Scalable, Hardware-Accelerated Network Analytics

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Network Monitoring & Analytics

Applications
- Network debugging
- Performance analysis
- Security

Data Collection
- Netflow/IPFIX
- Packet traces
- P4 telemetry systems

Data Analysis
- Generally post-hoc
- Batch processing, e.g., MapReduce
- Heavyweight deployments

Compromises in Today's Systems

Traffic Filtering  
Packet Stream  
Filtration (e.g., ip cam)  
Packet Stream  
Analytics  
Packet Stream  
Sampling (e.g., every 32)  
Packet Stream  
Analytics  
Packet Stream  
Aggregation (e.g., counts per 5-tuple)  
Packet Stream  
Analytics

An Ideal Network Analytics System

- Every single packet in software (no filtering, no sampling)
- Per packet data (no aggregation)
- In real time (processing as packets traverse the network)
- Composable, flexible analytics applications in software
- Analytics configurable at runtime without downtime

System Overview

Packet Stream  
Collector  
Packet Records for every Packet  
Analytics  
Packet Records  
Real-Time Results  
Analytics  
Packet Records  
Composable, Runtime-Configurable Applications in Software

High-Performance Software Analytics

- Processing system based on streaming analytics paradigm
- Processing elements organized in scalable stages
- Run in parallel
- Data is passed between processors through queues
- C++ API with pre-defined elements
- Custom elements easy to implement

Hardware Support

- Initial pre-processing in hardware (e.g., Smart NIC, PFE)
- Different queues per target application
- Batching of low-priority traffic
- Zero-copy read into user-space (e.g., DPDK)
- Netronome NFP-4000: 148M packet/s throughput

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API Example:

```c++
jetstream::app app;
auto source = app.add_stage<source>(1, "eth0");
auto per_src_counter = app.add_stage<pkts_per_src>(3);
auto threshold = app.add_stage<threshold>(1);
app.connect<pkt>(source, per_src_counter);
app.connect<src_count>(per_src_counter, threshold);
app();```