# Technical Report

## MTU Synchronization and Jumbo Frame Control

This document has been prepared as part of the ongoing network standardization, monitoring, and optimization efforts for the multi-campus infrastructure at **St. Francis School**. It outlines the MTU validation strategy, end-to-end jumbo-frame control, and operational guidelines for ensuring consistency across Aruba 6400/6300/2930F switching platforms.

Author: Antonio Pérez

Network Engineer — St. Francis School

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# 1. Objective

Correct performance degradation and streaming interruptions across the network (SonicWall NSSP 10700 + Cisco 9500 + Aruba 6400) caused by **MTU desynchronization** and improper use of **jumbo frames**.

# 2. Nomenclature

| Symbol | Description | Final value |
|---|---|---|
| MTU | Maximum Transmission Unit | 1500 bytes |
| MSS | Maximum Segment Size | 1460 bytes (1500 – 40 IP/TCP headers) |
| PMTUD | Path MTU Discovery | ICMP-based discovery |
| Jumbo Frame | Extended Ethernet frame | 9100 bytes (LAN/Storage only) |

# 3. Theory

- MTU mismatches cause **fragmentation** and strong performance degradation (especially in UDP/QUIC).
- **MSS clamping** prevents TCP from sending segments larger than the effective MTU (MSS = 1460 B).
- Correct design: MTU 1500 B at the network edge; jumbo frames only where the entire path supports them.

# 4. Evidence

## 4.1 MTU Test

```
Windows:
ping 8.8.8.8 -f -l 1472   -> OK  (1472 + 28 = 1500)

Linux:
ping -c 4 -M do -s 1472 8.8.8.8 -> OK
```

## 4.2 Speed Tests

| Scenario | Before | After |
|---|---|---|
| VLAN 508 (users) | 91 Mbps | 650–760 Mbps |
| Direct public IP | 900 Mbps | 900 Mbps |

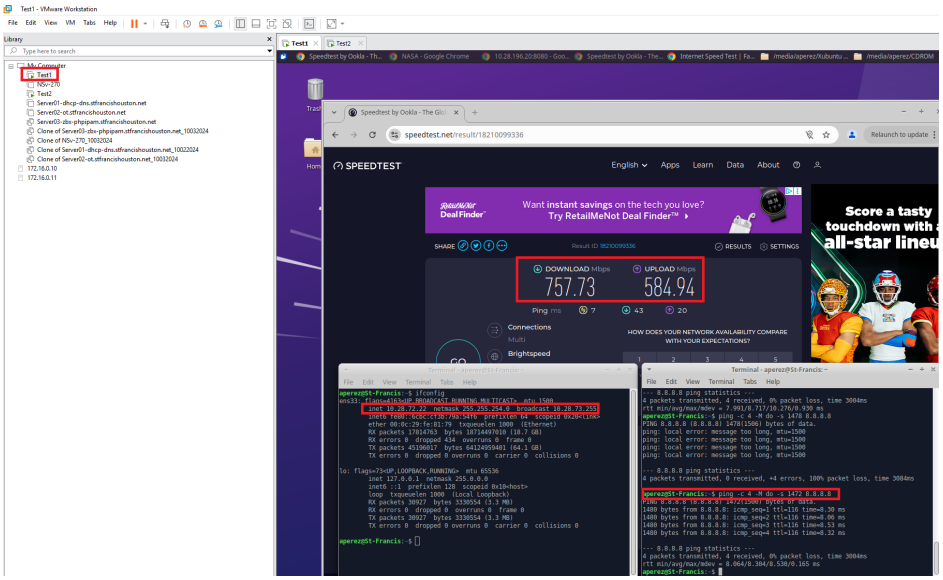


Figure 1: Speedtest behind UTM (VLAN 508).

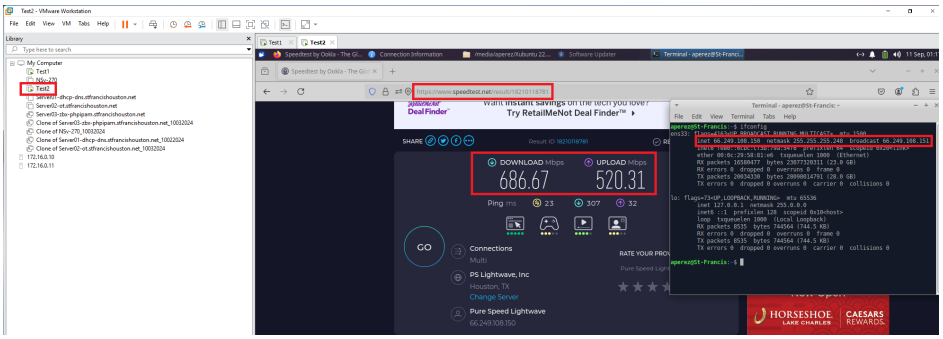


Figure 2: Direct speedtest with a public IP (VLAN 1015).

# 5. Applied Changes

## 5.1 SonicWall

| Parameter | Value |
|---|---|
| MTU WAN (X26) | 1500 bytes |
| Fragment packets (non-VPN) | OFF |
| TCP MSS (Enforce MSS) | 1460 bytes |
| Jumbo Frames | OFF |
| Connection mode | DPI Optimized |

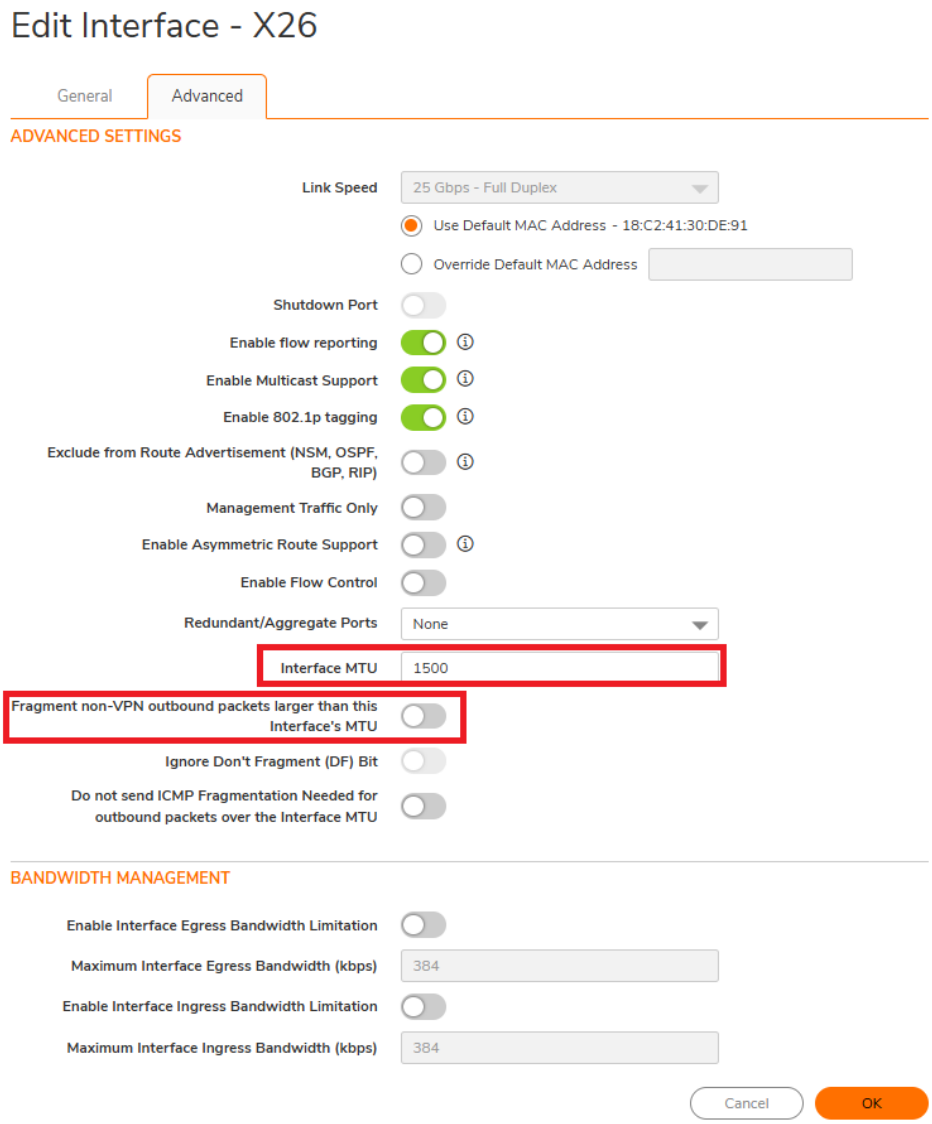


Figure 3: MTU on WAN interface.

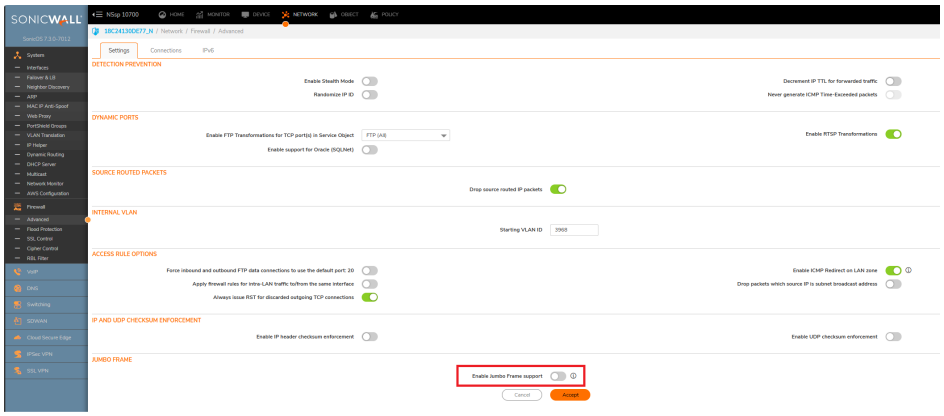


Figure 4: Jumbo Frames disabled.

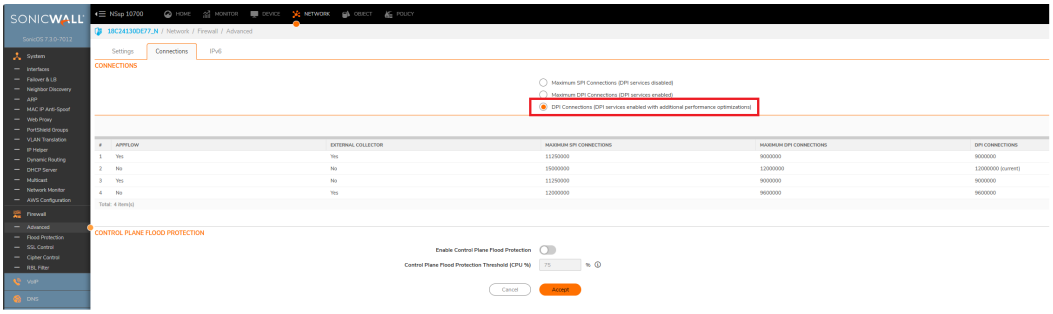


Figure 5: DPI-optimized connections.

## 5.2 Core (Aruba 6400) — Applied Lines

```
interface vlan 1
    ip mtu 1500
interface vlan 500
    ip mtu 1500
interface vlan 501
    ip mtu 1500
...
interface vlan 530
    ip mtu 1500
```

## 5.3 Cisco C9500

```
interface TwentyFiveGigE1/0/7
  switchport mode access
  mtu 1500

interface TwentyFiveGigE1/0/9
  switchport mode access
  mtu 1500
```

## 5.4 Aruba 2930F — AP (bridge mode) and MTU on VLAN 506

*Note: Client traffic is **bridged** on the APs; AP↔7220 control-plane and management use **VLAN 506**.*

### 5.4.1 Justification (why MTU must be modified here)

**Problem:** With jumbo enabled on access switches, if any hop or endpoint does not support >1500 B, the AP control-plane and multicast flows suffer **fragmentation/drops**. In Wi-Fi, clients operate at **MTU 1500**; any fragmentation severely impacts **multicast** (retransmissions, basic rates).

**Solution:** Enforce **MTU 1500** *only* on **VLAN 506** (AP management) on the 2930F switches and on the **SVI 506** on the 6400. Keep jumbo only where true end-to-end support exists (servers/storage).

### 5.4.2 Recommended Changes

**On 2930F (all access switches):**

```
configure terminal
vlan 506
   no jumbo
write memory
```

**On Aruba 6400 (SVI for VLAN 506):**

```
conf t
interface vlan 506
   ip mtu 1500
exit
write memory
```

### 5.4.3 Validation (PMTUD and multicast flow)

**PMTUD** (target: success with 1472 = 1500 - 28):

```
Windows: ping <AP_IP> -f -l 1472
Linux:   ping -c 4 -M do -s 1472 <AP_IP>
```

**IGMP Snooping (only interested ports receive multicast):**

```
2930F:  show igmp-snooping vlan 506
6400:   show ip igmp interface vlan 506
        show ip igmp groups vlan 506
```

### 5.4.4 WLAN Optimization (7220) for multicast in bridge mode

For every performance-sensitive **SSID** (not IoT):

```
(config) # wlan ssid-profile <SSID>
broadcast-filter arp
dynamic-mcast-optimization
dynamic-mcast-optimization-thresh 6
g-basic-rates 12
a-basic-rates 12
```

**AirGroup/mDNS**: enable only on SSIDs that require it; disable on Student/Guest if unused.

### 5.4.5 Jumbo Frame Usage Criteria (what NOT to change)

| Scope | Recommended MTU | Reason |
|---|---|---|
| VLAN 506 (AP management) | 1500 (no jumbo) | Avoid fragmentation in AP↔7220 control-plane; reduces multicast penalties. |
| User VLAN SVIs (6400) | 1500 | Wi-Fi clients use 1500; ensures E2E without fragmentation. |
| Server/backup/replication links | Jumbo (E2E only) | Beneficial for heavy data transfers if all end-points support jumbo. |
| Other access VLANs | 1500 (or jumbo if E2E) | 1500 preferred unless jumbo offers measurable benefit. |

# 6. Results

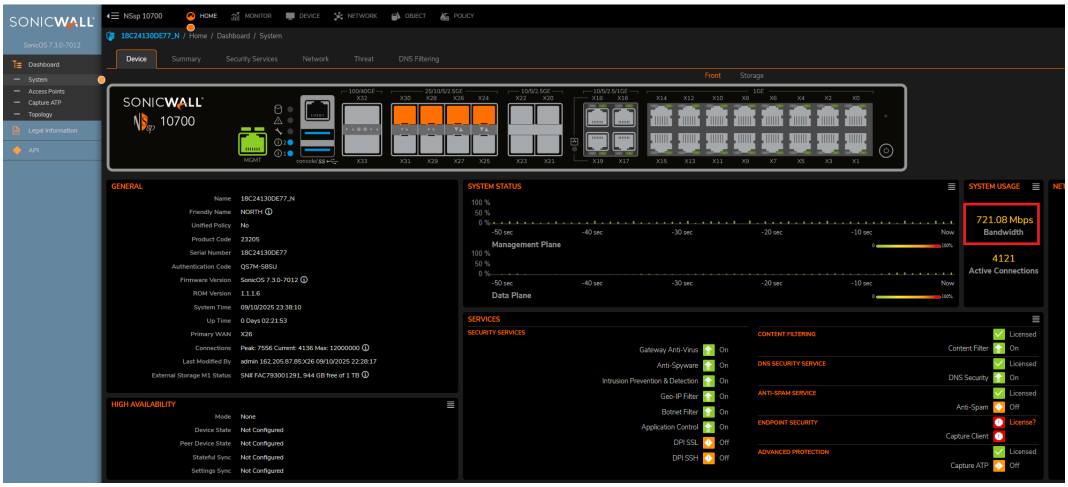


Figure 6: UTM reaching 721 Mbps peaks with aligned MTU/MSS.

# 7. Conclusion

**Root cause:** MTU desynchronization (LAN with 9100-B jumbo frames vs. edge at 1500 B).
**Solution:** MTU standardized to 1500 B on LAN and WAN; fragmentation disabled at the edge; **MSS = 1460 B** enforced.
**Effect:** Stable throughput (>650 Mbps on user VLANs) and uninterrupted streaming.