelessly connected miniaturized sensors and actuators placed in, on, and around the body form a body area network for continuous, automated, and unobtrusive monitoring of physiological signs to support medical, lifestyle and entertainment applications. BAN technology is in the early stage of development, and several research challenges have to be overcome for it to be widely accepted. In this article we study the core set of application, functional, and technical requirements of the BAN. We also discuss fundamental research challenges such as scalability (in terms of data rate, power consumption, and duty cycle), antenna design, interference mitigation, coexistence, QoS, reliability, security, privacy, and energy efficiency. Several candidate technologies poised to address the emerging BAN market are evaluated, and their merits and demerits are highlighted. A brief overview of standardization activities relevant to BANs is also presented.

Reconstruction of the correct temporal order of sensor network data

Collecting highly accurate scientific measurements asks for highest data quality and yield. But, satisfying these requirements is non-trivial, when considering phenomena common to wireless sensing systems such as clock drift, packet duplicates, packet loss and device reboots. Previous experience shows that these problems have not been resolved sufficiently by system design. In this paper, we introduce an offline approach to improve data quality by (a) providing a formal system model, (b) verifying conformance of packets received to this model, (c) providing the corrected packet sequence, and (d) providing additional information on packet generation inferred from temporally adjacent packets. We apply this method to a substantial amount of data from a real-world deployment and show the usefulness of this new intermediate packet processing step. In our validation of the proposed algorithm, we find that our approach successfully reconstructs the correct order of packet data streams. On application of the proposed data cleaning only a single violation is found when cross-validating a sequence of more than 4.6 million packets with ground truth derived from duplicate sensor data recovered from external storage post-deployment. The proposed method is thus suitable for both enhancing data accuracy on the occurrence of faults as well as the validation of data integrity.

EXISTING SYSTEM:

The problem in the existing system is the time spent on measuring and optimizing the end-to-end (i.e., node to sink) delay (or path delay), there usually lack accurate and lightweight methods for decomposing the path delay into the per-hop delay (or node delay). This decomposition is called delay tomography in previous literature.

Without the fine-grained per-hop delay information, packet delivery behaviors inside the network are invisible to network managers. This lack of network visibility poses great difficulties for the network designers to further optimize various network performances.

DISADVANTAGE:

The disadvantages of the existing system have the following reasons:

1) It does not scale well as the topology grows.
2) The flow rate is variable and the scan delay cannot be precisely controlled.
3) The High Speed TCP flow starves a TCP flow even in relatively low/moderate bandwidth.

PROPOSED SYSTEM:

• We propose Domo, an accurate and lightweight approach for Delay tOMOgraphy in wireless ad-hoc networks.

• We formulate the per-hop per-packet delay tomography problem into optimization problems and propose multiple methods for efficient problem solving.

• We extensively evaluate the performance of Domo by both trace-driven studies and large scale simulations. Results show that Domo significantly outperforms existing methods.

ADVANTAGE:

Our methodology offers several significant advantages over existing methods:

1) The existing methods require global clock synchronization for all routers in the networks. These works cannot be directly adapted to wireless ad-hoc networks due to several reasons, such as the constrained resource and the lack of global synchronization.

DOMO overcomes this difficulty by performing per-hop per packet delay reconstruction. At the meantime, Domo does not depend on synchronized global clock, which is usually not available in wireless ad-hoc networks due to its high message and energy overhead.

2) Knowledge on the per-hop delay provides paramount benefits for network measurement and management.

3) Per-hop delay information enables efficient detection of the problematic nodes, as well as other detailed network analysis.

4) There are passive measurement approaches with low-overhead to avoid the high probing overhead of the traditional probing based approaches.

IMPLEMENTATION:

Network measurement

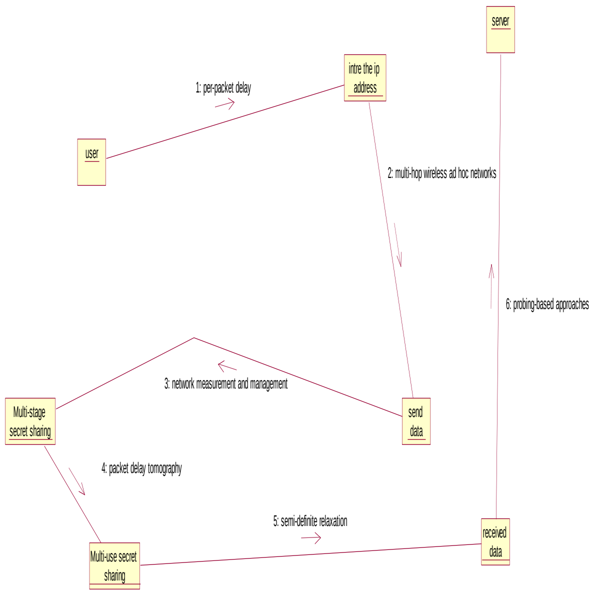
Knowledge on the per-hop delay provides paramount benefits for network measurement and management. Without the fine-grained per-hop delay information, packet delivery behaviors inside the network are invisible to network managers. This lack of network visibility poses great difficulties for the network designers to further optimize various network performances. The end-to-end delay distribution of a deployed network at time. A larger dot represents a longer end-to-end delay. We can see that end-to-end delays from different nodes can be very different. It is, however, difficult to pinpoint the problematic nodes with only the end-to-end delay information.

Delay tomography

For packets in a time window, we obtain their estimated per-hop arrival times by solving the optimization problem constructed by the packets in that time window. Due to the mentioned accuracy concern, we drop the estimated values near the time window boundaries and keep the ones far from the boundaries. Then we consider the next time window which has an overlapped area with the previous time window. We apply the same strategy on the second time window and drop some estimated values near the boundaries. The time windows are chosen so that after dropping a number of estimated values, the remaining values can also cover all unknown arrival times.

Wireless ad-hoc network

LDA is a compact data structure that efficiently computes the statistical delay of a link or a path, in a coordinated streaming environment. These Internet delay measurement approaches, however, cannot be directly adapted to wireless ad-hoc networks, due to the following two reasons. First, the resource (e.g., energy, computation, communication) in wireless ad-hoc networks is more constrained than that in the Internet. Therefore, it is desirable to passively measure the delay, instead of sending active probes, in wireless ad-hoc networks. Second, the passive Internet delay measurement approaches like LDA require global time synchronization to enable accurate time stamping at each node.



CONCLUSION:

We propose Domo, a passive, lightweight and accurate delay tomography approach to decomposing the packet end-to-end delay into each hop. Domo reconstructs per-hop per-packet delays by solving a set of optimization problems. SDP relaxation technique is used to improve the efficiency of Domo. Further, an improved time window method and a graph cut method are used to deal with large number of unknowns in the optimization problem. We implement Domo in Tiny OS and evaluate its accuracy in both simulations and test-bed experiments. Evaluation results show that Domo achieves higher accuracy compared with two related methods.

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