FlowQoS: Not Every Flow is Born the Same

UCSDCSE Computer Science and Engineering

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Motivation

- Traffic from one application might not share the same characteristics as the traffic from another.
- Network devices have DSCP-based QoS requiring applications to set the corresponding fields in IP header.

Solution

- Isolate different traffic using OpenFlow in separate queues each rate limited using OVS ingress policing to it's user-specified bandwidth share.
- Use Linux's advanced routing and traffic control to prevent under-utilization of available bandwidth.

Conclusion & Future Work

- FlowQoS improves performance and user experience for time-sensitive applications.
- HTB-based solution smoothens traffic and improves bandwidth usage but might increases latencies.
- Use OVS's NetFlow support for metering and analytics.
- Use SFQ discipline for equal share within each queue.

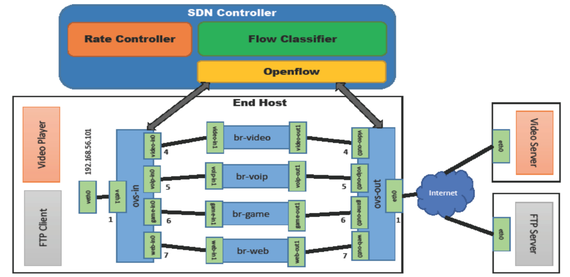
FlowQoS Classification & Rate Control

- Users configure priorities for specific high-level applications.
- The output from the portal is a configuration file that the rate shaper uses for shaping traffic.
- Enables per-class QoS by creating a two-switch virtual topology.
- Each link corresponds to a different traffic class and is rate-limited to the user-specified rate.
- Classification uses DNS records for HTTP traffic and first 4 bytes of the flow in either direction.

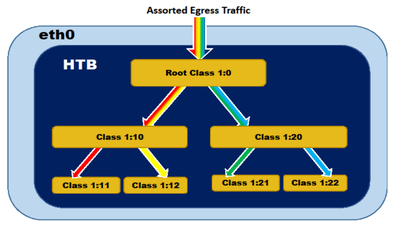
Linux Traffic Control

- Provides a handle **tc** for Linux kernel's network scheduler for low-level manipulation of network traffic flowing through it.
- Implements multiple queuing disciplines, traffic policers and shapers to provide QoS to matching traffic.
- HTB is classful queueing discipline that supports multi-level traffic classification and shaping on egress traffic at an interface.

FlowQoS Architecture

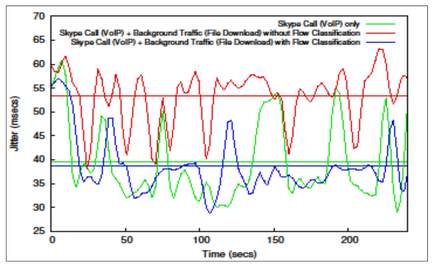


Heirarchical Token Bucket (HTB) Traffic Flow

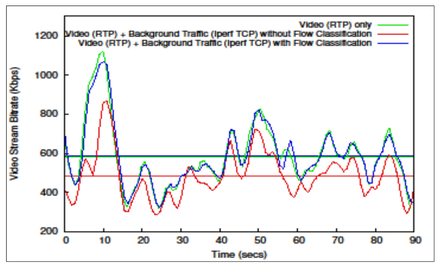


Results

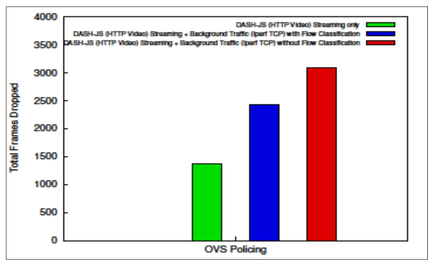
Improvements to Application Performance using OVS-Openflow Classification

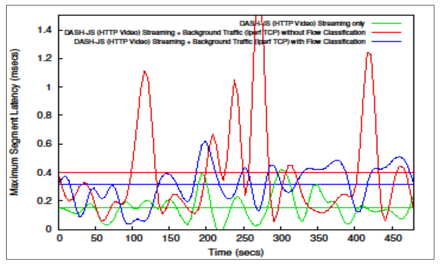


Reduced Skype Call Jitter



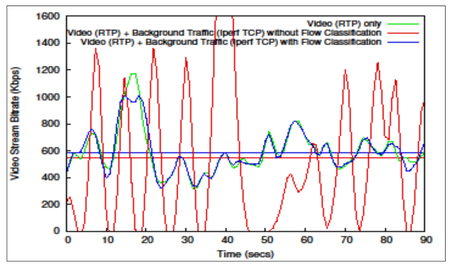
Improved VLC Real-time Streaming Bitrate



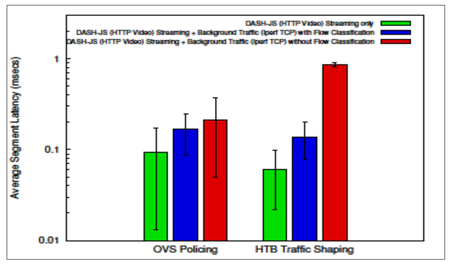


Reduced Frame Drops and Segment Latency in DASH (HTTP) Video Streaming

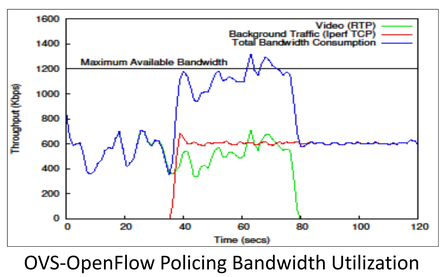
Additional Gains from using Hierarchical Token Bucket (HTB) in Linux Traffic Control



Improved Worst-Case VLC Streaming Bitrate

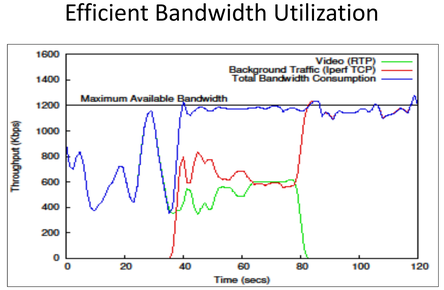


Reduced Latencies in DASH Video Streaming



OVS-OpenFlow Policing Bandwidth Utilization

Efficient Bandwidth Utilization



HTB Traffic Shaping Bandwidth Utilization