



CLOUDPHYSICS

WHITE PAPER

CloudPhysics Technology Overview

A New Approach

In today's world of software-defined datacenters, infrastructure is increasingly complex and change is constant. The potential for change-related risk to applications is greater than ever before. In spite of the abundance of tools available, IT administrators lack the ability – and time – to study all the known or unknown configuration issues in their vSphere infrastructure. They struggle to understand whether changes – intended or accidental – result in smoldering performance and availability issues waiting to ignite.

Further, when things go wrong, there's an inability to replay the changes over time to correlate events or trends that caused the current problem. This creates a significant drag on administrator effectiveness especially as they are thrown into firefighting mode to minimize the impact of unexpected application disruption and related costs.

The goal of CloudPhysics is to provide organizations with an analytics-driven approach to managing infrastructure that enables administrators to preempt emerging hazards and gives them the confidence to act boldly to reduce risk and waste in their vSphere environments.

Traditional IT Ops Mgt Tools	Analytics-Driven IT Ops Mgt Tools
<ul style="list-style-type: none">• Reactive• Monitoring-centric• Fragmented view• Alerts after the fact• Triggered by disruptions	<ul style="list-style-type: none">• Preemptive• Signal-centric• Contextual view• Early warning system• Triggered by analysis

Limitations of Today's Traditional IT Operations Management Tools

Today's IT Operations Management tools focus on a limited timeframe: the present. This forces IT organization processes built around such tools to become reactive. These tools collect vast amount of data, with limited context, creating a high degree of noise that distorts or muffles the true signal. Further, interpretation of this data is open ended, leaving all the real work to the IT teams, who generally rely on tribal knowledge and guesswork to unravel the issue: What do we infer from the data? Is there a problem? What is the problem?

Given the nature of traditional tools, discovery requires administrators to engage in ad hoc firefighting efforts in which they painstakingly pull, collate and correlate data from different layers, including across multiple vCenters, to assess the problem and make operational decisions. Clearly this does not translate to improvements in admin productivity or technical and business agility nor does it improve the admin-to-server ratio and OpEx efficiency.

Advantages of an Analytics-Driven Approach

On the other hand, processes designed around analytics solve these shortcomings. Analytics are not bound to the immediate present, rather stretch from the past and into the future allowing IT administrators to be deliberate and proactive. Analytics add structured context to

routine activities as well as planning projects, leading to less work to create interpretations and decisions from the data. IT analytics tools provide rich noise reduction to reach the signal and do so on a reusable basis resulting in continuous improvements.

CloudPhysics is leading this paradigm shift from reactive monitoring towards proactive and predictive analytics.

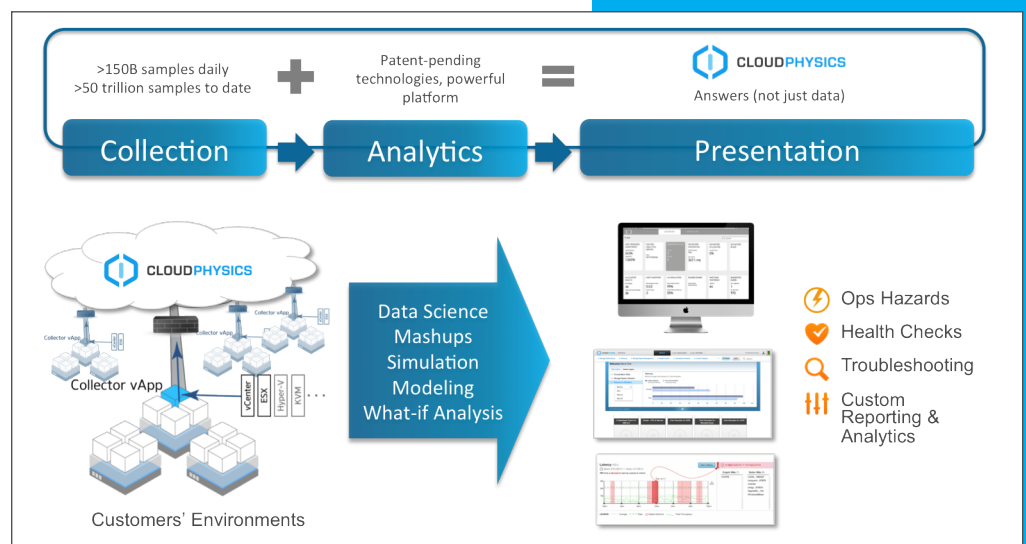
Monitoring Tools	CloudPhysics
Reactive	Proactive and preemptive
Report Symptoms	Reports the underlying issue that causes the symptoms
Focused on the present state	Reports past trends and lets you simulate the future
Produce many false positives	By reporting the underlying issue produces fewer or no false positives
Don't resolve problems or identify the cause	Help you to resolve problems and prevent monitoring tools from firing again
Inability to understand impact of change	Enables exploration of historical changes over time and simulation of impact of change

Leveraging this analytics-driven approach, CloudPhysics provides unprecedented visibility into the configuration and performance of VMs, storage and compute devices, allowing administrators to solve key performance, capacity and planning use cases more accurately and effectively than traditional monitoring tools. Further, because it is software as a service (SaaS), CloudPhysics offers cost and agility advantages compared to traditional management tools, all of which require on-premise deployment and maintenance by the IT team.

SaaS-based CloudPhysics collects, transforms, and analyzes your operational metadata to deliver actionable insights for reducing risk and improving efficiency.

How CloudPhysics Works

CloudPhysics is a SaaS application that consists of two key elements: a lightweight, agentless, secure virtual appliance (“Observer”) and a web-based portal. After you deploy an Observer to your environment, using a read-only API, it collects, scrubs, encrypts, compresses and streams operational metadata to the CloudPhysics platform where you can run pre-made analytics packages (called “cards”) or your own custom analytics against this data. These cards address typical use cases such as identifying and neutralizing operational hot spots, ongoing proactive health checks, performance troubleshooting and others.



Data Collection

CloudPhysics uses an extremely lightweight vApp, called an Observer, to unobtrusively collect configuration, performance and task metadata about VMs, hypervisor servers (hosts), clusters, resource pools, datastores and networks. Deploying the CloudPhysics Observer is straightforward and only takes 15 minutes:

- No agents
- Miniscule footprint for vApp (4 GB, 4G vRAM, 2 vCPU)
- Only one Observer vApp per vCenter
- No impact on vCenter performance
- No “Heisenberg Effect”*

*CloudPhysics’ VMware domain and API experts designed the Observer specifically to avoid the “Heisenberg effect” that often plagues other IT management tools, wherein the data collectors themselves adversely impact the performance of the systems they measure.

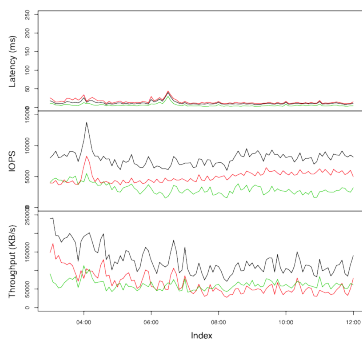
Data Granularity and History

Performance Data

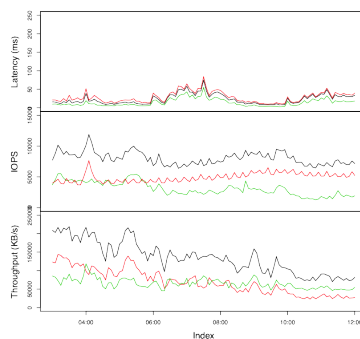
Rolled up data hides problems, leads to poor capacity estimation and resource rightsizing recommendations. CloudPhysics collects and stores performance data at its highest resolution (20 seconds, real time performance data), which is about 15 times higher than other management tools. The chart below shows the importance of full resolution data for understanding true performance behavior.

CloudPhysics imposes no history limits on performance data, so all historical data is available for analysis, which is particularly useful in understanding trends. All of this is done transparent to the CloudPhysics user; there is no requirement to change vCenter performance stats collection level.

*How Other Tools See It:
Rolled Up*



*How CloudPhysics Sees It:
With Full Resolution*



Configuration Snapshot History

For configuration data, CloudPhysics captures snapshots of the entire infrastructure every hour. Like performance data, no configuration information is deleted and there is no limit on the historical data available for analysis. This enables CloudPhysics to drill down to detailed information over time to pinpoint configuration drift.

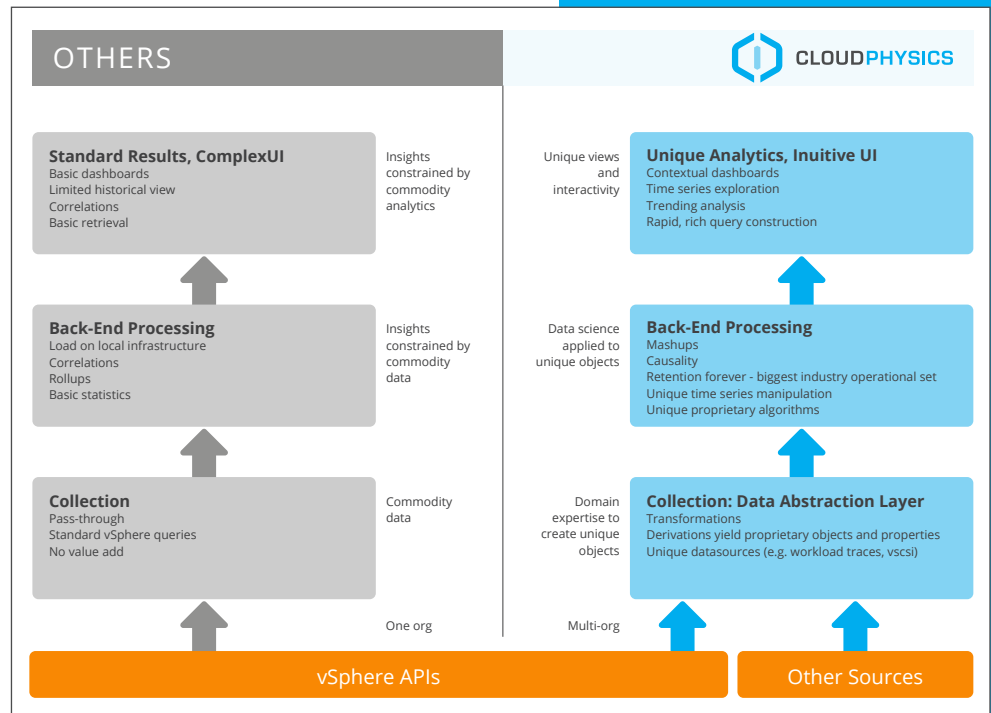


Understanding CloudPhysics Analytics “Value Chain”

The chart below shows the “value chain” around CloudPhysics data collection and transformations, which ultimately differentiates the solution from other tools, and are necessary to deliver the full value of its analytics-driven solution:

Starting at the bottom of the chart and moving up:

- CloudPhysics collects the highest resolution data in commercial computing in the number of dimensions and time resolution. With more than 500 dimensions and resolution from IO-by-IO to a few seconds at most, we enable the highest resolution analytics in the industry (15x finer than other IT operations management tools).
- The data from traditional APIs has to be extended to include data from other sources. CloudPhysics does that by uniquely augmenting its data set with data collection from the ESX-level as well as industry data like our proprietary KB article matching database and HCL matching dataset.



- CloudPhysics also performs and adds to API/Schema unique derivations on the source data (without losing the original) to yield computed properties missing or hard to obtain from the original APIs.
- For both configuration and performance data, historical snapshots are kept around forever to aid in retrospective RCA, reporting and audit purposes as well as for modeling and projecting future growth. The CloudPhysics SaaS architecture uniquely lends itself to these capabilities, which saves IT teams tremendous time and effort.

- As this volume of data is collected on CloudPhysics global platform, we apply analytics and data science to our unique aggregated data set (from across all users). These capabilities include causality estimation (for I/O contentions), monte carlo simulations (for space growth), data mashups, global data set comparisons, upgrade simulations, knowledge base / HCL matching, etc.
- Finally, the analytics value chain is completed with an intuitive UI that presents the information in a way that is easy to understand and act upon.

Core Capabilities and Features

CloudPhysics core capabilities and features included in this section include::

- Global visibility
- Dashboards
- Exploration mode
- Predictive capabilities
- Unique analytics (with examples)
- "What if" analyses (simulation)
- Custom analytics (with Card Builder)

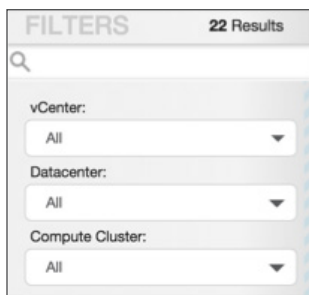
Many of the analytics are accessed through a visual metaphor called a "card." Cards are highly focused analytics targeting a specific task or use case. Their presentation construct is described in the subsequent section in this white paper. In addition to the unique analytics highlighted in this section, there are scores of other cards available to customers, both those created by CloudPhysics as well as those created by the others in the community and shared in the CloudPhysics Card Store.

CloudPhysics provides global visibility across vCenters and geographic boundaries.

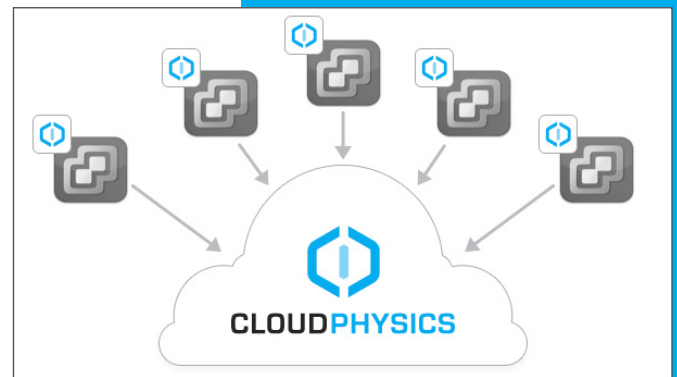
Global Visibility

CloudPhysics provides complete visibility of virtualized IT infrastructure across vCenter and geographical boundaries. Each Observer vApp collecting metadata uniquely identifies the datasource in the user's infrastructure. Metadata is then streamed to the CloudPhysics platform, where the datasets are aggregated from across all vCenter instances for global visibility.

By aggregating metrics and providing global structure to the dataset, metrics are available via various grouping and filtering levels (by cluster, organization, region, operating system type, storage type, etc.). Powerful filtering options with the ability to drill down information down to the individual VM and Host is provided, as well as across the infrastructure for aggregated reporting and analysis.



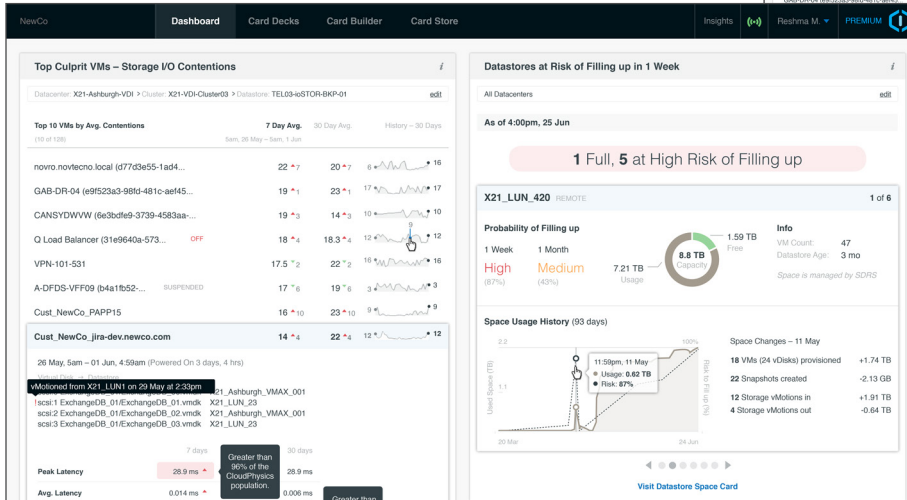
Navigation of the global view is also enhanced by an extremely fast search capability (with regex support), to find specific object(s) of interest.



Dashboards

The initial home page presented to users on login are unique dashboards summarizing health and hazard status. These dashboards contain multi-dimensional views which set a meaningful context for that view. The views are interactive, allowing the user to look across different time and event contexts or click-through to the Exploration mode described below.

Dashboards are configurable, with users and partners building and sharing them via the CloudPhysics' SaaS service. CloudPhysics also builds dash-



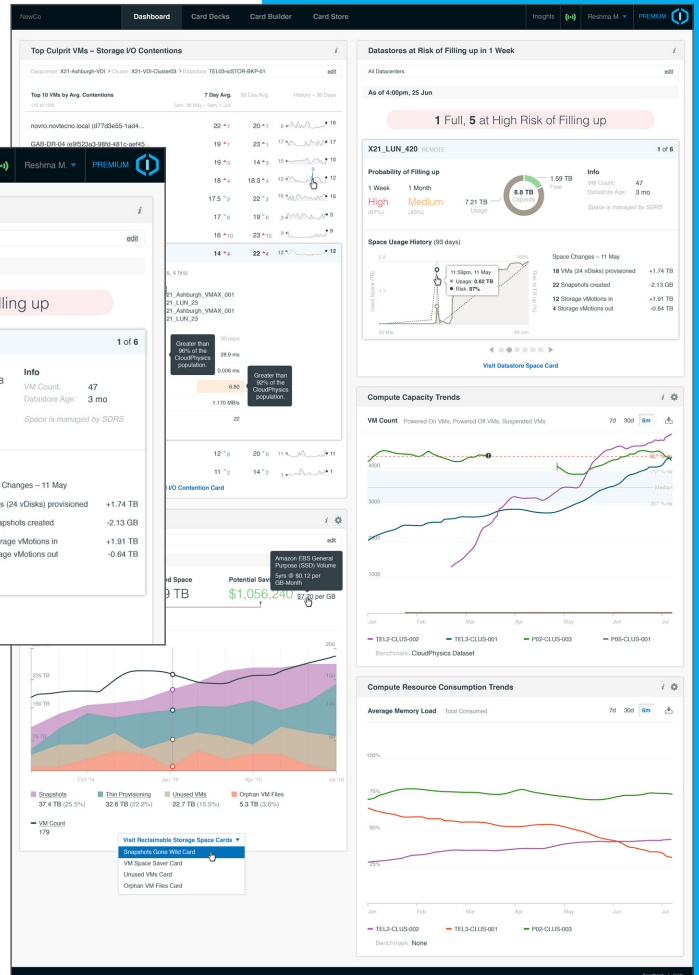
boards ongoing, as an increasing rich library of use-case specific views.

Core to the value of a dashboard is the ability to draw attention to issues or emerging trends, so that understanding, insight and effective actions are generated with 0-2 clicks. CloudPhysics' dashboards are built upon its platform's unique data collection and processing capabilities, including new types of data structures, global visibility across an organizations vCenters, time-series trending and prediction algorithms, and industry-wide analysis of patterns.

Exploration Mode

CloudPhysics' exploration mode presents the user with the ability to "explore" a specific context created by CloudPhysics, the end user, or a partner. Exploration is an interactive view to deliver the analysis of changes over time. In this mode an individual or mashed-up time series datasets are presented to the user to parameterize "slices" of time that can be zoomed-in or zoomed-out. In the same viewing pane, correlated events, identified issues, and configuration changes are associated with the selected time slice.

This form of correlation places the user immediately at a new level of understanding to identify causes of a performance or availability problem. The following screenshot of exploration mode for a VM reveals the causes of a performance problem: in this case, we can see the following in one view:



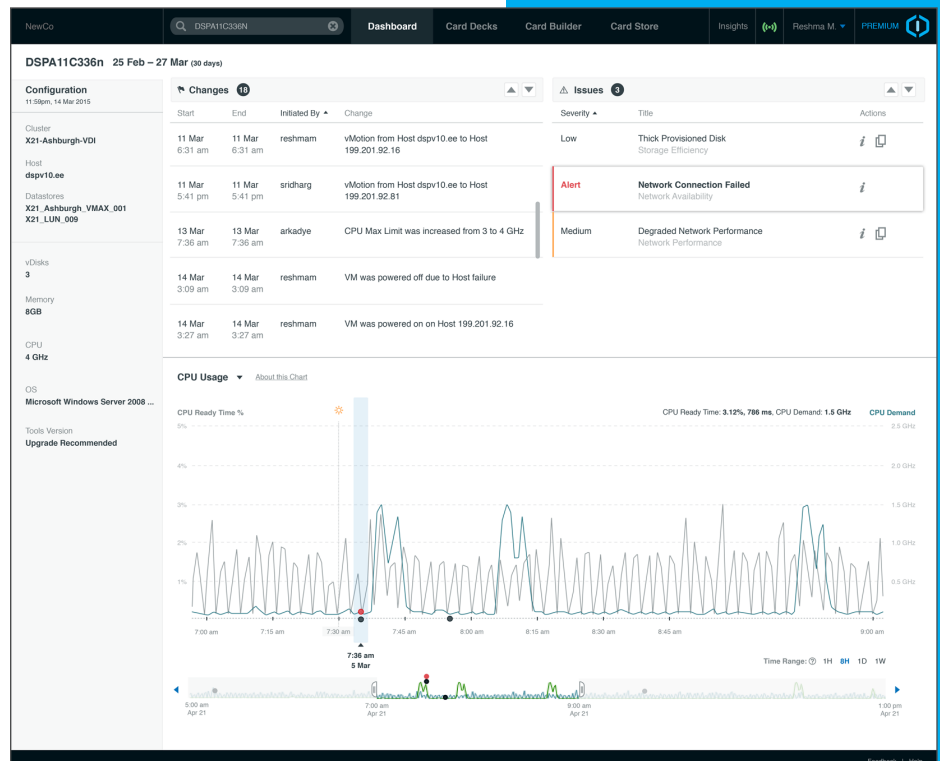
WHITE PAPER: CloudPhysics Technology Overview

The above shows a dashboard analyzing out-of-capacity conditions and limitations for clusters. A detailed view is shown at left.

- A network connection failure (seen as red in the upper right “Issues” pane preceded the spike in CPU demand (and associated lack of CPU availability for the VM) seen in the time series.
- The issue: the network connection failure caused the host CPU demand to spike to process the network failover or re-tries, impacting fulfillment of CPU needs for this VM – and thereby producing the performance issue/latency on the VM.

This view cannot be found in any other product in today’s market. It provides the fundamental and immediate correlations needed to find the direction or cause of an existing or emerging problem.

Exploration mode is accessed through the search function – by looking for a specific VM, for example – clicked through from a dashboard or card, or navigated to directly.

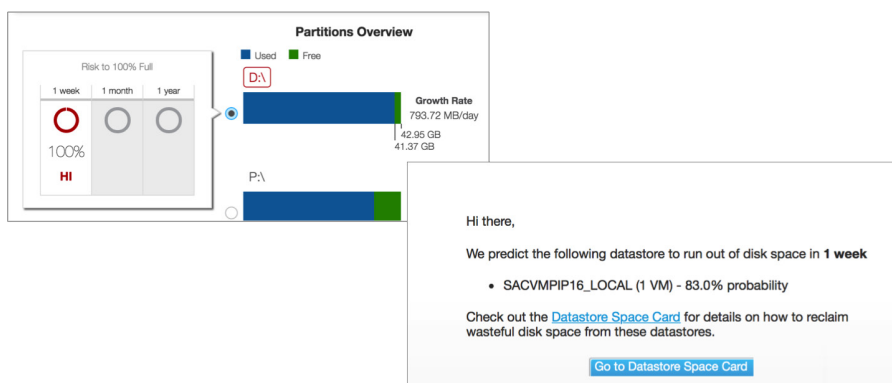


Predictive Capabilities

The CloudPhysics platform contains unique algorithms that operate on datasets to provide predictions in specific use cases. These predictive analytics go beyond the traditional and less effective use of linear regression models, to apply simulations appropriately to the use case. The output of these predictive analytics generates email alerts indicating the direction and type of risk associated with the use case, so that the risk can be avoided.

The example below is a smart alert generated by the Datastore Space management card, which uses Monte Carlo simulations of the virtual machines consuming the datastore to estimate when a crippling out of space condition will materialize. This simulation accounts for the variations in space consumption typical in virtual environments, where VMs are created, deleted, and moved around a cluster. Typical linear regressions cannot capture this behavior, while VM behavior simulations, as applied by CloudPhysics, can accurately identify and predict the risk created by this dynamic quality of VMs:

CloudPhysics continually develops simulations and predictions on trending across different use cases such as cluster space, resource consumption patterns, and performance.



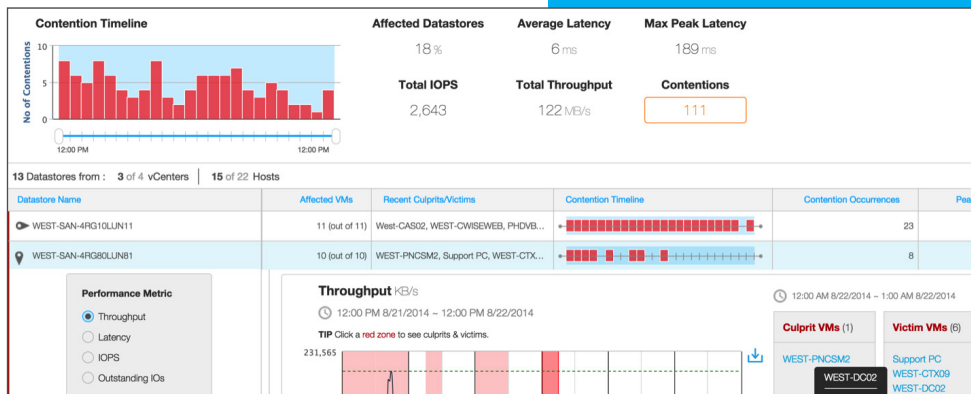
Exploration mode associates correlated events, identified issues and configuration changes with a selected “time slice” – all in a single-pane view.

Examples of CloudPhysics Unique Analytics

CloudPhysics contains analytics not available in any other product or platform for vSphere. These analytics are the result of encapsulating and combining domain expert analysis of a use case with a modern data science platform on which to process the data and analysis. Examples of these unique capabilities are outlined below.

I/O Contention Analysis

Virtualization workloads are constantly moving and changing, which makes performance issues difficult to track and pin down. More than 90% of performance problems are related to storage, so troubleshooting takes a huge amount of manual, tedious work to sift through data to get to answers you need. Across all of your datastores and VMs, how do admins find out which ones are experiencing contention and which ones are not? Even more importantly, which VMs are the culprits and which ones are victims? Today, admins must:



CloudPhysics provides deep visibility into storage contention issues, identifying VM culprits and victims.

- Pull storage config data from vSphere for each host, VM, and component involved
- Use vCenter stats and esxtop or third-party tools to find performance spikes
- Write scripts to collect and pull performance data from vCenter for more granularity or to go further back in time than is possible using native tools
- Use storage vendor's tools to determine what's going on at the array or target
- Put all the data together into a spreadsheet; create charts and graphs
- Get the virtualization and storage teams together for a war room exercise
- Determine possible solutions and how to test them out

In CloudPhysics I/O Contention cards, we have simplified all this by automatically classifying the datastores into those that require your attention and those that are noteworthy. CloudPhysics immediately turns your raw metadata into actionable information – without scripting, spreadsheets and an army of experts to decipher findings. Data-driven insights provide unprecedented visibility into your disk I/O workloads and automate culprit and victim analysis, helping quickly identify performance problems and accelerate troubleshooting. An interactive timeline visually correlates patterns among datastores and VMs, dramatically simplifying the exploration of hotspots.

Hot Spots and Operational Hazards

The premise of hazard-oriented analytics is that correct infrastructure configuration is the basis of reliable and predictable application operations. Each analytic looks at the configuration of the infrastructure and components that determine the performance and availability of the applications/VMs residing on the clusters – misconfigurations can result in “hot spots” increasing latency and opening up potential unseen hazards. Samples of these cards include:

- Beacon probing config
- DRS cluster health
- Network I/O control
- Network MTU health
- Network shares and limits
- Port group load balancing
- Port group security config
- Remote syslog
- Resource pools
- Resource pool hierarchy
- Storage I/O control
- vCenter inventory
- vCenter statistics level
- Virtual hardware allocation

Knowledge Base Advisor

Datacenters are becoming more complex than ever, and hardware and software vendors are continuously publishing Knowledge Base (KB) articles and best practices to help administrators fix issues and avoid pitfalls. However, it's difficult to pinpoint the important signals in the midst of all the KB noise, creating blind spots and operational risk.

CloudPhysics' Knowledge Base Advisor continually scans and incorporates new articles daily, covering VMware, vSphere and major datacenter host vendors such as HP, IBM and others. It also continually scans the datacenter, then intelligently matches relevant articles specifically to that environment. And it not only informs of a problem, it shows the severity of the problem and exactly which assets in the datacenter are affected.

Knowledge Base Advisor

FILTER BY KEYWORD: Type a keyword(s), vCenter, cluster, host or VM name.

164 RESULTS | 6 CRITICAL | 45 HIGH | 63 MEDIUM SEVERITY

- ESXi 5.1/5.5 host is disconnected in vCenter Server and reports the error: No buffer space available
SOURCE: VMware UPDATED: 04/09/2015 APPLIES TO: 16 Hosts SYMPTOM: Connection Dropped
- ESXi/ESX host disconnects from vCenter Server after adding or connecting it to the inventory
SOURCE: VMware UPDATED: 04/08/2015 APPLIES TO: 1 VC 22 Hosts SYMPTOM: Connection Dropped
- ESXi/ESX hosts with NetXen HP NC375/NC522/NC523 and CN1000Q series lose network connectivity
SOURCE: VMware UPDATED: 03/31/2015 APPLIES TO: 22 Hosts SYMPTOM: Connection Dropped
- ESXi/ESX 4.1 and ESXi 5.0.x host fails with a purple screen diagnostic error in the iSCSI stack
SOURCE: VMware UPDATED: 03/27/2015 APPLIES TO: 1 Host SYMPTOM: Purple Screen of Death/PSOD

HA Cluster Health

Configuration Summary (5 HA Clusters)

Healthy Configuration Violation (Required) Best Practices Violations (Recommended)

Sufficient Hosts 100% Healthy Redundant Network 100% Healthy Sufficient Hosts VMware vSphere HA requ

Host Monitoring 100% Healthy Multiple Shared Storage 100% Healthy

Shared Storage 100% Healthy Host Memory Allocation 2

Admission Control 4 Host CPU Resources 1

6 Clusters from: 4 of 4 vCenters

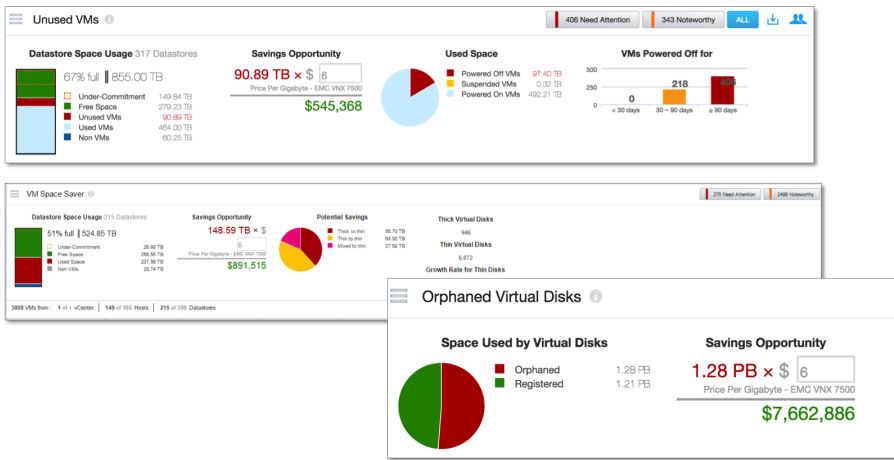
Cluster Name	HA Status	Host Count	Sufficient Hosts	Host Monitoring	Shared Storage
Cluster-mgmt	Not Enabled	1	X	✓	✓
Cluster-W1	Enabled	6	✓	✓	✓
Cluster01	Enabled	5	✓	✓	✓

DRS and HA Cluster Health

In the midst of constant change that has become the norm in today's virtualized datacenter, it's all too easy for critical systems to go out of compliance. VMware DRS and vSphere High Availability are critical for the overall health of the datacenter and can be notoriously difficult to configure correctly and according to best practice. CloudPhysics DRS and HA Cluster Health cards solve this problem automatically with up-to-date, continuous and proactive health checks.

Storage Waste and Space Reclamation

CloudPhysics automatically understands and anticipates when you will run out of space, helping you to proactively discover storage capacity needs and prevent downtime, without overprovisioning. CloudPhysics also identifies day-to-day storage space waste in the datacenter, showing potential space savings opportunities (both in TB and dollars). Examples of space-related analytics include:



Snapshots Gone Wild: Instantly pinpoints snapshot bloat – and opportunities for greater efficiency, eliminating wasted disk space and money.

Datstore Space: Quickly visualizes all datstores across datacenters, spanning multiple vCenter instances; allows admins to drill down into problem areas to proactively manage space issues and avoid datstore-induced disruptions.

Guest Space Saver: Enables proactive management of the needs of the guest. In just a click, provides details on space usage in the guest OS, and the probability of a guest disk partition running out of disk space in the next week, month or six months.

VM Space Saver: Identifies VMs whose virtual disks offer potential space savings, including space that could be reclaimed through thin provisioning. Provides datacenter-wide visibility so admins can optimize VM density for greater efficiency.

Unused VMs: Discovers virtual machines that are unused – either powered off or suspended state – and the disk space they are consuming enabling admins to reduce VM sprawl for good.

Upgrade Analytics

A common operational use case involves the upgrade of software or hardware components in a vSphere infrastructure. A typical vSphere cluster will contain components supplied by up to 6-7 different vendors. Discovering what is and what is not compatible in existing and new versions of software and hardware is often a question an administrator cannot accurately or confidently address. Unconfirmed compatibility means carrying the risk of outages and painful rollback processes.

CloudPhysics provides a set of cards that analyze operating system, hypervisor, NICs, storage, PCI-e, and other hardware and software components for their compatibility. This is done via continually updating and referencing vendor support documentation. Known and recently discovered incompatibilities are also covered in the Knowledge Base article matching process. Together, the compatibility checks and Knowledge Base Advisor cards dramatically reduce or eliminate the guesswork and dangers inherent in infrastructure upgrades.

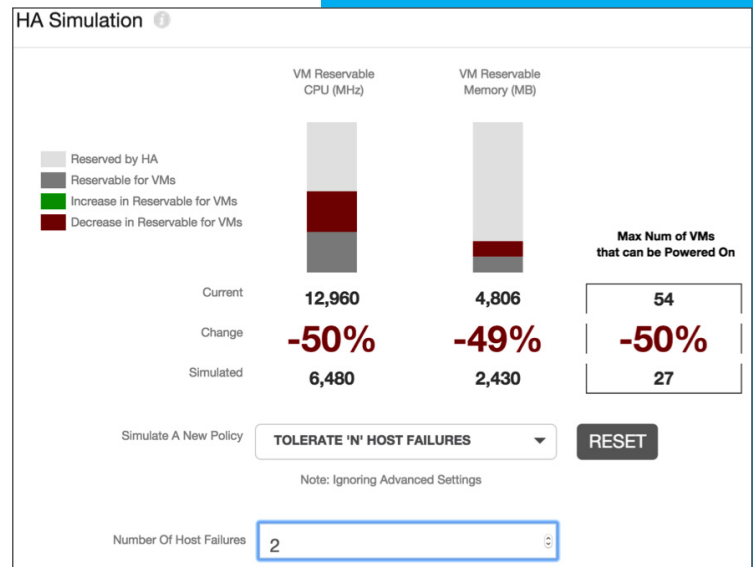
Simulation—What Ifs

HA Simulation

The CloudPhysics HA Simulation card allows you to simulate different admission control policies (e.g., tolerate “n” host failures, reserved percentages, and designated host failures) and parameters to quantify the impact on a cluster’s available resources and clearly identify its capacity for accommodating additional VMs.

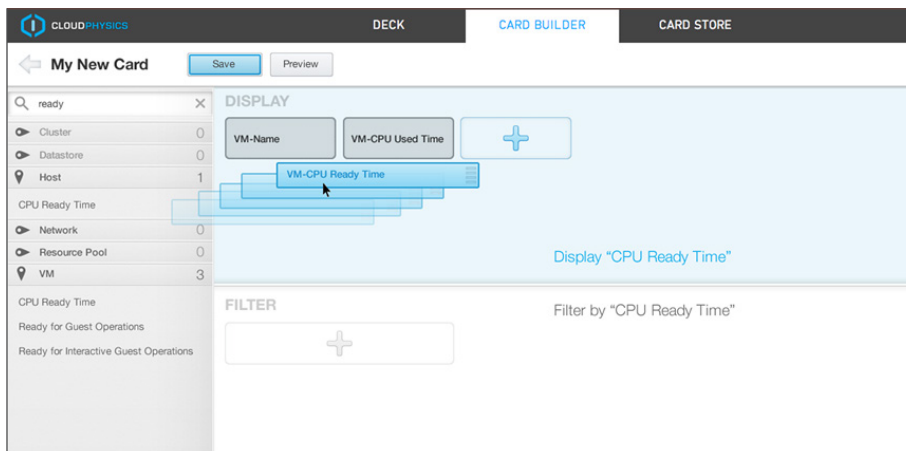
Cache Analytics

Available as part of an assessment service from CloudPhysics, this card uses its own set of modeling capabilities to prioritize VM disks with the best opportunities to benefit from caching and identify the specific cache sizes needed to achieve desired latency reductions.



Custom Analytics with Card Builder

A key feature of the CloudPhysics platform is the ability for users to build their own analytics through the Card Builder. Powerful analytics can be constructed in a drag and drop fashion, without requiring any scripting or coding. Because these analytics run on the CloudPhysics SaaS service, there is no impact on vCenter; too often, scripts interacting with vCenter create severe performance issues and cripple access to vCenter. With CloudPhysics, custom analytics can be generated in volume, run at scale, and easily shared and extended by team members and partners with zero operational footprint or impact.



With Card Builder, admins use more than 500 data properties to compose the analytic reflecting what they want to understand about the virtual environment. Additional capabilities include:

- Powerful filtering with prepopulated content specific to your environment
- Production of comprehensive reports based on the relationship of VMs and their associated objects such as hosts/datastores, network, etc.
- Use as an ad-hoc troubleshooting tool or a query engine

Here are some basic examples of common uses of Card Builder:

- There is a need to apply a security patch to all VMs running Windows 2008. Where are they? With Card Builder, admins can pinpoint those machines instantly.
- Admins need to ensure that all hosts are running the latest patch of ESX 5.1. Is the roll-out complete? With Card Builder admins can know in seconds by easily filtering for all hosts not of a particular version.
- New ESX hosts, DRS clusters and production VMs have been added to the environment recently. Are they sufficiently protected against host failures? With Card Builder, admins can quickly locate VMs that aren't enjoying proper HA protection.
- There is a KB article indicating a problem specific to a BIOS version on Dell servers. How do you determine which servers are affected? Admins can rapidly pinpoint these with Card Builder.

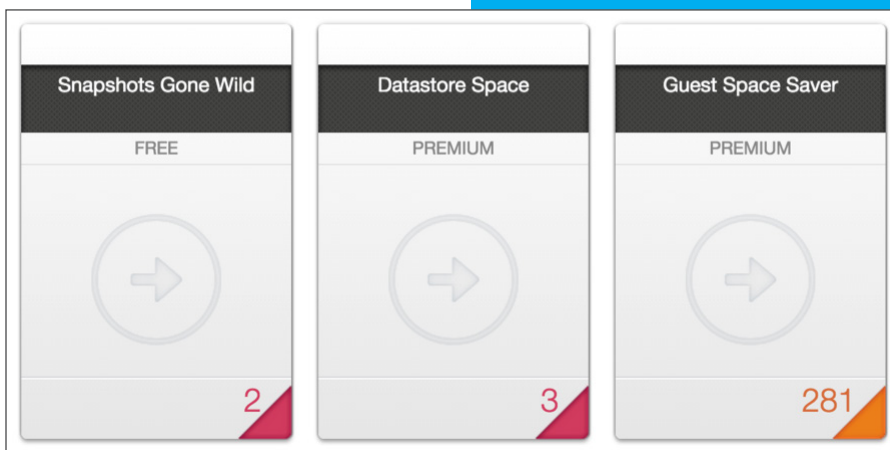
Presentation / User Interface

The user experience in operations management products has been problematic in providing access, meaning, and actionable context to users. Current offerings in the market continue the navigation-tree based, inventory-oriented view of how to look at and interact with the infrastructure. While this continues to have a place in operations management, the CloudPhysics user experience is drawn from other domains involving decision making. These are applied to the user experience in operations management and analytics. In particular, the use of visual metaphors found in Google Now “cards” and Microsoft “tiles” provide a task-oriented, focused view of a use case that cannot be rendered in other products or platforms whose design center remains inventory-oriented. CloudPhysics’ visual metaphor for that usability focus is cards – where a specific task and use case can be explored:

Inside CloudPhysics, admins work with cards. Each card is an analytics “app” – a slice of systems data and analytics, packaged together as a unit for admins to interact with. Cards self-tune, generate accurate information and provide actionable insight specific to each environment.

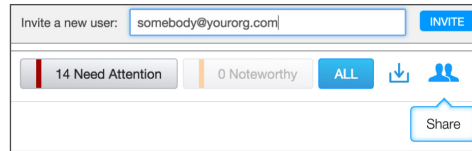
Cards can be navigated within their frame of reference, but they are also hyperlinked to enable cross domain analysis as a user explores a particular issue. This is particularly important for performance issues, where bottlenecks can be exhibited in different, sometimes unrelated areas of the infrastructure. An example of this is cross-linking from VM I/O Contention to Datastore Contention, to Host Resource Commitment, where a performance issue can be traversed to find a possible source problem in the resource configuration of the cluster.

Inside CloudPhysics, admins work with cards, each of which is an analytics “app” that generates insights.



Sharing Insights/Collaboration

Increasingly, the operation of a vSphere infrastructure is a team effort. To enable new and effective collaboration, CloudPhysics provides the ability to share Cards, insights and discoveries. Sharing on the CloudPhysics platform includes:



- Users can share individual cards (insights)
- Admins can easily invite (and un-invite) users into their instance of CloudPhysics.
- Likewise, cards can be easily shared, added to a personal dashboard, and published to members of your team.

Note that sharing does not involve the sharing of the actual data; rather sharing a card is sharing the logic of the analytic particular to that card. A user can only execute that shared card on the data in the org in which they belong.

CloudPhysics Platform Highlights

SaaS-Based

- No hardware required
- No software required
- No operational overhead
- Weekly free updates, bugfixes and feature improvements
- Secure access from anywhere and from any device

Performance and Scalability

- CloudPhysics Big Data Platform is designed for scale and extensibility
- A single vApp per vCenter
- All analysis is done on the CloudPhysics platform – no impact on your vCenter
- Scales with thousands of physical servers and VMs across many vCenters with no impact on the vCenter

Extensibility and Integration

- CloudPhysics data platform is data agnostic, it is easy to extend the platform to other external data sources
- CloudPhysics can customize and fine-tune algorithms to your specific need
- Customize user interface to your needs or create new cards for your specific use case

CloudPhysics Global Dataset

With thousands of deployments across the globe, CloudPhysics is collecting billions of pieces of machine metadata every day and has amassed a data set of over 80 trillion objects. This global dataset is a means of creating what CloudPhysics calls “collective intelligence.” Access to this machine metadata is securely managed and anonymized, which is used in several ways to benefit our customers.

First, the data scientists at CloudPhysics use this ever-growing data set to continuously fine-tune the algorithms and analytics that are exposed via the CloudPhysics platform. Regularly evaluating the efficacy of algorithms over the collective dataset ensures ever-greater accuracy of results. For instance, our simulation algorithms to evaluate potential for datastore fill leverage the collective knowledge of how data growth behaves in all environments to improve the accuracy of predictions.

Second, the data scientists use the data set to evaluate trends and changes in the overall nature of datacenter environments. They look for patterns and trends that may signal new issues that can then be exposed to customers in the form of additional analytics (cards) or dashboards. The team has published several blogs and thought leadership articles related to the collective intelligence such as a recent study on the lifecycle of Windows operating systems. In addition the team has made available a set of benchmark data to illustrate how customers compare to the overall data set for items such as consolidation ratio or resource utilization. The team continues to look for correlations and causation within the data set and to illustrate patterns that signal a potential that can be used to forewarn of a likely negative outcomes.

The advantages to a customer are to receive a broader perspective of IT operations within datacenters and benefit from the analysis the CloudPhysics technical team is able to perform. Realizing these benefits is automatically available for all users of the CloudPhysics platform and again we refer to this as collective intelligence.

CloudPhysics Data Science Expertise

The CloudPhysics technical team includes some of the world's foremost experts in virtualization, management, and data science. The team brings vast functional expertise in development, performance testing, and mission critical support for a number of technology leaders, including VMware, Google, Veritas, Symantec, Cadence, NetApp, and Sun Microsystems.

Members of the technical staff collectively have over 150 patents issued or pending across a variety of areas including virtualization, processor scheduling, memory management, quality of service (QoS) management, I/O scheduling, caching, and anti-spam methods.

The technical staff develop and operate the award-winning CloudPhysics platform and have performed custom projects for companies to address complex IT management challenges. These include resource management across distributed IT environments, baselining of key operational metrics, and analyses of cache for workloads.

About CloudPhysics

CloudPhysics provides data-driven insights for smarter IT, with operational analytics that give IT teams more power than ever before to understand, troubleshoot, and optimize their virtualized datacenters, reducing risk and waste. The company, based in Mountain View, Calif., serves thousands of users worldwide across a variety of industries.