

AMIS: Programmable Privacy-Preserving Network Measurement for Analysis and Troubleshooting

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¹ **Abstract**—Network measurement and monitoring are instrumental to network operations, planning and troubleshooting. However, increasing line rates (100+Gbps), changing measurement targets and metrics, privacy concerns, and policy differences across multiple R&E network domains have introduced tremendous challenges in operating such high-speed heterogeneous networks, understanding the traffic patterns, providing for resource optimization, and locating and resolving network issues. There is strong demand for a flexible, high-performance measurement instrument that can empower network operators to achieve the versatile objectives of effective network management and resource provisioning. In this demonstration, we present AMIS: Advanced Measurement Instrument and Services to achieve programmable, flow-granularity and event-driven network measurement, sustain scalable line rates, to meet evolving measurement objectives and to derive knowledge for network advancement.

I. INTRODUCTION OF AMIS

The AMIS (Advanced Measurement Instrument and Services) aims to help planning and management of ultra-high speed international research networks connecting critical science instrument (e.g. LHC and LSST) and HPC centers. First, AMIS takes full advantage of capabilities of state-of-the-art multi-core processors and emerging packet processing techniques (e.g. DPDK, RSS) to deliver a highly programmable network measurement appliance scalable to line rate of 100+Gbps. Second, the event-driven query language, software APIs, libraries and tools are developed to support programmable and software-defined measurement that empowers the network operators to design complex and responsive measurement tasks. Third, AMIS delivers operational prototypes at the already-identified and future international R&E network exchange points to conduct measurement operations and gather network flow information for analysis and sharing, while preserving data privacy. The AMIS will strengthen ongoing academia-industry collaborations and lead to new cooperation among national and international partners.

The AMIS enables network operators to 1) launch measurement queries in a declarative language, 2) build network events (e.g. packet loss rate exceeds a threshold) into

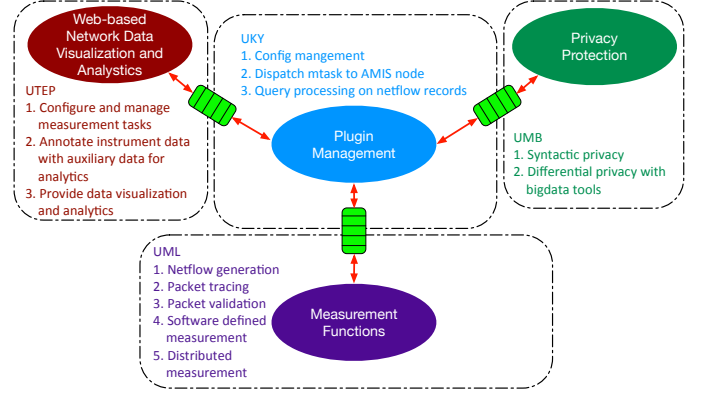


Fig. 1. AMIS Architecture

a measurement query to trigger subsequent measurement tasks, 3) design event-driven measurement queries to diagnose network issues along paths, 4) acquire fine-grained network flow statistics while preserving user privacy and 5) trace packets and flows to answer multipurpose queries.

As shown in Figure 1, there are four major parts in AMIS. For more details, please check our wiki page: <https://acanets.uml.edu/amis/w/index.php/Overview>

II. DEPLOYMENT OF AMIS INSTRUMENTS

Unlike the perfSONAR node that performs active measurement, the AMIS instrument performs only passive network measurement which does not bring any impact over the existing live traffic. There have been 5 AMIS instruments deployed at University of Massachusetts Lowell, University of Kentucky, StarLight, AMPATH and LSST (Chile), shown at the bottom of Figure 3. To analyze the live traffic, as shown in Figure 2, each AMIS instrument is mapped onto a Dell PowerEdge R740 server which is connected to a Dell Z9100 switch.

The AMIS instrument supports a set of APIs and measurement operations instantiated on an open multicore-based programmable platform to capture flow-granular metrics, and speeds up packet processing on 100Gbps links using Data Plane Development Kit (DPDK) and Receive Side Scaling (RSS). Distributed measurement is supported by designing algorithms to dynamically dispatch tasks and aggregate results. The AMIS instrument also leverages state-of-the-art privacy preserving algorithms to deliver

¹This demo paper is about the concepts presented in the paper "Edison: Event-driven Distributed System of Network Measurement"

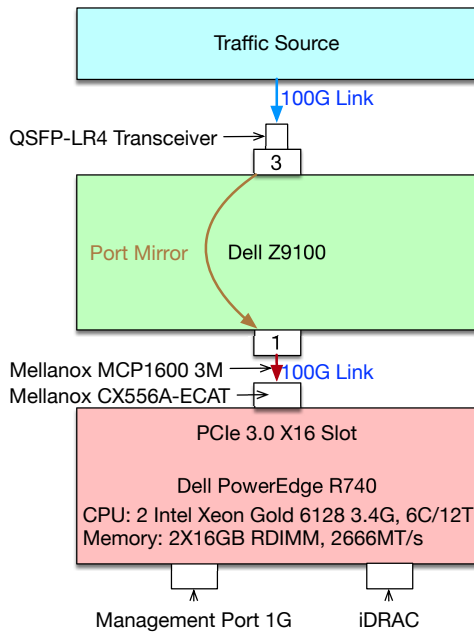


Fig. 2. AMIS Deployment

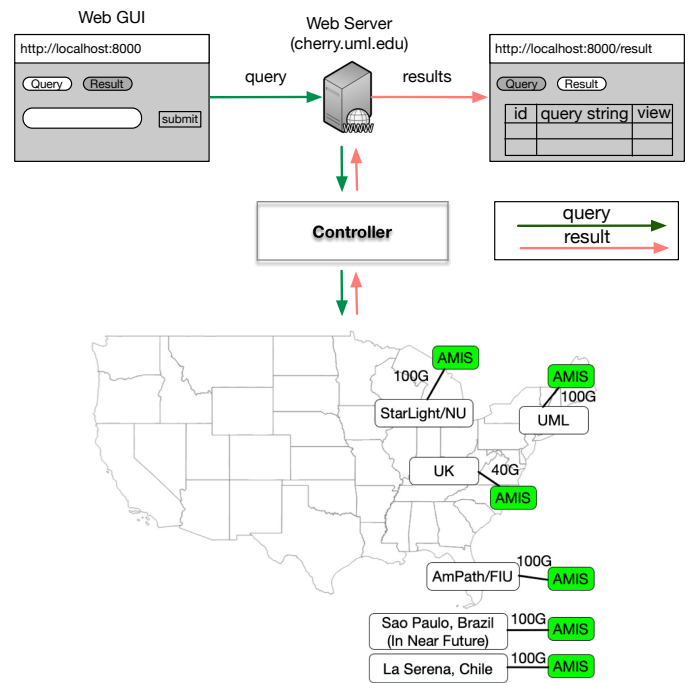


Fig. 3. AMIS Integration

network usage analytics without unnecessarily exposing user information. The configuration and data management is scalable due to the use of a cloud-based data processing architecture.

III. DEMONSTRATION RESOURCES AND IMPLEMENTATIONS

At the time of demonstration, there will be 100G live network traffic via internet2 across continents (LSST/Chile $\leftrightarrow$ Ampath/FIU $\leftrightarrow$ StarLight $\leftrightarrow$ NCSA) which will be monitored by our AMIS instruments on the path. To integrate the effort from all the parts (Figure 1), we have designed the webpage at cherry.uml.edu. As shown at the top of Figure 3, each user only needs to submit their query via web GUI and wait for measurement results.

IV. DEMONSTRATION DETAILS

The live demonstration will present several features of AMIS via the webpage cherry.uml.edu, which include the following.

- 1) Introduce the deployment of the AMIS instruments which are the foundation of distributed AMIS measurement framework.
- 2) Visit each AMIS instrument and present its corresponding Netflow information of the top 10 flows.
- 3) Present the event-driven query language and initiate several measurement queries to show fine-grained flow statistics at each AMIS instrument.
- 4) Acquire fine-grained network flow statistics while preserving user privacy.
- 5) Visualize traffic analysis results.

With regard to the demonstration equipment, we need a tripod for our poster and a monitor for the live demo.

ACKNOWLEDGMENT

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