Performance Evaluation of Ringbased Peer-to-Peer Virtual Private Network (RING-P2P-VPN)

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1. State Goals and Define the System

- ✓ Goals
 - ✓ Quantitatively evaluate performance of RING-P2P-VPN
 - ✓ Confirm feasibility of RING-P2P-VPN in realistic environment
 - ✓ Analyze effectiveness of several improvement options
 - √ Bi-directional tunnel
 - ✓ Dynamic signaling (i.e., GWDP) frequency control
 - $\checkmark \mbox{Periodic round-trip time resampling}$
 - ✓ QoS-aware gateway selection (e.g., bandwidth, latency)
 - ✓ Priority control for SYN/SYN ACK packets

1. State Goals and Define the System (Cont'd)

- System Definition
 - SUT (System Under Test)
 - ✓ RING-P2P-VPN network including...
 - ✓ Underlying IP network (routers and links)
 - ✓ VPN gateways
 - ✓ End hosts✓ CUS (Component Under Study)
 - Bi-directional tunnel
 - ✓ Dynamic signaling (i.e., GWDP) frequency control

 - ✓ Periodic round-trip time resampling✓ QoS-aware gateway selection (e.g., bandwidth, latency)
 - ✓ Priority control for SYN/SYN ACK packets

2. List Services and Outcomes

- Services Provided
 - ✓ Dynamic VPN topology configuration/reconfiguration
 - ✓ VPN entity discovery/joining/removal
 - ✓ Secure communication among VPN gateways
 - ✓ Minimum resource usage at VPN gateways
- Outcomes
 - √ Higher connectivity between end hosts
 - ✓ (Possibly) lower transmission delay
 - ✓ Smaller number of IPsec tunnels maintained at VPN gateways

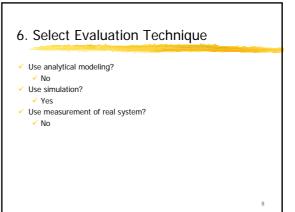
3. Select Metrics

- Speed (case of successful service case)
 - Individual
 - ✓ TCP/UDP throughput, latency, packet loss probability
 - ✓ Global
 - ✓ VPN configuration time
 - ✓ VPN throughput, latency, packet loss probability
 - √ Total # of IPsec tunnels
- Reliability (case of error) None
- Availability (case of unavailability)
 - Global
 - ✓ VPN reconfiguration time (i.e., VPN recovery time)

4. List Parameters

- System parameters
 - Network related
 - ✓ Topology
 - ✓ Link bandwidth, latency, loss ratio
 - Queue size and discipline (e.g., DropTail or RED)
 - ✓ VPN gateway related
 - ✓ Failure rate
 - ✓ Ad-hoc tunneling threshold (IPSec signaling delay?)
- Workload parameters
- # of VPN gateways
- ✓ # of TCP/UDP flows, TCP/UDP traffic pattern
- ✓ Background traffic pattern

5. Select Factors to Study System parameters Network related Topology (10-100 nodes, random or tier) Link bandwidth (1-100Mbps), latency (0.1-100ms), loss ratio Queue size and discipline (e.g., DropTail or RED) VPN gateway related Failure rate (0, 0.001, 0.01, 0.1) Ad-hoc tunneling threshold (IPsec signaling delay?) (0.1-1000ms) Workload parameters # of VPN gateways # of TCP/UDP flows, TCP/UDP traffic pattern Background traffic pattern



7. Select Workload

* # of VPN gateways: 2-100

* TCP flows

* Persistent traffic (simulating FTP traffic)

* # of TCP flows: 1--100

* Bursty traffic (simulating Web traffic)

* # of TCP flows: 1--100

* UDP flows

* Persistent traffic (exponentially distributed)

* UDP traffic rate: 0--100% of the link bandwidth

* Background traffic

* 30% of the bottleneck link bandwidth

8. Design Experiments

First phase (many factors & few levels)

System parameters

Network related

Topology (40 nodes, random)
Link bandwidth (10Mbps), latency (1-10ms), loss ratio
Queue size and discipline (e.g., DropTail or RED)

VPN gateway related

Failure rate (0)
Ad-hoc tunneling threshold (IPsec signaling delay?) (100ms)

Workload parameters

of VPN gateways (20)
of TCP/UDP flows (10 TCP), TCP/UDP traffic pattern (persistent)
Background traffic pattern (30%)

Second phase (few factors & many levels)

Not yet

9. Analyze and Interpret Data

✓ Not yet

10. Present Results

Not yet