

Day 53 – IxNetwork 5.40 ViperCore for Converged DCE testing

Testing Challenge:

Significant development and innovation are underway in consolidating the data center network. Many technology components make up the next generation Converged Data Center, from high level items such as RFC2544 tests and converged FCoE and LAN traffic, to small yet critical details such as ETS behavior and PFC PAUSE statistics. It can be challenging for test engineer to cover all test requirements in a unified test tool.

IxNetwork 5.40 Solution:

IxNetwork 5.40 provides many infrastructure as well as emulation features that are well suited for converged data center testing. This document briefly highlights a few selected features that should be used to test various technology components of the converged data center.



IxNetwork

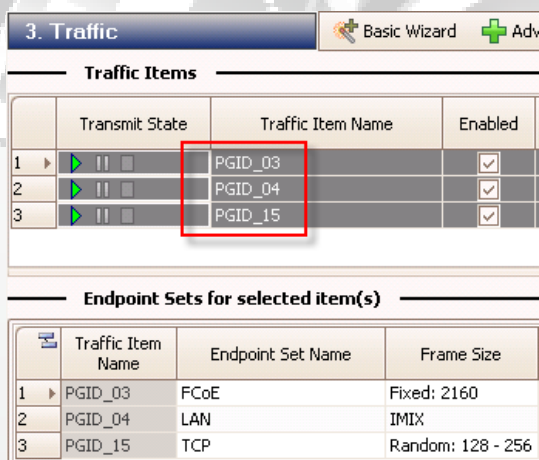
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Using Traffic Items, Flow Grouping and Rate Change on-the-fly to model ETS traffic profiles:

IEEE 802.1Qaz Enhanced Transmission Selection improves the bandwidth allocation and management engines of a Data Center switch. To verify the implementation of ETS on a switch, being able to precisely group traffic profiles and precisely control each is very important. The biggest challenge test engineers have today in this area is to easily create traffic from different Priority Groups, and precisely controlling each Priority Group, and precisely controlling multiple traffic classes within each Priority Group. The following ViperCore features allow the user to easily create and execute ETS test scenarios.

- Use the Advanced Traffic Wizard to create three traffic items, and name them PGID15, PGID3, and PGID4. In each traffic item, use the Packet/QoS editor to easily map VLAN Priorities 6 and 7 to PGID15, VLAN Priorities 2, 3 and 4 to PGID3, and VLAN Priorities 0 and 1 to PGID4.



The screenshot shows the '3. Traffic' configuration window in IxNetwork. It features a 'Traffic Items' table and an 'Endpoint Sets for selected item(s)' table. The 'Traffic Items' table has columns for 'Transmit State', 'Traffic Item Name', and 'Enabled'. The 'Endpoint Sets' table has columns for 'Traffic Item Name', 'Endpoint Set Name', and 'Frame Size'. A red box highlights the 'Traffic Item Name' column in the 'Traffic Items' table.

	Transmit State	Traffic Item Name	Enabled
1	▶ II	PGID_03	<input checked="" type="checkbox"/>
2	▶ II	PGID_04	<input checked="" type="checkbox"/>
3	▶ II	PGID_15	<input checked="" type="checkbox"/>

	Traffic Item Name	Endpoint Set Name	Frame Size
1	PGID_03	FCoE	Fixed: 2160
2	PGID_04	LAN	IMIX
3	PGID_15	TCP	Random: 128 - 256

- Use the Flow Grouping feature to group traffic into independent streams based on VLAN Priority to automatically create 8 distinct streams out of all traffic flows.
- Once the traffic items PGID15, PGID3 and PGID4 are created, use the Rate Change on-the-fly feature to dynamically change the bandwidth consumption used by each VLAN Priority or by each PGID to validate the DUT properly manages the bandwidth allotted to each PGID during run-time.

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Using Per Priority PFC PAUSE Rx statistics to monitor rate throttling:

IEEE 802.1Qbb improves the 802.3x PAUSE flow control mechanism by allowing a Data Center switch to flow control traffic on a per priority basis, as opposed to the entire port. A common validation process used by test engineers is to watch the test port transmit rate to confirm if the DUT has transmitted PFC PAUSE frames. This approach is insufficient because a small and short-lived change in transmit rate is not detectable. The following ViperCore features allow the user to easily and accurately confirm receipt of PFC PAUSE frames from the switch and the PAUSE priority values.

- Use the per priority PFC PAUSE stats in Port Statistics view to verify the count and rate of PFC PAUSE frames transmitted by the DUT during a test. The PFC PAUSE Rx count and rate stat is maintained separately for each VLAN Priority value, from 0 to 8.

Stat Name	Rx Pause Priority Group 3 Frames	Rx Pause Priority Group 3 Frames Rate	Rx Pause Priority Group 4
10.200.100.72/Card01/Port01	953,932	10,783	
10.200.100.72/Card01/Port02	0	0	
10.200.100.72/Card01/Port03	0	0	

Using the QoS editor to assign VLAN Priority and PFC Queue mapping:

In the converged data center infrastructure, storage and LAN traffic coexist on the same link. To differentiate the type of traffic, VLAN Priority is used. In addition, some traffic type will be carried on a PFC enabled queue vs. other traffic types.

- Use IxNetwork’s Advanced Traffic Wizard’s QoS editor to easily set VLAN Priority to traffic classes, and to assign PFC Queues to them.

PFC Queue	VLAN Priority	Type	OX_ID	RX_ID
Default...	Default (0)	0	0	0

Copy from - VLAN Priority

Value

<Select Profile>

▼ PFC Queue

1 ▶ 3

2 <Type to add value>

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Using the Advanced Traffic Wizard to build converged traffic:

The key theme in Converged Data Center testing is to build converged FCoE and LAN traffic, where LAN traffic can be plain Ethernet, IPv4, IPv6 and a mix of unicast and multicast. The challenge for test engineers today is to easily create all the traffic types, and be able to easily manage each traffic type. IxNetwork’s Advanced Traffic Wizard provides many powerful features that allow the user to customize the way traffic classes are organized, grouped, controlled and tracked with simple checkboxes.

- Use the Endpoints page to select FCoE or Ethernet/IP traffic type, and use the Endpoints Filter to quickly filter out specific source and destination endpoints.

(Hint: highlight an endpoint set and press F2 to name the endpoint set)

	Encapsulation	Source Endpoints	Destination Endpoints	Traffic Groups
	Name: FLOGI VN_Port endpoints			
1	Ethernet II.VLAN....	1 Endpoints	1 Endpoints	None selected
	Name: NPIV FDISC VN_Port endpoints			

- Use the Packet/QoS page to easily assign VLAN Priority and PFC Queue, as well as to edit parameters such as SEQ_ID, SEQ_CNT and OX_ID.

PFC Queue	VLAN Priority	Type	OX_ID	RX_ID
From - VLAN Priority	Default (0)	0	0	0
<input type="radio"/> Single value <input checked="" type="radio"/> Increment <input type="radio"/> Decrement <input type="radio"/> List				
		Start	1001	
		Step	1	
		Count	100000	



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- Use the Flow Grouping page to customize the way traffic is grouped and controlled based on MAC address, VLAN ID, VLAN Priority, S_ID, D_ID, PFC Queue, and many more.

— Create Flow Groups based on —

<input type="checkbox"/>	None (use default distribution)
<input type="checkbox"/>	Src/Dest Endpoint Pair
<input type="checkbox"/>	Rx Port
<input type="checkbox"/>	Frame Size
<input type="checkbox"/>	Ethernet II : Destination MAC Address
<input type="checkbox"/>	Ethernet II : Source MAC Address
<input type="checkbox"/>	Ethernet II : Ethernet-Type
<input type="checkbox"/>	Ethernet II : PFC Queue
<input type="checkbox"/>	VLAN : VLAN Priority
<input type="checkbox"/>	VLAN : VLAN-ID
<input checked="" type="checkbox"/>	FCoE : Destination ID
<input type="checkbox"/>	FCoE : CS_CTL/Priority
<input type="checkbox"/>	FCoE : Source ID
<input type="checkbox"/>	FCoE : OX_ID

- Use the Tracking page to configure the way traffic is tracked and analyzed based on MAC address, VLAN ID, VLAN Priority, S_ID, D_ID, PFC Queue, and many more.

— Track Flows by —

<input checked="" type="checkbox"/>	Traffic Item
<input type="checkbox"/>	Source/Dest Endpoint Pair
<input type="checkbox"/>	Source/Dest Value Pair
<input type="checkbox"/>	Source/Dest Port Pair
<input type="checkbox"/>	Source Endpoint
<input type="checkbox"/>	Dest Endpoint
<input type="checkbox"/>	Source Port
<input type="checkbox"/>	Traffic Group ID
<input type="checkbox"/>	Frame Size
<input checked="" type="checkbox"/>	Ethernet II : Destination MAC Address
<input type="checkbox"/>	Ethernet II : Source MAC Address
<input type="checkbox"/>	Ethernet II : Ethernet-Type
<input checked="" type="checkbox"/>	Ethernet II : PFC Queue
<input checked="" type="checkbox"/>	VLAN : VLAN Priority
<input type="checkbox"/>	VLAN : VLAN-ID
<input checked="" type="checkbox"/>	FCoE : Destination ID
<input type="checkbox"/>	FCoE : CS_CTL/Priority
<input type="checkbox"/>	FCoE : Source ID
<input type="checkbox"/>	FCoE : OX_ID
<input type="checkbox"/>	Custom Override

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Using the real-time stat drilldowns to analyze converged traffic:

The key theme in Converged Data Center testing is to build converged FCoE and LAN traffic, where LAN traffic can be plain Ethernet, IPv4, IPv6 and a mix of unicast and multicast. The challenge for test engineers today is to easily track statistics and analyze the test results for each traffic type. IxNetwork’s Statistics viewer provides many powerful features to get port based statistics, customized aggregate statistics, customized per flow statistics, with real-time drill down capability.

- Use the Traffic Items view to get aggregate statistics based on traffic type, such as FCoE, Ethernet, IP, etc.

Traffic Item	Tx Frames	Rx Frames	Frames Delta	Loss %	Tx Frame Rate	Rx Frame Rate	Rx Bytes
FCoE traffic	1,445,854	1,445,854	0	0.000	57,339.500	57,339.500	3,123,044
LAN traffic	16,509,622	16,509,620	2	0.000	654,735.500	654,737.000	5,975,720

- Use the Dataplane view to get aggregate statistics for all signature traffic on each port.

Port	Tx Frames	Rx Frames	Tx Frame Rate	Rx Frame Rate	Rx Bytes
10.200.100.72:01:01-Ethernet	21,241,889	18,075,849	384,707.500	327,368.000	6,540,215,200
10.200.100.72:01:02-Ethernet	18,075,851	21,241,887	327,368.000	384,707.500	13,380,061,728

- Use the right-click DrillDown function to get real-time customized statistics based on MAC address, VLAN ID, VLAN Priority, S_ID, D_ID, PFC Queue, and many more.

- Drill Down per Ethernet II:Destination MAC Address
- Drill Down per Ethernet II:PFC Queue
- Drill Down per VLAN:VLAN Priority
- Drill Down per FCoE:Destination ID**
- Show All Filtered Flows
- Drill Down per Rx Port

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Using per-TLV statistics to verify DUT DCBX database:

In many scenarios, DCBX is the gate keeper for all subsequent lossless Ethernet and FCoE operations, and it does so by exchanging and configuring a range of local functions based on local and peer information via TLV exchanges. The challenge for test engineers today is to have an easy way of confirming the local and remote states of the DCBX TLV exchange between the test port and the DUT for each Feature TLV. IxNetwork’s per-TLV stat provides extensive insight into each exchanged Feature TLV, as well as the DCBX Control TLV.

- Use the right-click per-TLV stat Drill Down feature to get in-depth insight into the advertised and operating states of each Feature TLV.
- The per-TLV stat Drill Down also provides detail view of the advertised and operating content for each Feature TLV, such as the User Priority Mapping.

TLV Name	Local State	OperCfg	PeerCfg	Local Operating Version	Remote
DCBX-IEEE-PG-TLV-3	Use Peer Config	PGID Map = 0 0 0 1 0 0 0 0	PGID Map = 0 0 0 1 0 0 0 0		0
DCBX-IEEE-PFC-TLV-2	Use Peer Config	Priority Map: 0x8	Priority Map: 0x8		0
DCBX-IEEE-Application-TLV-2	Use Peer Config	Priority Map: 0x8	Priority Map: 0x8		0

Using per-Session statistics to verify FIP/FCoE MAC, FC-ID and VLAN assignment:

Fibre Channel is a mature protocol with a lot of information exchanged between requests and responses between the test port and the DUT. With the encapsulation of Ethernet, FCoE Initialization Protocol (FIP) provides many value-add functions to support discovery, initialization and maintenance of FCoE virtual links. IxNetwork’s per-session stat provides extensive insight into the request and response exchanges between each emulated ENode and the DUT on a per VN_Port basis.

- Use the right-click per-session stat Drill Down feature to get in-depth insight into information such as FCF-MAC, FPMA, assigned FC-ID, FIP VLAN ID, System Name, and many more.

Port Name	Interface Status	Failure Reason	Source ID	Switch Name	Fabric Priority	Fa
31:00:0e:fc:00:00:00:00	PLOGI Complete	None	4A.00.64	20:01:00:0D:EC:B1:F3:41	128	20:01:00:0D:EC:B1:F3:41
32:00:0e:fc:00:00:00:00	N5-Reg Complete	None	4A.00.5F	20:01:00:0D:EC:B1:F3:41	128	20:01:00:0D:EC:B1:F3:41

Conclusion:

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The Converged Data Center is a myriad of Ethernet and Fibre Channel protocols, unified from disparate infrastructures to coexist over a shared Ethernet framework. IxNetwork 5.40 ViperCore has many powerful emulation, traffic generation and statistics analysis capabilities to support testing the key components of the Converged Data Center with flexibility, accuracy and predictability.