

APPLICATION NOTE

Stress Testing Switches and Routers

How to perform a simple stress test on a Layer 2 switch device step-by-step.

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APPLICATION NOTE

The Xena testers can verify traffic forwarding performance, protocol scalability and services delivering capabilities of switching and routing devices across the enterprise, metro/edge and core. High traffic loads place demands on the hardware and software components of a Layer-2 or layer-3 networking device. Before deployment, its interfaces, memory, buffering and scheduling mechanisms, switching and routing tables must be thoroughly stressed to ensure the device can switch and route traffic from its input buffers to the appropriate output queues at full line rate.

This application note describes how to use a Xena tester to perform a simple stress test on a Layer-2 device's data plane and forwarding capability. You can build many different packet protocols, vary packet sizes, traffic profile, offered loads, and other test parameters, and then view real-time measurements to observe the effect on your router or switch. Because the Xena test platform can generate and measure Layer-2 or Layer-3 traffic with equal facility, you can easily adapt this test for a router forwarding IP traffic.



LAYER-2 FORWARDING PERFORMANCE TEST

This application note describes how to determine a switch's performance when forwarding Ethernet frames with randomly varying lengths to a very large number of MAC addresses.

A powerful and easy to use packet stream configurator makes it easy to build packet streams containing multiple encapsulations. You can define a packet length distribution and header type, and use a field modifier to vary a header field value such as the source and destination MAC address to emulate a very large number of end-host devices.

As shown in Figure 1 below, a source test port sends Ethernet frames of different lengths through the device under test (DUT) to a range of addresses on the destination test port while real-time performance statistics are taken. In this test the DUT is a switch or switch-enabled router.



Figure 1 Test setup

TEST SUMMARY

Step 1: Select test modules and ports. Reserve a destination port and a source port on the Xena tester. See Figure 2.

Step 2: "Teach" DUT the addresses of simulated hosts. On the destination test port, use the modifier function to define an Ethernet stream containing a range of source MAC addresses to simulate hosts behind the port. Then start the traffic generation to send the traffic from the destination test port to the source test port to teach the DUT the addresses. Unlink the traffic Start on the destination port from the global Start button to ensure that traffic will keep running, so that the MAC learning table entries in the DUT do not expire. See Figure 3 and Figure 4.



Step 3: Define traffic on the source test port. On the source test port, define Ethernet streams with randomized packet lengths, IP packet payloads, and use a modifier to generate destination MAC addresses identical to the source addresses simulated behind the destination test port. See Figure 5.

Step 4: Set the traffic properties. Define the traffic profile as constant or bursty, set the offered load, and specify the number of packets to send (e.g., continuous stream, or n packets). See Figure 6.

Step 5: Start traffic and measurements. Send traffic from the source test port to the range of MAC addresses simulated behind the destination test port while you view real-time performance measurements for e.g. packet loss, FCS errors, sequence and misorder errors, latency, and histograms for packet length, IFG, and latency distributions. You can use the global Start button to clear statistics and start traffic in one-click. See Figure 7.

Step 6: Increase the offered load and observe the switching performance. Monitor the effect on the DUT's switching performance. If you are sending traffic in continuous mode, you must manually stop the test. Stop and re-start the test with a new load. See Figure 8 and Figure 9.

Step 7: Save the test configuration. You can save the port configurations, including any streams you have defined. See Figure 10.

VALKYRIEMANAGER SCREENSHOTS FOR TEST STEPS 1 TO 7



Figure 2 Select test modules and ports (<u>step 1</u>)



STREAM: Dev GE / Module 0 / Port 1 / Stream 0 (TID = 0)	STREAM DEFINITION
Enable: 🕅 Stop after: packets Error injection: FCS error inject	
Description: Teach" DUT the MAC addresses of simulated hosts	
Insert test payload id, TID: 0 Insert frame checksum, FCS: 🔽	
Transmission profile: optional insertion of Test Payload for MAC training packets	
Rate: 0.672 percent Cap	
10000 packets per second 5.120 Mbps Send all learning packets in less than a second	
Inter packet gap: 99,488 ns (12,436 bytes)	
Burst: Size: packets Density: 100 percent Inter burst gap: - ns	
Packet content, auto-generated:	
Packet length: Fixed Imax: Min: 64 bytes Max: 1518 bytes	
Ethernet Add X 000000000000000000000000000000000000	ontaining s behind
Modifiers: 1 Add field modifier	
Modifier: Ethernet - Src MAC addr Position: 10 Mask: 1F FF Action: Increment Group size:	packets X
Incrementing payload: 🔽 Payload pattern: 💿	

Figure 3 "Teach" DUT the MAC addresses of 8192 simulated hosts (step 2)

	ster / Mo	dule 0 / Port 1	TRANSMIT CONTROL
Traffic status:	ON	Stop traffic	Unlink the traffic Start on the destination port from the global Start button to ensure that
Streams:	1	Add stream	traffic will keep running, so that the MAC learning table entries in the DUT do not expire.

Figure 4 Send the training packet forever, to avoid MAC learning table timeout (<u>step 2</u>)

Packet Length: Random M	lin: 64 bytes	Max: 15 Add X Length: 34	518 bytes	On the source test vithrandomized La fodifier to generat ource addresses s	port, define Ethernet stro yer-2 lengths, IP packet e destination MAC addre simulated behind the des	eams payloads, and use a sses identical to the tination test port
Modifier: Ethernet - Dst MAC ad	ldr Position:	4 Mask:	IFFF Action:	Increment	Group size:	packets

Figure 5 setup traffic on the source test port (<u>step 3</u>)



STREAM: De	v GE / Module 0 / Port 0	/Stream 0 (TID = 1)					STREAM DEFINITION
Rhable: 🔽	Stop after:	packets	Error injection:	FCS error	✓ Inject	×	
Description:	Generate 8192 Ethern	et flows					
Insert test pa	ayload id, TID:	_ . Insert frame	e checksum, FCS: 🔽	Define the tref	lie welle ee eenstent er b	water and the	
 Transmiss 	ion profile:			offered load, a (e.g., continuo	nd specify the number of pous stream, or N packets).	ackets to send	
Rate:	50 percent	Cap		/			
	77065 packets	per second					
	487.669540 Mbps						
	Inter packet gap:	1,458 ns (182 byte	is)				
Burst:	Size: 10 packet	s Density: 80	percent				
-	Inter burst gap:	53,362 ns (6,670 by	tes)		•		

Figure 6 setup Set the traffic properties (<u>step 4</u>)

▲ Ports: 8			GLOBAL CONTROL
▶ START	Stop at:	STOP	× CLEAR

• Figure 7 Start traffic and clear statistics in one clock (step 5)

PORT: Dev GE / Module 0 / Pe	ort 1						RECE	IVE STATISTICS
Receive status: IN SYNC								
Mark Clear 🔽	Save	Mbits/sec	Packets/sec		Bytes	Packet	s	
Total traffic for port:		97.508	15,697	128,	334,873	164,61	5	
Without test payload:		0.000	0		0		3	
With FCS errors:						0	5	
Pause frames:						31-	4	
Test payload traffic:	Throughp	out per stream						
Clean		Mbits/sec	Packets/sec		Bytes	Packet	5	
TID = 1:	C	97.507	15,696	128,	335,739	164,61		
Test navload diagnostics:						Analyz / integrit	e loss, sequence/n ty errors, and laten	nisorder/payload
Calibrata	Source next-	Packets	Sequence	Misorder	Integrity	Minimum	Average	Maximum
Calibrate	Sourcepore	lost	errors	errors	errors	latency, ns	latency, ns	latency, no
TID = 1:	Port 0	(running)	136,640	0	0	2,648	8,392	14,320
Filter traffic:								

• Figure 8 Monitor the packet loss and throughput, and Increase the offered load (step 6)





Figure 9 Analyze histograms for frame length distribution, IFG, and latency of received packets (step 6)



Figure 10 Save the test configuration (<u>step 7</u>)