

# Fibre Channel Traffic Access Point Technical Brief



## Fibre Channel Traffic Access Point

In an age when television commercials show everyday people effortlessly accessing their bank accounts information from a street corner by way of a cell phone, it is ironic that accessing data flowing within its physical source—the storage network—is, without advanced preparation, nearly impossible. The truth is that, for many IT organizations, the storage network itself has become an impenetrable black box. This is particularly true for Fibre Channel Storage Area Networks (SANs). While FC technology has yielded the desired result—increased speed and availability—it has made access to the data flowing through connections within the network more difficult. Unlike peer-to-peer networks with centralized data flows, where access is a simple matter of acquiring data as a peer node, FC switched networks have a decentralized structure with no ready access points. When network problems or slowdowns occur, or when monitoring becomes desirable, administrators often do not have the necessary access to network data flows to diagnose their problems or to monitor.

This paper discusses the simplest, most effective, and most cost efficient way to gain access to the data within switched FC Storage Area Networks—the Traffic Access Point (TAP).

### What is a TAP?

As the name implies, a Traffic Access Point is a hardware device that provides access to traffic flowing on a physical connection (link) between two or more points within a network. The TAP normally resides in the link between the network devices, termed “inline / out-of-band”. In other words, a single physical link connection between two points is replaced with two; the first from point A to the TAP, and the second from the TAP to point B. The TAP provides an output which reflects the data flowing between the two network points, effectively creating a virtual copy of all traffic.

### What does a TAP do; how does it work?

A TAP uses fiber optic splitters to provide an out-of-band copy of a live optical signal that can be used by monitoring and diagnostic devices. The core technology in a TAP is a passive fiber optic splitter that divides an incoming optical signal (generated by the upstream device’s TX port) between two outputs. The splitter is constructed by fusing a second fiber very precisely onto a first, creating a “Y” shaped assembly with a single input and two outputs. The primary, or “live”, output from that splitter is connected to the downstream device’s RX port; the secondary, or “TAP”, output provides a copy of the signal coming into the splitter’s input to monitoring and diagnostic equipment. A TAP uses two such splitters, inserted into both of the fibers that comprise a bidirectional link, to provide access to all traffic passing across the link.

### Summary:

- A Traffic Access Point is a hardware device that provides access to traffic flowing on a physical connection (link) between two or more points within a network.
- TAPs use fiber optic splitters to provide an out-of-band copy of a live optical signal.
- TAPs are critical enablers for non-intrusive FC SAN monitoring and diagnostics.
- TAPs are the only way to provide out-of-band, lossless, full line rate, and real-time access to the traffic traveling over an optical link.
- TAPs are completely passive, do not induce latency on either output, and do not vary the signal on the live output whether or not the TAP output is used.

## Why instrument the SAN with TAPs?

Perhaps the most compelling reason for installing TAPs is that installation allows network maintenance activities requiring network data visibility without disturbing or stopping the SAN I/O. With the cost of downtime for some business critical application exceeding millions of dollars per hour, the ability to troubleshoot the network without bringing it down pays for the installed TAPs in literally less than a second, given the insignificant cost of the devices—typically less than 1% of the cost of the network. Another compelling but less well known reason is that often bringing down the network to install analysis or monitoring equipment to resolve a problem can hide or mask the issue. When the link is reestablished the communications are reset as well. This can temporarily resolve the issue until the conditions that caused the problem in the first place reoccur and the problem once again appears. Without TAPs in place, administrators and field support personnel often have to chase a problem around the network and try and trigger it to occur. With TAPs in place instrumentation can be put in place while the problem is still present on the network allowing for much quicker diagnoses.

## What are the key TAP selection considerations?

The three critical TAP characteristics are:

1. The TAP provides one or more outputs that reflect the data passing through the device.
2. The monitoring outputs do not modify or degrade the signal passing through the device.
3. A TAP continues to pass data on its ports without disruption, requires no power, and has no electrical components.

TAPs are available from several vendors may at first glance appear to be functionally equivalent. The proper selection of TAPs is entirely dependent on assessing two fundamental characteristics - the *split ratio* and the *signal quality*. The TAP split ratio is the distribution of output optical power between the splitter's live and TAP outputs. While splitters can in theory be manufactured with any split ratio, in practice most are manufactured with 50-50, 70-30, or 80-20 split ratios. These indicate, respectively, that 50%, 70%, and 80% of the total output is directed to the live output, and 50%, 30%, and 20% to the TAP output. Note that the total power output of a TAP is slightly less than 100% of the input power, as small amounts of incoming optical power are lost at the connection to the TAP and within the merged fibers of the splitter. The combined impact of the split ratio and this small amount of additional loss is reflected in the insertion loss measurement, which is taken for both the live and TAP outputs. The insertion loss measures the output power relative to the input power in dB of attenuation. A typical insertion loss measure for a 50% output (whether a live or TAP output) is 4.5 dB; for a 70% live output, 2.4 dB; for a 30% TAP output, 5.8 dB. To best address both customer considerations and our own requirements, Virtual Instruments strongly recommends – and only sells as standard – TAPs with a 70/30 split ratio.


Sufficient optical power is absolutely necessary, but alone not sufficient to ensure proper operation of downstream devices attached to both the live and TAP outputs. The manner in which TAPs are constructed – especially with asymmetrical split ratios – can induce large amounts of jitter onto outputs, resulting in signal bit errors that are seen as code violations by the downstream devices.

Signal quality is assessed by measuring the bit error ratio, or BER, across the device(s) under test. The applicable Fibre Channel standard, FC-P1-4, requires that receivers and transmitters be proven to operate with a bit error ratio below  $10^{-12}$  with a specified test signal. Consistent with this standard, VI requires that all TAPs utilized with our components be proven to pass PRBS test patterns in compliance with the eye mask, or BER contour, applicable to the operating line rate and with a bit error ratio below  $10^{-12}$ . **All VI TAPs are certified to meet these requirements on both the live and TAP outputs at line rates up to and including 10 Gb/s.**

## Summary

Virtual Instruments' TAPs provide a simple, effective and cost efficient way to provide a window to the data flowing across a Fibre Channel SAN. TAPs allow access to network traffic in real-time for troubleshooting, analysis, or monitoring without affecting network operation. They do not create a location to modify or corrupt data, and they do not represent a prospective point of failure. In short, if properly selected and installed, TAPs are as predictable, reliable, and low maintenance as the rest of the physical fiber infrastructure.

Virtual Instruments' TAPs are used in many of the world's largest public and private data centers, enabling the instrumentation of thousands of Fibre Channel links and hundreds of petabytes of data.

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