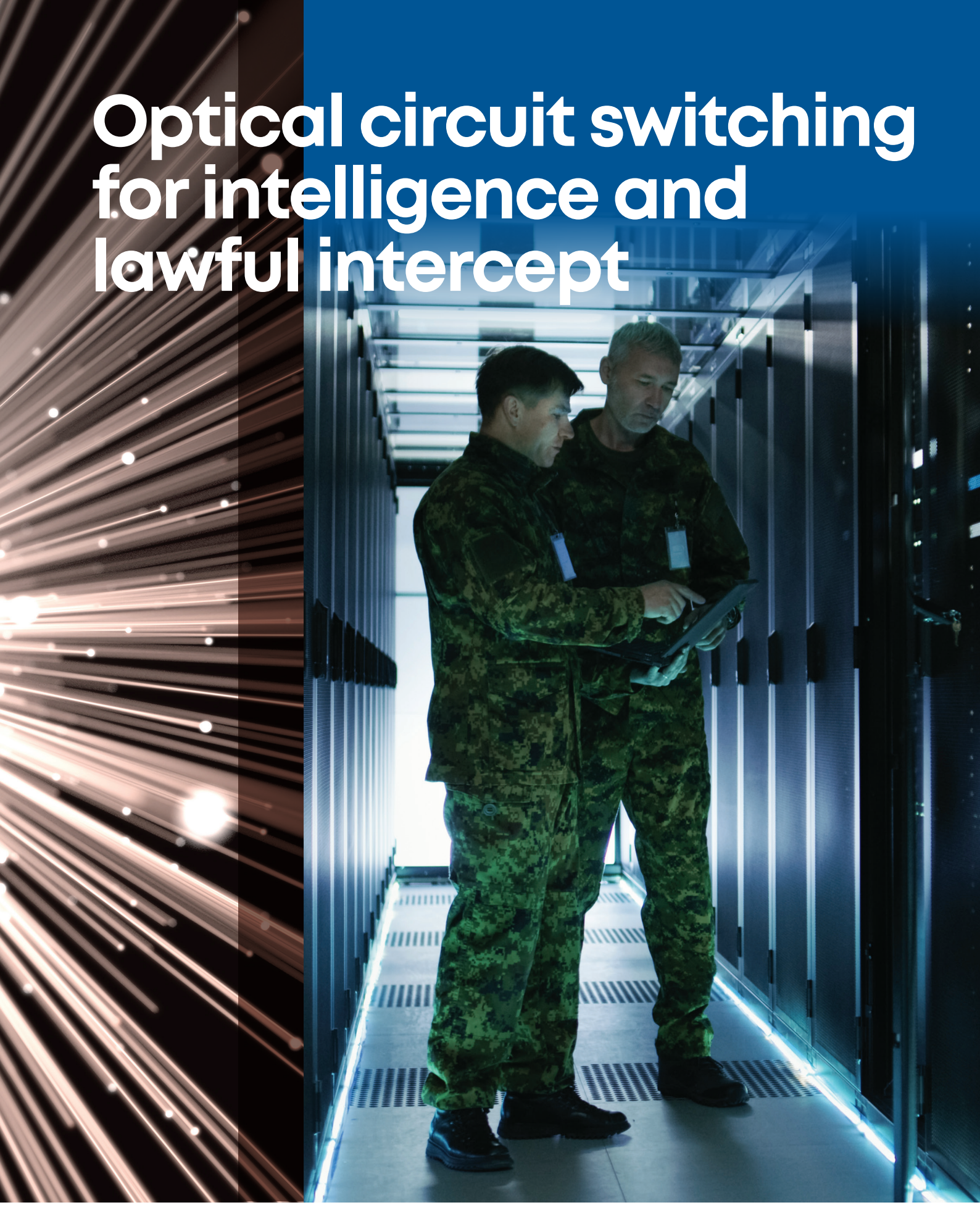
Optical circuit switching for intelligence and lawful intercept



White Paper

HUBER+SUHNER

Ensuring national security with cost effective network monitoring systems

Ever increasing data rates and volumes drive the need for cost effective network monitoring solutions.

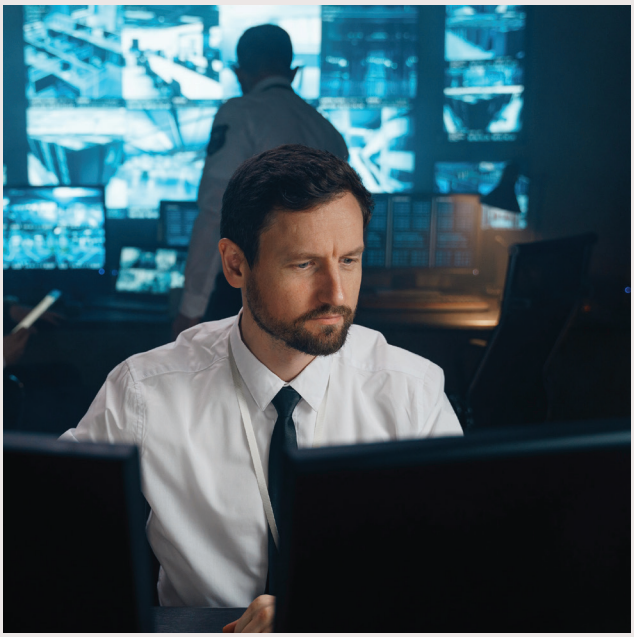
Global internet usage continues to grow to record levels, having increased a thousand-fold since 2002. Over 5 billion people, 66 % of the world's population, now have access to and use the internet around the globe. In the US alone 3,138,420 GB of internet traffic is generated every minute.

The explosion of internet traffic, and the increase in rates at which it is transmitted, has made it increasingly difficult and expensive for governments to monitor internet traffic and identify threats.

Government entities responsible for law enforcement and foreign intelligence collection have to sort through petabytes of internet and telecom traffic to find critical pieces of information in order to support law enforcement and national security requirements.

Cost effective network monitoring solutions, with mission critical reliability, are required for governments to effectively protect their citizens and their national interests.

In order to provide these network monitoring services, systems have been developed to locate and extract specific pieces of important information buried in mounds of other traffic while protecting the privacy of legitimate users.

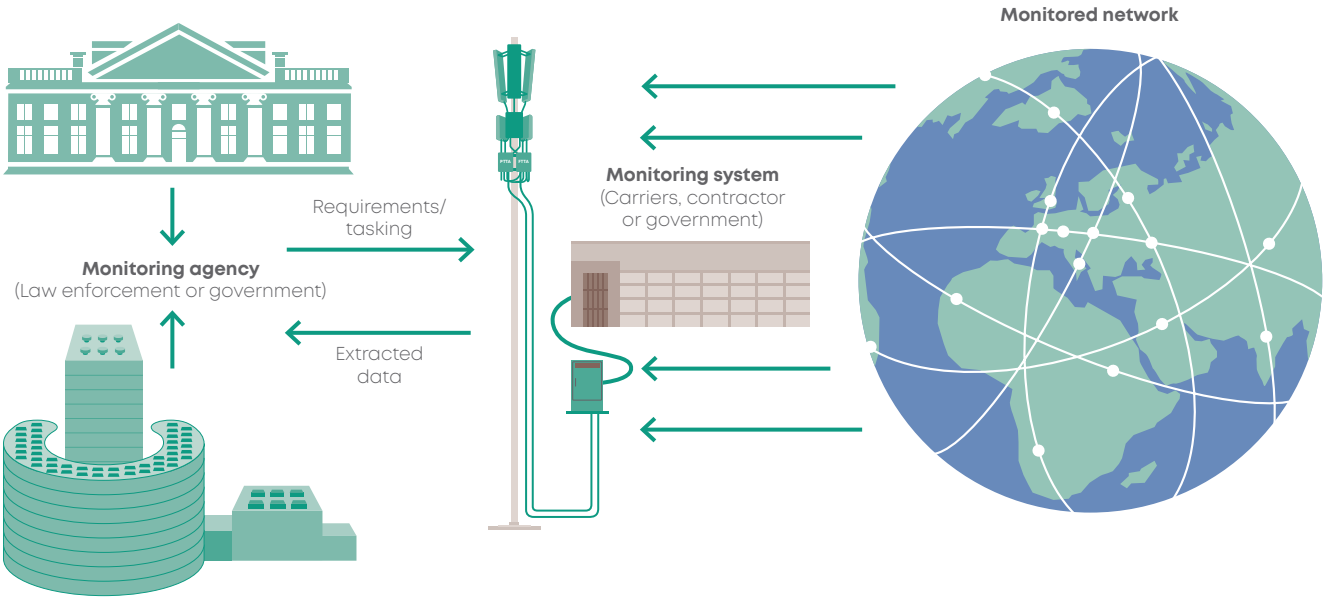


The challenge of cost effectively monitoring network traffic

The networks to be monitored, and the point of intercept, can take on many different forms.

The point of monitoring could be at a submarine cable landing station, in a carrier facility, internet exchange or data center, or on a network that is monitored for national security purposes. That location may be unmanned and possibly even remote.

In many of these applications the numbers of fibers to be monitored can be in the hundreds or even thousands. Each of those fibers can be carrying hundreds of gigabytes of traffic which creates a challenge for those tasked to sort through mountains of traffic in order to find specific information of interest.



Simplified overview of network monitoring and intelligence gathering

The network monitoring process is complicated further by the wide variety of formats, data rates, wavelengths, protocols and encryption that are present across the links being monitored. Advanced analysis and collection tools operating at line rates are deployed to break down the traffic on any given link to be able to identify and extract the particular signals of interest, while making sure to protect the privacy of other users.

Ideally, these tools would be applied to every line traversing the point of monitoring in order to provide broad, real-time, network visibility. However, the huge number of lines to be monitored means that 100% monitoring is cost prohibitive, particularly at line rates of 100 Gbps and higher.

Cost effective ways of sorting through large amounts of high speed data are required. The network monitoring systems need to be designed to leverage a smaller number of analysis and collection tools across a larger number of lines to be monitored, in order to utilize these expensive tools in the most cost-efficient way. A lower cost front end can be used to preselect fibers to be monitored and only forward those fibers involved in active survey or monitoring tasks to the tools and appliances that can extract the information of interest. In turn that information is forwarded to analysts or databases, securing a superior return on investment in these tools.

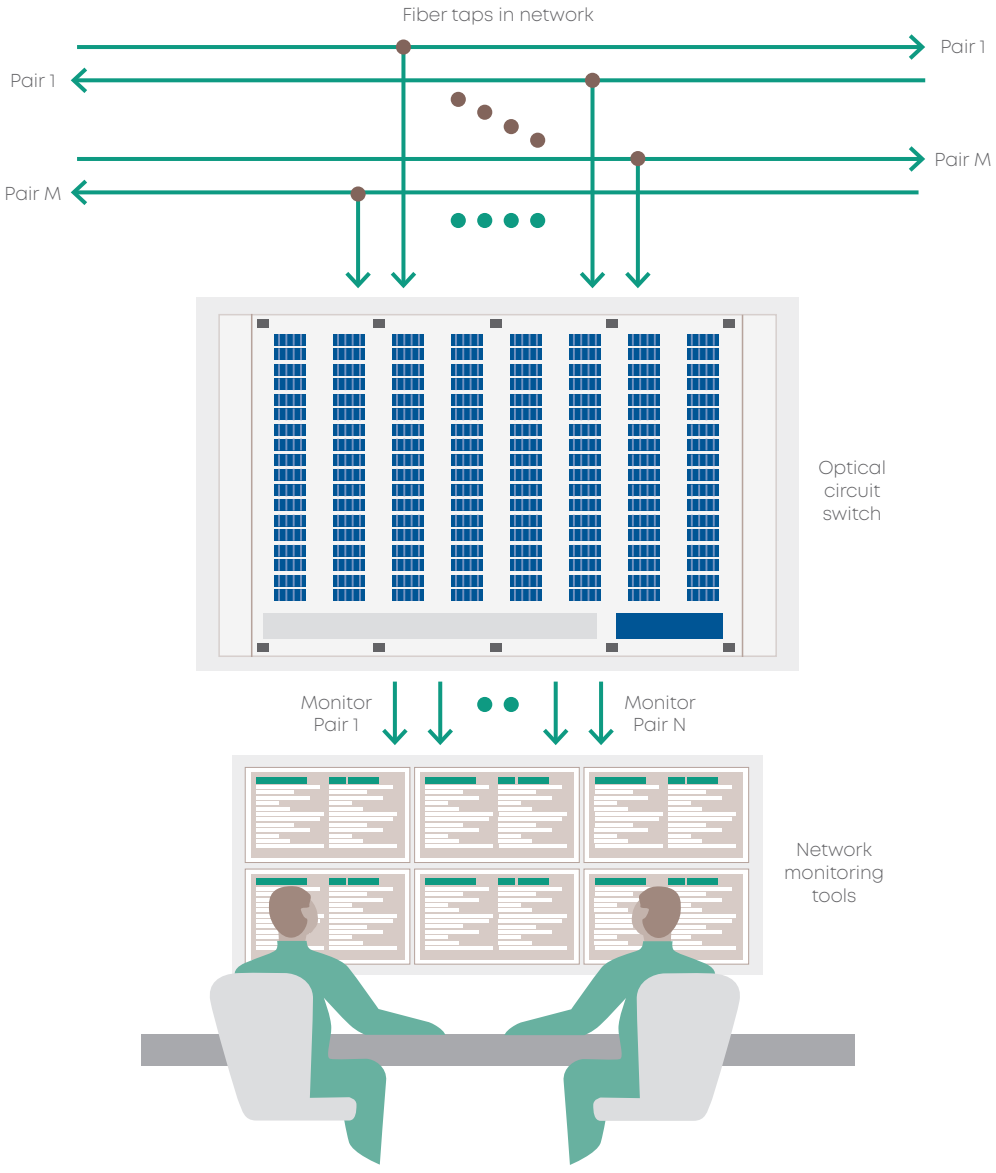
Solution

The role of optical circuit switching in network monitoring systems

An efficient and cost-effective solution

An optical circuit switch provides a cost-effective front end solution for preselecting the fibers to be passed on to the network analysis tools on an as-needed basis. The capability of the optical circuit switch to pass data completely irrespective of the wavelength, protocol or data rate present on the fibers is essential. The signal agnostic nature of the optical circuit switch provides a future proof solution. Even when the underlying network protocols or data rates change the switch front end will continue to function.

An optical circuit switch can be used to route fibers to auto-discovery tools that can analyze the content of any given fiber and either forward the signal of interest for collection purposes or save the information to a database for further analysis. The fibers can be routed one by one to the auto-discovery tool on a rotating basis in order to build up a full picture of the types of traffic traversing the network over time. The database can then be monitored to provide insight as to where specific signals are located in the mass of network traffic. This allows the network monitoring administrator to perform a cost-effective network survey, and when a target is identified, the optical circuit switch can be commanded to direct that specific data stream to a persistent collection device for analysis and reporting.



Optical circuit switch as intermediary between network taps and monitoring tools

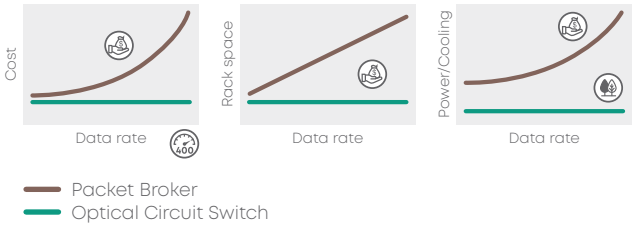
Solution

How optical circuit switching enhances network monitoring

Linking Packet Brokers (PB) and Optical Circuit Switches (OCS)

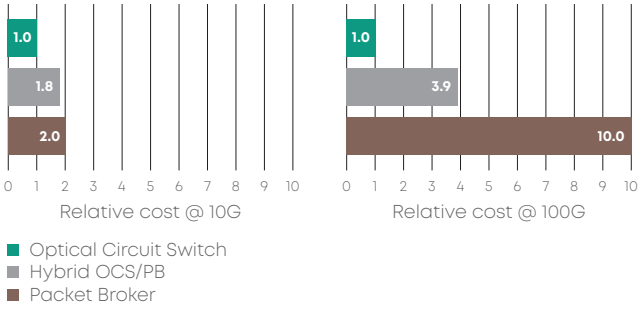
In a network monitoring system, the auto-discovery tools do the heavy lifting of drilling into the transport protocols to strip off extraneous traffic and extract the desired information. These tools operate at line rates and tend to be very expensive. Packet brokers are often placed in front of the tools in order to groom the signals being forwarded to maximize the tool utilization.

These packet broker ports can provide a range of functionality but must run at line rates. As the data rates increase to 100 Gbps, 400 Gbps or even higher, the cost per port for packet brokers increases dramatically and it becomes cost prohibitive to have a packet broker port for each tapped line.

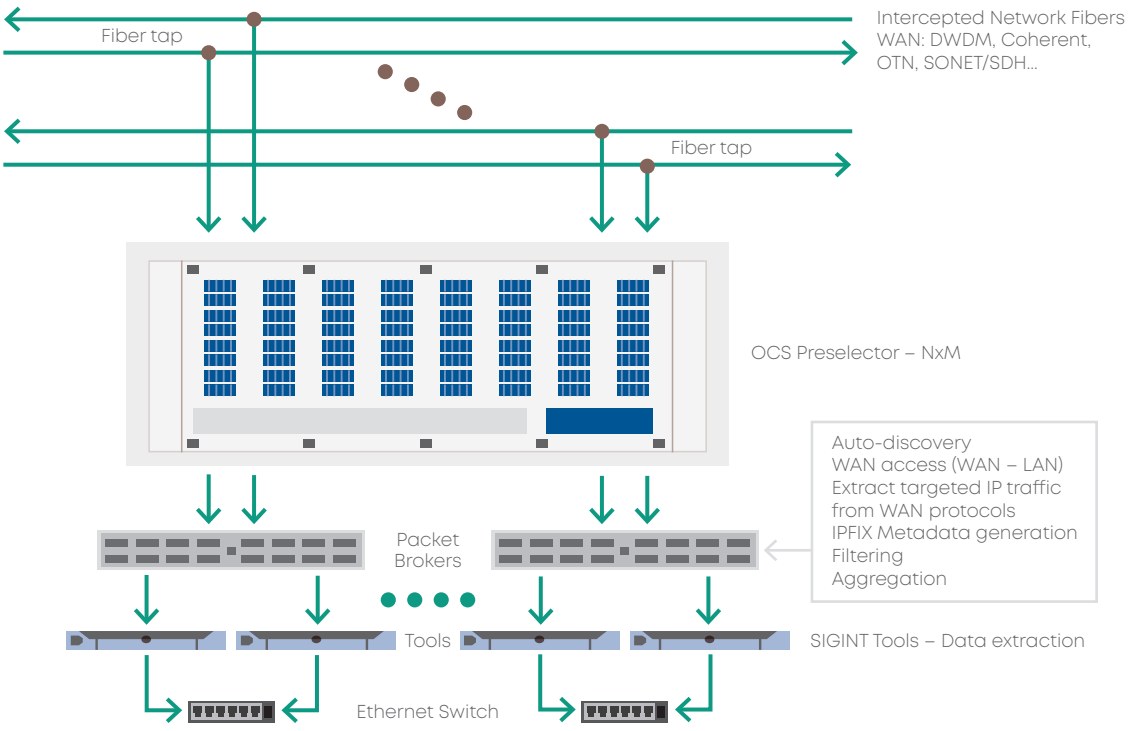


An optical circuit switch positioned between the line taps and a reduced number of packet broker ports provides a cost-reducing design option, balancing network visibility against overall system cost. Further cost reduction can be achieved by eliminating the packet broker layer altogether at the expense of further reduced network visibility. The charts below show the relative costs.

Relative cost of 192 fiber pair Network Monitoring Solutions



Hybrid network monitoring system



The optical circuit switch of choice – POLATIS® from HUBER+SUHNER

The mission-critical component for network security

The highly dynamic nature of the network survey and collection environments requires optical circuit switches that switch quickly and provide superior long-term reliability. As the preselect element in these architectures, the optical circuit switch becomes a mission critical component of the network survey and collection systems. POLATIS switches have been deployed thousands of times over the past 20 years and they continue to provide fast and reliable connections in support of many network monitoring applications.

In a typical application, the network fibers are passed through a passive optical tap which pulls out a small amount of the light on the fiber and directs it towards the collection system, thus allowing the bulk of the light to continue in the network and not degrade the network performance to any significant degree. The low level of the signals routed to the collection systems requires the connections through the optical switch to be as low loss as possible to preserve the integrity of the optical signals being analyzed. POLATIS optical circuit switches provide the lowest insertion loss available with typical losses of only 0.6 dB for switches with port counts up to 96x96. Larger POLATIS switches still deliver best-in class low loss performance.

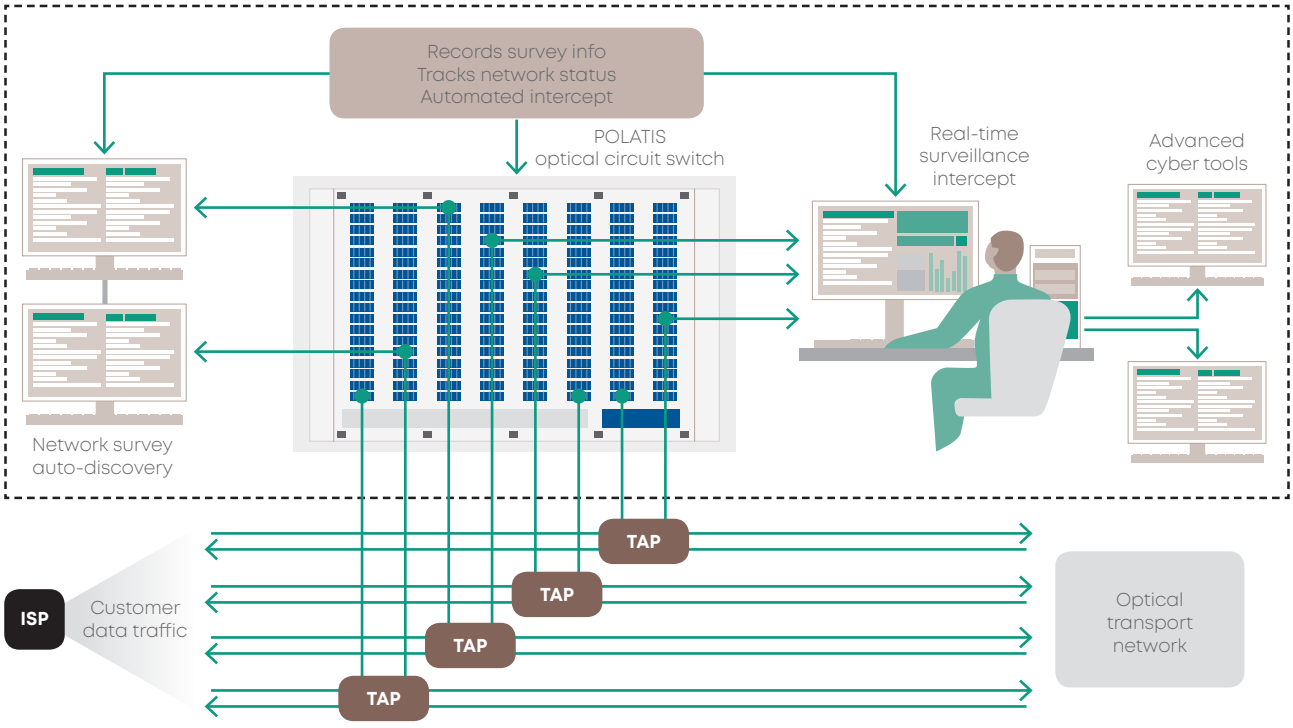
Low loss is important, but it is also important that the fidelity of the collected signals is not impaired by the optical switch. This ensures the accurate collection and analysis of sensitive signals to support mission requirements. An optical circuit switch with stable connections that do not add noise to the signals traversing them is required and in this respect, POLATIS optical circuit switches are best in class.

Large port count, non-blocking optical circuit switches are required to handle the large number of fibers typically present in network monitoring systems. A non-blocking, as opposed to partitioned, switch solution means any fiber tap input can be routed to any packet broker or tool port, optimizing utilization of those ports without conflict.

The POLATIS range from HUBER+SUHNER provides the largest port count optical circuit switch available on the market today at 576x576. POLATIS switches are also available in asymmetric configurations such as 384x192 to support down-select configurations.

Leading vendors of network monitoring tools have fully integrated the software-defined POLATIS optical circuit switches into their systems, creating automated mass cybersurveillance solutions.

Example of an Automated Cyber Surveillance System



Solution can scale to include hundreds or thousands of fibers

Advantages

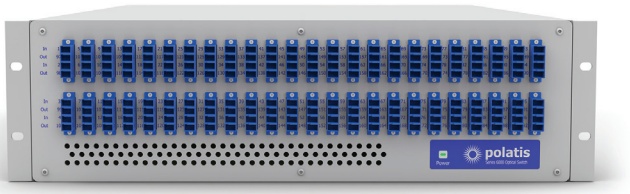
POLATIS® optical circuit switching for network monitoring

Advanced and proprietary fiber optic switching technology

POLATIS® optical circuit switches have significant advantages over other optical switching solutions for network monitoring, including:

- The industry's lowest optical loss and superior stability, which are critical to ensuring signal integrity.
- The broadest range of symmetric (NxN) and asymmetric switches (MxN), in non-blocking matrix sizes from 8x8 to 576x576 ports, with the potential to scale to survey tens of thousands of fiber connections.
- POLATIS 576x576 has 80% more ports than any optical circuit switch from other suppliers.
- High density switch matrices occupying very little rack space (8 RU for 576x576).
- Protocol and data rate agnostic so can switch signals of any type.
- Switching times from 25ms-75ms (subject to matrix size) support rapid cycling through multiple tap feeds.
- True dark fiber switching, which requires no light to make and hold connections, and is critical when switching low power signals, bidirectional or intermittent signals, and enables pre-provisioning of future paths.
- Optional integrated Optical Power Monitors, enabling measurement of the optical power of the signals passing through the switch.
- Optional integrated Variable Optical Attenuation (VOA), which enables power levels through the switch to be managed to prevent damage to sensitive receivers.
- Support for the broadest range of Software Defined Networking (SDN) and command line interfaces, including TL1, SCPI, SNMP, NETCONF and RESTCONF.
- Fully software-defined for a seamless interface with leading cybersurveillance solutions.
- Robust by design to be highly reliable for mission critical applications, with dual redundant, hot-swappable network interface cards and power supplies.
- POLATIS 576x576 switch also has dual redundant controllers and optional field addressable spare ports for increased field resilience.
- Eco-friendly, low power consumption.
- Made in the UK and the EU.

POLATIS 576x576 Optical Circuit Switch with MTP Connectors



POLATIS 96x96 Optical Circuit Swtich with LC Connectors

The HUBER+SUHNER advantage

HUBER+SUHNER Polatis has twenty years' experience globally in network monitoring and cybersecurity applications.

In addition to the POLATIS optical circuit switch, HUBER+SUHNER offers a broad range of products for network monitoring including network taps, optical amplifiers, signal regenerators, WDM components, transceivers, fiber cables, patch cords, fiber management systems, structured cabling solutions and more.

Worldwide sales and support are available to make sure your network monitoring systems continue to operate day in and day out, providing the mission critical data needed to ensure effective law enforcement, intelligence collection and cyber security.

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