CALIENT
OPTICAL SWITCHES

Optical Circuit Switch in Test Automation

Whitepaper | CALIENT Solution Brief

Automating the optical fiber infrastructure in product development and manufacturing test laboratories is an application where optical circuit switching delivers tremendous value. As more labs migrate solutions to 40 Gbit/s and 100 Gbit/s, traditional OEO automation solutions are either extremely expensive or simply unavailable. The protocol and speed transparency of CALIENT's S Series Optical Circuit Switches (OCS) also delivers an additional benefit in labs – as interface rates scale in the future the OCS requires no upgrade, meaning that the total cost of ownership is extremely low.

This solution brief describes the economic and operational advantages that Layer 1 Optical Circuit Switching (OCS) can bring to laboratory and test automation environments. The primary benefits are improved utilization of expensive capital equipment, reductions in labor and travel costs, consolidation of multiple lab facilities and overall enhanced return on investment. The OCS product delivers the ability to reconfigure the physical optical topology in the lab with near zero latency and unlimited scalability.

The Challenge

Equipment manufacturing and R&D test labs are under pressure to reduce their true cost of test while meeting accelerated test schedules. For test lab managers, this means deploying equipment in a way that minimizes capital spending while maximizing the efficiency of man hours spent in the lab.

The challenge with existing test labs is that these facilities are very expensive to build and equip with a wide variety of high value test and networking equipment and often the resources are seriously underutilized due to the large scale and lengthy reconfigurations that are required for every job or test. With traditional manual reconfiguration methods, these reconfigurations can take days or weeks to complete, during which the lab and all its resources are completely unusable by any other functional group or for any task. Unproductive time is costly, and the cost escalates when human labor is factored into the wait/work time to make changes to lab configurations and setups.

The Calient Automation Solution

The CALIENT lab automation solution combines reliable and field proven hardware with intuitive management software to create a dynamic optical layer in test environments. This drastically reduces the lab provisioning time from days or weeks to minutes, each and every time a change is required, resulting in increased resource utilization rates, reduction in costly wait time, and much faster testing and release to customers for new product features and fixes.

With a minimal amount of training, any technician can use the system to reconfigure the test bed in seconds without needing to spend time and resources cleaning and inspecting the new optical connections. Furthermore, the OCS enables technicians with administrative access to set user levels by port, thus preventing usage conflicts that can arise if independent test groups try to access each other's resources.

As illustrated in Figure 1, networking hardware is interconnected via the OCS, allowing topology, configuration, and test equipment changes to be made dynamically under software control without manual intervention.

Reconfiguration is handled seamlessly and reliably each time without human intervention or errors. Users build the required test topology using the CALIENT OCS (locally or remotely) and network settings can be easily saved and recalled on demand for the next series of tests.

The CALIENT S320 and Edge|640 Optimization Solution

CALIENT Technologies using the S320 and Edge|640 Optical Circuit Switches has solved this challenge by providing flexible optical layer on-off ramps between different equipment and network domains. As shown in Figure 1, adding Optical Circuit Switches (OCS) at the edges of metro and wide area networks allows the multi-layer control plane to access and select resources from any domain or vendor, including a legacy network.

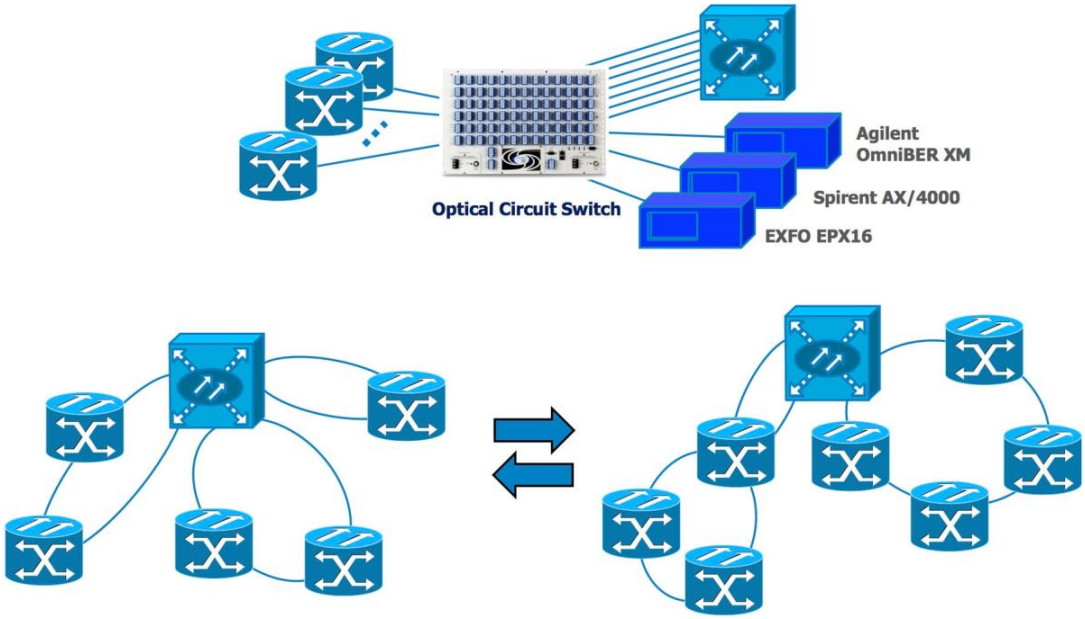

Figure 1: Improving Test Lab Facility ROI with CALIENT Optical Topology Reconfiguration.

CALIENT's OCS technology delivers this capability in an extremely reliable, field proven, low energy cost effective package.

CALIENT Core Technology

CALIENT's Optical Circuit Switch is a large port count all-optical (OOO) switch that establishes, monitors and switches physical layer connections between single-mode optical fibers using Micro Electromechanical Systems (MEMS) based optical switching. Connections are made between fibers carrying signals with any data rate or protocol. Any input fiber on the S-Series OCS can be connected to any output fiber making a fully non-blocking switch fabric.

Light is directed from the input fibers to the output fibers using arrays of tiny silicon mirrors that are fabricated using the proven CALIENT MEMS process. An optical signal transmitted through the OCS passes through three sections of the switch core: the input collimator array, which directs the light from each input fiber to its input mirror; the mirror matrix, an array of MEMS input mirrors and an array of MEMS output mirrors; and the output collimator array, which couples light from each output mirror back into its output fiber. High-quality mirrors and collimators and precise electrostatic control of the position of each mirror, enable typical switch times of less than 50ms and optical loss that is less than 3.0 dB for CALIENTs complete line of optical circuit switches.