

On Scalable Edge-based Flow Control Mechanism for VPN Tunnels --- Part 2: Scalability and Implementation Issues

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1. State Goals and Define the System

- ✓ Goals
 - ✓ Confirm validity of our I2VFC simulation results
 - ✓ Demonstrate usability of I2VFC in real networks
 - ✓ Examine I2VFC scalability and find its bottleneck in terms of...
 - ✓ Number of VPN flows
 - ✓ Number of TCP/UDP flows
 - ✓ Link bandwidth
- ✓ System Definition
 - ✓ VPN service provider network including...
 - ✓ ingress and egress PE (Provider Edge) routers
 - ✓ core network devices (routers and links)
 - ✓ but excluding...
 - ✓ VPN sites (CE (Customer Edge) routers, end hosts)

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2. List Services and Outcomes

- ✓ Services Provided
 - ✓ Congestion control for VPN flows
 - ✓ Active fairness control among VPN flows
 - ✓ Passive fairness control among TCP/UDP flows
- ✓ Outcomes
 - ✓ High link bandwidth utilization?
 - ✓ Low packet loss probability?
 - ✓ Low packet transfer delay?

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3. Select Metrics

- ✓ Speed (case of successful service case)
 - ✓ Individual
 - ✓ VPN throughput, round-trip time, packet loss probability
 - ✓ TCP/UDP goodput, round-trip time, packet loss probability
 - ✓ Global
 - ✓ PE router processing time, memory usage, queue occupancy
- ✓ Reliability (case of error)
 - ✓ None
- ✓ Availability (case of unavailability)
 - ✓ None

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4. List Parameters

- ✓ System parameters
 - ✓ Network related
 - ✓ Topology
 - ✓ Link bandwidth, latency, loss ratio
 - ✓ Queue size and discipline (e.g., DropTail or RED)
 - ✓ PE router related
 - ✓ Control parameters (Δ , a , b , W_{max} , W_{min} , W_0)
 - ✓ Queue size
- ✓ Workload parameters
 - ✓ # of VPN flows
 - ✓ # of TCP/UDP flows, TCP/UDP traffic pattern
 - ✓ Background traffic pattern

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5. Select Factors to Study

- ✓ System parameters
 - ✓ Network related
 - ✓ Topology
 - ✓ Link bandwidth, latency, loss ratio
 - ✓ Queue size and discipline (e.g., DropTail or RED)
 - ✓ PE router related
 - ✓ Fairness criteria
 - ✓ Control parameters (, a, b, W_{max} , W_{min} , W_0)
 - ✓ Queue size
- ✓ Workload parameters
 - ✓ # of VPN flows
 - ✓ # of TCP/UDP flows TCP/UDP traffic pattern
 - ✓ Background traffic pattern

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6. Select Evaluation Technique

- ✓ Use analytical modeling?
 - ✓ No
- ✓ Use simulation?
 - ✓ No
- ✓ Use measurement of real system?
 - ✓ Yes

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7. Select Workload

- ✓ # of VPN flows: 2 up to 12VFC limitation
- ✓ TCP flows
 - ✓ Persistent traffic using iperf (TCP benchmarking tool)
 - ✓ # of TCP flows: 1 -- 100
 - ✓ Bursty traffic using ? (HTTP traffic generator)
 - ✓ # of TCP flows: 100
- ✓ UDP flows
 - ✓ Persistent traffic using iperf (TCP benchmarking tool)
 - ✓ UDP traffic rate: 0 – 70% of the bottleneck link bandwidth
 - ✓ Persistent traffic using ? (VoIP traffic generator)
- ✓ Background traffic
 - ✓ 30% of the bottleneck link bandwidth

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8. Design Experiments

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9. Analyze and Interpret Data

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10. Present Results

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