ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

EFFICIENT ROUTING SOLUTIONS FOR AVOIDING NETWORK TRAFFIC USING FINE GRAINED STREAM BASED MEASUREMENT SCHEME

V.Ruckmani Gayathri [*], M.Sathya

[*] Department of CSE, Mount Zion College of Engg & Tech, Pudukottai, Tamilnadu, India
Department of CSE, Mount Zion College of Engg & Tech, Pudukottai, Tamilnadu, India

ABSTRACT

The network system usually falls into the complexity of preventing the real time anomalies in the created architecture, some streaming analysis and measurements are created for preventing the anomalies but it is critical for detecting and preventing those problems. The traditional mechanism of slow open-loop measurement scheme is not feasible for the high speed and complex networks. A new approach called Closed-loop measurement is introduced and demonstrated the practical realization and functionalities of an efficient network mechanism. Three streaming algorithms are proposed to provide a tight integration between the measurement platform and the measurements. The algorithms provide to varying degrees of computational budgets, detection latency, and accuracy. We empirically evaluate our streaming solutions on a highly parallel and programmable measurement platform. The algorithms demonstrate a marked 100% accuracy increase from a recently proposed MRT algorithm in detecting Denial of Service attacks made up of synthetic hard-to-track elephant flows. The proposed algorithms maintain the worst case complexities of the MRT, while empirically demonstrating a moderate increase in average resource utilization.

KEYWORDS: Streaming Analysis, Detection Latency, Denial of Service Attack, Multi-Resolution Tiling.

INTRODUCTION

Accurate traffic measurement and monitoring is key in a wide range of network applications such as detection of anomalies and security attacks, and traffic engineering. A number of critical network management decisions such as blocking traffic to a victim destination, re-routing of traffic, or detection of anomalies, require extraction and analysis of real-time spatio-temporal patterns in network traffic. A high-quality network measurement tool is crucial for extracting such patterns of interest and making informed decisions to ensure proper network operation. Today's high speed networks see huge amounts of streaming traffic, posing enormous computational and storage requirements for accurate traffic measurements. Traditionally, the measurements are performed by maintaining limited information of the streaming data. This is done by programming conservative sampling factors over to the routers that maintain some very limited local storage. The collected sample is next periodically expired to high-end servers where it is post-processed in answering some higher level user-queries, such as traffic passing through a subnet or detecting a network anomaly.

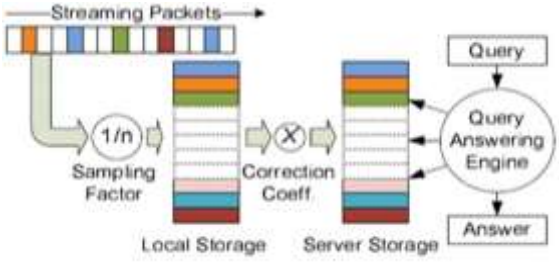

Figure 1. Traditional Open Loop

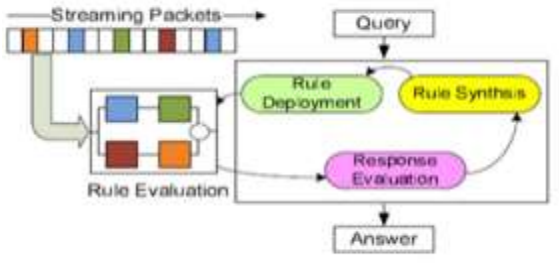

Figure 2. Proposed Closed Loop

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

The traditional paradigm is open-loop based in which the measurements are typically blind, or orthogonal, to the user requirements. Being orthogonal, the open-loop schemes not only perform redundant measurements, but the scheme's reliance on sampling incurs significant measurement inaccuracies. There is a vast amount of research that is based on open-loop schemes and their shortcomings. However, the speed and scale, the size, and complexity of today's networks limit the feasibility of the paradigm in closing the loop between the measurements and the requirements in a streaming setup. We address the problem using smart, goal-oriented closed-loop measurement solution. Central to our proposed scheme is a tight integration between the measurement requirements, available resources, and the actual measurements. This is achieved by breaking a higher level user-query into multiple rules of finer granularities and their iterative refinement over time until the user-query gets answered.

The contention is that the interesting traffic patterns could be detected or learned on the fly, via iterative rule based traffic measurements, online analysis of collected information, and closed-loop evolution of subsequent rules for further and finer traffic inspection. Each round in the iterative process guides the subsequent measurements towards the goal, thereby reducing redundant measurements and leading to answering the user-query over time. The closed loop scheme thus temporally distributes the complexity in answering the user query by breaking it down into multiple rules, or a rule-set, to be answered over multiple iterations. Multi-Resolution Tiling (MRT) Algorithm has been previously employed in coming up with the rule-sets in an offline closed loop settings, performing multiple passes over the same data.

In an online setting, such multiple-pass flexibility is not available, and may necessitate an aggressive formation of the rules, leading to large and redundant rule-sets. Thus the challenge in closed-loop streaming measurements is in the formation of a representative set of rules that can accurately answer the user query in reasonable time, while remaining within the computing budgets. In this work, we present an online closed-loop measurement system that provides solution to the above challenges. Fundamental to our streaming solution are three novel algorithms that cater to different levels of computational and storage budgets, detection latencies, and user level knowledge of the anomaly. A key goal of our work is to reduce redundant measurements by closely associating the computational resources towards the required query, that is, directing the limited resources where they are needed the most. Another consideration in the design of our algorithms is to maintain scalabilities in computation and storage costs, while not compromising on the accuracy and latency of the final answer.

We integrate our proposed algorithms using state of the art rule-processing platform, the BURAQ that provides highly parallel and programmable computational resources on a commodity FPGA device. We provide both empirical and analytical analysis of our algorithms. The worst case computational complexities of the proposed algorithms are similar to that of the MRT, whereas two of the three algorithms also demonstrate similar worst case storage complexities. The results show a marked 100% increase in the detection accuracies from the MRT, with low to moderate resource utilization of the BURAQ platform. Finally, we provide mathematical upper bounds on expected false alarms while using our solution. The bounds yield interesting insights in fine tuning the system accuracy and latency, under any given network conditions and computational budgets.

LITERATURE REVIEW

This section literature review has provides an overview and a critical evaluation of a body of literature relating to a research problem. Literature review is the most important step in software development process.

Online Identification of Hierarchical Heavy Hitters: Algorithms, Evaluation and Applications

In this paper [2], we propose that Sampling has become an integral part of passive network measurement. This role is driven by the need to control the consumption of resources in the measurement infrastructure under increasing traffic rates and the demand for detailed measurements from applications and service providers. Classical sampling methods play an important role in the current practice of Internet measurement. The aims of this review are to explain the classical sampling methodology in the context of the Internet to readers who are not necessarily acquainted with either, to give an account of newer applications and sampling methods for passive measurement and to identify emerging areas that are ripe for the application of statistical expertise.

Diamond in the Rough: Finding Hierarchical Heavy Hitters in Multi-dimensional Data

According to this paper [5], We propose that Data items archived in data warehouses or those that arrive online as streams typically have attributes which take values from multiple hierarchies (e.g., time and

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

geographic location; source and destination IP addresses). Providing an aggregate view of such data is important to summarize, visualize, and analyze. Develop the aggregate view based on certain hierarchically organized sets of large-valued regions ("heavy hitters"). Such Hierarchical Heavy Hitters (HHHs) were previously introduced as a crucial aggregation technique in one dimension. In order [1] to analyze the wider range of data warehousing applications and realistic IP data streams, we generalize this problem to multiple dimensions. Identify and study two variants of HHHs for multi-dimensional data, namely the "overlap" and "split" cases, depending on how an aggregate computed for a child node in the multi-dimensional hierarchy is propagated to its parent element(s). For data warehousing applications, present offline algorithms that take multiple passes over the data and produce the exact HHHs. For data stream applications, we present online algorithms that find approximate HHHs in one pass, with provable accuracy guarantees. Show experimentally, using real and synthetic data, that our proposed online algorithms yield outputs which are very similar (virtually identical, in many cases) to their offline counterparts. The lattice property of the product of hierarchical dimensions ("diamond") is crucially exploited in our online algorithms to track approximate HHHs using only a small, fixed number of statistics per candidate node, regardless of the number of dimensions.

Applications, Technologies, Architectures and Protocols for Computer Communications

In that paper [1], Traffic monitoring, accounting, and network anomaly detection, it is often important to be able to detect high-volume traffic clusters in near real-time. Such heavy-hitter traffic clusters are often hierarchical, they may occur at different aggregation levels like ranges of IP addresses) and possibly multidimensional, they may involve the combination of different IP header fields like IP addresses, port numbers, and protocol). Without prior knowledge about the precise structures of such traffic clusters, a naive approach would require the monitoring system to examine all possible combinations of aggregates in order to detect the heavy hitters, which can be prohibitive in terms of computation resources. In this approach, focusing on online identification of 1-dimensional and 2-dimensional hierarchical heavy hitters (HHHs), are two most important scenarios in traffic analysis. The problem of HHH detection can be transformed to one of dynamic packet classification by taking a top-down approach and adaptively creating new rules to match HHHs. Adapting several existing static packet classification algorithms to support dynamic packet classification. The resulting HHH detection algorithms have much lower worst-case update costs than existing algorithms and can provide tuning deterministic accuracy guarantee. As an application of these algorithms, we also propose robust techniques to detect changes among heavy-hitter traffic clusters. Our techniques can accommodate variability due to sampling that is increasingly used in network measurement. Evaluation based on real Internet traces collected at a Tier-1 ISP suggests that these techniques are remarkably accurate and efficient.

A Programmable Architecture for Scalable and Real-time Network Traffic Measurements

In this paper [3], we present that SIGCOMM is the flagship annual conference of the ACM Special Interest Group on Data Communication (SIGCOMM) on the applications, technologies, architectures, and protocols for computer communication. SIGCOMM members include scientists, engineers, educators and students. They study all aspects of computer communications and networks, analysis, technical design, engineering, measurement and management. Members are particularly interested in the systems engineering and architectural questions surrounding computer communication.

A Dynamically Reconfigurable System for Stateful Measurement of Network Traffic

According to this paper [4], we Programmable analysis of network traffic is critical for wide range of higher level traffic engineering and anomaly detection applications. Such applications demand stateful and programmable network traffic measurements (NTM) at high throughputs. Exploiting the features and requirements of NTM, and develop an application-specific FPGA based Partial Dynamic Reconfiguration (PDR) scheme that is tailored to NTM problem. PDR has traditionally been done through swapping of statically compiled FPGA configuration data. Besides being latency intensive, static compilation cannot take into account exact requirements as they appear during real-time in many applications like NTM. In this paper, novel use of fine-grained PDR, performing minute logic changes in real-time and demonstrate its effectiveness in a prototype solution for programmable and real-time NTM. Specifically make use of flexibility available through the application and present a number of novel tools and algorithms that enabled developing the BURAQ system. Our results show 4x area and 1.3x latency improvements of BURAQ from a comparative statically compiled recent solution.

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

PROPOSED APPROACH

In the Proposed Approach, A novel network routing technique is proposed, called MRT that aims to overcome the shortcomings of the previously reported network routing schemes which provides an efficient and cost effective fine grained data transfer. The main goal is to achieve a superb applicability to the network scenario with densely distributed hand-held devices. The main feature of this system is the strong capability in adaptation to the fluctuation of network status, traffic patterns/characteristics, user encounter behaviors, and user resource availability, so as to improve network performance in terms of message delivery ratio, message delivery delay, and number of transmissions.

The proposed scheme is characterized by the ability of adapting itself to the observed network behaviors, which is made possible by employing an efficient time window based update mechanism for some network status parameters at each node. This approach uses time-window based update strategy because it is simple in implementation and robust against parameter fluctuation. Note that the network conditions could change very fast and make a completely event driven model.

- This scheme takes less energy consumption, and small amount of transmission bandwidth and less memory space, which could easily simplify the network resource and provide efficient data transmission.
- Provide good support in high traffic loads, which results in a significant performance and scalability.
- Visibility under the scalable measurements, packets can dynamically move under the bandwidth circumstances.
- Measurement wastages are low during the detection of latencies.

Multi-resolution Tiling Algorithm

The MRT algorithm helps in guiding the measurements in the vast n-tuple search space. However, the limited visibility under which the guided measurements have to base their decisions can lead to false negatives and positives in detecting an anomaly. For instance, a brief spike in activity may lead the MRT to incorrectly declare presence of a heavy flow, when it may only be a Flash crowd. Similarly, a brief absence of an anomaly can lead the MRT to disregard a region from future consideration.

Streaming Algorithm

Streaming Algorithms that address the above challenges in goal oriented rule-based online traffic measurements. A key challenge answered in designing the streaming measurement algorithms is to maintain measurement scalability, by maintaining an optimized rule-set. We demonstrate streaming solutions that can maintain the accuracies while significantly reducing the resource budget from naive methods.

Equilibrium Rollback Algorithm

The Equilibrium Rollback (ER) Algorithm addresses the problem of MRT resets by adjusting the granularities of the expanded flow sets according to the temporal variations in the traffic. This is in contrast with the MRT that resets the granularities to the highest levels if the threshold requirements are not met.

Flow Momentum Algorithm

The Equilibrium Rollback helps to gracefully degrade the zoomed granularity when an anomaly temporally goes under the measurement radars. However, in doing so, the algorithm ends up maintaining information about the entire traversed hierarchy in the hope that it may be needed if the algorithm needs to rollback.

Directed Momentum Algorithm

A Smart Directed Momentum (DM) algorithm that directs the search process by associating limited resources where they are deemed more profitable. We develop the algorithm in the context of elephant flows. However, the ideas behind the algorithm are applicable for other types of anomalies.

SYSTEM DESIGN

System Architecture

The major part of the project development sector considers and fully survey all the required needs for developing the project. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations. Generally algorithms shows a result for exploring a single thing that is either be a

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

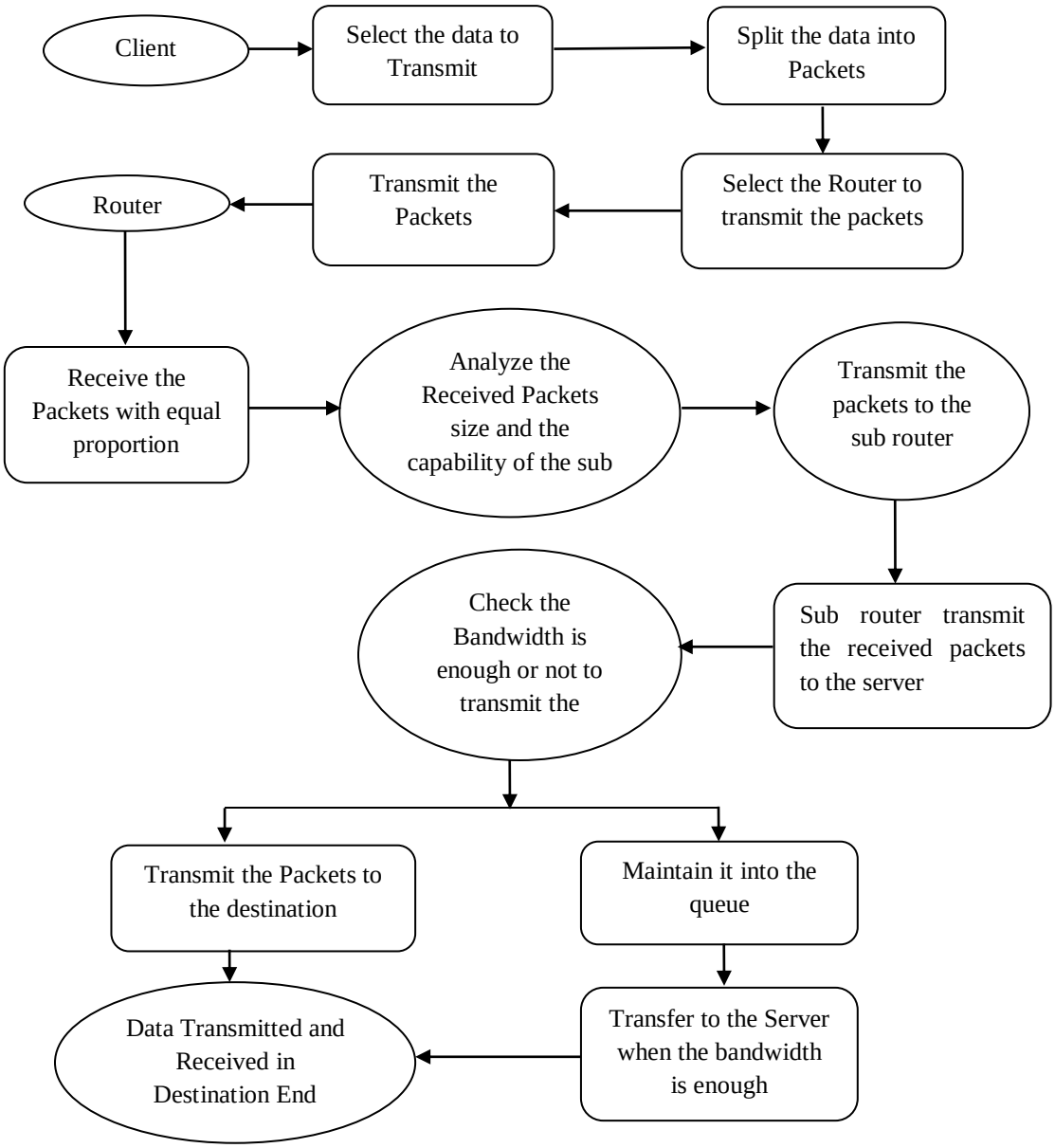

Fig 3: System Architecture

performance, or speed, or accuracy, and so on. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. System architecture can comprise system components, the externally visible properties of those components, the relationships (e.g. the behavior) between them.

Modules

1. Network Module
2. Delay Tolerant Network
3. Dynamic Routing
4. Randomization Process
5. Routing Table Maintenance
6. Load on Throughput

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

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.

Delay Tolerant Network
DTN is characterized by the lack of end-to-end paths for a given node pair for extended periods, which poses a completely different design scenario from that for conventional mobile adhoc networks (MANETs). Due to the intermittent connections in DTNs, a node is allowed to buffer a message and wait until the next hop node is found to continue storing and carrying the message. Such a process is repeated until the message reaches its destination. This model of routing is significantly different from that employed in the MANETs. DTN routing is usually referred to as encounter-based, store-carry-forward, or mobility-assisted routing, due to the fact that nodal mobility serves as a significant factor for the forwarding decision of each message.

Dynamic Routing
To propose a distance-vector based algorithm for dynamic routing to improve the security of data transmission. We propose to rely on existing distance information exchanged among neighboring nodes (referred to as routers as well in this paper) for the seeking of routing paths. In many distance-vector-based implementations, e.g., those based on RIP, each node maintains a routing table in which each entry is associated with a tuple, and Next hop denote some unique destination node, an estimated minimal cost to send a packet to t, and the next node along the minimal-cost path to the destination node, respectively.

Randomization Process
The delivery of a packet with the destination at a node. In order to minimize the probability that packets are eavesdropped over a specific link, a randomization process for packet deliveries, in this process, the previous next-hop for the source node s is identified in the first step of the process. Then, the process randomly picks up a neighboring node as the next hop for the current packet transmission. The exclusion for the next hop selection avoids transmitting two consecutive packets in the same link, and the randomized pickup prevents attackers from easily predicting routing paths for the coming transmitted packets.

Routing Table Maintenance
In the network be given a routing table and a link table. We assume that the link table of each node is constructed by an existing link discovery protocol, such as the Hello protocol in. On the other hand, the construction and maintenance of routing tables are revised based on the well-known Bellman-Ford algorithm.

Load on Throughput
Investigate the effect of traffic load on throughput for our proposed DDRA; the traffic is also generated based on variable-bit-rate applications such as file transfers over Transmission Control Protocol (TCP). The average packet size is 1,000 bytes, and source-destination pairs are chosen randomly with uniform probabilities.

CONCLUSION
Iterative measurements offer streaming measurements and analysis and help overcome the offline nature of traditional measurements. However, the effectiveness of iterative measurements is heavily tied with smart algorithms that can efficiently make use of constraints as imposed by the measurement platforms. The state-of-the-art MRT algorithm is too sensitive to specific traffic patterns and is blind to any constraints or opportunities arising from measurement platforms. We address the issues with three iterative streaming algorithms that cater to varying degrees of computational and storage budgets, detection latency, and accuracies of query response. We evaluate the streaming algorithms on diverse hardware and software-based measurement platforms, for local as well as distributed measurement settings. The results demonstrate a marked 100% improvement in detection accuracy compared to MRT, with a moderate increase in storage and computational complexities. In future the proposed ER and FM algorithms are suitable where detailed information about the anomalous behavior and computational platform is not available. The algorithms trade computational complexity with storage costs and detection latencies, with FM offering increased accuracy. The DM algorithm showcases superior accuracy and detection latency

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 2.114

while employing minimal resources, making it an ideal candidate in scenarios where exceeding the available resources is prohibitive and/or increased characterization of an anomaly is possible.

FUTURE WORK

The work addressed the challenges in closed-loop streaming measurements and analysis in today's high speed and complex networks. In particular, we addressed the issues in tracking down anomalous flows within a desired accuracy and latency, in a given resource budget. In the present work the following algorithms like streaming algorithm, equilibrium rollback algorithm are neatly explained and implemented with the help of dynamic routing and throughput maintenance modules. In the future the created modules needs to be expand further by means of routing table handling module, which is used in the network by giving a routing table and a link table. The link table of each node is constructed by an existing link discovery protocol, such as the Hello protocol in. On the other hand, the construction and maintenance of routing tables are revised based on the well-known Bellman-Ford algorithm, which is used in many ways to help us to move the transmission without any delay and maintaining the sequence in correct order with the help of other two algorithms like flow momentum and direct momentum.

Acknowledgements

Our completion of this paper could not have been accomplished without the support of staff members those who are working with us. We are very much thankful to them. For the reference, we refer many articles and research papers of many authors and institutions those are available in online and offline. We offer our sincere appreciation for the learning opportunities provided by those authors and institutions. At last but not least, our heartfelt thanks to all our family members for caring us and for the huge support.

References

[1] L. Yuan, C.-N. Chuah, and P. Mohapatra, "Progme: towards programmable network measurement," in *Proc. SIGCOMM*, 2007, pp. 97–108

[2] F. Khan, N. Hosein, C.-N. Chuah, and S. Ghiasi, "Streaming solutions for fine-grained network traffic measurements and analysis," in Proceedings of the Seventh ACM/IEEE Symposium on Architectures for Networking and Communications Systems, ser. ANCS '11, 2011.F. Khan, L. Yuan, C.N.Chuah "A Programmable Architecture for Scalable and Real-time Network Traffic Measurements", 2008.

[3] F. Khan, S. Ghiasi, and C.-N. Chuah, "A dynamically reconfigurable system for closed-loop measurements of network traffic," IEEE Transactions on Computers, vol. 99, p. 1, 2012.

[4] G. Cormode and S. Muthukrishnan, "An improved data stream summary: the count-min sketch and its applications," J. Algorithms, vol. 55, pp. 58–75, April 2005.

[5] F. Khan, L. Yuan, C.-N. Chuah, and S. Ghiasi, "A Programmable Architecture for Scalable and Real-time Network Traffic Measurements," in ANCS 2008

[6] G. Huang, S. Raza, S. Seetharamanh, and C.-N. Chuah, "Dynamic measurement-aware routing in practice," in IEEE Networks Special Issue on Network Traffic Monitoring and Analysis, 2011, pp. 29–34.

[7] N. McKeown, T. Anderson, H. Balakrishnan, G. Parulkar, L. Peterson, J. Rexford, S. Shenker, and J. Turner, "Openflow: enabling innovation in campus networks," SIGCOMM Computer Communication Rev., vol. 38, no. 2, pp. 69–74, Mar. 2008.