



ProphetStor DiskProphet*: AI for Hardware Failure Predictions and Resource Monitoring

ProphetStor DiskProphet uses patented AI technology to make long-range predictions about upcoming disk failures with up to more than 95 percent accuracy, enabling organizations to preserve high-value services.¹



Executive Summary

Competitive pressures are driving organizations to improve the performance and reliability of their data centers while also lowering the total cost of ownership (TCO) of their existing hardware resources. As a result, IT managers often look for inefficiencies that can be eliminated as a way to improve service and lower costs.

One source of inefficiency that has largely remained unexplored before now relates to disk failures. Disk failures normally occur without any warning, and when they do occur, they can result in a significant drop in performance and threaten service-level agreements (SLAs). This performance drop accompanies the rebuilding phase immediately after a faulty disk is replaced.

In addition, with the industry shift toward the faster storage medium of solid state drives (SSDs), the very nature of the threat of disk failure is changing. Data from failed SSDs cannot be recovered, as it can often be with hard-disk drives (HDDs). Organizations that are adopting SSD storage must therefore compensate for this difference with additional precautionary measures just to retain the same level of risk for data loss as before.

ProphetStor DiskProphet* addresses these problems by using artificial intelligence (AI) to accurately predict disk failures long before they occur. With weeks of advance warning before a disk's failure, IT staff can replace the disk before it fails in a way that reduces disruption, minimizing any performance impact. Being able to replace disks before they fail removes potential threats to performance SLAs, and as an added benefit, it provides an additional buffer of protection against the threat of data loss.

ProphetStor DiskProphet integrates into a VMware vSphere* environment and reads Self-Monitoring, Analysis, and Reporting Technology (SMART) data from VMware vSAN ReadyNode* storage nodes. DiskProphet and vSAN ReadyNode hardware both provide excellent performance when powered by Intel® Xeon® Scalable processors, together ensuring that organizations are well-positioned with their hardware investments for years to come. The latest Intel Xeon Scalable processors provide a step up in power compared to previous generations of Intel® Xeon® processors, and these new processors are especially well-suited to AI and predictive analytics, driving high performance and predictive accuracy.

ProphetStor DiskProphet* Uses AI to Improve Efficiency in the Data Center

Customers today insist that businesses deliver any information-based services both at a high level of performance and at a low cost. To meet these challenging standards, many organizations often seek to increase efficiencies within their data centers so that they can improve service and pass cost savings along to customers.

Disk Failures Degrade Performance

Inefficiencies surrounding disk failures in the data center provide one untapped area in which to improve performance, lower costs, and increase returns on infrastructure investments. Currently, when a disk fails, the data must be rebuilt, and write performance can degrade 25–75 percent during this rebuilding phase. This period of performance degradation often lasts about 10 hours and can put compliance to existing SLAs at risk, as illustrated in Figure 1.²

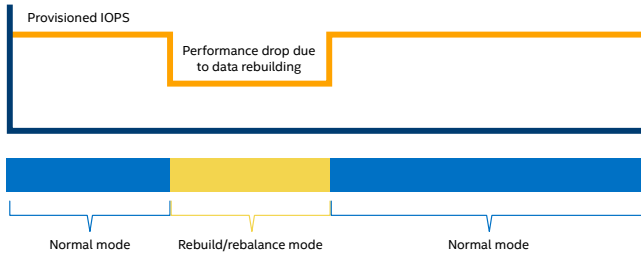


Figure 1. Performance slows during the data rebuilding phase

Beyond this problem, many IT organizations currently lack the ability to:

- Easily identify the status of physical drives
- Identify the ideal times to add, remove, or redeploy physical drives
- Predict overload conditions

Data Center Storage Management, with Added Efficiency through AI

ProphetStor DiskProphet is an application and AI engine that monitors disk performance, trends, and vital signs with SMART data. DiskProphet then uses that SMART data to predict performance degradation and identify disk failures before they occur with a high degree of accuracy.

Maintaining Performance SLAs through Disk-Replacement Plans

Organizations can use DiskProphet to help avoid periods of performance degradation that could threaten SLAs.

DiskProphet uses patented AI technology to provide a disk-replacement plan that is based on predicting a disk's failure as many as 45 days in advance. The disk-replacement plan also recommends the best day and time to replace a drive when it is nearing failure, corresponding to a period of low predicted input/output operations per second (IOPS). In this way, DiskProphet helps minimize the performance impact of a disk's end of lifespan, as illustrated in Figure 2.

DiskProphet supports industry storage standards, monitoring usage trends and metadata for Serial ATA (SATA), Serial Attached Small Computer System Interface (SAS), and NVM Express* (NVMe*) drives, and both HDDs and SSDs, helping ensure a consistent experience for customers.

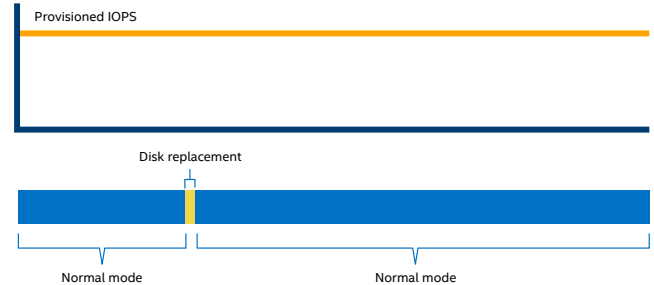


Figure 2. Performance degradation is minimized when a disk is replaced before a failure occurs

Resource Monitoring for VMware vSAN*

DiskProphet monitors more than disks. DiskProphet is a comprehensive monitoring hub that collects data from a VMware vSAN* environment, performs predictive analysis, and displays dynamic streaming data about many vSAN resources. DiskProphet provides many graphical dashboards for viewing current, historical, and predictive states of the main resources in a VMware vSAN environment, including all physical hosts, virtual machines (VMs), physical disks, the CPU, the memory, and the network. A REST API allows more fine-grained querying of results by data centers, hosts, racks, vendors, or other entities.

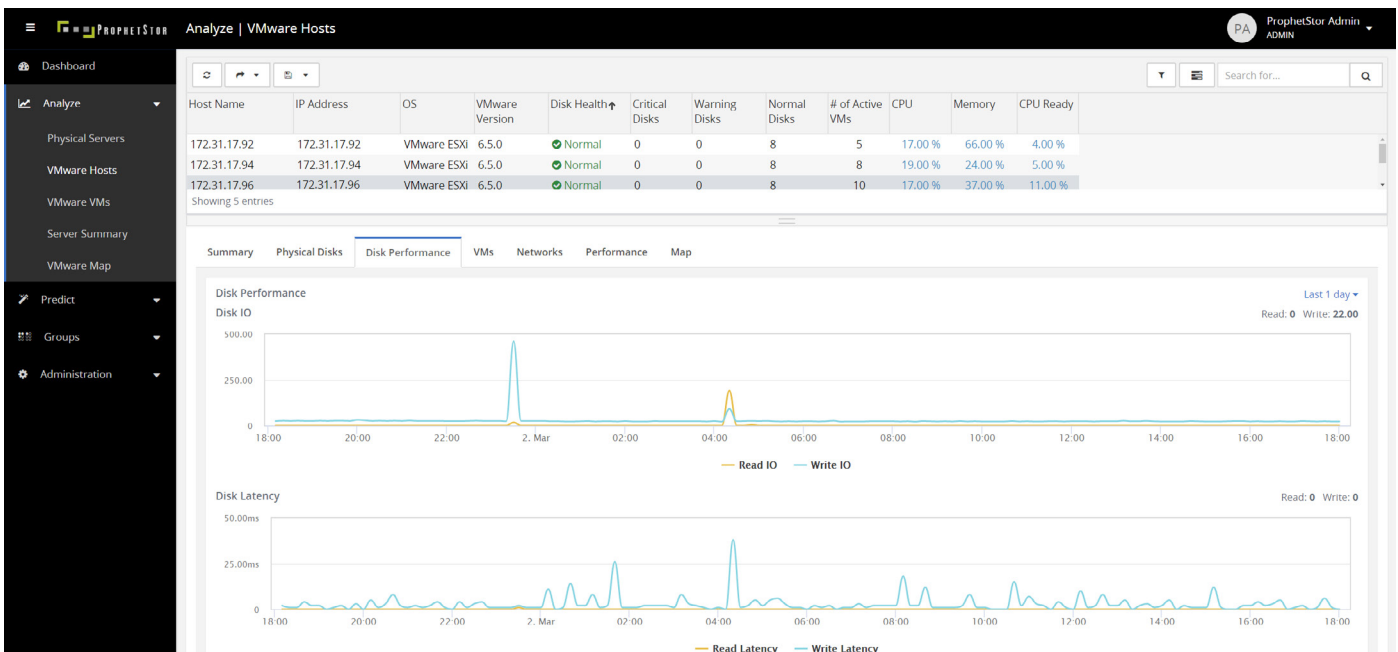


Figure 3. ProphetStor DiskProphet* monitors performance of the main resources in a VMware vSAN* environment

Figure 3 shows a DiskProphet view of VMware hosts (physical servers) in the vSAN environment, along with current and historical resource-usage statistics.

Predictive Analytics to Forecast Future Performance

DiskProphet draws upon its AI engine to make predictions about the future performance of hardware resources. Built-in machine learning models enable these predictions with up to more than 95 percent accuracy from data collected from VMware vCenter*, VMware ESXi* hosts, and Intel® architecture-based server infrastructure.¹ When a hardware error or resource conflict is predicted to occur, DiskProphet delivers notifications to administrators through Short Message Service (SMS) or e-mail.

Figure 4 shows one view of disk failure predictions in the DiskProphet interface.

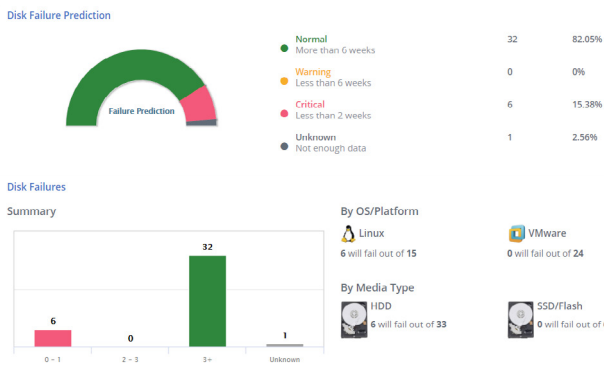


Figure 4. A predictive view of disks' lifespans with ProphetStor DiskProphet*

Figures 5 and 6 show other views that display historical CPU and memory utilization for a VM, respectively,

along with a prediction about utilization for that VM for the following days. The view of resources can be changed to show similar predictions for disk resources for either VMs or physical hosts.

DiskProphet* Integrates into a VMware vSphere* Environment

Developed in a microservices model, DiskProphet is a containerized application that is easy to deploy and scale in a vSphere environment, whether on physical machines or in VMs, and regardless of the size or design of the network.

DiskProphet includes two main components, hosted either in one or two VMs. The ProphetStor* server provides the dashboard, engine, and database. The ProphetStor data collector reads SMART data from vSAN components and communicates these findings to both VMware vCenter and to the ProphetStor server. Figure 7 illustrates how DiskProphet works directly with both vCenter and storage disks to provide its AI-driven services.

Intel® Xeon® Scalable Processors Offer Excellent Performance and Capabilities for DiskProphet*

Intel Xeon Scalable processors provide an evolutionary leap in agility and scalability for the modern data center. From the new Intel® Mesh Architecture and a higher core density to newly integrated, hardware-accelerating and offloading technologies, Intel Xeon Scalable processors enable new breakthrough levels of capabilities and performance for today's software-defined data center infrastructure.

Intel Xeon Scalable processors include a new design that accelerates analytics and AI. For example, Intel® Advanced Vector Extensions 512 (Intel® AVX-512), built into Intel Xeon Scalable processors, has been developed to directly benefit computationally intensive workloads like AI.³ And with a

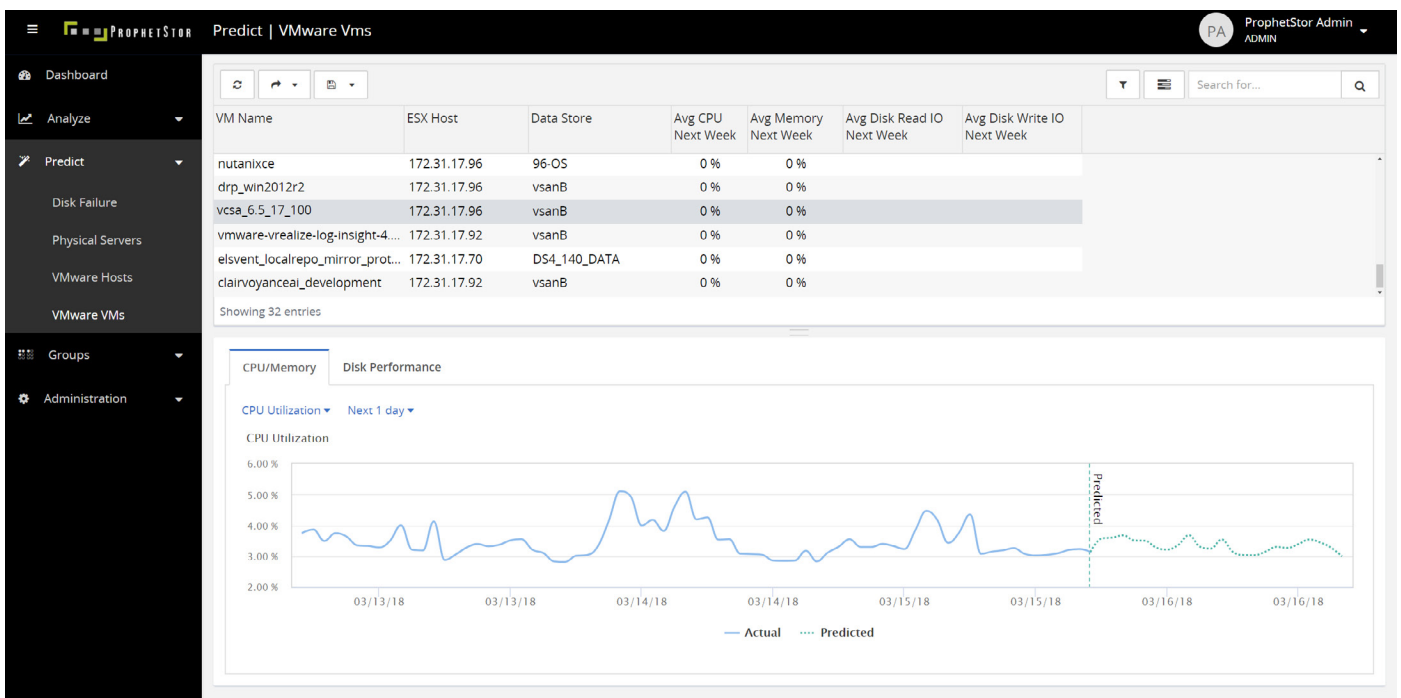


Figure 5. A predictive view of CPU utilization in a VMware vSAN* environment using ProphetStor DiskProphet*

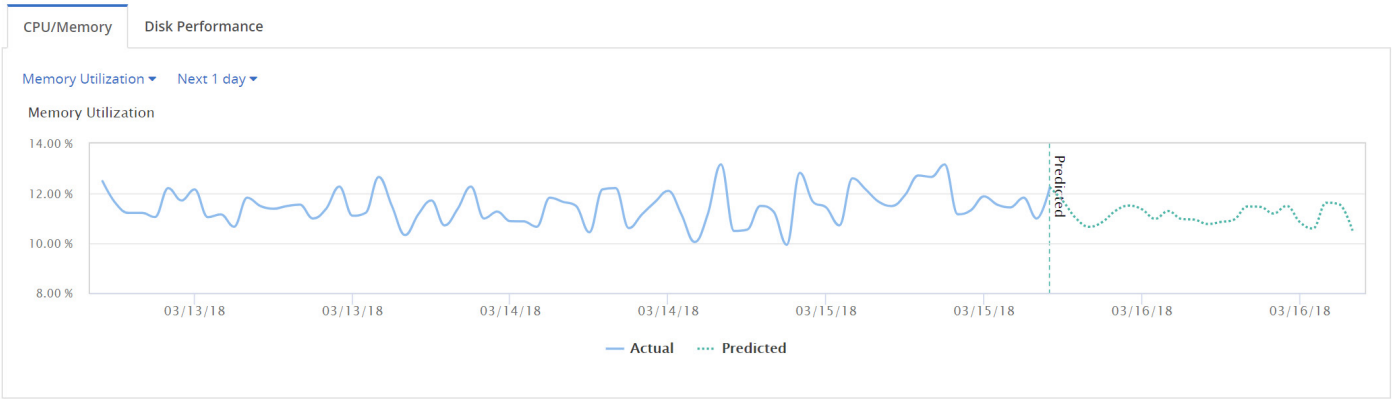


Figure 6. A predictive view of memory utilization in a VMware vSAN* environment using ProphetStor DiskProphet*

greater number of cores and increased memory capacity compared to previous-generation Intel Xeon processors, Intel Xeon Scalable processors—particularly Intel® Xeon® Platinum processor and Intel® Xeon® Gold processors—provide a more scalable, agile, and efficient platform, with increased security features for all enterprise use cases.

Intel Xeon Scalable processors provide a solid foundation for DiskProphet, with excellent levels of performance that will provide headroom for workloads to grow for many years into the future. In addition, for companies that have invested in highly performing infrastructure components, such as Intel Xeon Scalable processors, Intel® SSDs for the data center, or Intel® Optane™ technology, removing any external obstacles to high performance is critical to maximizing return on investment (ROI). Intel SSDs for the data center, such as the Intel SSD DC P4500 Series or the Intel® Optane™ SSD DC P4800X Series, are optimized for performance, reliability, and endurance, and they can help modernize data center storage infrastructures. ProphetStor DiskProphet enables an organization to protect its investments by helping avoid hardware-failure scenarios that weaken competitive advantage and threaten performance SLAs.

Meet Performance SLAs for Years to Come with ProphetStor DiskProphet* and Intel Xeon Scalable Processors

Innovations in storage technologies, such as Intel SSDs with NVMe and Intel® Optane™ SSDs, are continuing to increase in availability. As the adoption of these new technologies drives higher performance in storage, it becomes more important than ever for organizations to protect their investments by preventing any problems that could degrade that higher expected level of performance. Furthermore, with the industry shift toward SSDs, the threat profile of disk failure has changed, requiring additional strategies to avoid such failures.

DiskProphet helps maintain high performance and prevent data loss in the data center through its patented AI engine, which enables disk failure predictions with weeks of advance notice, and with an accuracy rate that grows to more than 95 percent within a two-week window.¹ When IT staff is alerted to disk failures and is also notified of an ideal replacement time, it can minimize the performance degradation that normally accompanies such failures and that often threatens SLA benchmarks.

Another reason the AI innovation delivered through ProphetStor DiskProphet is especially needed for today's IT infrastructure is that the nature of disk failure itself is changing. The compelling performance advantages offered by SSDs are driving an industry-wide shift in the data center away from HDDs and toward flash storage media. But unlike HDDs, data on failed SSDs cannot be recovered. Consequently, data centers must strategize to avoid catastrophic disk failures at all costs. ProphetStor DiskProphet offsets this new threat by providing a reliable way to make such catastrophic failures more unlikely than ever.

The adoption of ultra-fast SSDs is moving performance bottlenecks away from storage subsystems, which in turn requires upgrades in other network components such as CPUs in order to meet that same high level of performance. Intel Xeon Scalable processors are optimized for analytics and offer a high-performing hardware configuration and roadmap for DiskProphet, enabling a foundation for excellent performance for years to come. And beyond offering these advantages in today's Intel Xeon Scalable processors, Intel will continue to develop additional features and capabilities for the platform that will provide even more benefits to DiskProphet and similar workloads in the future.

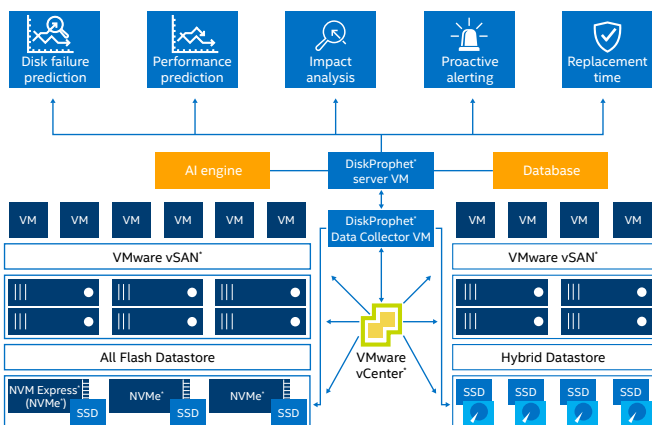


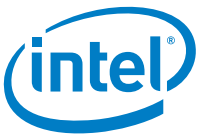
Figure 7. ProphetStor DiskProphet* provides its services based on SMART data collected from devices in a VMware vSphere* environment

Learn More

Intel Xeon Scalable processors: intel.com/xeonscalable

Intel® Builders: <http://builders.intel.com>. Follow us on Twitter: [#IntelBuilders](https://twitter.com/IntelBuilders)

ProphetStor DiskProphet: prophetstor.com/insight-analytics-and-prescriptive



¹ ProphetStor. "FAQ: ProphetStor DiskProphet™." prophetstor.com/faq-diskprophet/. 95 percent refers to the level of accuracy over the next 14 days.

² Based on testing performed by ProphetStor. Testing simulated disk-group failure triggered by stopping one VMware vSAN* node in a four-node cluster. vSAN Settings: all flash, failure to tolerate (FTT)=1, RAID5/6, vSAN datastore = 20 TB.

³ Intel® Advanced Vector Extensions (Intel® AVX) provides higher throughput to certain processor operations. Due to varying processor power characteristics, utilizing AVX instructions may cause a) some parts to operate at less than the rated frequency and b) some parts with Intel® Turbo Boost Technology 2.0 to not achieve any or maximum turbo frequencies. Performance varies depending on hardware, software, and system configuration, and you can learn more at intel.com/go/turbo.

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