

## VirtualWisdom® Analytics Overview

Today's operations are faced with an increasing dynamic hybrid infrastructure of near infinite scale, new apps appear and disappear on a daily basis, making the challenge of assuring and optimizing infrastructure performance near impossible to do without an IPM platform that provides actionable insights, to find, resolve and optimize performance.

VirtualWisdom's pedigree is rooted in application service assurance, workload and capacity optimization, and problem resolution and avoidance. Our Application-centric Infrastructure Performance Management (IPM) platform collects machine and wire data from the instrumented environment and performs self-learning complex analysis, that removes bottlenecks in the system, accelerates the flow of work in the organization, and leads to better business agility. This makes teams more effective and promotes systems that bring higher value to the business.

For Problem Resolution and Avoidance, our analytics enable you to identify infrastructure issues before they impact application end users. Our Workload & Capacity optimization allows you to understand workload behavior and optimize performance and placement across the life-cycle from Dev/Test to Production. And Application Service Assurance exists to guarantee delivery of the optimal infrastructure to applications. Our approach is to not only manage service levels but assure that performance comes from understanding business behavior and cycles.

With VirtualWisdom Analytics, we've taken the expertise gained from working with hundreds of enterprise clients and built that wisdom right into the platform. We incorporate our troubleshooting and diagnostics with suggested analytics. Specifically, each investigation workflow provides guidance to the analytics that apply to that investigation. The analysis that used to take experts hours or even days is now executed in seconds. Example use cases include:

- Want to verify load balancing across your hosts? Use Balance Finder.
- Need to find out if any deviations from typical workload behavior require attention? Use Event Advisor.

### PROBLEM RESOLUTION & AVOIDANCE

- Event Advisor
- Trend Matcher
- Queue Solver

### WORKLOAD & CAPACITY OPTIMIZATION

- Balance Finder
- VM Coordinator
- VM Deployment Advisor
- Workload Analysis
- Storage Port Balancer

### APPLICATION SERVICE ASSURANCE

- Seasonal Trend

- Want to understand causality between trends? Use Trend Matcher.
- Need to understand the impact of different I/O queue depths across hosts? Use Queue Solver.
- Want to better align virtual workloads to underlying servers? Use VM Coordinator.
- Need to identify the optimal cluster and host to deploy a VM on while maintaining optimal performance and balance? Use VM Deployment Advisor.

## Actionable insights delivered by VirtualWisdom Analytics

Analytics focuses on the critical findings that exist beyond your raw data. The Analytics capabilities are delivered on a subscription basis, specific to the scope and scale of your unique VirtualWisdom implementation. This licensing model provides customers with all the standard analytics for proactive problem resolution and avoidance, workload and capacity management, and application service assurance.

### Problem Resolution & Avoidance

- Event Advisor - Get a prioritized list of potentially interesting events (spikes, relevant performance issues, anomalous behavior, etc.) that require attention, ranked by magnitude and duration.
- Trend Matcher - Accepts a base trend for a target metric, compares it with every device in the database over a specified timeframe then provides a list of matching devices sorted by correlation.
- Queue Solver - Recommends the resetting of an execution (or queue depth) throttle on the HBA card(s) of a specified host which enables you to optimize the read or write response time of that host.

### Workload & Capacity Optimization

- Balance Finder - Checks that the hosts in the environment have functioning path failover by comparing traffic patterns of all the ports associated with a single host to determine whether the multi-pathing software is functioning as intended.
- VM Coordinator - Provides optimal placement for VMs across a cluster and recommends reconfiguration to reduce contention for CPU or memory resources.
- VM Deployment Advisor - Identifies the optimal cluster and host to which to deploy a VM based on available capacity and expected VM workload across CPU, memory, I/O, and network.
- Workload Analysis - collects workload profile data and transfers information from VirtualWisdom to Load DynamiX Enterprise, for building an optimized storage infrastructure.
- Storage Port Balancer - Identifies overloaded storage ports and makes HBA/Host move suggestions that would rebalance the front-end ports of a Fibre Channel storage array.

### Application Service Assurance

- Seasonal Trend - Data informed prediction of resource needs within seasonal business patterns by hour, day, month, quarter or year

Analytics deliver the authoritative insights for the compute, fabric, and storage infrastructure that you need to maintain agility and sustain your competitive edge.

## Problem Resolution & Avoidance

### Event Advisor

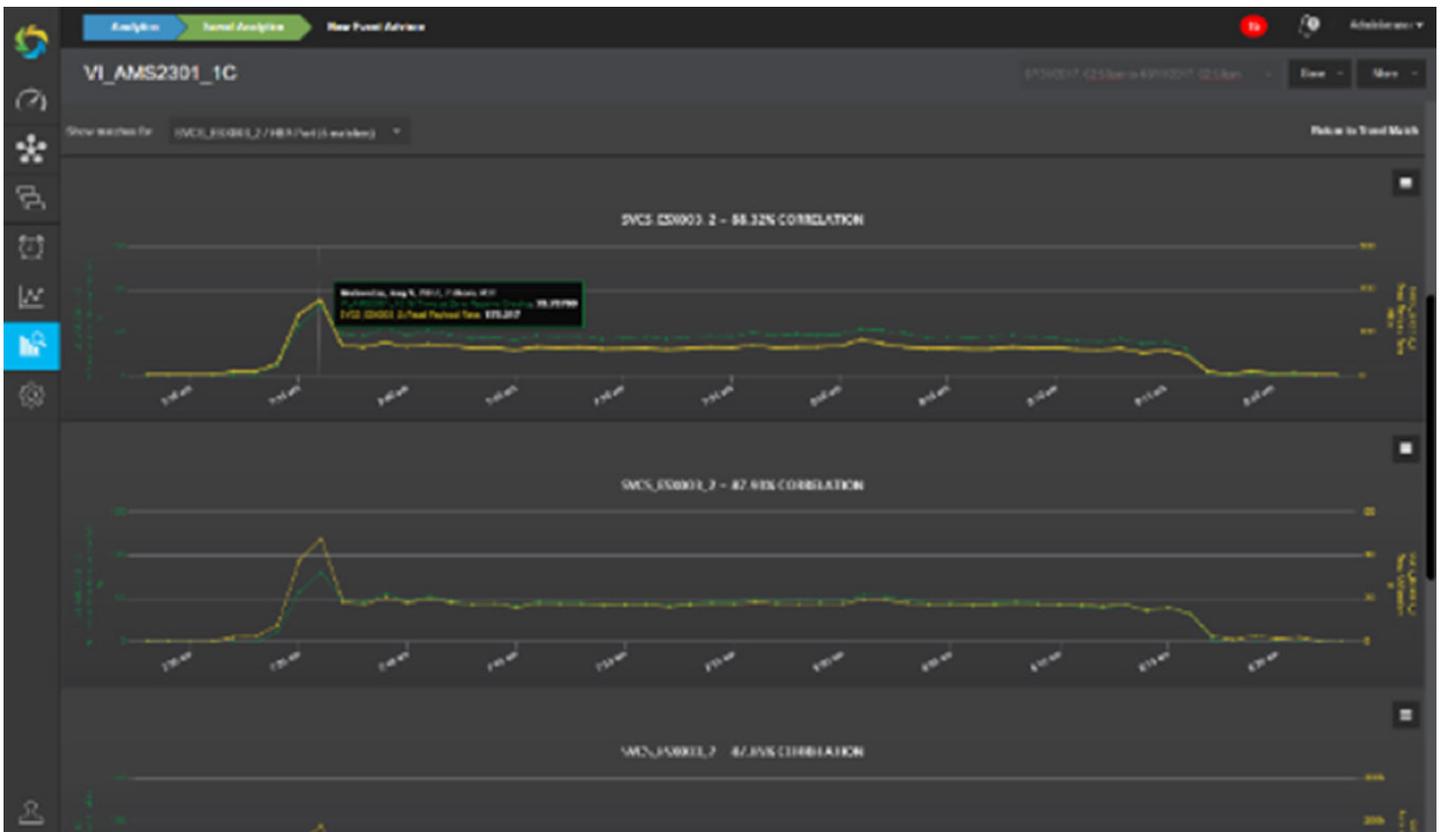
Event Advisor enables you to specify a given metric or set of metrics, and “ask the platform” if there are any trends or events that should be investigated or noted across the entire environment. Simply specify a timeframe and Event Advisor provides a list of potential events, and the associated entities and metrics—all ranked by magnitude and duration. This provides a prioritized list of relevant issues for investigation in seconds, instead of requiring you to look through every device and timeframe manually searching for anomalies.

In most cases, Event Advisor is used in conjunction with Trend Matcher. For example, if you have a mission-critical application entity that appears to be suffering from performance degradation, historically finding the root cause has been a manual, time and resource-intensive process. Instead of searching for the answer, you can ask Event Advisor to look across the environment for any changes in the performance metrics that indicate potential performance impacting events.

## Trend Matcher

Trend Matcher takes a source trend, either identified by the user or by the Event Advisor, compares the trend with every entity in the database for the time-frame specified, and provides a list of suspect entities or devices sorted by correlation, number of metrics, and workloads. This enables the user to immediately identify the probable source of a recognized event, and the other entities that might also be affected.

Trend Matcher works in conjunction with Event Advisor. A common example where these analytics deliver significant value is in the case of slow draining devices. In this case, Event Advisor quickly and automatically identifies areas where buffer credit starvation is happening—which is a primary indicator of a slow drain. Trend Matcher then quickly and accurately identifies the most probable source of the slow draining device—in many cases an unrelated and misbehaving host that cannot keep up with the data it is requesting—resulting in broad performance degradation in the shared environment.



Trend Matcher enables you to identify the probable source of a recognized event and the other entities

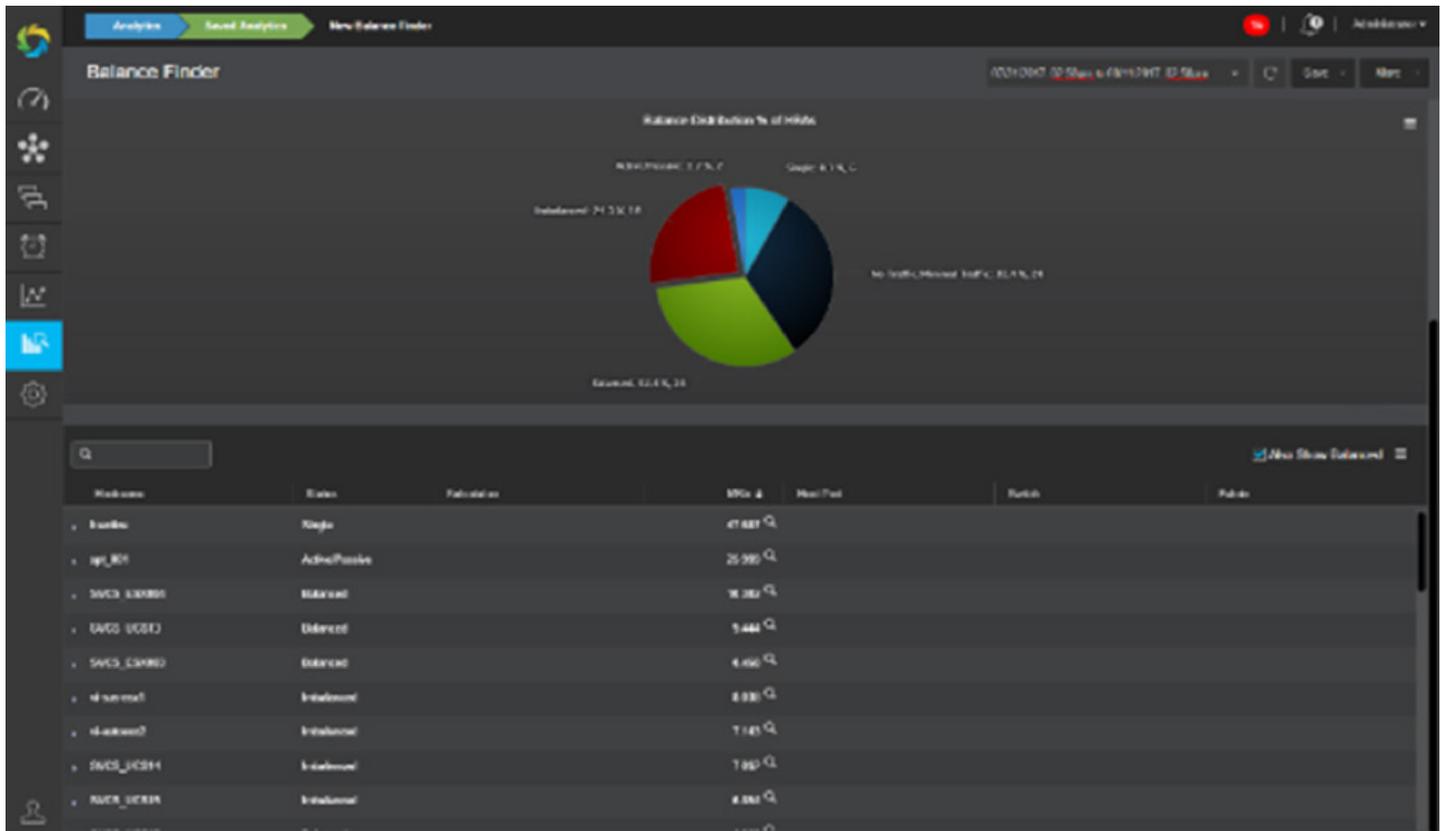
## Workload & Capacity Management

### Balance Finder

Balance Finder actively measures traffic patterns in the environment to determine if they are optimally balanced across host connections. The goal is to make sure that the host workload and the associated traffic are appropriately balanced across the environment. With Balance Finder, the VirtualWisdom platform automatically determines if the environment is balanced or imbalanced, if it is setup for active/ passive connectivity, and tracks indicators of any change in the balance of an environment. This enables the ability to validate available capacity in the event of a path or component failure in the environment—mitigating risk and optimizing resource utilization.

Using Balance Finder, you can generate a balancing report for your entire environment in a matter of seconds. This report provides the percentage of infrastructure that is balanced, imbalanced, active/ passive, and identifies any single points of failure. It also provides this information as a comprehensive list that includes every server, so you can quickly see the balance of workload by server and port.

Finally, from this baseline, the system automatically notifies you of any changes. For example, if some servers were balanced in the past but are currently imbalanced, perhaps from a change in workload, both the prior and current state are presented in the user interface. Additionally, you can instantly see a trend chart for any HBA to understand when the risk was introduced into the environment.



Balance Finder balances the host workload across the environment

The very essence of Balance Finder is to very quickly give you visibility into areas of risk, and opportunities for optimization, and to alert you to changes that require immediate attention—so that you can take action and ensure you won't have any issues over time.

## VM Coordinator

VM Coordinator provides accurate guidance on the optimal placement of virtual machines across clusters before degradation occurs, and helps eliminate over-provisioning and unnecessary rebalancing.

VM Coordinator examines historical resource usage for every VM host across the estate and determines how best to organize the environment. The analytic presents performance improvement projections for every forecast it makes, as well as providing a script that can deliver the migrations. This delivers an experience that aligns virtualized workloads to infrastructure assets with higher fidelity than what is currently available.

**Recommendation for analyzed hosts** 9 Based on 965 iterations (100% completion) and the analysis of 9 ACTIVE servers and 76 ACTIVE VMs we recommend to reconfigure 9 VMs

VMs to be Moved	From ↓	To
vi-SVCS-VW4-VM003_4.2.2_snap	vi-svcs-ucs14.vi.local	vi-prd-esx1.vi.local
vi-SVCS-VW4-VM021_4.2.1	vi-svcs-ucs12.vi.local	vi-prd-esx5.vi.local
vi-SVCS-VW4-VM039	vi-svcs-ucs12.vi.local	vi-prd-esx1.vi.local
vi-SVCS-VM201	vi-svcs-ucs11.vi.local	vi-prd-esx1.vi.local
vi-SVCS-VM016	vi-svcs-ucs11.vi.local	vi-prd-esx2.vi.local
pa42-trfc01	vi-prd-esx5.vi.local	vi-prd-esx4.vi.local

**Projected Group Changes for analyzed hosts**  
 Group CPU Congestion: -14.7%    Group Memory Congestion: -6.6%    Group Disk Usage: -2.1%    Group Network Usage: 0%

**Projected Changes per Host**

Name ↑	CPU Max		CPU Typical		Memory Max		Memory Typical	
	Current	Projected	Current	Projected	Current	Projected	Current	Projected
vi-prd-esx1.vi.local	16.83%	26.67%	8.31%	19.29%	24.82%	87.24%	17.01%	80.07%
vi-prd-esx2.vi.local	23.56%	16.86%	7.32%	9.8%	76.88%	88.2%	73.88%	82.32%
vi-prd-esx4.vi.local	2.37%	2.38%	2.37%	2.38%	65.91%	70.76%	65.68%	70.54%
vi-prd-esx5.vi.local	17.02%	13.45%	14.47%	11.22%	91.5%	65.92%	91.1%	65.51%
vi-svcs-ucs11.vi.local	52.33%	39.4%	33.49%	29.33%	91.86%	88.1%	84.03%	79.03%
vi-svcs-ucs12.vi.local	22.61%	19.88%	13.02%	17.05%	92.69%	88.68%	92.25%	88.12%
vi-svcs-ucs14.vi.local	53.91%	44.41%	35.6%	25.04%	92.32%	78.79%	91.97%	77.54%

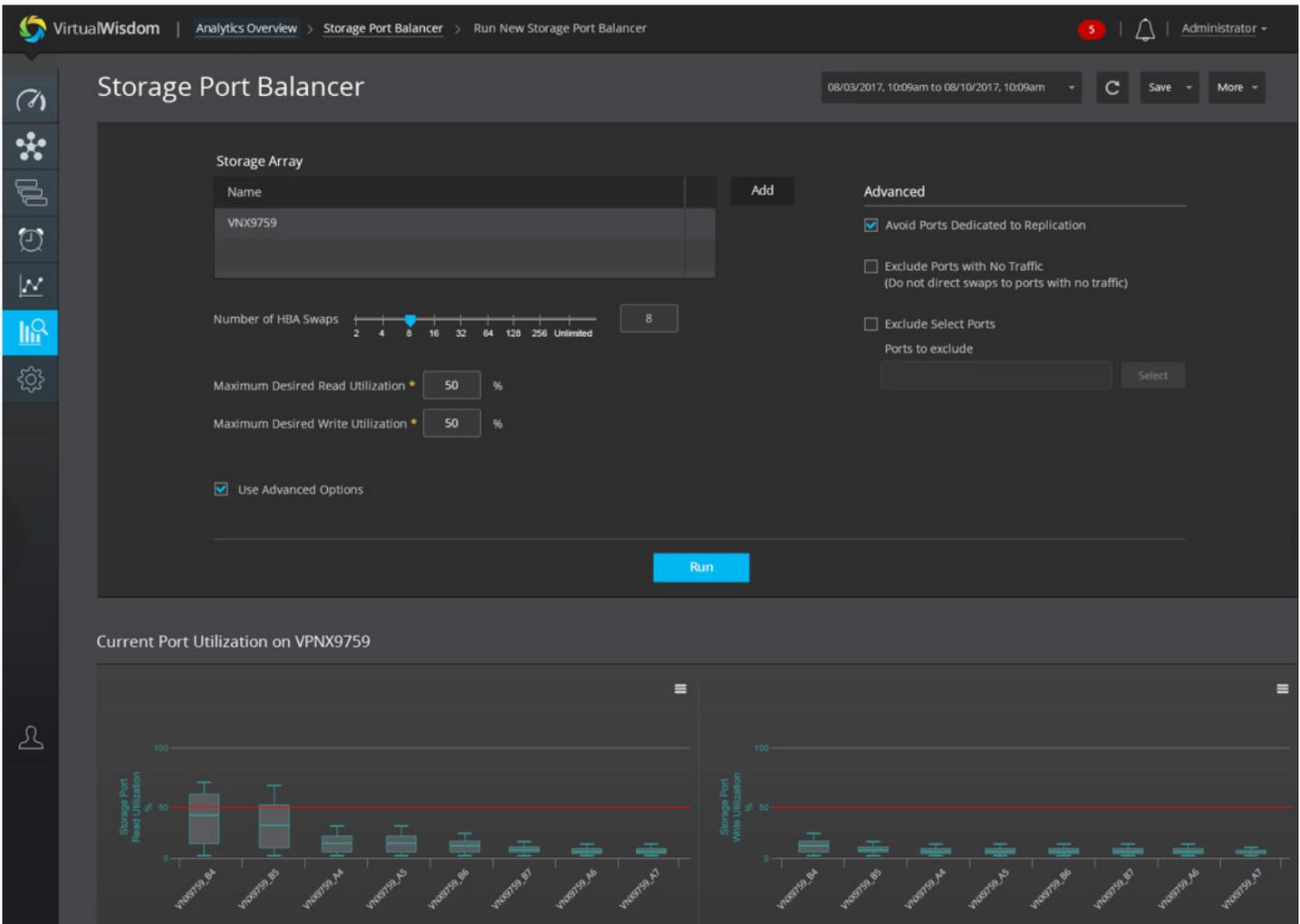
VM Coordinator finds which ESX, Hyper-V, or PowerVM hosts are overbooked. Above, VM Coordinator recommends VMs to move, and projects the new balances after the projected move.

### VM Deployment Advisor

This analytic works in conjunction with the VM Coordinator and identifies the optimal cluster and host to deploy a VM, based on available capacity and expected VM workload across CPU, Memory, I/O and Network. VM Deployment Advisor finds which ESX, Hyper-V, or PowerVM hosts are overloaded. If overloaded, you then run VM Coordinator to rebalance the workload.

### Storage Port Balancer

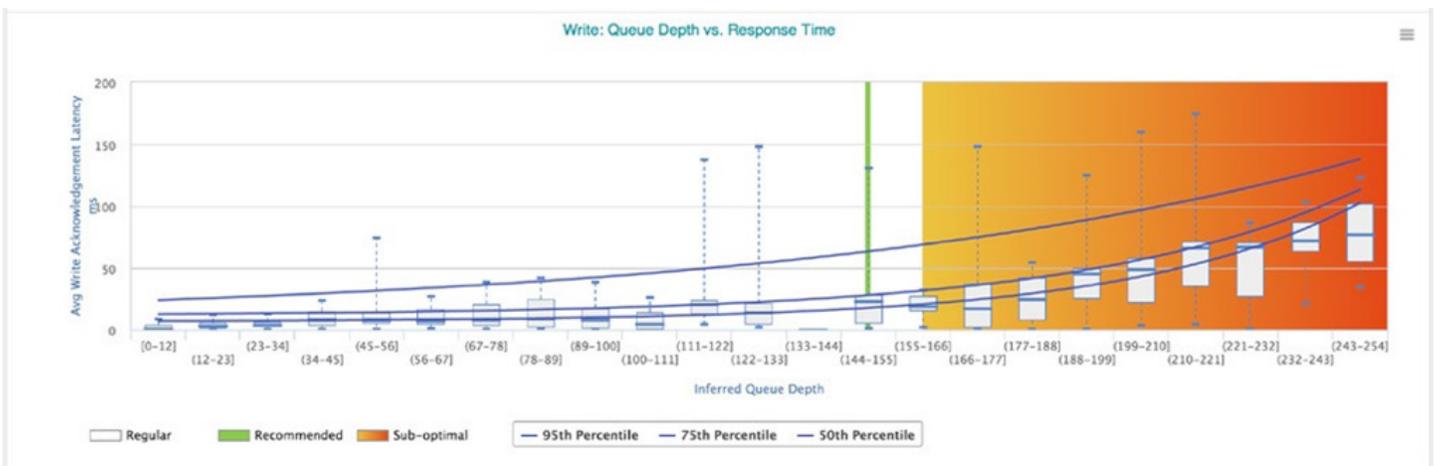
Storage Port Balancer resolves under or over-utilized storage ports on the arrays. It determines utilization, then with user-defined thresholds, analyzes each host for its usage, and recommends rebalancing on the same fabric, within a single array (at a time). It's not unusual for average port utilization to be in the 3% range, with some small number of ports at or near 100%. This analytic can avoid expensive over-provisioning of ports and performance bottlenecks at the same time.



Storage Port Balancer recommends moves to balance the system based on usage. Here, we can see that the B4 and B5 ports are much more heavily utilized for reads than the other 6 ports in the system. So there is definitely an opportunity to improve this system by rebalancing the workload.

## Queue Solver

Queue Solver examines actual historical host configuration settings (HBA queue depths) and performance data to provide detailed recommendations to optimize the system-wide performance. This allows you to establish server configuration settings based on application-specific historical data instead of guesses or rules of thumb. The Queue Solver analytic can be used to build and tune server configuration standards over time.

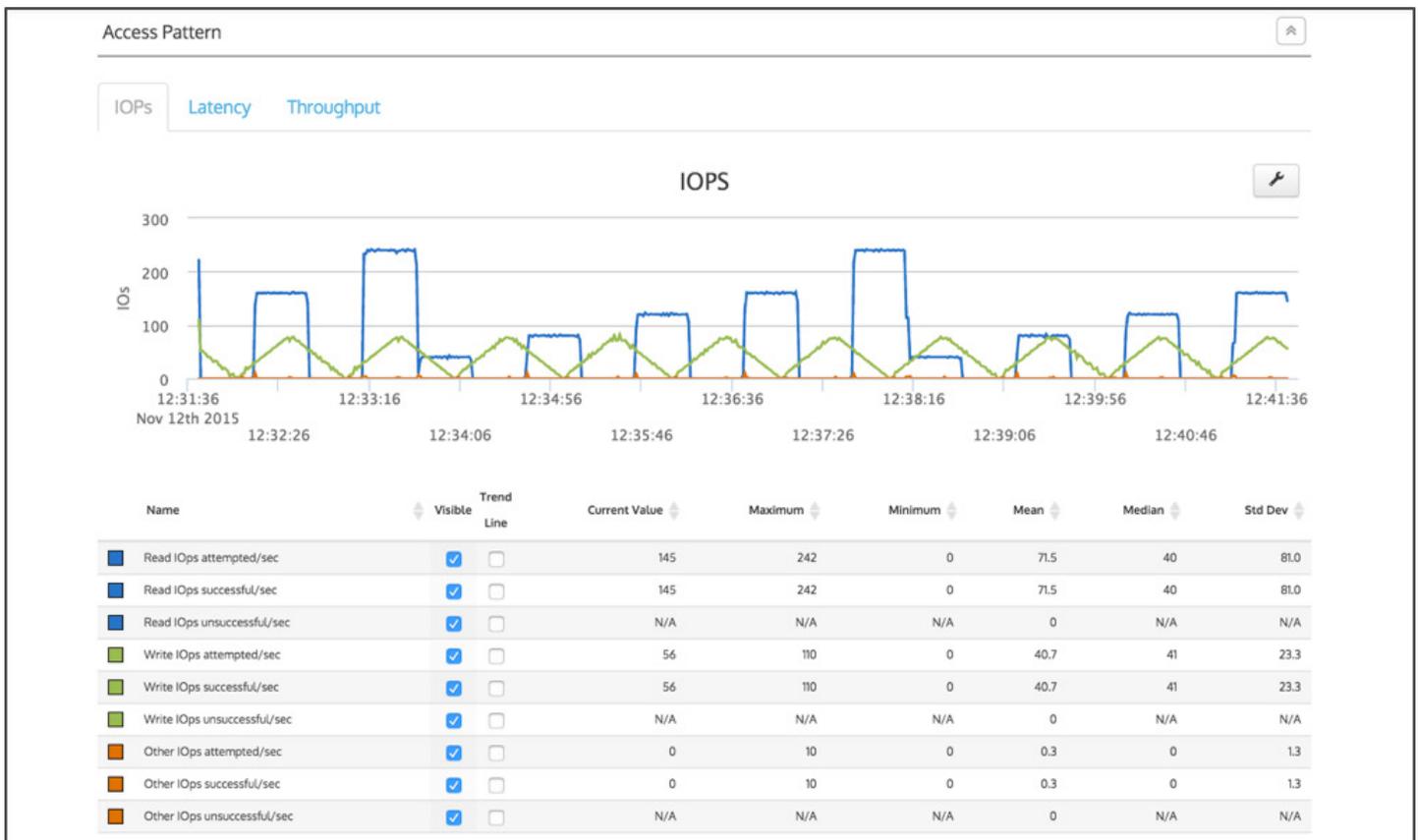


Queue Solver, showing optional white background, enables you to quickly identify the queue depth setting that optimizes performance

## Workload Analysis

Workload Analysis collects and transfers production workload I/O profile modeling data to Load DynamiX Enterprise, enabling the most hyper-realistic storage testing and validation possible today. It enables you to visualize and understand workload behavior. Simple to deploy and configure, the Workload Analyzer module of Load DynamiX Enterprise presents a dynamic analysis and clustering of workload I/O behavior across time and locality, offering a powerful real-time or offline visualization and analytics solution that helps storage professionals:

- Make better purchase and deployment decisions via simplified storage performance planning
- Avoid many performance related issues
- Resolve problems fast



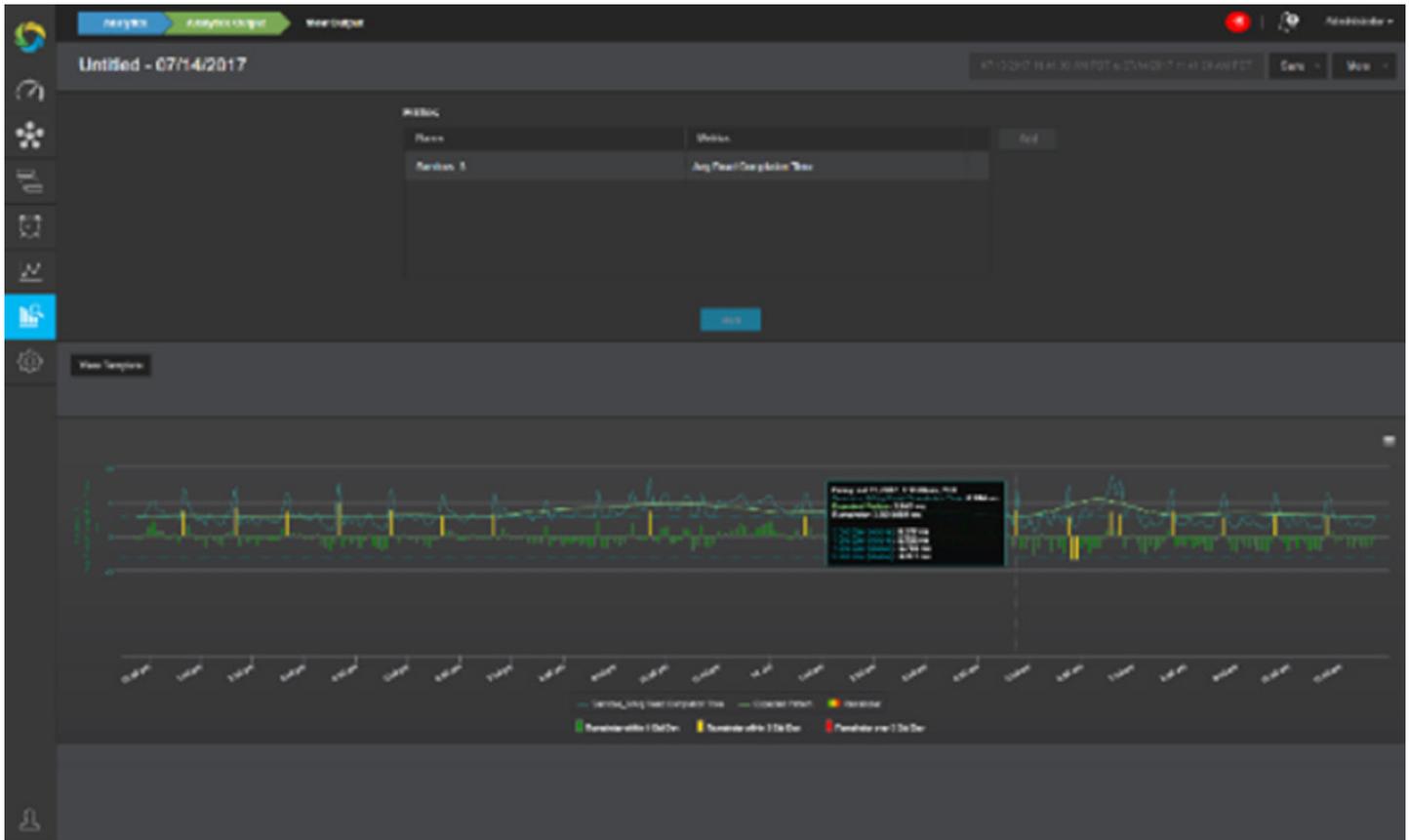
Workload Analysis collects and transfers production workload modeling data to Load DynamiX Enterprise

## APPLICATION SERVICE ASSURANCE

### Seasonal Trend

Setting thresholds and alarming is too cumbersome to manually do. This important analytic learns from “seasonal” business patterns—whether a season is hourly, daily, weekly, monthly, quarterly, yearly, etc. Or from business behavior, like nightly backups, end-of-month closing, or quarterly activities. With it, customers can set multivariate thresholds, and make tuning adjustments on-the fly via data-informed prediction of resource needs. Included is the ability to set alarms or thresholds by tier, by the importance of the application to the business. Its primary benefit is that it detects variances above or below established thresholds, based on the seasonality of business workloads.

Seasonal Trend Advisor identifies all periodic trends, and builds an observed versus expected overlay model so that it can monitor and alarm normal/expected workload states if they go beyond specified standards of deviation. It can run against any and all metrics in the VirtualWisdom platform, such as I/Os per second, MBs per second, CPU Utilization for ESX, etc.



Seasonal Trend Advisor vastly improves the validity of alerts by taking business patterns into account for thresholds

Performance degradation problems caused by host configuration issues are both very common and can be extremely difficult to troubleshoot because the system is not in an errored state. This analytic can be used in conjunction with Event Advisor and Trend Matcher to not only identify the problem, but provide detailed recommendations on how to optimize the system-wide performance.

### Environment-Specific Subscription Model

VirtualWisdom Analytics are available via an annual subscription model. This licensing model provides customers with all the standard analytics mentioned. This approach ensures customers

have immediate access to any enhancements made in the existing analytics, as well as a seamless method for licensing additional analytics as they become available.

The pricing for the analytics subscription is based specifically on your existing VirtualWisdom deployment. This ensures that you get exactly what you need for exactly what you have deployed, based on your unique VirtualWisdom environment.



**Sales**  
[sales@virtualinstruments.com](mailto:sales@virtualinstruments.com)  
 1.888.522.2557

**Training**  
[training@virtualinstruments.com](mailto:training@virtualinstruments.com)

**Website**  
[virtualinstruments.com](http://virtualinstruments.com)