Digital Lightwave®

NIC Platform

# Advanced 40/100G Optical Testing

Brochure

## Reduce Test Time and Rollout Costs with the NIC

## The Impact of a Bandwidth Burst

The marketplace today is comprised of players from both private and public sectors who share an increased need for real time data transfer through voice, video, or text, via a variety of delivery devices (Figure A). In order to meet the rising demands of the "data consumer" more efficiently and to remain profitable, carriers must reduce their cost to deliver as well as meet the increased bandwidth demands of the large telecom highways that continue to grow from 1G to 10G to 40G to 100G and beyond. Network Equipment Manufacturers (NEMs) are facing challenges to meet this need, and are being driven to deliver more cost effective network solutions with a lower cost per port and new technologies to better package the information being transmitted.

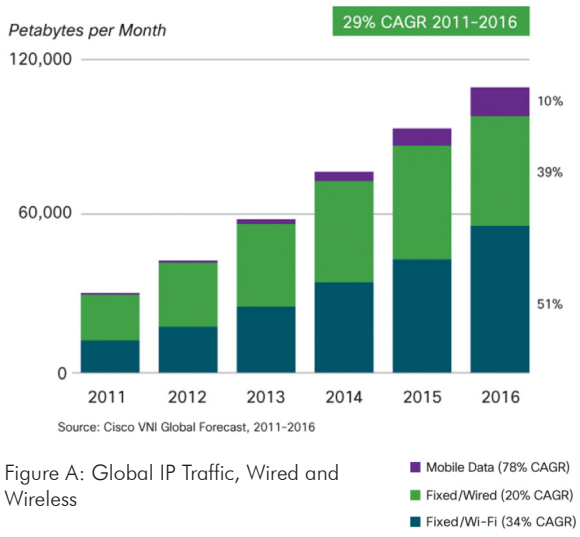


Figure A: Global IP Traffic, Wired and Wireless

Digital Lightwave, a provider of optical test equipment and technologies for the telecommunications industry, is striving to provide NEMs and carriers with cost effective tools that meet the changing demands of the market and support forward movement during the rapid evolution of the bandwidth burst.

## Common Ground

The common and most painful challenge experienced by all players in this space is the increased weight from pricing pressure. The pressure felt by NEMs is becoming heavier due to increased competition, and throughout the entire technology lifecycle, NEMs will continue to be forced to share limited resources in order to bring new products to market. Due to these limited resources, fewer engineers and technicians will be responsible to perform more duties, and therefore automating testing, remotely sharing test equipment, and getting more test capabilities in a single instrument are quickly becoming necessities of today's market.

With the advent of higher speeds and evolving technologies, NEMs and carriers are experiencing a need for more efficient ways to test in lab environments. In order to provide high value, the equipment must meet the minimum test standards including a tool for automation and remote control while being delivered at a lower cost. Their focus is geared towards the building or updating of new or existing infrastructures for purposes of design, development, system verification testing, and technical support. Present testing requirements for these NEMs and carriers include multiple protocols and high port counts at rates of 100G and below.

Another major consideration is that the test equipment must provide flexibility for testing across multiple interfaces and multiple protocols. This necessary capability will allow for resources within the NEM's and carrier's lab, such as the limited and highly important test equipment, to be shared and efficiently utilized, thus enabling increases in productivity and aiding in the maximized performance of the lab as a whole.

Highly reliable tools that provide a low Mean Time To Repair (MTTR) and meet the multi-protocol needs of today's networks, are also extremely important. Along with the need for those reliable tools is the need for simple to use test equipment such as a one touch operation, as well as available team training from the equipment vendor upon delivery of the equipment.

The need for efficient test equipment is also increasingly important because it plays a key role in troubleshooting and restoration of links during network outages. Carriers will likely have specific test equipment deployed in close proximity to critical links in their network. Alternatively, a remote test solution may be ideal for the carrier, which will not only minimize or eliminate truck rolls, but allow for collaborative troubleshooting that typically leads to faster restoration of the link.

## Challenges in a Lab Environment

Along with common trends and needs experienced by all players in this space, come many shared pains. Rapid and evolving technologies that are crucial for the future growth of business often bring challenging obstacles to the key players and decision makers in the industry such as:

**Struggle to meet expectations of a Higher ROI:** Expectations for an increasing ROI can lead to challenging financial situations. Due to the Lab Testing's struggle and goal to achieve increased

ROI, NEMs and carriers are creating operations budgets that typically call for more efficient utilization of test equipment. Which forces their purchases to be used across multiple projects and applications.

**Increased need to improve efficiency:** Test processes need to become more efficient in order to provide NEMs and carriers with their desired solution. With the development of higher speeds, more complexity, and higher port count equipment, managers are currently unsatisfied with the level of efficiency and are demanding more out of their test equipment with the same engineering staff.

**Disruptions during automation:** Upgrades to software can disrupt the automation process and the need to add new test capabilities with little or no disruption to the automation process is very evident. Occasionally, rewriting an entire automation script around a new test instrument due to a change in vendor or technology is necessary, yet detrimental because the cost of this downtime could become a large financial burden on the company.

**Removal of human error and increased quality control:** There is also a need to increase repeatability for more consistent quality control and system verification results. Many of the repeatability issues are due to human error or inconsistent test processes and procedures.

**Limited budgets:** Avoidance on spending money for features that are not needed for their application is crucial. As the test plans are passed along through test groups as part of the development of a product, the requirements may change. The features required in the Research and Development team may not be the same as the features required by System Test or Manufacturing Test groups. The lack of feature flexibility on test equipment will often lead to non-forecasted expenses, such as the need to buy a different test set, during the project lifecycle.

## Challenges in the Field

The many discomforts brought on by lab testing needs are extremely painful, however, the challenges brought on by requirements from field testing should not be overlooked either:

**Lack of equipment portability:** Portability for Field Testing is a standard requirement, and all technicians and engineers working in the field constantly want smaller, lighter, battery-operated test solutions that will meet their test requirements so that there is less strain on the user, as well as less freight cost when shipping the equipment.

**Lack of ease-of-use:** As equipment is deployed in the field, the training curve for the average technician is so steep that extensive training and experience is required to operate. This application typically requires an intuitive interface, pre-configured test procedures, and simple report generation.

**Excessive test sets:** Technicians currently require multiple test sets for the job. Equipment must be multi-functional in order to minimize individual tools that technicians carry into the field. In today's complex network environment, the testing matrix has become much harder to capture with an all-in-one solution.

**Lack of Cloud connectivity:** Simple remote connectivity can prove to be a huge benefit to the customer by increasing group productivity. Reporting from the equipment must be seamless and potentially connected directly to a network database allowing for collaborative remote troubleshooting, report data basing, asset tracking, and remote configuration.

**Delayed network issue/outage investigation:** The faster the resolution of the issue can become, the less money lost during the investigation period. The test solution should prove to minimize the time between the occurrence and the investigation.

**Lack of desired skill set for solving network issue/outage:** Without the proper experience and skill set investigating the problem, the downtime for the network will be extended. If the test tools can compensate for the lack of skills, downtime can be reduced and less money will be lost during this period.

**Test equipment is scrutinized for Total Cost of Ownership.** Continued financial pressures and the drive to spend "wisely", has driven many financial decision makers to look at this data more closely. This will have to take into account initial investment, warranty, Mean Time Between Failure (MTBF), repair costs, etc.

## Our 40/100G Solution

Digital Lightwave's NIC is a solution used for verifying and qualifying the performance of today's multi-protocol global communications networks. With an extremely flexible software/firmware-based architecture, the scalable NIC platform combines, the multitude of traditional hardware-based test sets that are required to install, maintain, and monitor high-speed multi-protocol networks in a single platform.

### The "One Box" Testing Solution

The NIC, a "one-box" solution for testing all telecom and datacom infrastructures supports 100G down to 1.5M, multi-protocol, OTN switching, Ethernet/IP, Packet over OTN, GFP, SONET/SDH, Fibre Channel, & PDH/T-Carrier all in the same chassis (Figure B).

Figure B: NIC Plus Configured for 100G to 1.5M Testing

The NIC supports the following:

■ **Ethernet/IP/GFP:** The platform supports comprehensive traffic generation and analysis capabilities for all standardized Ethernet interface rates and client mappings from 100Gbps to 10BASE-T. It supports 32 simultaneous/independent test streams, which can be configured as IPv4 or IPv6 with up to 4 VLAN/MPLS tags and independent settings for addressing, rate, packet size, and many more options. Service validation can also be performed with RFC 2544 and Y.1564, test suites, and traffic reflection modes support logical loopbacks at the far end (Figure C). Latency, packet jitter, service disruption, round trip delay and more performance measurements are analyzed.

■ **OTN/FEC:** The platform supports OTN interface rates up to OTU4/112G (Figure D). It provides the following capabilities: client mappings that include support for Ethernet/GFP, Fibre Channel, SONET/SDH, & PRBS; OTN switching verification with ODTU and ODUflex multiplexing capability to the ODU0 level; and performs jitter and wander testing up to 10.7G.

■ **SONET/SDH:** The platform supports SONET/SDH interface testing from 52M to 40G. The solution supports "All Path Testing" options allowing for simultaneous testing of all STS/HP containers supporting any combination of homogenous or mixed mappings (Figure E). Service disruption events are analyzed on all channels simultaneously. It provides the following capabilities: client mappings that include STS/HP & LP/VT PRBS, VCAT/LCAS, Ethernet/GFP, PDH, & ATM; and performs jitter and wander testing up to 10G.

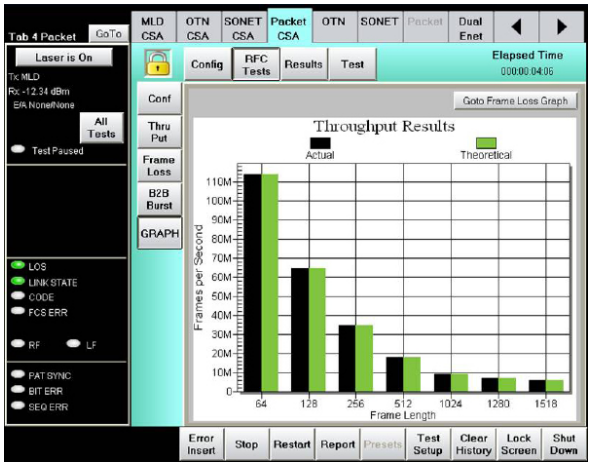


Figure C: NIC Ethernet RFC 2544 Testing

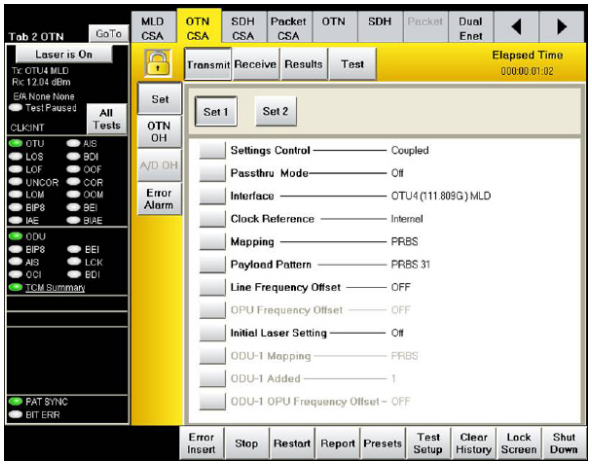

Figure D: NIC OTN OTU-4 PRBS

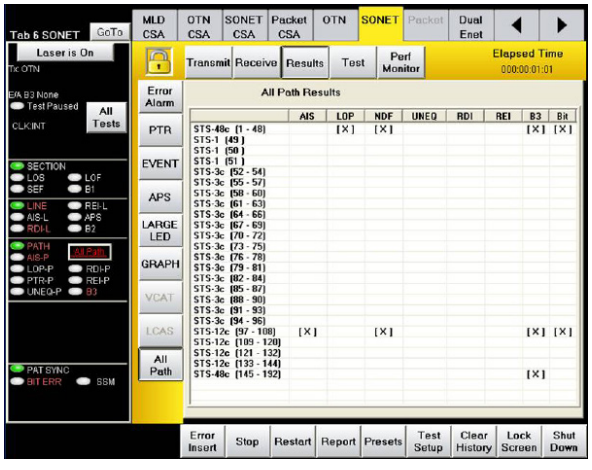

Figure E: NIC SONET/SDH All Path Testing

■ **PCS/Logical Lanes:** The platform supports generation, analysis, and stressing of PCS/Logical lanes. It includes skew generation/analysis, virtual lane manipulation/analysis, error/alarm generation and monitoring, per lane frequency and optical power measurements, and CFP module interface stressing with signal conditioning settings (Figure F).

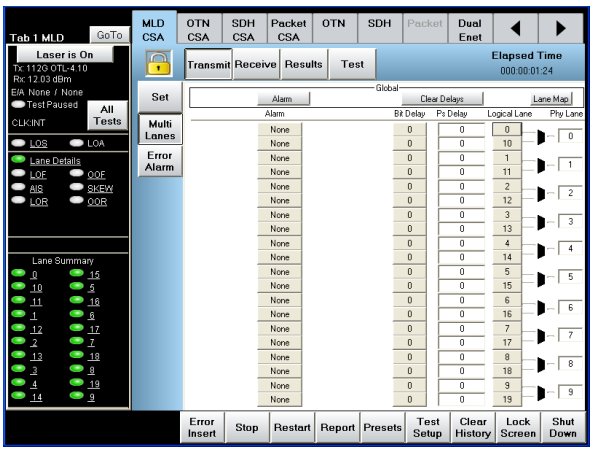

Figure F: NIC Multi-Lane Configuration

■ **Fibre Channel:** The platform supports comprehensive traffic generation and analysis capabilities for all standardized Fibre Channel interface rates and client mappings from 11.3Gbps to 1G. The solution stresses F-Ports of switches with Point to Point modes including Extended Link Service Requests (with or without Fabric and Name Server logins). The features also include configurable stream parameters, buffer to buffer credit analysis, latency, and service disruption measurements.

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Additional technology modules supported by the NIC platform include: PDH/T-Carrier 1.5M/2M/34M/45M/139M interface module with jitter/wander testing; C & L band channel monitoring module; ATM module; and Serial interface (RS530/RS232) analyzer module.

The flexible design and architecture of the platform allows for seamless additions of new capabilities due to a change of needs or evolving technologies. This can be done without changing the chassis of the product, and meanwhile, protects the NEM's and carrier's initial investment. The extensive test options, provided by the NIC, support the vast needs of converged telecom and datacom markets, which ultimately allows NEMs and carriers to experience increased efficiency and ROI, and feel decreased financial pressures from such things as lowered shipping costs and logistics. Further benefits to the customer is that there are less test sets to carry and manage for the job, which will efficiently lower the costs of the initial investment and lowers the Total Cost of Ownership (TCO).

## Simultaneous, Multi-port, Multi-rate

To facilitate the high demands of today's system verification requirements, the NIC supports simultaneous, multi-port, multi-rate test capabilities (Figure G). The expanded capabilities of this instrument allow for simultaneous testing to be performed on each test port, and in addition, it can also be configured with various multi-port test options. Individual test ports also have independently configurable interface rates, protocols and settings.

By providing simultaneous testing capabilities, NEMs and carriers can meet increasing multi-port, and multi-rate test requirements. Due to the fact that the need for a large amount of test sets will decline, and the necessary space requirements will decline, NEMs and carriers will see a decrease in their test times. The ability to meet those requirements and together with the simultaneous test capabilities, they will inevitably experience increased productivity and efficiency leading to higher profitability and lower operating costs.

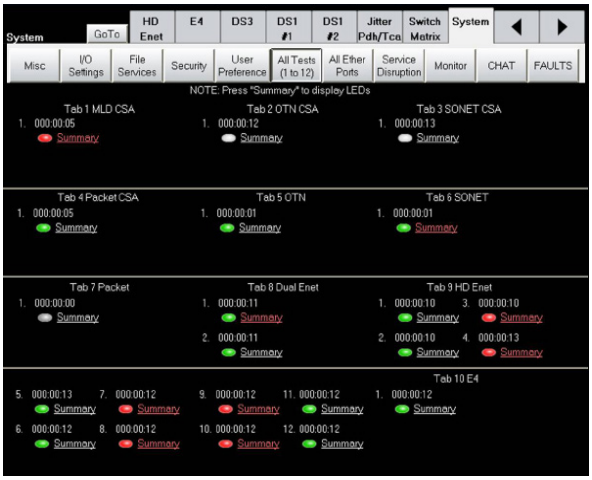

Figure G: NIC Multi-port Testing

## Simultaneous Multi-user, Local and Remote Operation

The platform supports a simultaneous, multi-user environment with concurrent local and remote user capability. It allows up to 20 simultaneous active users, and 512 system users can be defined with prescribed user level privileges ranging from 'read-only' to 'administrator'. The security lock status of each test port is graphically communicated to the user interface by intuitive user lock/unlock status icons. The multi-user platform supports simultaneous test capabilities, and also allows for independent user's to control the instrument directly from the local touch screen, from the remote GUI or from the SCPI automation interface.

This capability is essential for NEMs and carrier labs because they can effectively share resources, both locally and in network operation mode, which provides them with a higher ROI. In addition, this feature enables a more efficient and effective collaboration for troubleshooting that delivers complete test results in real-time, thus shortening the overall user experience, decreases the time to investigate and resolve issues, and allows the employees to become more efficient and thorough in other areas.

### Highest Port Density in Portable Form Factor

The NIC platform supports an industry leading test port density in a portable platform (Figure H). The typical chassis configurations are shown in the table:

| Typical Multi-port Unit Configurations |
|---|
| (2) 40/100G Ports |
| (5) 11G-52M and (10) 1/2/4G or BASE-T Ports |
| (60) 1/2/4G or BASE-T Ports |
| (20) T-Carrier/PDH Ports |
| Combinations of the above |

Providing the highest port density in a portable form factor enables NEMs and carriers to conveniently utilize tools that are cost effective and will return scalable, long-term results. The convenience measure of this feature decreases the strain of use, and provides a solution to the customer that allows the user to test quickly, efficiently, and with decreased error.

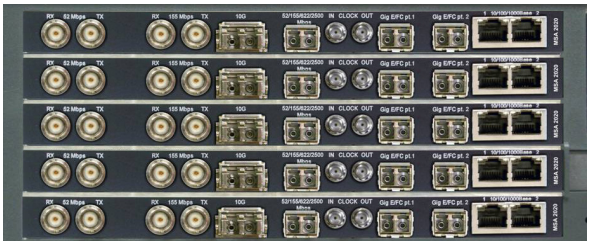

Figure H: NIC Plus Configured with Five MSA-series Modules

### Every Feature Available Locally, Remotely, or in Automation Mode, in a Variety of Form Factors

Every system verification feature supported by the NIC platform is available to the end-user from the solution's touch screen, remote control interface, or from the system's industry standard SCPI automation interface. All of these capabilities are packaged into a truly portable platform with a battery-powered option. The NIC platform also supports rack-mounted chassis that are available for embedded environments. The complete testing functionality of the NIC is available from the graphical user interface on the unit's touch screen (Figure I), from the remote control interface or from the SCPI automation interface.

Figure I: NIC Remote Graphical User Interface (GUI) on a Tablet

The abundant capabilities available for rapid implementation assist the NEMs, carrier labs, and carrier field personnel, in meeting their goals and needs at any stage along the technology lifecycle, and therefore bring to the surface new opportunities to strengthen current customer relationships, as well as foster new ones. This feature delivers a depth of capabilities so diverse, that it can successfully and effectively meet all applications requirements, and can be custom tailored to meet specific needs for both the lab and the field.

### Uniform Setup and Workflow

The NIC has the most intuitive, fastest, uniform setup and workflow across all interfaces and technologies. This workflow has been consistent over time within the product. The workflow of the Graphical User Interface (GUI) only goes one menu deep, there are no hard buttons on the instrument, and menu buttons never change from their original position. All of these features are supported on a user-familiar system touch screen.

These capabilities are important because they help the user to minimize test time including total setup and execution, as well as minimize user-error. The user is more likely to use the product in the right way, and the time needed for training will be minimized, thus increasing productivity and efficiency.

### Industry Proven Platform

The NIC is an industry proven platform designed to provide continuity, maintain familiarity, long-term support, and service to the industry. The platform has been relied on to verify global networks and infrastructure for several years. The platform has been consistent since its introduction in the market. Its look/feel, and workflow have been widely adopted by the industry. As testing and verification needs have changed, so has the NIC platform supporting technology as required by the constantly changing converged telecom/datacom market. Additionally, free 24-hour global technical support and free software upgrades are provided to all end users.

The NIC platform can be updated with new technology modules including the 40/100G CSA 4100 module, and there is no need to purchase or spend training time learning the operation of a new test instrument. This means equipment already purchased can be upgraded to support the latest technology, thus saving on unnecessary expenditures increasing ROI.

## Grow with Digital Lightwave's 40/100G Solution

Digital Lightwave continues to dedicate their technological advances and efforts toward providing NEMs and carriers with cost-effective tools that meet the changing demands of the market and support forward movement into the future. To learn more, please visit our website at www.lightwave.com or contact your sales representative.

*For more information or a sales quote, visit www.lightwave.com/contact or email dlisales@lightwave.com*

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