

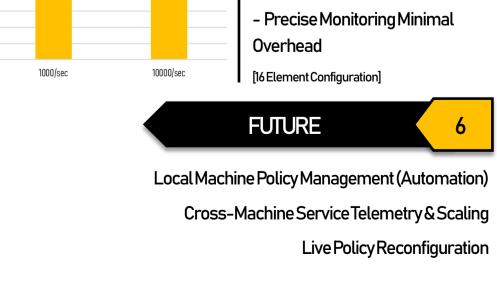




EPSRC UNIMON Lightweight Bottleneck Detection for Virtualized Network Services UNIMON [collection] UNIKERNELS 4 Unikernel - Single Purpose Configuration - Single Address Space Application - Small Size (< 5MB) **Required Libraries** - Fast Boot Times (order of ms) eckDetec Build Element (Function) Tree CPU: 1% pps: 100% Kernel - Examples: CPU: 5% pps: 100% CPU: 6% CPU: 1% pps: 100% [ClickOS, Mirage, Rump] Hypervisor CPU: 2% pps: 100% CPU: 1% pps: 100% CPU: 19% pps: 94% PROBLEM 2 Monitor Each Element - Flag Expensive - No Internal Monitoring Features in Micro-VNFs - Limited by VIM metrics (e.g. OpenStack Ceilometer) - Hardware Metrics, Packet Throughput - Poll Based NFV uses ~100% CPU Scaled Service **Closely Monitor Flagged Elements** - Detailed Data Required for Effective Policy Management Click Click Click Unimon Domain 0 Domair Domain Domair Domain - Few Options for Closed-Loop Operations - High Bandwidth Consumed by Monitoring Analysis & Aggregation Monitor Monitor Monitor - Internal Monitoring Impacts Performance & Size Shared Memo Xen CPU: 98% Mem: 79% CPU: 99% CPU: 99% Mem: 68% - Observer Effect Mem: 81% Hardware DomU Dom0 DomU DomU Externally Analyze & Aggregate Data VNF VNF VNF Config Config Config Mirror Арр Арр Арр **EVALUATION** 5 OvS Kernel Kernel Kernel - Low Overhead % Overhead of BottleneckDetect Xen (in a UDP Mirror configuration) -6.8% Overhead at 10,000 samples/ Hardware NIC second - 4.4% at 1,000 sample/second UNIMON [analysis]

| \square | Fully Internal |
|-----------|---|
| | Packet Processing Collect Analysis Packet Processing Collect Analysis |
| \square | Internal Collection External Analysis |
| | Packet Processing Collect Copy Packet Processing Collect Copy |
| \square | Internal Collection External (witch zero-copy) |
| | Packet Processing Collect Packet Processing Collect Packet Processing |
| | time |

- Externalise analysis onto local system via zero-copy
- Fully internal allows for all monitoring in a single binary image
- Have local and service policy management





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