



## Telecom company deploys VirtualWisdom to monitor its SAN to ensure highest possible data availability

- *Anticipate the peaks and valleys caused by product launches*
- *Avoid or mitigate problems before they cause application slowdowns or outages*

### Overview

This U.S. telecommunications company provides fixed and mobile telephony, broadband and subscription television services, as well as internet services, with tens of millions of customers.

### IT Environment

Their IT department supports three major U.S. data centers, with data warehouses generating heavy I/O workloads. Activities often peak during significant product launches of new mobile phones, when hundreds of thousands of activations occur in a short period of time. IT is considered a strategic advantage and the goal is to continue to push the envelope and to be more leading edge. Product launches are expected to be fully supported with 99.999% availability and no negative impact to response time.

Storage is split between tier 1 and tier 2 arrays, with customer-facing services on tier 1, primarily HDS and EMC enterprise class arrays. Tier 2 storage is based primarily on HP EVA systems. Total online storage exceeds 75 PB and is growing.

Servers mostly run Unix and Linux, but their IT department supports many host operating systems connected to their SAN. The Fibre Channel switches are nearly all director-class devices. The SAN infrastructure is provided by a variety of top tier vendors.

Because this institution considers IT to be a competitive edge, there is pressure to not only maintain superior customer-facing application performance and overall high application availability, but also to deploy the newest technologies quickly. Existing measurement tools and

### Challenges:

- Escalating costs of IT in a hyper-competitive market puts pressure on staff to do more with existing CAPEX and OPEX
- Supporting the I/O peaks and valleys caused by significant product / service launches
- Being alerted to failing components and quickly replacing them before users are impacted

### Solution:

- Virtual Instruments VirtualWisdom software and SANInsight hardware monitoring and professional services consulting

### Customer Benefits:

- Causes of potential application slow-downs identified and corrective action provided before users are even aware of a problem
- Ability to accurately monitor, analyze and optimize I/O in real-time, even in the face of large spikes in I/O
- Reduction in the need to replace suspected bad SAN components because of superior fault diagnosis, which saves on both CAPEX and OPEX



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testing methodologies such as EMC's Ionix ControlCenter and Brocade's DCFM, while critical to many management tasks, were not up to the challenge of optimizing existing applications, improving customer service, and making technology leaps all at the same time.

## Challenges and Concerns

One of the key challenges was in maintaining traditional high service levels in the face of accelerating data growth and huge spikes in I/O load, while keeping costs down. In such a service-oriented business, response time and availability are absolutely critical. Any negative user experiences become front-page news around the world. With a growing number of ports and disk, lack of standardization amongst vendor-supplied tools, and an inability to do predictive problem avoidance, it was becoming a challenge to manage and optimize the SAN. For a select number of business-critical services, increasing data availability and reducing performance issues were the key imperatives. But simply buying more hardware and over-provisioning the infrastructure was becoming cost-prohibitive.

## Solution Evaluation

The IT team was challenged with tight budgets and with getting better performance from existing resources. To do this, senior IT management knew it must be proactive; it had to avoid problems and anticipate issues before users and application owners were affected. The only way to do this without dramatically increasing the staff size was to find some way to proactively automate the monitoring and analysis of the effect of the SAN on application availability. The team put a set of criteria together and specifically looked for:

- A complementary solution to existing vendor-oriented management and monitoring solutions. A reporting mechanism that could take a deeper look than vendor-supplied tools, something at the hardware level to find things that might cause application problems
- Centralized monitoring, to accommodate multiple datacenters
- A predictive analysis tool, something that could alert to issues before they become serious problems that would affect users
- A vendor-neutral solution that would enable them to avoid finger pointing and empower the vendors to offer better advice in a proactive manner

## VirtualWisdom was the Answer

After an initial consulting-only engagement, VirtualWisdom software and SANInsight hardware monitoring were deployed in 2010, eventually supporting over 35,000 fibre channel ports, including over 500 ports connected to the ProbeFC8. Specific Virtual Instruments benefits to the IT team included:

- Improved communications with server team and storage vendors. Customer can send vendors the VirtualWisdom reports and ask for their advice. The vendor and device-independent support of VirtualWisdom virtually eliminates vendor finger pointing
- A non-intrusive monitoring solution with no impact on application hosts
- Problems are identified before they affect application performance or availability
- Storage tiering strategies can now be validated via a neutral third-party solution to help match application requirements with the appropriate tier of storage

*"Guys, I can't tell you how long it's taken us to get a tool in place like this to provide us this level of information, it's exactly what we've needed!"*

SAN Administrator  
U.S. telecom company



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- Quantitative modeling helps eliminate “rules of thumb” capacity and performance planning; provides critical input for future purchasing decisions.
- Faster troubleshooting – incident identification and resolution process was dramatically improved via trend analysis and access to metrics there was simply no other way to see
- Helps enable the IT infrastructure to comply with service level agreements

*“If your suppliers are concerned about your use of 3<sup>rd</sup> party monitoring, then you should be concerned about your suppliers”*

SAN architect

U.S. telecom company

## Troubleshooting the SAN

According to this leading telecommunications service provider, VirtualWisdom has enabled them to more quickly respond to potential performance and availability problems. In many cases, they got an early warning of failing devices and were able to replace them before they completely failed and caused significant problems.

## Application Performance

Ultimately, the storage staff is judged by how effectively they support the application consumers. According to a senior administrator, “reducing the instances of response time problems has probably been the most obvious benefit to deploying VirtualWisdom. Getting fewer trouble tickets is an obvious way to point to a solid ROI for this decision”.

## SAN QuickStart Assessment

In late 2010, VI performed a QuickStart Assessment Service at one of the major datacenters; below are a couple of the key findings.

### Class 3 Discards

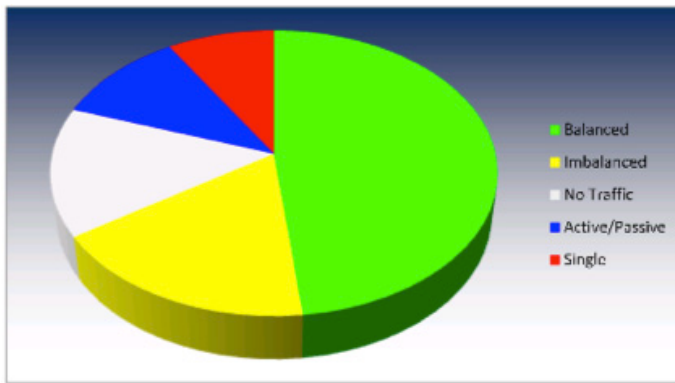
A Class 3 Discard occurs when a switch drops a Fibre Channel frame while providing the Class 3 level of service. The switch notes that it has dropped the frame but no notification is provided to either the initiator or the target. Higher-level functions on the host or storage array are typically designed to overcome the problem of the missing frame. These dropped frames have several side effects. The multiple full exchange requests attempted in order to complete a single problematic data request will cause increased utilization as well as a significant delay in completing the data request. A high volume of Class 3 Discards may also cause a switch to perform a Link Reset, in order to re-negotiate the number of buffer-to-buffer credits it has available. Leaving the root cause of a Class 3 Discard unresolved also leaves the SAN in a state that is more likely to see a significant diminishment of service or an outage caused by compounding root causes. The numbers found were significant and immediate remediation was recommended.

Port	Attached Port WWN	Ch	Link Name	Attached Port Name	Class 3 Discards
12	060b0000228b8	Ch 2	fcd02d02::12	p3tg02_02d02p12	52,012
12	060b0000228b8	Ch 2	fcd01d02::12	p3tg02_01d02p12	52,010
10	5000051eb8860	Ch 2	fcd02d23::1 ISL	02d19:: ISL	50,900
10	5000051eb8820	Ch 2	fcd01d23::1 ISL	d01d19:: ISL	50,772
2	0000051eb74f0	Ch 2	fcd01d21:: ISL	d01d20: ISL	50,722
2	0000051eb8a00	Ch 2	fcd02d21:: ISL	d02d20: ISL	50,613
12	1000051eb8a00	Ch 2	fcd02d21::1 ISL	d02d20: ISL	40,043

*Class 3 Discards table*

## Multipathing

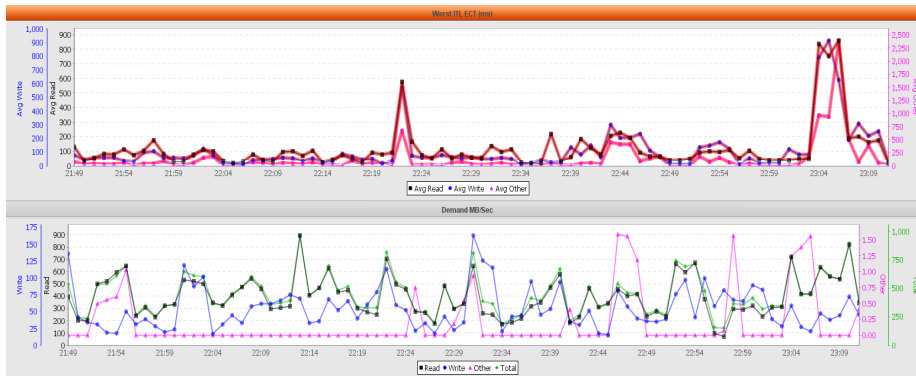
The multipath verification and redundancy analysis showed that 48% of the HBAs were balanced while 18% were Active/Active but not balanced. 11% of the servers were configured as Active/Passive. 10% of the HBAs were found not to have a peer HBA that could be identified. Because there can be a significant performance impact due to servers not working in an Active/Active fashion, VI recommended that the environment should be reviewed to ensure that all servers are performing per their configuration. The HBAs that do not have peers should also be reviewed to ensure they don't require redundancy or are peers themselves. The imbalanced HBAs should be checked to make sure they are all zoned to the same storage array or are behaving as expected.



*Multipathing report graph*

### Performance

During the review period, there were two large spikes in response times. These spikes were further investigated, by looking at the one minute summary on the dashboard to examine long Exchange Completion Times. Both slowdowns only occurred for 3-4 minutes (see graph below), something that other monitoring tools could not find due to their use of averaging metrics. By drilling down further, it was demonstrated that an HBA with a high queue depth setting was impacting the performance of the other hosts. VI's recommendation was to set the queue depths to a lower figure and set an alert on those ITL paths to watch for any problems.



*One-minute granularity – worst ITL ECT*

### HBA Queue Depths



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As mentioned above, queue depths can have a dramatic impact on performance. With Queue depth settings set too high, storage ports can be overrun or congested, you can experience poor application performance and even data corruption. Though there is a queue depth policy in place, several serious violations were found, as evidenced by “Max Pending Exchanges” below.

Probe Name	Link Name	Initiator Name	Max Pending Exchanges
FX02_fab02_R	MX4_5359_13	0x1305	129
FX02_fab02_R	MX4_4974_14	0x1154	125
FX02_fab02_R	MX4_4974_14	DMX_0119_10AB_02	113
FX02_fab02_R	MX4_4974_14	0x1110	57

### Queue Depth Usage

#### Lessons Learned

When asked what the IT team would recommend to new VirtualWisdom customers, the person who uses VirtualWisdom most frequently replied “Take advantage of the collective experience of the VI consultants and of other VI customers. VirtualWisdom generates a lot of metrics and learning quickly to pay attention to the most important ones is critical”.

The company found that most vendors welcomed the additional reports they got from VirtualWisdom. It’s interesting to see which vendors like the idea of a third party monitoring solution like Virtual Instruments. Since the company has a redundant SAN infrastructure, it was easy to add the SANInsight Fibre Channel TAPs (signal splitters) during maintenance windows with no effect on users. Having said that, it would be better to provide TAPs when the initial SAN is deployed, and make it a corporate standard. The cost is small, and the upside is significant.



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