



White Paper

NetApp Cloud Insights

Accelerate Troubleshooting Across Your Hybrid Cloud

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Abstract

Your IT environment is more complex and more dynamic than ever before. Heterogeneous infrastructure, hybrid and multicloud deployments, and complex applications make troubleshooting even more crucial—and more difficult. NetApp® Cloud Insights is a SaaS solution that goes beyond simple monitoring to identify the relationships between resources—both on your premises and in the cloud—so that you can pinpoint the source of slowdowns and outages quickly with less domain expertise.

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1 About This White Paper Series

This white paper is the third in a series about NetApp® Cloud Insights, an innovative software-as-a-service (SaaS)–based monitoring tool that spans on-premises and cloud environments. Cloud Insights helps you monitor, troubleshoot, and optimize your storage systems, from legacy hardware to container environments. The papers in this series cover the following topics:

- [A New Way to Monitor Your Cloud Infrastructure | WP-7291](#)
- [Enhance Monitoring by Understanding the Relationships Between Resources | WP-7302](#)
- Accelerate Troubleshooting Across Your Hybrid Cloud | WP-7308
- Optimize Resource Allocation in Multicloud Environments

This series focuses on both on-premises and cloud environments.

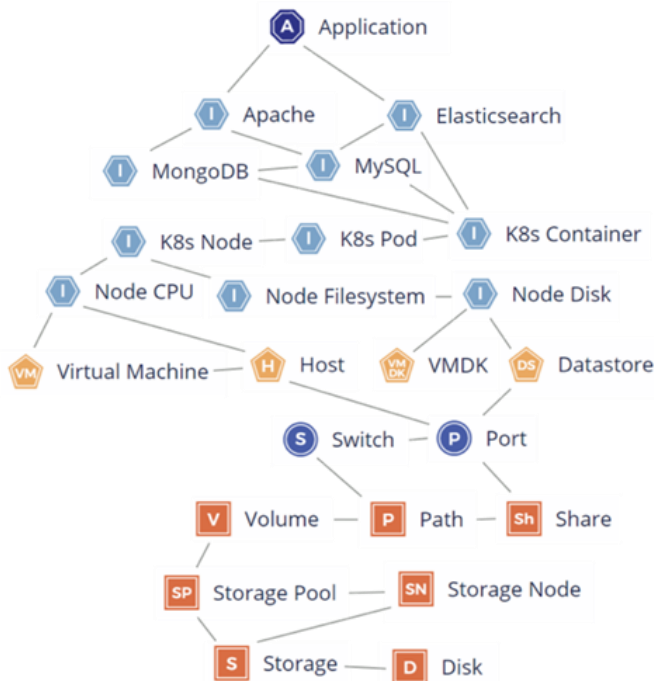
2 The Imperative to Troubleshoot Faster

Troubleshooting is a fact of life for IT teams. Even if you do everything in your power to monitor infrastructure and applications closely and address issues proactively, problems arise. With the cost and impact of outages increasing, decreasing mean time to resolution (MTTR) has never been more important.

Unfortunately, the tools that most IT teams turn to when problems occur have not kept pace with the needs of modern applications and infrastructure. When it comes to resolving issues quickly, you face three main challenges:

- **Complexity is increasing.** Your IT environment is more complex and more dynamic than ever. Your current operations may include hybrid cloud and multicloud environments, diverse infrastructure, and traditional and cloud-native applications. A single application can depend on dozens of underlying resources, as illustrated in Figure 1.

Figure 1) The correct operation of a single application may depend on dozens of separate but interconnected elements.



- **Finger-pointing is inevitable.** Given the level of complexity, serious issues can lead to finger-pointing. Even before hardware and software vendors are involved, it's common for application, network, storage, and virtualization teams to deflect responsibility. Finger-pointing is so common in troubleshooting situations that at NetApp we've created a new metric that's a corollary to MTTR, mean time to innocence (MTTI). MTTI is a measure of how quickly you can identify the component that's creating the problem, thus determining which components are "innocent." The lower the MTTI, the more quickly those responsible for the innocent components can get back to their day jobs.
- **Expertise is essential.** Troubleshooting a difficult problem can require significant expertise. Application, database, network, storage, and virtualization experts may all get pulled into the effort. If you're one of those experts, you must ask yourself whether troubleshooting is the most productive way to spend your day. If you're responsible for hiring people with expertise, you have an entirely different concern. In a [2019 survey](#) conducted by the Uptime Institute (registration required), 61% of respondents reported significant difficulty in hiring and retaining technical staff. It's impossible to be certain that people with the necessary expertise will be available when a problem occurs.

Most teams use a diagnostic approach that is similar to an emergency room doctor evaluating a patient. The doctor relies on a variety of tests, progressing from simple to complex—temperature, blood pressure, pulse, blood tests, x-rays, MRIs, and so on—drawing on experience to synthesize the available information into a diagnosis.

Your team does the same thing, relying on separate server, storage, network, application, and other metrics and attempting to synthesize all that information into an actionable "diagnosis." Our goal with NetApp Cloud Insights is to create a *tricorder* for diagnosing IT problems, allowing you to pinpoint problems the same way that doctors on Star Trek use a medical tricorder to quickly pinpoint even the most esoteric ailments. Cloud Insights cuts through complexity, reduces the expertise required to identify problems, and reduces MTTR by up to 90%.

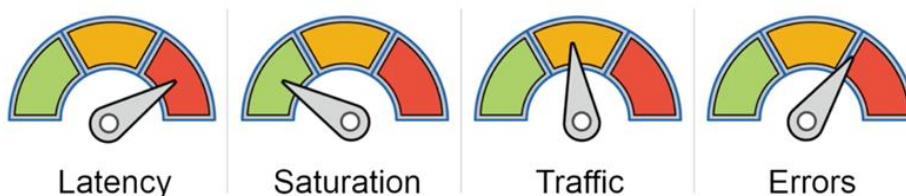
With Cloud Insights, you can understand at a glance how all the elements that make up your IT environment are connected and drill down to the source of a problem. Your team is able to troubleshoot problems quickly and effectively without finger-pointing, and administrators can take advantage of the tool to identify problems even if they don't have deep expertise in every domain.

This white paper explores the troubleshooting capabilities of Cloud Insights in depth. It includes a review of how to configure Cloud Insights for optimum results and explains how to take advantage of Cloud Insights' ability to understand relationships between resources and identify correlated, greedy, and degraded resources.

2.1 Cloud Insights Focuses on Four Key SLIs

To help you make sense of your environment, understand your operations, and achieve agreed-upon service levels, Cloud Insights focuses on four key service level indicators (SLIs): latency, saturation, traffic, and errors.

Figure 2) Key indicators used in monitoring.



- **Latency.** When latency spikes, affected users submit trouble tickets. Cloud Insights dashboards focus on latency as a key indicator so that you can identify and correct latency problems before users complain.
- **Saturation.** Latency issues often result when you ask too much of a device and push it beyond its resource limits. Understanding the cause of saturation is a key step in root-cause analysis. Cloud Insights simplifies identification of saturation points and provides intelligent alerts that distinguish between momentary spikes and real problems.
- **Traffic.** Saturation might be triggered by an increase in traffic. An unexpected rise in user demand or a misbehaving application can create noisy-neighbor effects that can affect unrelated applications. Cloud Insights helps you correlate increased latency with other events that are driving traffic.
- **Errors.** Errors and alerts are a fact of life in any IT environment. Cloud Insights helps you quickly determine when an error indicates that a real problem exists, discover the root cause, and begin remediation.

3 Configuring Your Environment for Troubleshooting Success

NetApp Cloud Insights gives you the power to store and analyze critical monitoring data at cloud scale. A single tool shows you everything in your IT environment, both in your data centers and across multiple clouds. You see updates in near real time and can view trends and changes over extended periods.

It can often require hours of effort from people with significant domain expertise to get to the bottom of what seems like a simple problem. A key advantage of Cloud Insights is that it automatically discovers service paths, so you can visualize the relationships between resources, and it correlates events to establish cause and effect. In many instances, Cloud Insights automatically identifies correlated, greedy, and degraded resources.

3.1 Discovering Service Paths and Identifying Correlated, Greedy, and Degraded Resources

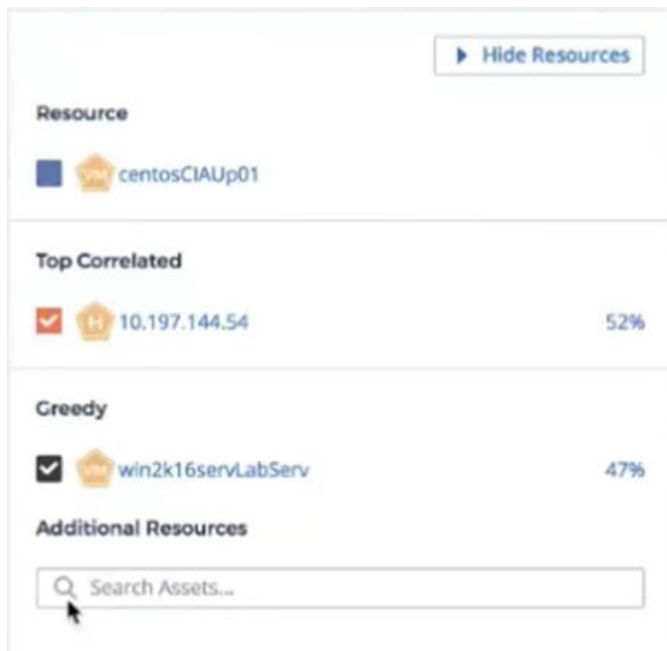
Cloud Insights discovers service paths for individual elements. Figure 3 illustrates how a virtual machine (VM) maps to a hypervisor or server and underlying storage.

Figure 3) Typical service path mapping.



Cloud Insights also automatically identifies correlated, greedy, and degraded resources that may be affecting a resource, allowing you to zero in on the most likely culprits with almost no effort.

Figure 4) Likely greedy resources effecting performance.

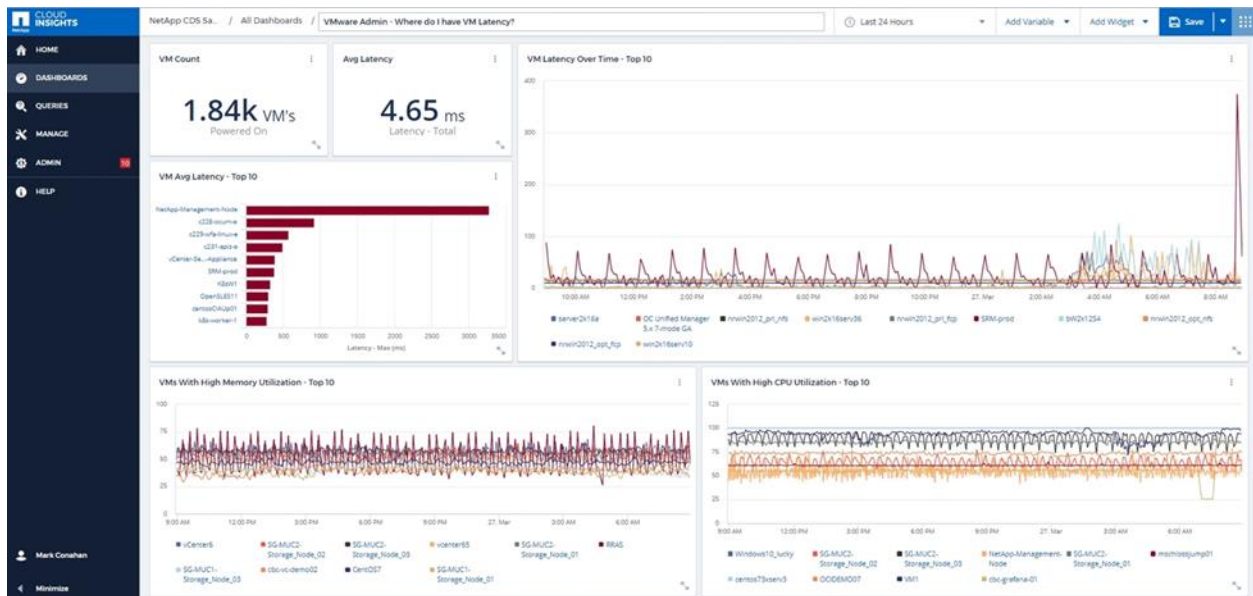


NetApp makes it easy to get started with Cloud Insights. You just need to configure at least one acquisition unit and at least one data collector. However, to get the most from your Cloud Insights environment, you should take some additional steps, including configuring annotations, queries, alerts, and dashboards that are specific to your environment:

- **Annotations.** Some information can't be obtained through discovery alone. By using annotations, you can add custom metadata that is specific to your IT and business needs. Cloud Insights provides a set of default annotations that you can use, and you can create your own annotations to slice monitoring data in other ways. Annotation rules can be created that automatically assign the appropriate annotations to new resources as they come online.
- **Queries.** Cloud Insights provides a powerful visual search engine with filters and finders that enable you to easily monitor and troubleshoot a hybrid cloud environment. You can search assets at a granular level based on various criteria, including annotations and performance metrics.
- **Alerts.** You can create performance policies to generate alerts when a resource exceeds a specific SLI. This feature enables you to proactively monitor your environment to detect problems before they affect your operations. You can easily create smart alerts to detect problems while reducing the noise in your monitoring environment to avoid alert fatigue.
- **Dashboards.** Cloud Insights comes with a default set of dashboards based on the data collectors that you enable. (See Figure 5 for an example dashboard.) Each dashboard is designed to help you answer specific questions about your environment. Your team can also create highly tailored dashboard views to meet diverse monitoring and troubleshooting needs. You can start from an existing dashboard and customize it, or you can create entirely new dashboards from scratch, using powerful tools to visualize available data.

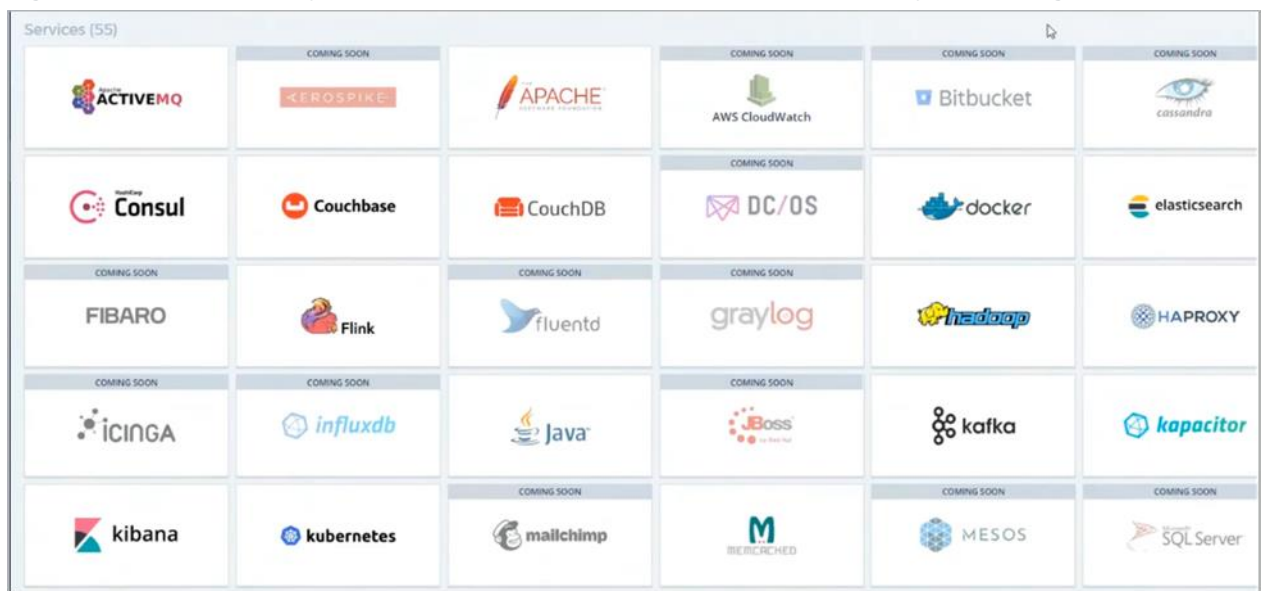
These capabilities are described in detail in the [previous paper in this series](#), including tips on configuring and using each feature.

Figure 5) Example Cloud Insights dashboard showing VM latency.



NetApp is actively expanding Cloud Insights capabilities. Since the previous white paper was published, we've added more than 50 new data collectors for a variety of popular application services, as shown in Figure 6.

Figure 6) Some of the many application and service data collectors supported by Cloud Insights.



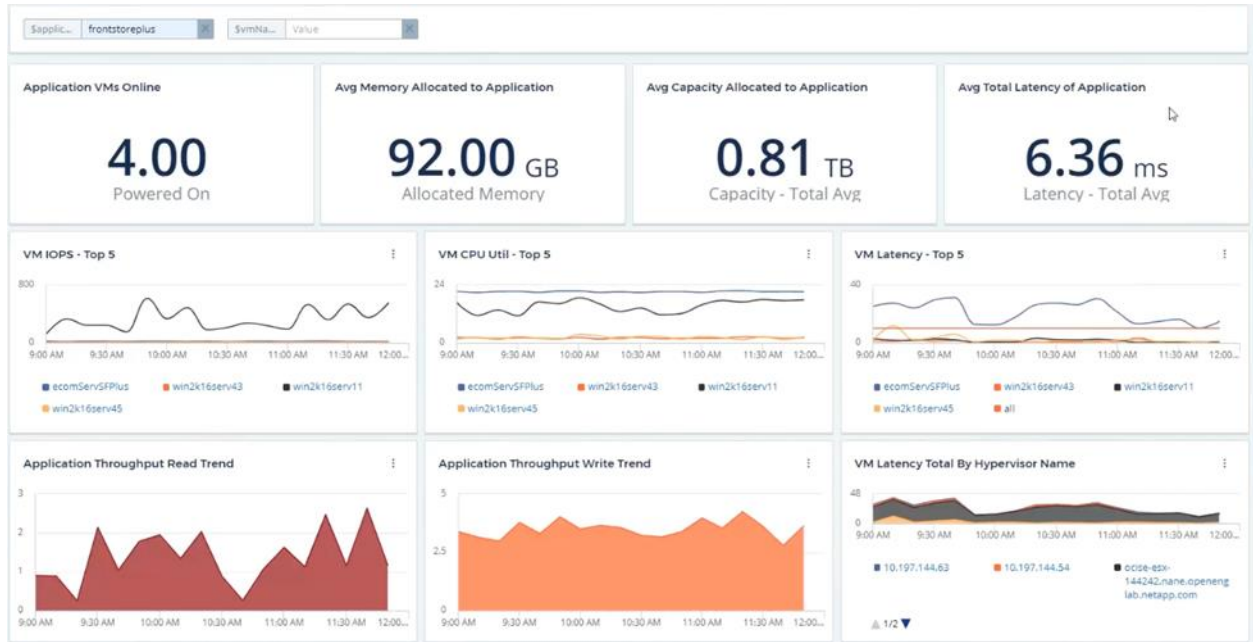
4 Troubleshooting with Cloud Insights

The best way to illustrate the troubleshooting power of Cloud Insights is by example. Suppose that an e-commerce team is having trouble with an important application called FrontStorePlus. The application is running slowly and affecting customer transactions, so it's crucial to resolve the issue quickly.

4.1 Identifying the Resources Used by an Application

The first step is to narrow your investigation to the resources that are relevant to the application. Based on the annotations configured for this environment, you simply enter the application name to see high-level metrics that are relevant to the application, as shown in Figure 7.

Figure 7) High-level metrics for the FrontStorePlus application.

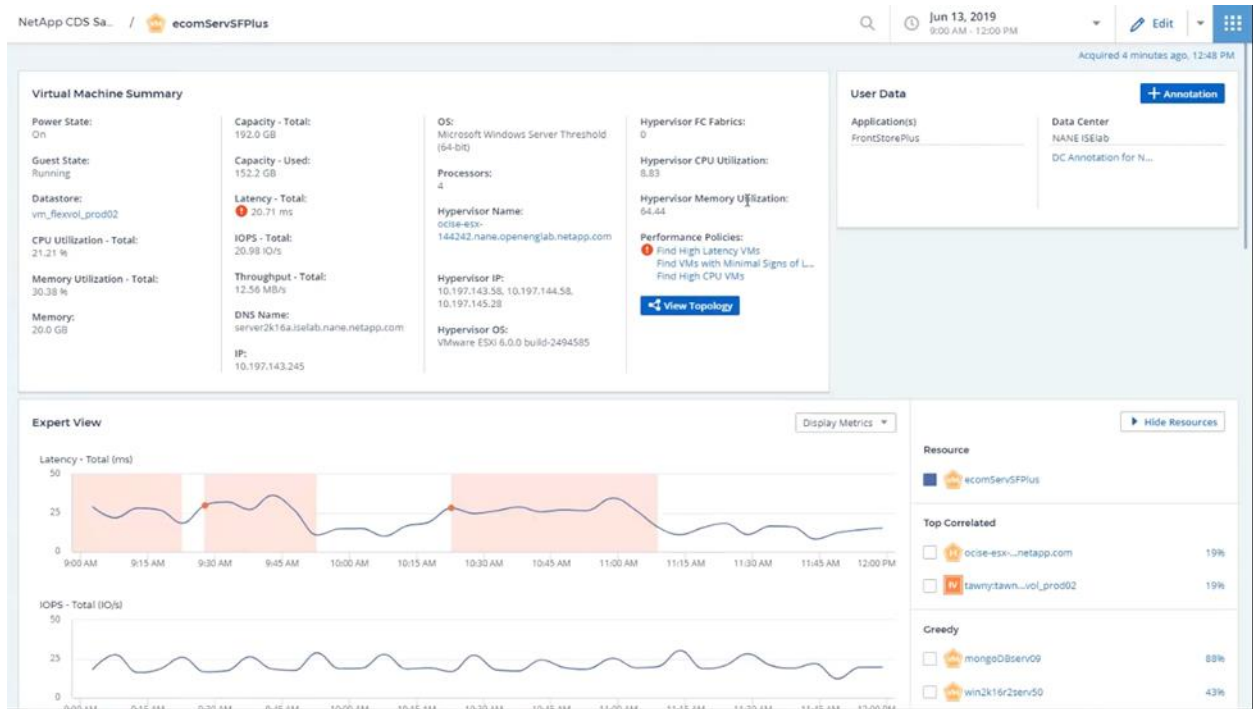


From the top-level statistics, we can see immediately that there are four VMs allocated directly to the application, using 92GB of RAM and just under 1TB of storage, with about 6ms average latency. That's helpful, but not enough to identify the cause of the slowdown. Looking at the next level down on the dashboard, we see more information on the VMs supporting the application in terms of IOPS, CPU utilization, and latency. From the pane in the center-right of the figure, it's clear that one VM, ecomServSFPlus, is experiencing much higher latency than the others.

4.2 Drilling Down to Investigate a Resource

To drill down to investigate the VM that appears to be having trouble, click its name at the bottom of the pane. The whole interface is dynamic, so whenever you see something you want to know more about, you can drill down quickly and easily. The result is shown in Figure 8.

Figure 8) Cloud Insights summary for VM with high latency.



The summary at the top left of the dashboard shows that this VM is experiencing latency in excess of 20ms, even though its CPU utilization and IOPS aren't particularly high. It also shows the performance policies (alerts) applicable to this VM, and that it has violated the Find High Latency VMs policy. The Expert View pane shows a graph of latency versus time. The shaded regions indicate periods when the VM was violating the configured latency policy.

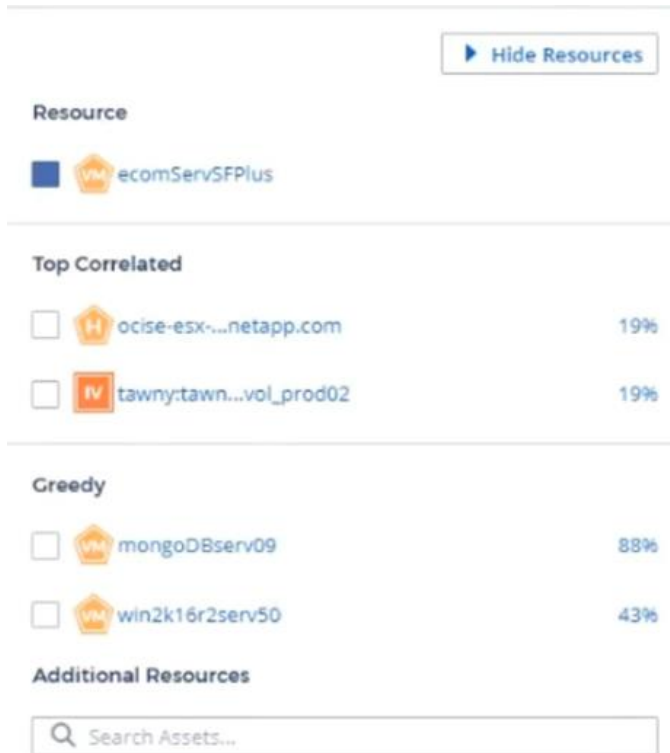
With a few clicks, we've identified a VM associated with the slow-running application that has a latency problem. We can also see that the VM itself isn't working particularly hard. That's a sign that it is probably being affected by a noisy neighbor—another VM that shares the same resources—or some underlying resource that is saturated.

4.3 Identifying Correlated and Greedy Resources

This is where Cloud Insights really differentiates itself. With most monitoring tools, it's difficult to identify noisy neighbors and overloaded resources in complex environments. Cloud Insights makes this process simple.

The lower right pane in Figure 9 shows correlated and greedy resources that are related to the affected VM. Figure 9 shows a complete view of this pane with more detail.

Figure 9) Expanded view of correlated and greedy resources affecting a VM.

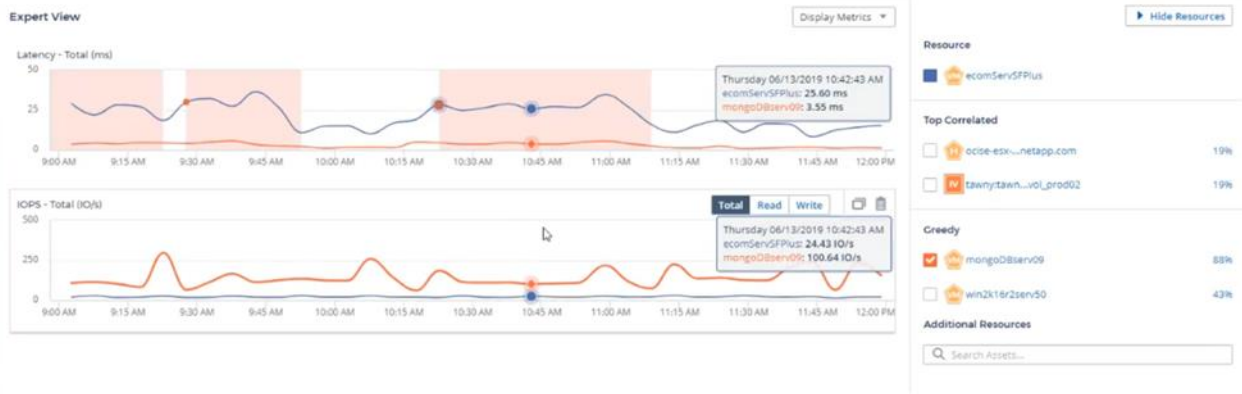


Correlation offers a way to associate a given resource (in this case a VM) with the underlying resources it uses. Here, we can see both the hypervisor and the storage volume used by the VM. The percentages at the right of each correlated resource show how much the ecomServSFPlus VM is contributing to the workload on the correlated resources—19% on both.

Moving on to greedy resources, we see two other VMs that are affecting the performance of the e-commerce VM: mongoDBserv09 and win2k16r2serv50. The percentages at the right indicate the relative effect of the greedy resource. The IOPS generated from mongoDBserv09 are impacting the latency of ecomServSFPlus by 88%.

To see more about the effect that the greedy VM is having, select the checkbox next to the VM. As Figure 10 shows, the greedy VM has much lower latency and much higher IOPS than the e-commerce VM, and the periods of high latency on the e-commerce VM correlate closely with the IOPS of the greedy VM.

Figure 10) Select the checkbox next to a greedy resource to see how closely its activity correlates with the negative impact on the affected resource.

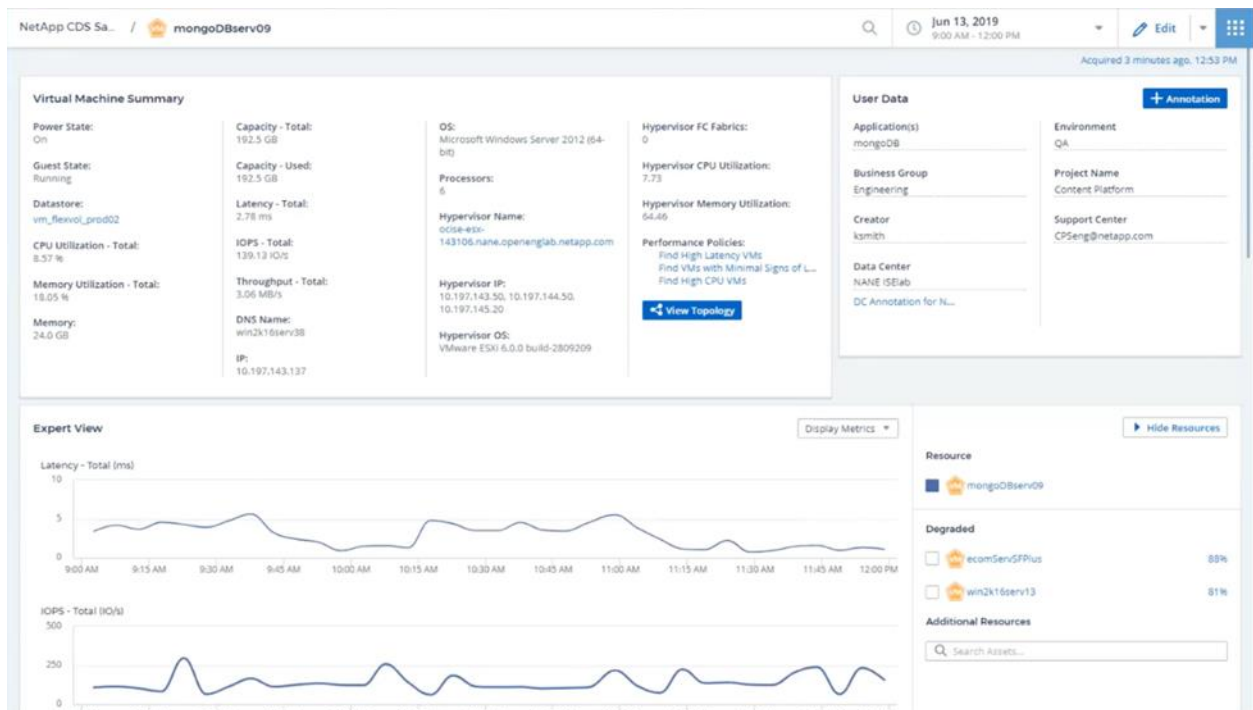


In minutes, we've identified the probable culprit without requiring the use of multiple tools and without having to call in domain experts.

4.4 Investigating a Greedy Resource

The next step is to investigate the greedy resource to find out what it does and who it belongs to, and to figure out how to correct the performance problem. To accomplish this, click the name of the greedy resource to drill down on that resource, as shown in Figure 11.

Figure 11) Details for the greedy VM. Note that it includes a list of resources this VM is degrading.



This is where the annotations and metadata in your environment come into play. Because the Cloud Insights metadata model is fully extensible, you can add the information that's most relevant to your operations. You can do this manually, but more often than not you can use an annotation rule, as described in the [previous white paper in this series](#).

The User Data panel in the upper-right pane of Figure 8 shows what is known about the VM, which in this example is quite a lot. The running application is MongoDB (something you could have guessed given its name), the business group is Engineering, and the environment is QA. From that information we can conclude that for some reason a QA VM is sharing resources with the production e-commerce VM, which is clearly not a best practice. We can also see who created the VM, and who is responsible for supporting it.

Also note that the lower-right pane in Figure 8 shows the resources that are being degraded by the greedy VM. In addition to the e-commerce VM, a second VM is being affected. That may warrant a separate investigation, but it is likely to be mitigated when you address the greedy VM.

With the greedy and improperly resourced VM identified, the next step is to correct the problem. Possible remedies include:

- Contacting the responsible group to correct the situation
- Shutting down or throttling the VM
- Moving the greedy VM to a more appropriate server and datastore
- Moving the affected VM to a resource that is less heavily loaded

Which option you choose depends on the severity of the problem and the specifics of your operations.

4.5 Incident Response: Making Operational Improvements

It's good to be able to troubleshoot a problem quickly, but the ideal situation is to identify a potential problem and take corrective action before it escalates into a fire drill. Any time you troubleshoot a problem—especially a high-profile one—you should do a postmortem to identify corrective actions to prevent the same problem from occurring in the future.

In this example, there was actually a policy violation that generated warning-level alerts, but those alerts didn't result in corrective action. This can occur when no one is specifically responsible for responding to alerts or when too many alerts are being generated in the environment.

Cloud Insights gives you the tools to fine-tune monitoring processes and alerting to fix these types of problems:

- **Granular alerting.** Cloud Insights alerting gives you the ability to easily specify multiple thresholds. You can specify as many thresholds for an object as necessary. An alert can be set to take effect only if all the thresholds are crossed, or you can specify that it is triggered if *any* of the thresholds are reached. This gives you the ability to fine-tune alerts to limit the number of false alarms, so that you receive alerts only when they are truly warranted.
- **Anomaly detection.** The Cloud Insights anomaly detection engine uses machine learning to determine what “normal” looks like for your environment and alerts you when something abnormal occurs—like a QA server running in production.

5 Summary and Next Steps

NetApp Cloud Insights can help you monitor, troubleshoot, and optimize your infrastructure. This paper examines the troubleshooting capabilities of Cloud Insights, explaining how you can quickly isolate a resource, such as a VM that is having a problem, and identify other correlated resources, greedy resources causing interference, and degraded resources. Cloud Insights goes far beyond the capabilities of simple element managers, showing you the relationships between resources so that you can identify problems and bottlenecks quickly. Multithreshold alerts help you minimize the occurrence of false positives and maximize your ability to identify problems before they affect users.

To see Cloud Insights in action for yourself, register for a 14-day free trial. Go to NetApp Cloud Central at <https://cloud.netapp.com/cloud-insights> to learn more about NetApp Cloud Insights and start your free trial.

Where to Find Additional Information

To learn more about the information that is described in this document, review the following documents and/or websites:

- NetApp Cloud Central
<https://cloud.netapp.com/cloud-insights>
- NetApp Cloud Insight Documentation Center
<https://docs.netapp.com/us-en/cloudinsights/>
- NetApp Product Documentation
<https://docs.netapp.com>

Version History

Version	Date	Document Version History
Version 1.0	September 2019	Initial release.

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