Next-Generation Firewall Performance Benchmarking Methodology Draft

draft-balarajah-bmwg-ngfw-performance-02
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Goals

- Provide benchmarking terminology and methodology for next-generation network security devices including
  - Next-generation firewalls (NGFW)
  - Intrusion detection and prevention solutions (IDS/IPS)
  - Unified threat management (UTM)
  - Web Application Firewalls (WAF)
- Strongly improve the applicability, reproducibility and transparency of benchmarks
- Align the test methodology with today's increasingly complex layer 7 application use cases
# Table of Contents (1)

1. Introduction  
2. Requirements  
3. Scope  
4. Test Setup  
   - Test Bed Configuration  
   - DUT/SUT Configuration  
   - Test Equipment Configuration  
5. Test Bed Considerations  
6. Reporting  
   - Key Performance Indicators
Table of Contents (2)

7. Benchmarking Tests
   1. Throughput Performance With NetSecOPEN Traffic Mix
   2. Concurrent TCP Connection Capacity With HTTP Traffic
   3. TCP/HTTP Connections Per Second
   4. HTTP Transactions Per Second
   5. HTTP Throughput
   6. HTTP Transaction Latency
   7. Concurrent SSL/TLS Connection Capacity
   8. SSL/TLS Handshake Rate
   9. HTTPS Transactions Per Second
  10. HTTPS Throughput
Test Setup

- Aggregation Switch/Router (optional)
- Emulated Router(s) (optional)
- Emulated Clients
- Emulated Servers
- Test Equipment
- Solution Under Test
- Aggregation Switch/Router (optional)
- Test Equipment
## Feature Profiles

<table>
<thead>
<tr>
<th>Feature</th>
<th>NGFW Initial</th>
<th>NGFW Future</th>
<th>NG-IPS</th>
<th>AD</th>
<th>WAF</th>
<th>BPS</th>
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Key Performance Indicator (KPI) Definitions

- TCP Concurrent Connections
- TCP Connection Setup Rate
- Application Transaction Rate
- TLS Handshake Rate
- Throughput
- URL Response Time, Time To Last Byte (TTLB)
- Application Transaction Time
- Time To First Byte (TTFB)
- TCP Connect Time
- ... more to come
7.1: Throughput Performance With Traffic Mix

Objective: Determine the average throughput performance of the system under test when using application traffic mix

Variable test parameters
- Number of clients and servers
- IPv4/v6 traffic distribution
- Initial and target throughput

Test Procedure: Run with initial, then target objective; iteration with binary search

Test Results Acceptance Criteria
- Failed application transaction rate < 0.01 %
- Unexpected TCP RST < 0.01 %
- Max TTLB deviation < X
- Max TCP connect time < Y; max TTFB < 2 * Max TCP connect time
7.2: Concurrent TCP Connection Capacity With HTTP Traffic

Objective: Determine the maximum number of concurrent TCP connections the SUT sustains when using HTTP traffic

Variable Test Parameters

- As before, plus:
- HTTP object size 10 KBytes
- Test to be conducted at 25 % maximum throughput

Test Procedure: Run with initial, then target objective; iteration with binary search

Test Results Acceptance Criteria

- Consistent with test case 7.1
Traffic Mix

- Modern Enterprise Perimeter Traffic Mix for Firewall, IPS and NGFW tests
- Blend of 70% HTTPS and 30% HTTP
- Over 10,000 unique URLs and approximately 1,000 FQDNs
- Approximately 400 unique Certs
- Future traffic mixes will be developed that represent specific industry verticals and/or use cases
- Already implemented in at least one emulator

Source: netsecopen.org
## Proposed Schedule

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<td>Added test case 7.2</td>
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<td>Add traffic mix annex, test cases 7.7/7.8</td>
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<td>Modifications resulting from PoC testing</td>
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Request for Action

- Please review
  - More test cases with every draft version

- Please contribute
  - Specifically new traffic mixes (SP, web application firewall)
  - Security effectiveness test methods
Thank you for your interest!

For further information, please contact the authors:

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1. Do you have any public cloud traffic (Amazon EC2, Azure, Google Cloud etc.) included in this mix?
   - The FQDN list in the traffic mix includes some AWS and Azure FQDNs
   - No specific packet sizes have been selected for cloud traffic

2. What about non-HTTP traffic such as SSH/SSL, IPsec VPNs?
   - These are not included because they are insignificant in volume for a typical NGFW deployment with office clients connecting to the internet
   - The traffic mix does not cover intranet applications based on other legacy protocols that don’t go to the internet
   - Adding more protocols would increase complexity and make it harder to achieve reproducible results across test tools
3. Are alternative transport protocols such as Google QUIC already covered?
   - Most enterprises block QUIC in order for HTTPS visibility and security controls to work without changes
   - Test tool support for QUIC is limited today
   - QUIC could be included in a traffic mix for service provider firewalls

4. Why is Microsoft Office 365 traffic the biggest share of the traffic mix?
   - It’s a popular application which consumes a significant portion of bandwidth at enterprises.

5. What SUT detection/inspection mechanisms does the traffic mix support?
   - FQDN, HTTP HOST, TLS SNI, TLS Cert Subject Common Name and Partial URL Path detection
6. Overall, what is the projected life time of the traffic mix? How often will it need to be updated in the RFC to stay relevant?

- While almost a year old, the mix is still first of its kind in stressing all the described parameters of NGFWs including logging, profiling and by app decisions as block or inspect.

- Vendor feedback so far has been no mix is truly realistic but if every one tests with the same mix the comparison is better and closer to real NGFW throughout numbers vs. single large HTTP transaction performance numbers typically found on datasheets.