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Traffic Generator Upgrade

Expanding capabilities of a Xena Traffic Generator may require investments in test modules. In many cases, a L1 Matrix can be used to defer the investment.

OVERVIEW

Communication networks evolves constantly and new data rates are defined, optimizing the network capacity. Ethernet communication devices used in the networks require testing during development and manufacturing. New data rates typically lead to investments in test equipment, but the use of a Layer 1 (L1) Matrix can defer these investments.

During development and manufacturing it may be required to test a multiport Ethernet communication device loaded with traffic on all ports. This can be achieved with a high number of test ports in an Ethernet traffic generator. Alternatively, a L1 Matrix can to duplicate a signal passing through it and output this to numerous ports.

In an environment where multiple communication devices need to be tested, connections between test equipment and the devices may need to be reconfigured between tests. When done manually by moving cables this is a time-consuming task that easily lead to errors, causing faulty and useless test results. If a L1 Matrix is used between the test equipment and the devices to be tested, it is easy to ensure that the intended and needed connections are set up for each test.

Xena test modules that do not support data rates to be tested, can be enhanced to support higher speeds by the port aggregation capability of the NPB-II packet broker from CGS Tower networks. The NPB-II also supports multi-port Ethernet traffic duplication and can act as a switch between the Xena test platforms and Ethernet communication devices to be tested. The NPB-II operates as an advanced cross connect – a L1 Smart Matrix.

"New test requirements may lead to investments in test equipment upgrades. In many cases, investments can be reduced or deferred by combining the test equipment with a L1 Matrix."

TRAFFIC GENERATOR UPGRADE

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INTRODUCTION

Ethernet network devices need to be tested during development and manufacturing. This is done with test equipment that generates a test signal with Ethernet frames with various characteristics. With this the performance of the devices is tested, including verification of:

- Throughput – maximum data rate that can be transferred through the device/path
- Latency – time it takes to transfer data through the device/path
- Frame loss – data frames lost during the transfer of data through the device/path
- Back-to-back frames – identifies the longest burst of frames with minimum inter-frame gaps that can be sent through the device/path without frame loss
- Jitter – variation in delay of transferred data frames (also known as Frame Delay Variation)

Testing is in typically done in accordance with the RFC 2544 Benchmarking Methodology for Network Interconnect Devices tests. RFC 2544 specifies throughput, latency, frame loss and back-to-back testing – most Ethernet testers also include jitter testing in their RFC 2544 test suite.

The tests can also be done using the basic features in the test equipment. The equipment will typically be able to send the test traffic as a number of streams, which can be configured differently regarding traffic load, frame size, priority etc. Hereby various aspects of the tested device's capabilities can be verified or troubleshooted.

It is of course essential that the test equipment supports the data rates of the ports of the Device Under Test (DUT). The typical higher order Ethernet data rates has for many years been 10G, 40G and 100G. Recently a new rate has been defined in the range between 10G and 40G: 25G, driven by a need for efficient bandwidth expansion in data centers. When a new, higher rate emerges, investments in test equipment are typically required to support the new rate. However, using port aggregation in a Layer 1 (L1) Matrix can defer these investments by aggregating a lower data rate to the required higher rate.

During development and manufacturing it may be required to test a multiport Ethernet communication device with traffic loaded on all ports. This can be achieved with a high number of test ports in an Ethernet traffic generator. Alternatively, you can use a L1 Matrix with the ability to duplicate a signal passing through it and output it to all ports involved in the test.

If a test setup includes multiple Ethernet communication devices that need to be connected in various ways during a sequence of tests, connections between test equipment and the devices need to be changed between the tests. This may be done manually by moving cables, which is a time-consuming process that may lead to errors, causing faulty and useless test results. If a L1 Matrix is used between the test equipment and the devices to be tested, it is easy to ensure that the intended and needed connections are set up when the tests are conducted.

Port Aggregation

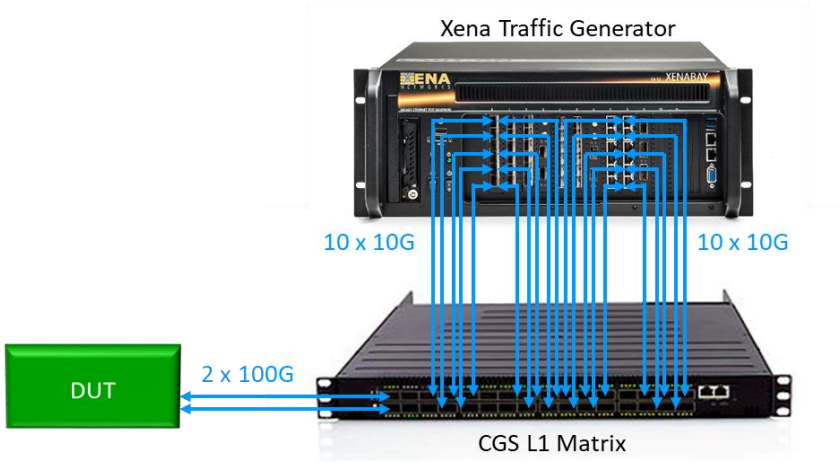

Figure 1: 10 x 10G aggregation to 100G Ethernet

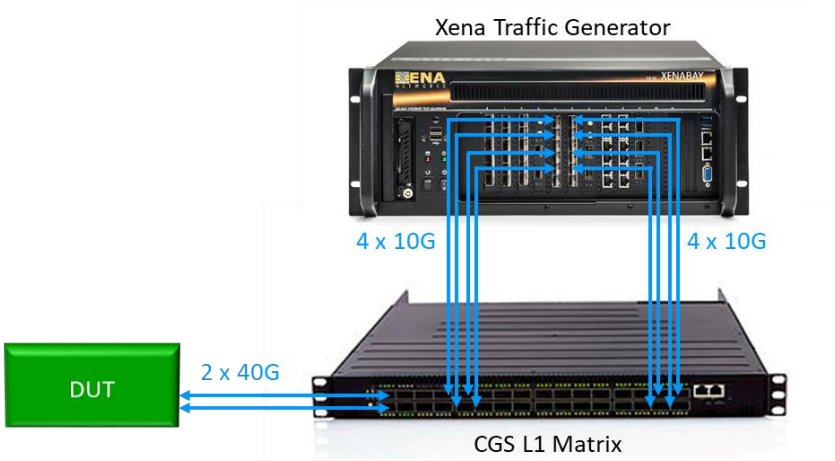

Figure 2: 4 x 10G aggregation to 40G Ethernet

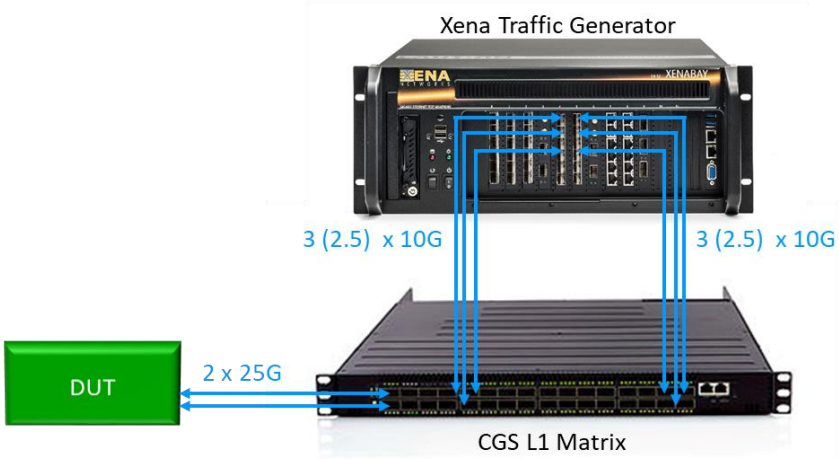

Figure 3: 3 or 2.5 x 10G aggregation to 25G Ethernet

If you have a XenaBay chassis equipped with one or more 10G test modules like the M6SFP+ wire-speed 6-port 10G L2-3 test module, the CGS L1 Matrix in combination with the Xena test ports can be used to test Ethernet devices running at 25G, 40G or 100G as shown in figures 1 to 3 by aggregating 10G signals to the required higher rate.

In case a 25G signal is required, it is important that the total traffic from the 3 ports generating the 10G signal in figure 3 does not exceed 25G. In figure 3, a total of 6 ports in the Xena Traffic Generator are used to generate two 25G test signals. This can also be done with 5 ports in the Xena Traffic Generator, using a filter in the CGS L1 Matrix to split one of the 10G signals into two 5G signals. Each 5G signals combined with two 10G signals will form the 25G test signal.

The traffic can be VLAN tagged by the CGS L1 Matrix ingress ports, aggregated to the higher port rate, and egresses to the DUT. On the way back from the DUT, the ports tagged aggregated streams are separated and forwarded to the individual Xena test ports.

Please observe that when port aggregation is used, the Traffic Generator will treat the signals from its ports as separate signals. This means that when 10 10G ports are aggregated into a 100G signal, each of the 10G ports must be configured individually and the results are presented individually for the 10 ports. If it is important to configure the signal and see results as one 100G signal, the Traffic Generator must be equipped with a 100G test module.

Multiport Traffic Generation

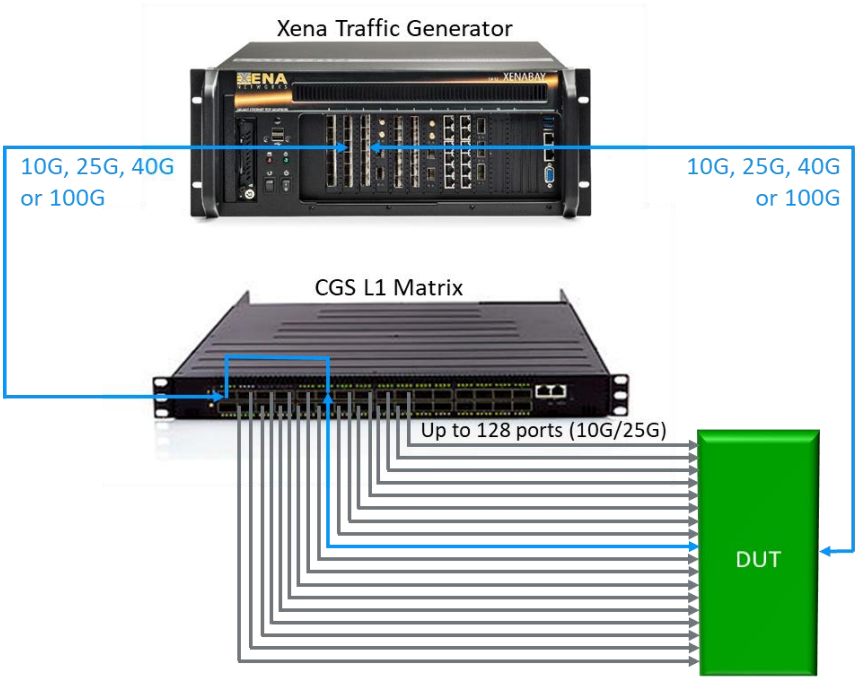

Figure 4: Test DUT port-to-port while copying test traffic to all ports

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The CSG L1 Matrix in combination with a Xena Traffic Generator can be used to test a multiport Ethernet communication device with traffic loaded on all ports. The L1 Matrix can send a copy of an incoming signal to multiple ports on the DUT to stress test it (see figure 4). This can be conducted as a manual test, where the user configures the CSG L1 Matrix and the Xena Traffic Generator directly through the user interface of each device. If relevant the user may also configure the DUT through a service interface on the DUT.

A test can also be conducted, analyzing the performance of a multi-port DUT from any one port to any one port with traffic on all the remaining ports. This can be handled with a Xena Traffic Generator in combination with a CSG L1 Matrix. Such a test could be done manually, but that would be a tedious task with high risk of introducing errors. In this case it will be more appropriate to utilize the programming interfaces of both the Xena Traffic Generator and the CSG L1 Matrix to create an automated test procedure. Both products have a Command Line Interface (CLI) through which text commands can be entered to control the functionality of the products (see figure 5).

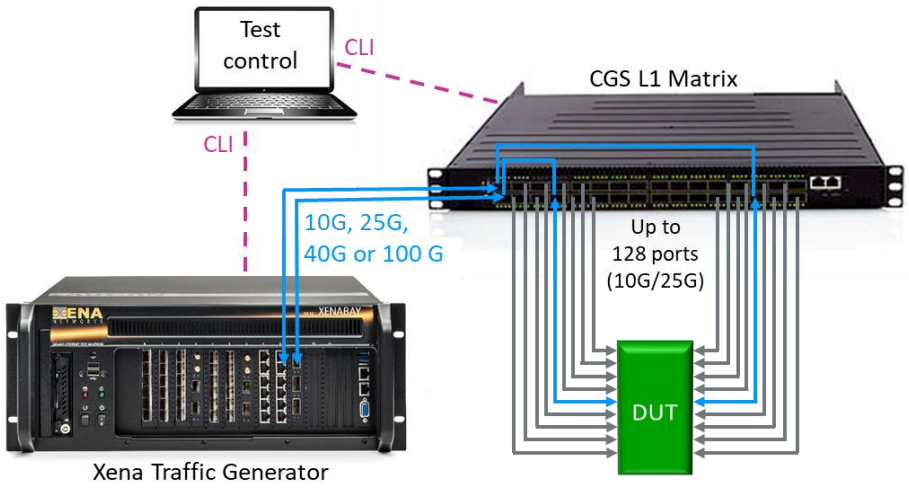

Figure 5: Step through DUT ports while copying test traffic to all ports

When traffic is duplicated by the CGS L1 Matrix, all DUT ports receive traffic with identical contents. The traffic can however be VLAN tagged by the CGS L1 Matrix at its ingress ports. If more programming of the background traffic (the grey lines in figures 4 and 5) is required (e.g. definition of MAC address, IP address etc.) you will need to equip the Xena Traffic Generator with multiple test ports instead of using the CGS L1 Matrix to achieve multiport traffic generation.

Connect Xena Traffic Generator with Devices Under Test

When a L1 Matrix is inserted between the Xena Traffic Generator and the devices under test, it is easy to ensure that the intended and needed connections are set up for a test. A test control unit can be programmed to make the L1 Matrix connect the relevant test ports with the device or devices involved in a particular test. This can include port aggregation, if only 10G test ports are available and 25G, 40G or 100G Ethernet testing is required.

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The test control unit can also be programmed to configure and control the test ports of the Xena Traffic Generator as needed to conduct the test.

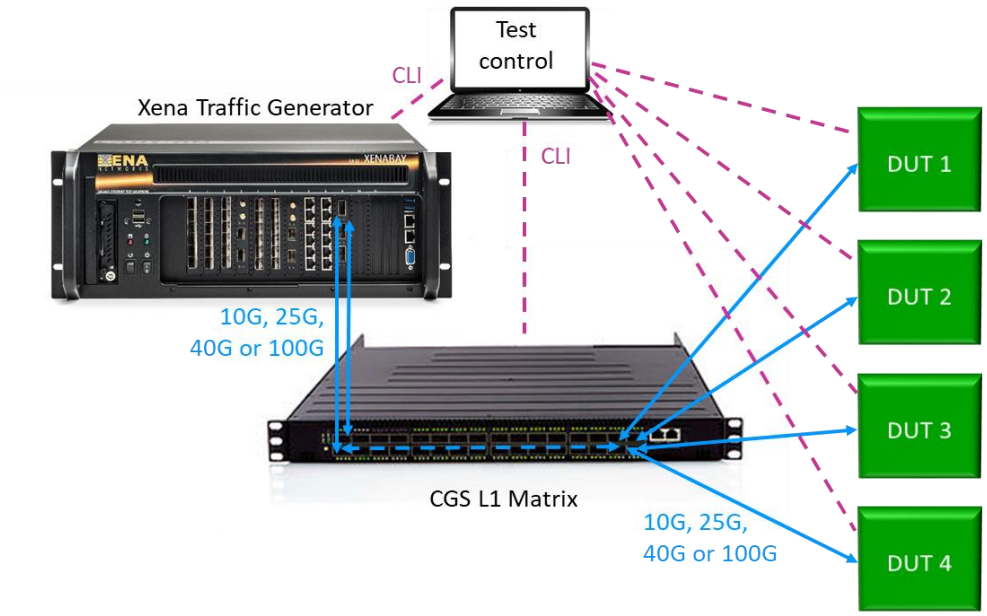

Figure 6: Connect Ethernet test ports with Devices Under Test

CGS Tower Networks Smart L1 Matrix NPB-II

Figure 7: The CGS Tower Networks Smart L1 Matrix NPB-II

The NPB-II meets the requirements of mid-level to high-level networks that include 10G, 25G, 40G and 100G links in a powerful small form factor chassis. It performs aggregation, replication, filtering, stacking and load balancing that enable and optimize the benefits of cyber security and monitoring tools and is an ideal solution for deployments that require a large number of links with affordable upgrade options starting from 10G all the way up to 100G within the same appliance. It supports 32 x 40G/100G ports that can each break out to 4 x 10G/25G ports, resulting in a total of 128 x 10G/25G ports. The appliance is based on superior hardware,

performance, scalability and reliability, without hidden costs such as port licenses nor proprietary transceivers, resulting in the best packet broker in the market at an affordable price and compelling TCO.

NPB-II Capabilities

NPB-II supports the following capabilities:

- High density port count Cross connect device with a small footprint, allowing to connect many tester ports to many test-beds
- Multi-rate support covering 10G, 25G, 40G, and 100G
- Multiple Media support: MM, SM, Direct Attached Cable (DAC)
- High Density port counts: 128 x 10G/25G or 32 x 40G/100G and combinations
- Aggregation, Tagging, In-line application support
- Flexible Forwarding Capabilities Many-to-Any, Any-to Many (see figure 8)
- Web UI for manual operation
- Management interface (CLI, SNMP, NetConf, REST API) that can be controlled/configured via an Automation environment
- Statistics (Counters for any forwarding, drop, error events)

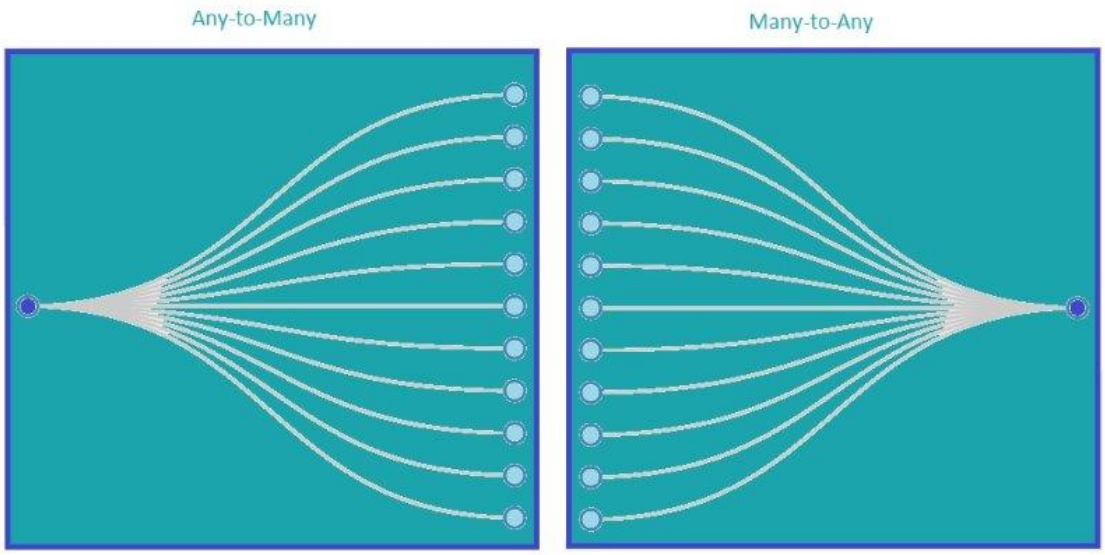

Figure 8: Any-to-Many and Many-to-any forwarding supported by the NPB-II

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Xena Networks Layer 2-3 Test Solutions

Figure 9: The versatile and powerful Xena Networks Layer 2-3 Traffic Generators XenaBay and XenaCompact

Testing up to Layer 3

Based on Xena's advanced architecture, XenaBay and XenaCompact equipped with relevant test modules are proven solutions for Ethernet testing at layers 2 and 3. Advanced test scenarios can be performed with XenaBay and XenaCompact equipped with relevant test modules using the free test applications for the modules:

XenaManager-2G test software is used to configure and generate streams of Ethernet traffic between Xena test equipment and Devices Under Test/Systems Under Test (DUTs/SUTs) and analyze the results. Test functions include:

- Multistream traffic generation at line rate
- Flexible frame size setting including dynamic change of frame size during test
- Generation of unicast, multicast and broadcast frames
- Generation of IPv4 and IPv6 traffic
- Generation of traffic streams with UDP and TCP headers

One XenaManager-2G can control multiple XenaCompact and XenaBay test chassis, which can be located far away from each other, e.g. at the ends of connections-to-be-tested supporting one-way measurements.

Xena3918 makes it easy to create, edit and execute multicast test types specified in RFC 3918. Xena3918 supports multicast protocols IGMPv1, IGMPv2/MLDv1 and IGMPv3/MLDv2.

Xena2544 offers full support for the 4 test types specified in RFC 2544: Throughput, Latency, Frame loss and Back-to-back frames; Jitter (Frame Delay Variation) is also supported. Xena2544 lets you enable one or more test types and supports different network topologies and traffic flow directions on both Layer 2 and Layer 3.

Xena1564 provides full support for both the configuration and performance test types described in Y.1564 for complete validation of Ethernet Service Level Agreements (SLAs) in a single test.

Xena2889 is an application for benchmarking the performance of Layer 2 LAN switches. Xena2889 supports test types specified in RFC 2889.

XenaScripting is a powerful and easy-to-use command-line-interface (CLI) scripting API that makes test automation easier for test engineers:

- Ideal for test automation of e.g. production environments
- Controls XenaBay and XenaCompact chassis with installed test modules
- Powerful CLI approach from any TCP/IP capable tool environment
- Unified syntax for CLI- and GUI-generated test port configurations makes it easy to learn
- Script examples of Tcl, Perl, Java, Ruby, BASH and Python available
- Intelligent console tool bundled free with XenaManager-2G

Multi Port Testing

Xena test modules provide 1 to 6 (at 10G up to 12) test ports per module depending on the module type and data rate. Up to 12 test modules can be installed in a XenaBay chassis.

Multi Rate Testing

By installing the appropriate test modules in a XenaBay chassis, a wide range of Ethernet rates can be tested:

- 100G, 50G, 40G, 25G, 10G, 5G, 2.5G, 1G and 100M Ethernet

CONCLUSION

As testing requirements for communication network devices change, the test equipment used needs to be upgraded. Xena Networks offer a wide range of test modules supporting a variety of interfaces and functions to fulfil the new requirements. However, owners of the Xena test equipment may want to defer the investment in new test modules.

CGS Tower Networks Ltd

A Xena Traffic Generator equipped with 10G test modules can support 25G, 40G and 100G by combining the Traffic Generator with a CGS Tower Networks Smart L1 Matrix NPB-II. The NPB-II can aggregate 10G ports to higher rates, providing a cost-effective solution to the new testing needs.

Multi-port testing can be achieved by adding test modules – and test ports – to the Xena Traffic Generator. As an alternative, a L1 Matrix like the CGS NPB-II can be used to duplicate traffic from a test port on a Xena Traffic Generator providing a test signal that can be sent to many ports.

The L1 Matrix can also be used between the Xena Traffic Generator and Devices Under Test when several devices need to be tested in various setups. A test controller can be programmed to ensure that the right test ports are connected to the devices. Port aggregation can be included if relevant.

The CGS Tower Networks Smart L1 Matrix NPB-II in many cases gives owners of Xena Networks Traffic Generator two options to fulfil new test requirements:

- Upgrade the Xena Traffic Generator
- Combine the Xena Traffic Generator with the CGS Tower Networks Smart L1 Matrix NPB-II

For more information on CGS Tower Networks solutions please visit www.cgstowernetworks.com

For more information on Xena Networks solutions please visit www.xenanetworks.com

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