Demo/Poster Abstract: Efficient and Flexible Packet Tracing for Virtualized Networks using eBPF

Kun Suo*, Yong Zhao*, Wei Chen#, Jia Rao*
* The University of Texas at Arlington # University of Colorado, Colorado Springs

Motivation

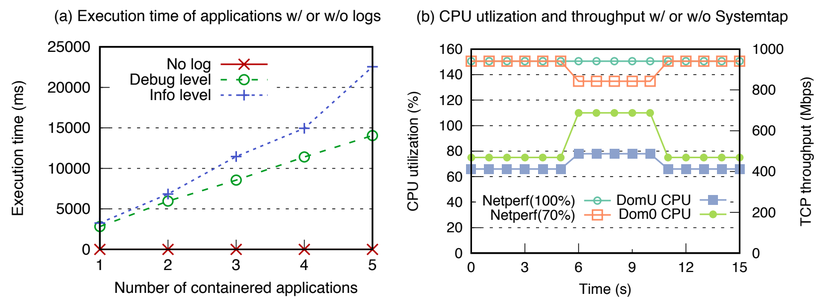
- **Virtualized network have been widely adopted by cloud providers. However, to provide an efficient and useful network monitoring profiler is difficult in the virtualized network.**
  - Production environment has strict performance requirements of network, and the virtualized resources are highly consolidated and low tolerance to overhead.
  - Tracing tools should involve as few modifications and interferences as possible on the existing system.
  - Monitoring should provide high flexibility and customizability as SDNs and NFVs are usually changing rapidly and dynamically.

Background

- **Tracing based on system logs**
  - Non-negligible runtime overhead
  - Not meet dynamic virtualized network and capricious user requirements
- **Tracing based on the annotations or middleware layers**
  - Involve significant modifications
  - Incur additional overhead
- **Dynamic system tracing**
  - Limited in the virtualized environments with many hardware and software boundaries
  - Depend on predefined tracepoints

vNetTracer

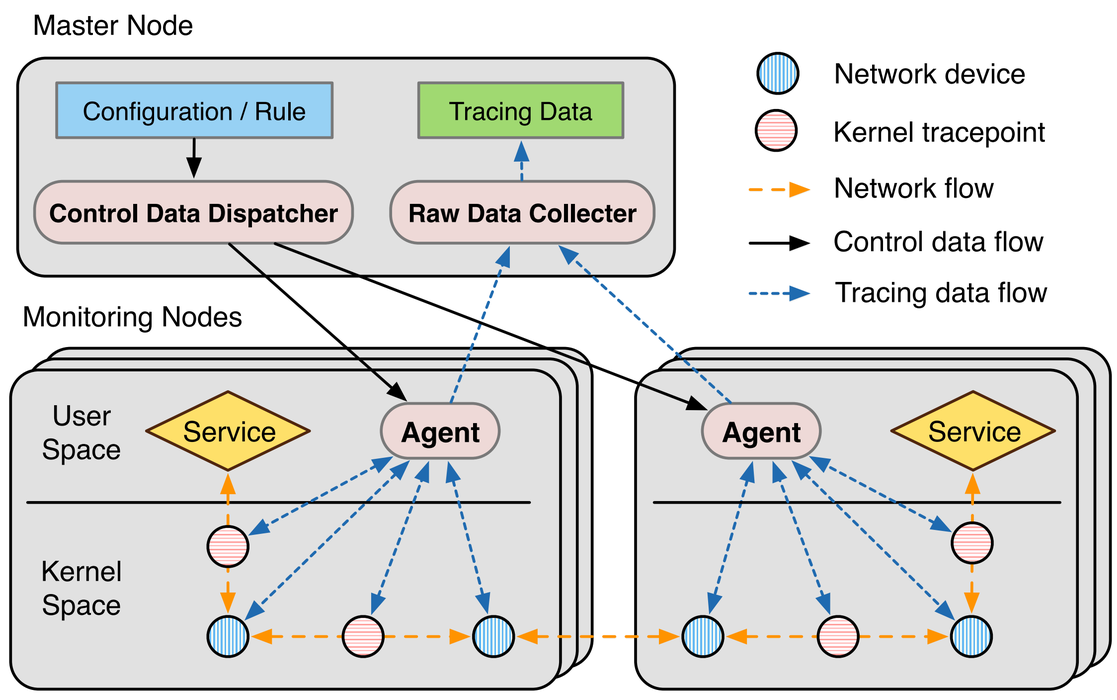
- **Efficiency**
  - Incur marginal runtime overhead in the highly consolidated and optimized virtualized networks
- **Programmability**
  - Supports customized network packet tracing and can be configured based on different goals
- **Transparency**
  - Not require modifications to the applications



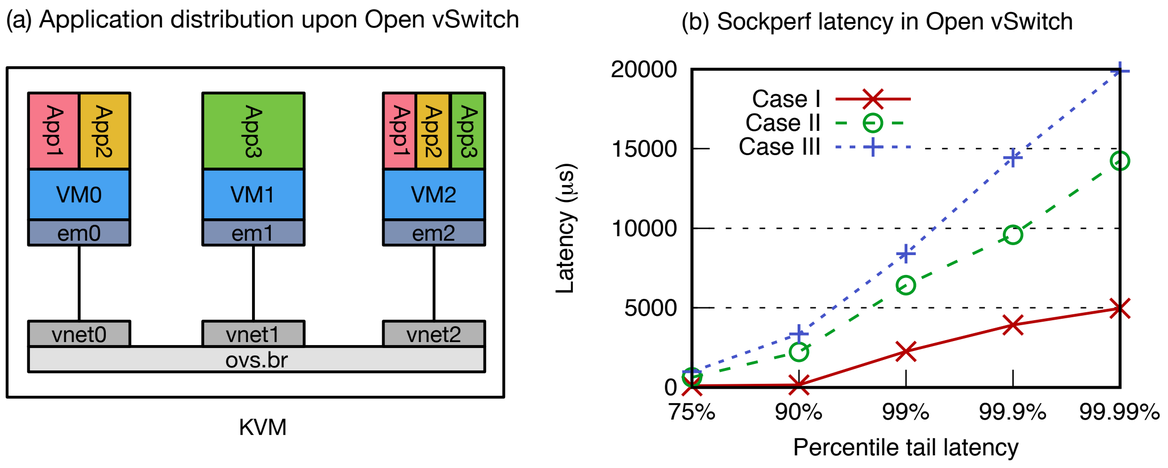
Real world tracing impact analysis.

vNetTracer Architecture

- **A highly efficient and programmable tracing framework for virtualized network**
- **Control data dispatcher**
  - Reads user input, and generates formatted configuration files in control packages
  - Sends the files to agents on remote monitoring machines
- **Agent**
  - Receives the configured files from the dispatcher and executes eBPF programs
  - Collect the tracing data based on the rules
- **Raw data collector**
  - Collects the raw tracing data
  - Performs offline analysis

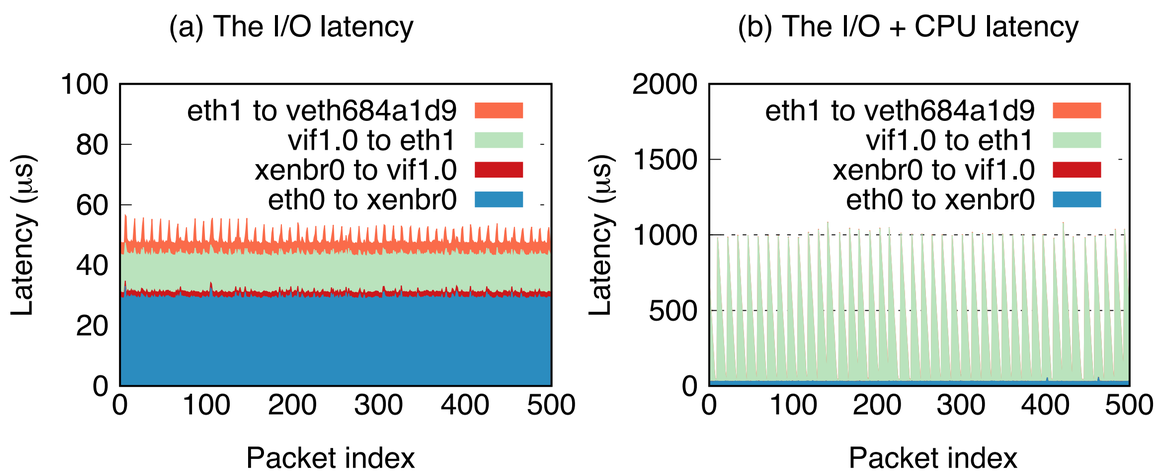


Network Delay in the Open vSwitch



- Network delay in the congested network of virtualized switches. Why did the network delay happen?
- Where did the main bottleneck come from?
- How to mitigate the issue along the network path?

Tail Latency in Hypervisors



- The 99.9 percentile of latency increased 22x when the I/O-bound VM shared the CPU resources with the CPU-bound VM.
- Bugs inside the Xen scheduler.