

Making the Invisible Visible – the modern data center requires infrastructure visibility

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Today, when we bring up the topic of “visibility” within the mission critical networks of the enterprise, most organizations turn immediately to their practices with sniffers, traffic analyzers, and trending tools – more often than not focused purely on their IP-based communication networks. But these tools can turn into nothing more than a temporary placebo when fighting performance problems, and trying to gain visibility into the infrastructure for more strategic management. Why? The performance of business critical applications often depends upon more difficult to access fabrics – such as the fiber of Fibre Channel (FC) and FICON networks threaded between mission critical storage, switches, directors, and HBAs of computing systems. Peering into an easier to access communications network may offer valuable insights into symptoms such as increasing latency, but such tools will reveal little about the domain of the infrastructure that is really the root of most performance issues – the storage network. Treating such symptoms without insight into the underlying cause does little more than applying a short-term patch to the problem. We can call out time and again the tales of IT practitioners where a troublesome problem could only be solved, or the claims of a vendor could only be verified, by peering into an enterprise SAN.

In the past, it used to be costly and difficult to analyze interactions across fiber connections. But the equipment to tap into and analyze the data streams within a fiber connection are now more affordable than ever, and designing in easy access for monitoring and visibility of these fabrics should be a ubiquitous best practice. But too often it remains the case that access is an afterthought - often coming to light only after a significant failure occurs. With out-of-sync expectations about cost, and increasingly complex fabrics, the enterprise often fails to think about how and where to integrate access when systems are being designed and deployed. In turn, gaining visibility when problems occur means retrofitting access and this can become an enormous problem, often requiring planned downtime, or causing unplanned disruption. This shouldn't be the case.

In this solution profile, we'll examine the importance of SAN visibility. We'll then examine one solution for integrating physical access – Virtual Instrument's SANInsight TAP Patch Panel Systems, and look at the common questions that come into practitioners' minds about how, when, why, and where to integrate access into today's infrastructures.

Visibility – beyond mandatory

Providing visibility into the complex data center is an increasing challenge. Data centers have become denser, larger scale, and more complex than ever before. With complexity, the laissez-faire approach to traditional troubleshooting – figure out what tools are available, or find a sniffer, and then figure out how to get access to the right parts of a data stream – is simply no longer viable. Systems are too complex and too mission critical to tolerate such latencies. Moreover, visibility is simply mandatory for optimizing the use of the virtualized data center – environments without visibility will never observe latency issues, transmission errors, or misconfigurations before they become problems or extract a needless premium in wasted capabilities. Then when such common issues (we've never seen an infrastructure without at least a few) do fully blossom into full-fledged problems, IT staff will find it impossible to cost-effectively drill into the root causes behind these issues.

Patching over Access

The problem boils down to getting the right physical access to this complex infrastructure in the midst of increasing density and scale – and physical access in this case is inclusive of access by a human body or monitoring tool, as well as access to live, unaltered data streams. While physical access is difficult enough in the ubiquitous IP network, the IP network barely touches the more mission critical fabrics in the enterprise – such as the fiber networks supporting protocols like Fibre Channel or FICON. And while the ubiquitous IP network – as a point of

physical access for monitoring and observation – may offer somewhat better access than fiber networks, the underlying issues behind major application problems or performance impacts are today as often as 9 times out of 10 related to storage interactions, and the fiber networks that such interactions commonly take place upon.

In our view, this is a strange problem to have in an industry that has long ago come to terms with a strategic use of patch panels being a best practice when designing physical connectivity. Physical cabling is a key asset in today's complex data center, and can be so dense and interwoven that it practically becomes a part of the physical building. Integrating patch panels provides configurability, and flexible on-going use of the cabling plant as the data center changes.

But in this industry immersed in patch panels and highly standardized cabling practices, designing cabling infrastructure for visibility into the SAN has barely matured. Today's systems simply cannot tolerate disruptions, and the lowly patch panel does nothing to provide access to live sessions. The consideration of access to these networks, even within environments leveraging highly optimized cabling plants and state of the art connectivity, is too often left by the wayside.

Devices = Access-lite

In realization of this, network vendors have long built equipment to perform actions like port mirroring. But there are too many cases where port mirroring simply isn't sufficient. A port mirror never represents pure

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unadulterated access to a live data stream. With mirrored ports, lower level interactions on a fabric are filtered out as frames are repeated out the monitoring port. Such repeated traffic only includes logical and data interactions, and may miss many physical characteristics on any given cable – such as framing or CRC problems, latency, and other characteristics – that can only be directly observed. Within the 5 layer, FCo to FC4, Fibre Channel corollary to the abstract OSI Reference Model for network communications, over half of the layers are missed with port mirroring approaches. Moreover, port mirroring can do little to easily provide real-time, latency-aware access to interactions that cross multiple devices and ports, or provide full visibility into sessions that exceed the bandwidth of single ports on single switches. Mirror ports also shut down when traffic is heavy, which is exactly when you need data on infrastructure performance the most.

Access must be Best Practice

Given the importance of visibility, and the limitations of switch and router based solutions, it stands to reason that the industry should be insisting on physical access to a degree never before witnessed. For many in the industry, the possibility of increasing access to specialized high performance networks is often overlooked because it is assumed to be unobtainable or economically unfeasible. But this simply isn't true. The technology exists today to provide access to these infrastructures – even fiber-based networks – even on a very wide scale that includes every port on even the largest fabrics. These devices are Traffic

Access Points (TAPs) – passive in-line splitters that are integrated in dense patch panels to provide full visibility of what is being transmitted over individual cables and ports. Moreover, these solutions are economic in cost and physical space and consume no power. Such solutions can make access economically achievable for any organization.

Organizations too often do not consider these technologies, and when they do consider them, they are pressed to figure out why and how to integrate such technology into their infrastructure.

To be clear, retrofitting TAPs into an existing infrastructure can be a challenging endeavor. While organizations facing a crisis and suddenly in need of access within existing physical plants easily overcome any of the potential obstacles, the simple truth of the matter is that reworking an operational physical plant often demonstrates one or more of Murphy's laws (accidents will happen when least convenient), and that putting technologies like multi-pathing to the test turns up less robustness than expected.

In turn, there are three places in which to realize that physical access is a best practice, and to make efforts to put physical access into place.

Best Practice #1: With visibility in mind, realize access should be a “built-to” specification for all new data center infrastructure. First, with an understanding of the importance of visibility and its relationship to physical access at top of mind, all data center technologists should

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turn to intentionally bridging the gap between how their organizations *build the data center* versus how they need to *use the data center*. Each new build should make sure that physical plant specialists and technologists work together to design for access into their mission critical fabrics.

Best Practice #2: Realize visibility is a mandatory best practice in the consolidating infrastructure, and you should therefore introduce improved visibility with every major system change. But it isn't necessary to wait until a new data center is built to improve access. Systems change periodically, and it is quite possible that such changes will provide an opportunity to non-disruptively implement access for broad swaths of the physical fiber in your data center – as we'll discuss, solutions available on the market today can be implemented within the same footprint as existing patch systems, without drastic changes to physical configurations.

Best Practice #3: Plan and implement physical access when the symptoms show up, and before it is too late. But outside of new data centers and new equipment, the organization often has more than justified reason to implement access. When symptoms of performance issues show up, do so before it is too late. This may happen during the integration of new technology, or when administrators are less than confident that full performance and system capabilities of any system are being delivered. On the other hand, this may be when latency or general slow downs occur, and the specific interactions behind the slow down cannot be fully determined. NetNet,

anytime lack of confidence surfaces, your visibility isn't good enough. Instead of wild reaction, realize the lack of visibility makes it clear that better access is needed, and begin planning to introduce better access into the physical plant during any available maintenance windows.

With this in mind, we've selected one vendor from which to more closely examine what is available in TAP technology today. We'll highlight Virtual Instruments, as they bring a unique selection of both TAP and analysis technology to the table. At the end of the day though, we believe key questions remain in many administrator's minds about how and why to tap infrastructures. Following a review of Virtual Instrument's capabilities, we'll examine how the Virtual Instruments technology should be brought into an infrastructure by addressing the most common questions about TAPs that we regularly field from today's data center practitioners.

Focus on Virtual Instruments TAPs

Virtual Instruments, based in Scotts Valley, CA was spun out of Finisar in 2008 and is a recognized leader in SAN monitoring and analysis solutions. They primarily sell virtual infrastructure optimization (VIO) solutions to companies with large SANs running business-critical applications. Their primary products include VirtualWisdom, a software monitoring and analysis solution, and SANInsight, their hardware solutions for SAN instrumentation and monitoring.

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Virtual Instruments has long been providing sophisticated analysis and management solutions for the enterprise infrastructure – ranging from the virtual infrastructure to a sophisticated and time tested platform for SAN instrumentation.

SANInsight TAP Patch Panel System

In April of 2010, Virtual Instruments introduced a comprehensive line of physical access systems to accompany their monitoring systems. Those products are patch-integrated Traffic Access Points (TAPs) for all manner of fiber fabrics - 50 and 62.5um multimode and 9um single mode. Under the solution set name of SANInsight TAP Patch Panel Systems, this product line includes mounting shelves and accompanying TAP Patch Cassettes, as well as untapped cassettes and adapter plates. While the standard TAP Patch Cassettes are compatible with VI's own shelves, cassettes to fit other vendor's shelves and enclosures are available by special order. Virtual Instrument's TAP Patch Cassettes are available with a mix of LC and MT connectors for the live, patch, and TAP connections; the number of fibers per Cassette varies with the connector type. The densest configuration uses MT connectors for both trunk and TAP connections, supporting 24 live fibers (12 duplex links) per cassette. At 96 fibers per 1U rack shelf, this configuration matches the density of the most efficient patch-only shelves.

While the pure basics of being able to get access when it is needed in our view justifies integrating TAPs as a best practice, the technical benefits of integrating TAPs go way beyond this. An integrated TAP Patch

System works with all fabric material – single and multi-mode up to 10Gbps specifications, and provides low loss access to the full physical fiber with zero latency introduced. In turn, when paired with the right analysis tools such as Virtual Instrument's NetWisdom or VirtualWisdom, organizations can see everything from bad connection indications at the FCo layer up to individual SCSI transactions in the upper layers, empowering complete SAN optimization.

Differentiation in Integration

With that kind of physical access in place, all it takes is integration with the right analysis and monitoring tools to greatly extend the management and troubleshooting capabilities within an infrastructure. And in this category, the SANInsight TAP Patch Panel System is truly differentiated, as it comes from the same vendor who is behind the considerable reputation and longevity of the only well-recognized SAN instrumentation and monitoring solution around – NetWisdom. NetWisdom and its next-generation instantiation, VirtualWisdom, give companies a sophisticated, distributable management platform that can peer into a SAN running atop a fiber infrastructure and fully analyze application-level interactions across the infrastructure. This allows them to identify problems in real-time, collect trending information, and serve up a comprehensive set of dashboards and reports to improve the monitoring and management for all of the key systems in an enterprise. Over the years, we have time and again encountered a long list of NetWisdom customers. They consistently have concrete evidence that

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NetWisdom helps with their most significant challenges, including:

- Providing instrumentation to ensure optimal infrastructure performance
- Reducing troubleshooting time and effort – as well time to problem resolution – to a fraction of what was required before.
- Providing monitoring and utilization trending that helps lower OPEX and CAPEX costs by enabling strategic planning for optimal infrastructure purchases, both for storage and SAN equipment.

Those capabilities along with massively improved physical access through the SANInsight TAP Patch Panel System add up to cost of ownership impacts that are nothing less than highly significant.

Integrating TAP Patch Panel Systems

Following our best practices, when it comes to putting a TAP Patch Panel System in place, new datacenter buildups or large scale refreshes can make use of TAP Patch components in Virtual Instrument's own shelves. But for nearly any use, including existing physical plants, custom cassettes are available by special order for retrofit installation into existing installed shelves in live environments, where matching the existing cabling design and density is critical to minimizing disruption.

One example: LGX-compatible cassettes for the densest, fully-populated LC-LC 288 4U panels where TAP output is accommodated over jacketed ribbon cables that are broken out separately to LC connectors for monitoring connectivity. For connectivity in less dense panels that have sufficient

available mounting space, retrofit cassettes will simply add additional LC adapters for the TAP outputs.

Using such solutions can enable organizations to pursue our best practice recommendations in any scenario.

Strategic Considerations

As we talk to end users about the potential issues lurking beneath the surface of their fiber networks, and why physical access should be a prioritized pursuit, we consistently find ourselves addressing a number of common questions. Let's explore the most significant of these questions that call out the strategic importance of insight into the fiber foundations of the enterprise. In our mind, every data center architect should consider these questions during the design of the physical cable plant behind their fiber networks.

Q: Why do I need physical access into my cabling infrastructure?

In our view, physical access into fiber cabling plants should be considered nothing short of an industry best practice in order to confirm optimal operations, diagnose root causes, resolve problems and optimize performance within today's complex infrastructures, well beyond the capabilities of sniffers and analysis tools restricted to limited ports of access and the port mirroring capabilities of network devices, especially when unused ports are a rarity in today's dense and highly oversubscribed fabrics.

In the world of high performance fiber, it takes access to ensure that everything is

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operating smoothly. In directly monitored environments, it is common that we see new equipment implementations suffering from misconfigurations and incompatibilities. Undetected, misconfigurations can become entrenched in an environment, and lead to additional equipment purchases or replacements well before they are needed. Even worse, in this critical infrastructure within the enterprise, lack of access may mean you are left without tools to resolve trouble with anything less than disruptive exercises that may well end up as extended, uninformed guesswork to resolve problems. And just as importantly, lack of access leaves you without the tools to understand and plan for the long-term needs of your applications.

Q: Can I afford physical access?

With products like Virtual Instruments TAPs, enterprises can build in access in typical patch panel locations without additional space or power requirements, minimal signal deterioration, and a minimal incremental cost. Moreover, those minimal incremental costs are especially negligible when weighed against the long term cost implications of insufficient access. What are those costs? As we survey the enterprise customers for the issues they are facing in their infrastructure, limited visibility and access is reflected in indirect costs incurred in 3 dimensions.

1. *Lack of access costs you in lost capabilities.* This first shows up in customer's limited ability to extract and validate promised performance from key technology systems. With no ability to see into fabrics, minor misconfigurations may mean that realized performance is much lower than the promised performance customers should be

realizing. This may be a correctable condition, but only if configurations can be altered. In other cases, this may be entirely a matter of false advertising, and having access and the accompanying visibility may provide the customer with a tool to hold the vendor's feet to the fire, and negotiate contractual or new solution remedies. Without visibility, less than promised performance can be common, and leads many customers to add or replace key systems, such as storage arrays, well before they've fully utilized what they bought.

2. *Lack of capabilities costs you in troubleshooting time, effort, and delays.* The second case where costs show up is around limited troubleshooting capabilities. As we've discussed, without physical access, valuable information may not be visible to diagnostic tools, and we've frequently observed cases where troubleshooting effort is exponentially increased because of the difficulty involved in identifying where and how to access a fabric. Moreover, in the worst of cases, such access may require an operational outage. In the best of these worst cases, such an outage is planned, but we have many times heard tales of physical access attempts – unplugged cables, or changed device configurations – accidentally disrupting production systems. When such events happen in highly utilized production environments, they can have significant impact on revenue generating or key supporting platforms.

3. *Lack of access costs you in planning and strategic management.* Third, limited access and the consequent reduced

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visibility into the infrastructure can indirectly create costs in long-term management and planning. Limited visibility can easily leave enterprises without utilization trending data. Without an awareness of infrastructure growth and demand for resources, enterprises will typically overprovision their infrastructure (often by factors of 5 to 10 times), unnecessarily wasting valuable capital and operating costs. With access to the right data, SAN switching expenses can be greatly reduced and lower cost storage can be deployed as instrumentation will enable SAN managers to guarantee their SLAs when using lower cost, lower performance storage.

We believe the on-going costs of underutilization, increased management, and poor infrastructure performance will always exceed the cost of building in physical access and integrated monitoring. For customers examining these costs in greater detail and using the specifics of their own infrastructure, we believe the penalties incurred by lack of physical access to key fabrics will far outweigh the costs of even comprehensive solutions on the market today.

Q: Will physical access compromise the simplicity and efficiency of my cabling infrastructure?

TAPs in the market today, such as Virtual Instrument's TAPs, are low loss and can deliver similar functionality and simplicity when compared to regular cabling plant patch panels that have long been accepted as best practice. In fact, using the TAP Patch

Panel System, the simplicity of integrated and modular TAP and patch panels can actually improve upon legacy patch panels, and allow users to easily upgrade or change connections for small subsets of cables, while preserving physical access. In our view, the strategic use of TAPs throughout key fabrics in the infrastructure is every bit as important a best practice as the use of patch panels.

Q: Where should I tap?

Understanding where to tap, and making sure that TAPs are built into the infrastructure at all the right points, takes an understanding of the applications and systems that are associated with your infrastructure, and should be an exercise that is elevated well beyond where it has been considered in the past; a concern of solely physical layer specialists. With the right multi-disciplinary stakeholders at the table, it is our opinion that accessibility should be looked at as a standard for the enterprise, and should be incorporated in all new system and storage deployments.

Moreover, for existing infrastructure, the possibilities on how to get to this ideal are endless, and we recommend working closely with physical plant partners who also understand data systems. Significant infrastructure evolution is well underway in the enterprise today, with data centers growing to greater scale than ever before. While ideally TAPs should be installed near core directors for more effective access, for organizations adding dense racks of servers or pockets of high performance servers, we can even see opportunities to deploy solutions like the SANInsight TAP Patch Panel System chassis as a top of rack

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patching and TAP panel, along with distributed, rack-integrated monitoring probes. This would integrate TAPs gradually, following a pattern similar to best practices for integrating new fabrics into the enterprise.

Q: What should I tap with?

Look for a TAP solution from a vendor who can also help assess your infrastructure and give you insight on where to tap and how you're going to gain intelligence by leveraging those TAPs alongside a sophisticated set of analysis and management solutions. In this regard, Virtual Instruments is distinctly differentiated as they bring both intelligent software – the only solution on the market truly capable of peering deep into a Fibre Channel SAN – along with a comprehensive set of TAP solutions that can provide physical access anywhere in an infrastructure and within the same efficient footprint that your current cabling plant utilizes.

Taneja Group Opinion

It is clear to us that considering visibility within next generation data centers is more important than ever. In fact, we're confident that neglecting the full consideration of how to peer into the performance behind a consolidated, high performance data center will significantly limit the capabilities of that data center. For the strategic enterprise, those considerations should be top of mind

during any significant data center activity that presents the opportunity to open up a portal into the mission critical fiber networks that make up the real muscle behind enterprise IT.

Moreover, with solutions like Virtual Instruments TAP Patch System on the market, there simply isn't a reasonable excuse to not build access into the infrastructure. The cost is negligible, and dwarfed by the tremendous impact that access can have in the form of extracting maximum infrastructure use, and massively reducing the time and effort involved in troubleshooting as well as the operational and strategic, long term management of that infrastructure. A look around the industry makes it clear that these capabilities are at the very center of IT best practices today. Incident management? Yes, pure visibility delivers massively reduced time and effort. Capacity management? Yes, pure visibility delivers better than the alternative (guesstimates drawn from less insightful tools). Problem management? Yes, pure insight gives you the toolset to optimize away recurrent issues. And the list goes on. In today's service-driven enterprise IT practice, visibility is simply a must have. For organizations realizing this, it is clear that this is a strategic consideration, and that there simply must be long term, intentional planning to better implement access and visibility with each and every IT effort.

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