THE GORILLA GUIDE TO... ®

AI-Driven Operations with HPE InfoSight

Becky Elliott & Ed Tittel

INSIDE THE GUIDE:

- Proactive Wellness for Your IT Infrastructure
- Boost IT Performance, ROI, and Planning with AI/ML-Driven Management
- Understanding Cross-Stack Analytics and Optimizing Workloads Through the Infrastructure Stack

HELPING YOU NAVIGATE THE TECHNOLOGY JUNGLE!

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AI-Driven Operations with HPE InfoSight

By Becky Elliott & Ed Tittel

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ABOUT THE AUTHORS

After dropping out of a liberal arts college that focused on reading and discussing the "Great Books," Becky Elliott found her way to a career in IT. For 20+ years, she has held a number of roles in Dev and Ops, and the area in between the two. In working for organizations in which poor security practices can cost lives, she's an ardent believer in integrating security through the entire design process. Becky holds a number of industry certifications including the Certified Information Systems Security Professional (CISSP).

Ed Tittel is a 30-plus year veteran of the IT industry who writes regularly about cloud computing, networking, security, and Windows topics. Perhaps best known as the creator of the *Exam Cram* series of certification prep books in the late 1990s, Ed writes and blogs regularly for GoCertify. com, Win10.Guru, ComputerWorld, and other sites. For more information about Ed, including a resume and list of publications, please visit EdTittel.com.

ENTERING THE JUNGLE

CALLOUTS USED IN THIS BOOK

SCHOOL HOUSE

The Gorilla is the professorial sort that enjoys helping people learn. In the School House callout, you'll gain insight into topics that may be outside the main subject but are still important.

FOOD FOR THOUGHT

This is a special place where you can learn a bit more about ancillary topics presented in the book.
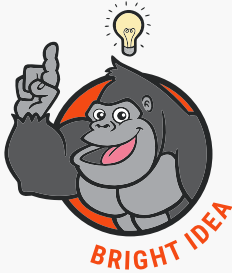
BRIGHT IDEA

When we have a great thought, we express them through a series of grunts in the Bright Idea section.

DEEP DIVE

Takes you into the deep, dark depths of a particular topic.

EXECUTIVE CORNER

Discusses items of strategic interest to business leaders.

ICONS USED IN THIS BOOK

DEFINITION
Defines a word, phrase, or concept.

KNOWLEDGE CHECK
Tests your knowledge of what you've read.

PAY ATTENTION
We want to make sure you see this!

GPS
We'll help you navigate your knowledge to the right place.

WATCH OUT!
Make sure you read this so you don't make a critical error!

TIP
A helpful piece of advice based on what you've read.

INTRODUCTION

Boost IT Performance, ROI, and Planning with AI/ML-Driven Management

Welcome to The Gorilla Guide To...® AI-Driven Operations with HPE InfoSight.

This Gorilla Guide explains how organizations can take a predictive and proactive approach to managing IT, using a health and wellness-oriented outlook. Along the way, it digs into understanding the challenges that modern IT operations face, and how employing an artificial intelligence (AI)-driven IT operations model based on health and wellness can improve responsiveness, reduce downtime and performance delays, and foster a more innovative, user-forward approach to IT service delivery. It also explains the key role that automation plays in establishing and maintaining IT wellness, and how data-driven insights, predictions, and recommendations can steer IT organizations to better performance, improved use of resources, and a better ROI on their IT infrastructure investments.

This Guide will also explore how organizations can use AI and machine learning (ML)—together (AI/ML)—to let historical performance data create and maintain a comprehensive view of their IT assets that supports management, troubleshooting, optimization, and planning for future growth and expansion.

In particular, predictive analytics play a vital role in helping to anticipate and avoid potential issues or delays before they manifest as full-blown problems or failure that need immediate treatment and triage. In addition, analytics can also drive more optimal technology deployments, and help organizations get the best possible value from their IT technology spending.

This book is for C-level execs with IT or related portfolios and responsibilities. It's also a great read for IT managers at all levels, and for architects and team leads in functions related to operations, software development, and business operations from customer service and supply chain management, to product development and delivery.

We start our journey with a discussion of how IT operations can use AI to gain insights and information to do more and get more done, and offer more and better services to users, while minimizing firefighting and other reactive responses to ever-changing conditions. So if you're ready to get going, grab your pith helmet and machete, and let the Gorilla be your guide.

One AIOps Platform to Rule Your Infrastructure

In This Chapter:

- IT challenges on multiple fronts
- The promise of AIOps
- Bring intelligence and autonomy to your infrastructure and appliances

"Do more with less" is a mantra for modern times. It's only befitting that this "do more" imperative would trickle down to IT. And, boy does it. Demand for higher application availability has surged, while sizes of IT teams and maintenance windows have shrunk.

IT teams need to optimize ever-changing workloads while simultaneously tuning their infrastructure for better performance. Performance and optimization are no longer an afterthought. Not only do IT teams have to scramble to prevent operational issues that might affect uptime, they must also design and maintain non-disruptive availability for all workloads. How can this reactive firefighting be stopped?

IT Challenges on Multiple Fronts

IT is in constant service of business apps. The IT department is saddled with heightened expectations from the business and users, along with a long-standing requirement to continuously add business value.

Not only do business apps need the added value, but the business as a whole. All the while, IT teams face severe challenges on three different fronts.

1. Mounting Technical Debt Adds Complexity

Teams in constant firefighting mode frequently take shortcuts, which not only leaves in place current weaknesses (technical debt), but can lead to more debt. Slower hardware refresh cycles also mean aging infrastructure and more risk of hardware failures. If these factors weren't enough, the need to apply patches and updates can burden already overwhelmed teams.

2. Tools Shortcomings Lead to Information Overload

Most management tools are disparate, siloed, and single-purpose. These tools weren't designed to account for infrastructure complexity and deployments that span on-premises, cloud, edge, and co-location environments. In addition, these tools often trigger information overload with notifications and alerts. The volume of data generated by hardware and software stacks within IT infrastructure makes it difficult for humans to derive insights that allow timely interventions.

3. IT Skills Gap Creates People and Process Problems

IT generalists are everywhere. Gone are the days of dedicated subject matter experts (SMEs) for each technology. As budgets shrink, IT teams often must cover more ground with fewer people. Often, keeping the lights on leaves little time for innovation. Also, organizations don't want to be in the data center maintenance business: It's too rigid and costly. Preventing issues before they become problems is the only way to keep from falling behind.

According to the Global Knowledge 2020 IT Skills and Salary Report,[1] **which surveyed 9,505 members of the IT workforce, 80% of managers in North America, and 78% of managers around the world, find the IT skills gap "troubling."** The number of IT decision makers who report skills gaps has jumped since it was added to the survey in 2015, with only a marginal dip from 2019 to 2020. What's the impact of that gap? Managers report increasing stress on existing employees, plus difficulty attaining quality goals. How did this happen? The report cites the rapidly changing technology landscape wherein employees have trouble keeping up with emerging skills sets. But employers are also finding it harder to hire (or find) employees with the right kinds of soft and professional skills, too. This makes addressing the skills gap (or avoiding it) a key concern.

[1] https://go.globalknowledge.com/2020salaryreport

The Promise of AIOps

When times are tough, teams look for solutions. AI has transformed the medical and manufacturing industries, so why not IT operations, too? In fact, combining AI and ITOps, now popularized as AIOps, isn't new. Gartner Inc. coined the term in 2011 and defined it as a platform to "enhance IT operations through greater insights by combining big data, machine learning, and visualization."

AIOps can free IT staff for innovation by bringing intelligence to infrastructure management. It can prevent many problems that used to arise, and help quickly resolve many of the inevitable problems after the fact. AI-powered autonomous operations can improve IT productivity and costs by providing proactive recommendations, support automation, and simplify troubleshooting, capacity planning, performance tuning, and upgrade planning.

But not all AI and machine learning (ML) offerings are created equal. Here are some criteria to consider when evaluating AIOps solutions:

- Will the platform scale?

- Will the solution help with the full infrastructure stack?

- Can it help prevent and resolve complex and unique issues that cause the most pain?

- Can decisions be made for at least the less complex problems, and can I control which actions can be taken without human intervention?

- Does the platform deliver information, guidance, and support that technical experts can use to enhance or augment the scope of the services?

Let's explore a solution that delivers those benefits and more: HPE InfoSight.

HPE InfoSight Brings Intelligence and Autonomy to Infrastructure and Applications

HPE InfoSight is the scalable AIOps platform that uses advanced ML to provide predictive analytics and recommendations. Built on a decade of data collection and refinement of its ML models, HPE InfoSight is one of the industry's most advanced AIOps solutions—it can help prevent software and hardware problems before they can cause pain.

It goes further than that, though—HPE InfoSight helps create an autonomous infrastructure that self-analyzes, self-troubleshoots, and self-triages. HPE InfoSight for Nimble Storage has the most advanced functionality among all platforms supported.

In addition, HPE InfoSight has been rapidly expanding coverage to other HPE platforms. See **Figure 1** for supported platforms.

HPE InfoSight

AUTONOMOUS AND CONTEXT-AWARE

Storage	Servers*	Hyperconverged

HPE Nimble Storage   HPE 3PAR   HPE Primera   HPE Servers   HPE Synergy   HPE SimpliVity   HPE Nimble Storage dHCI

ProLiant (Gen8-10), BladeSystem, Apollo (Gen8-10), Moonshot, Edgeline

* Most servers also require iLO4 or iLO5
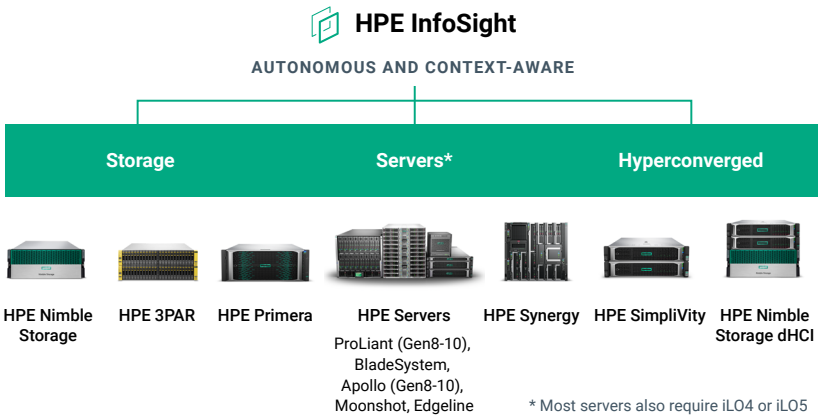
Figure 1: HPE InfoSight coverage across the HPE portfolio

At the core of HPE InfoSight is the global intelligence engine, where cloud-based ML happens. With these insights, InfoSight does the following:

- Identifies what the problem is, points to root-cause of the problem, and recommends how to fix the problem

- Provides continuous monitoring and adaptive behavior through global learning of vast telemetry accrued over time

- Identifies and prioritizes problems across the different layers (cross-stack) to help optimize the infrastructure proactively

- Develops unique signatures based on workloads and customer environments, and proactively recommends resolutions to enterprise IT before it even occurs

- Applies predictive analytics to recommend infrastructure upgrades when necessary

- Automates support where possible/also recommends when to call support

By recognizing underlying patterns and examining the configurations of each system, HPE InfoSight's global intelligence engine can then predict problematic behavior and configurations, drive support automation, and make problem-solving recommendations.

Leveraging analytics collected across HPE customer platforms worldwide, HPE InfoSight iterates through cycles of observing/learning/predicting/recommending/acting. This cycle of continuous improvement powers advanced visualizations and dashboards for users, and provides suggestions to realize workload-optimized infrastructure.

The power behind HPE InfoSight is an extensive knowledge base that enables customers to self-solve problems. Customers can also expect personalized performance recommendations and best practice advice to help optimize resources and manage capacity planning.

Because HPE InfoSight is a Software-as-a-Service, or cloud-based, customer portal, customers get an AIOps solution that spares them the maintenance and upkeep of the platform and stays current.

Other vendors make similar claims, however—let's delve into what makes HPE InfoSight unique.

The HPE InfoSight Advantage

Most AIOps platforms focus on issues that are easy to detect and resolve. HPE InfoSight goes far beyond those limitations, tackling the complex issues that take the most time and cause severe issues.

Its secret sauce is the breadth of its telemetry and the maturity of its ML. This advantage, in part, comes from the decade HPE InfoSight has spent collecting telemetry data and retraining ML models.

Each second, millions of sensor measurements capture the state of the systems, subsystems, and surrounding IT infrastructure. This data is collected and analyzed across the HPE global customer base. Global visibility and a plethora of data leads to greater insights and

ultimately enables HPE InfoSight to make more intelligent decisions and recommendations.

In some cases, managing too much telemetry data can generate dashboards, which can cause alert fatigue with busy screens, raw metrics, and noisy alerts. Many management tools suffer from this issue, but HPE InfoSight applies contextual insights to show only the most pertinent and important alerts and information. It also offers personalized performance recommendations and best practice advice for optimizing resources and planning capacity.

No mention of HPE InfoSight's competitive advantage would be complete without spotlighting the benefits of integrating HPE InfoSight with HPE Pointnext Services, and how InfoSight's AI-enabled recommendations become even more useful and actionable. HPE Pointnext Services is HPE's global services organization, comprised of 23,000 staff experts who provide support or supplement ITOps support.

By tapping this expertise, IT teams benefit from additional skillsets and experience. HPE InfoSight and HPE Pointnext Services together help customers go beyond traditional hardware support to receive recommendations on how to better run their workloads.

HPE InfoSight has transformed the customer experience by bringing the ability to predict, prevent, and resolve IT problems to its customers. This kind of transformation is only possible because of the maturity of HPE InfoSight's ML models, breadth of HPE product integration, and value-added professional services.

It works, and the results are real, as you'll see next.

Case Study: Faster Troubleshooting and a Trusted Partner

Basefarm, a managed service provider based in the European Union, leverages HPE InfoSight together with HPE Pointnext Services to monitor infrastructure, predict problems, and greatly reduce time spent troubleshooting.

"As a service provider that needs to know everything about our capacity, growth potential, and systems health, it's good to know we can get all those reports in one window with HPE InfoSight," says Morten Nyhuus-Eriksen, manager of Storage and Backup for Basefarm.

Especially in its extensive virtual machine (VM) environment, the far-reaching capabilities of the platform can save IT staff time and predict problems before they occur, even outside of storage. "In our VMware environment, we can spend a lot of time chasing ghosts trying to locate the source of a problem," Morten says. "Now when there's a problem with a VM, we know exactly where to strike—HPE InfoSight goes beyond the hardware down into the VM level, saving us a lot of time. With InfoSight, we can get servers back up and running about 80% faster."

Basefarm also relies on the expertise and support of professionals from HPE Pointnext and HPE Datacenter Care. "We see our HPE Pointnext engineers as trusted members of our team at Basefarm. We can put them in front of whatever comes up, and they know exactly how to handle the situation," Morten explains.

It's a partnership that has contributed to Basefarm's past growth as well as its future trajectory. "We rely on HPE Pointnext for business continuity as well as our vision going forward," Morten says. "It's a partnership that gives us a way to solve things faster while getting a direct line to what's coming next."

Learn More About HPE InfoSight

By covering a broad range of platforms, HPE InfoSight makes HPE the only vendor who can offer a unified AIOps platform across the infrastructure stack, integrated with a services organization that offers people and processes to deliver a personalized, predictive experience.

HPE InfoSight optimizes your infrastructure by preventing or resolving problems faster, enabling IT to innovate and add business value, as you'll see in Chapter 2.

Proactive Wellness for Your IT Infrastructure

In This Chapter:

- Automating wellness and monitoring for powerful protection
- Leveraging artificial intelligence and machine learning to enhance IT operations
- The Centris AG success story

The title for this chapter is based on the well-known understanding that it's far better to prepare for and anticipate problems in IT, rather than waiting for problems to pop up and then jumping into action. A well-calibrated IT team knows that problems are inevitable and understands that some problems are more likely to occur than others. And such a team is already doing what it can to identify issues before they turn into problems, and shares a good working understanding of a normal baseline so it can tell when things start going sideways, and corrective action is needed. It's easier to make sure things stay healthy, than to cure them when they are out of sorts, failing, or under attack.

If you've ever been on either side of the phone for a late-night outage call, you've witnessed IT teams scramble to resolve problems quickly. The team saves the day, and the systems come back online. However, responding to unexpected outages takes its toll.

Teams have limited resources and time. Reactively responding to issues often requires a significant amount of energy and time for troubleshooting and restoring apps and services. Reactively operating is exhausting and leaves IT teams little time for innovation and improvements. In even worse cases, the IT team gets blamed for failing to prevent the initial outages.

It's analogous—in a non-life-threatening way—to firefighting. Firefighters respond reactively, rushing to extinguish fires that have already started. The goal, however, is (or should be) to minimize fires in the first place.

This is a key duty of a fire marshal, who proactively, and at regular intervals, surveys buildings and other infrastructure for faulty wiring, capacity planning and a checklist of other fire hazards. Their job is to help prevent fires based on their knowledge of how fires *start*. With this knowledge, marshals can spot and mitigate the hazards before they become threats to life, limb, and property.

> ***Proactive wellness* is terminology that comes out of the medical profession.** Medicine has its roots in diagnosing and treating illnesses or chronic conditions. But the notion of proactive wellness comes from an understanding that keeping patients well leads to better outcomes—and longer lives—for patients treated proactively to become or stay fit and well. To some extent, this means teaching patients what kinds of behaviors are best for them to engage in, and which ones are best avoided. It also means monitoring health on a regular basis to make sure the patient remains well, and to diagnose and begin treating anything that needs it early on, rather than waiting for conditions to become chronic or acute. This approach translates surprisingly well and completely to managing IT environments and infrastructures.

In the same way, IT teams don't have to operate in reactive firefighting mode. There is a better way, which involves transitioning from reactive firefighter to proactive fire marshal. This monitoring and surveying is a precursor to *proactive wellness*.

Powerful Protection

Proactive wellness, or monitoring and assessing health before problems arise, is powerful protection against IT fires. But the reality is that it can't live up to its potential if it's comprised of manual processes.

In fact, it's impossible to do everything manually in the current age, given how wide and deep hardware and software stacks are in modern IT infrastructure. This is where AI enters the picture. AI has revolutionized everything, so why not leverage it to bring proactive wellness to your infrastructure?

In addition, AI simplifies infrastructure management. Simplicity is needed for today's heterogeneous and increasingly complex environments, since determining where in the stack problems occur is a major challenge.

These are the reactive tasks that consume IT cycles, and infrastructure ops teams spend far too much time and energy firefighting instead of adding business value. Imagine an era in which your ops teams aren't constantly on edge, waiting for the next fire—instead, these teams are freed to spend more time on projects that propel the business forward and ultimately create revenue-generating business value. End the firefighting once and for all by implementing proactive wellness.

Automate Wellness

Automation is particularly important to address IT challenges in the following areas:

Security: Too many breaches and attacks occur for security to ever be an afterthought. Good security postures start with patching and

vulnerability awareness. Patching is a time-consuming, never-ending job that's also subject to mistakes when humans are doing it. Two other common problems with security are that it's often difficult to know when to update firmware, and that updates can reduce a system's availability to users.

Interoperability: It's difficult to ensure that various hardware and software components will work together. Without the right tools, checking for interoperability can be a manual and error-prone process. In addition, updates are often hard to roll back once they've been applied, especially in firmware. Such hurdles to interoperability end up creating a situation in which ITOps teams are reluctant to make changes, which slows them down and stifles innovation.

Best practices: Ensuring that best practices are applied is the bedrock of a solid IT infrastructure, preventing failures and faults and bringing stability to systems. But once again, applying best practices turns into a manual process that can overwhelm teams.

Let's take a look at how HPE InfoSight's proactive wellness can jump these hurdles.

HPE InfoSight Enables Proactive Wellness for Infrastructure

HPE InfoSight is HPE's AIOps solution for proactive wellness in IT Infrastructure and the workloads running on it. As explained earlier in Chapter 1, AIOps, or "Artificial Intelligence for IT Operations," leverages ML and visualization to enhance IT operations.

HPE InfoSight also helps with troubleshooting, performance, security, interoperability, and best practices. This cloud-based AIOps solution delivers predictive analytics and support automation while bringing multiple HPE platforms from across the data center into a single pane of glass management environment. HPE InfoSight alerts you to the danger zones, putting you in the place of the fire marshal to prevent blazes from disrupting operations.
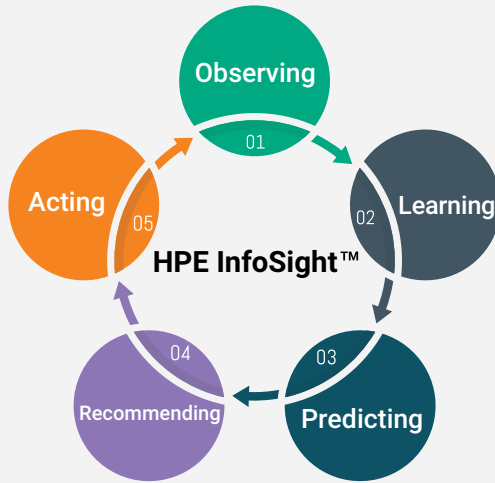
5 key steps in the machine learning and predictive analytics process of HPE InfoSight

1. Observing: the thousands of data points and sensors built into the HPE server and storage products

2. Learning: applying advanced pattern recognition to the sensor data collected across all devices globally

3. Predicting: anticipating problems based on the observations and learnings

4. Recommending: intelligent decisions that prevent issues, improve performance, and optimize resources

5. Acting: automation resulting in game-changing benefits and outcomes

Figure 2: HPE InfoSight improves efficiency through AI

A massive part of HPE InfoSight's value comes from extensive data collection and millions of hours of training and refining its ML models. More data and more time spent interpreting the data fuels the predictive analytics that ultimately bring proactive wellness to your infrastructure (see **Figure 2**).

At a high level, predictive analytics works like this:

1. Collect comprehensive telemetry data in real time and across the stack from the global installed base

2. From this data, create signatures to identify potential risk and interoperability issues

3. Run the data through deep learning and training models

4. Identify matching signatures in customer environments

By iterating through this process, HPE InfoSight can correlate, trend, and project faults, ultimately making predictions to prevent those faults.

HPE InfoSight's predictive analytics fuel proactive wellness in many ways, including denying updates that may negatively impact systems. Once HPE InfoSight detects a problem in its global install base, it stops the update from moving out to other customers.

HPE InfoSight can automatically generate cases when problems are detected. In addition, it promotes updates that improve security or reliability. An example of this feature is identifying a drive firmware update that will keep drives from prematurely failing.

The HPE InfoSight Way

HPE InfoSight monitors and assesses the overall health of firmware/drivers, hardware, software, security, storage snapshots, interoperability issues, and application workloads. It brings predictive wellness to servers, storage, virtual environments, and hyperconverged solutions.

Platforms currently supported are:

- HPE ProLiant, HPE Synergy, HPE BladeSystem, HPE Apollo, HPE Moonshot, and HPE Edgeline servers for wellness assessments. HPE InfoSight consumes Active Health System (AHS) and HPE iLo telemetry for a more in-depth view.

- HPE Nimble, HPE Primera, HPE 3PAR

- HPE SimpliVity, HPE Nimble dHCI

- Cross-Stack Analytics for VMware on Nimble, Primera, 3PAR, and Nimble dHCI

- Cross-Stack Analytics for Hyper-V on HPE Nimble

- VMware integration for HPE SimpliVity

Another key part of HPE InfoSight's value proposition is HPE Pointnext Services. This combines HPE InfoSight technology with people and processes to proactively support your infrastructure.

Providing preventative services and supporting proactive wellness is nothing new to HPE Pointnext Services, which often goes beyond fixing problems that arise to actually preventing them from occurring in the first place.

AI, analytics, and support automation work behind the scenes to drive this integration. These capabilities bring awareness to—and potentially prevent—complex, hard-to-diagnose threats before they occur. HPE InfoSight's AI capabilities can eliminate the costly impact of IT failures on your environment, while offering opportunities to improve performance and best practices.

Here's a real-world example of what it can do.

Success Story: One Service Provider Embraces HPE InfoSight and Proactive Wellness for Future Growth

Centris AG, a Switzerland-based IT service provider, develops and operates industry solutions for health and accident insurers. To enable future growth, the company needed to stop manually managing a complex server and storage environment across three data centers.

What Centris AG needed was to implement a cohesive solution that offered central management from a single platform or tool. The service provider got that with HPE InfoSight—but it also gained much

more than centralized management. Here are just a few of the benefits Centris AG realized:

- Significant improvements in support cases, including 80% faster creation, and 30% fewer cases

- Reduced security patch installation, going from weeks to hours

- Solid performance monitoring to predict and prevent issues

- Proactive, secure, and consistent management of firm-ware upgrades

Bruno Flückiger, senior system engineer at Centris AG, is thrilled with the results. "A lot of people in jobs like mine longed for a tool to manage their whole environment," he says.

"[HPE InfoSight] saves time and protects us from the risk of human error. It is truly beneficial to have one AI-powered tool as a central point of contact for everything we need to know about our system environment."

Read the full success story[1] for additional details on how HPE InfoSight transformed the way Centris AG manages its infrastructure.

Don't Fight IT Fires—Prevent Them Instead

Today's complex IT environments are harder to manage than ever—there are more moving pieces, traditional walled data centers are a thing of the past, and the bad guys seem to stay one step ahead of the good guys. This leads to lots of fires for IT to put out.

That's why you need HPE InfoSight. Its ability to predict and pinpoint potential sources of these fires means that your IT team won't be in constant reactive mode, squirting water here and there while more bottom-line-conducive activities lie dormant. They'll finally be able

[1] https://psnow.ext.hpe.com/doc/a50002382enw?jumpid=in_lit-psnow-red

to add value to the business. As you know, preventing fires is always better than fighting them. And optimizing your equipment to prevent those fires is the next step in maximizing your IT ROI, which is covered in the next chapter.

HPE InfoSight Performance Optimization and Recommendations Maximize IT ROI

In This Chapter:

- Salient features of HPE InfoSight
- Performance optimization in action
- Evolving your workloads with HPE InfoSight

The drivers behind performance optimization and insight-driven recommendations work best when they're informed by data of two kinds. First, data from the local environment is always most meaningful and relevant when it comes to local optimizations and configuration changes. Second, a sense of how the local environment compares to other, similar environments elsewhere puts the local into the more general context of how IT operations in general have benefited from optimizations and insights obtained elsewhere. This combination of focused, pointed insight and information tempered by global, related insight and information is what allows bodies of best process and practice to be created, and to keep improving with time.

As in other areas of IT, the "do more with less" imperative in modern business applies to personnel, and to all things infrastructure, including hardware and software. Throwing hardware at performance problems was never the ideal choice. Recently it has become even less

viable with less spend for capital expenditures and IT budgets in a deep freeze. Now is the time to tune and optimize your infrastructure for performance, and you will probably need help.

As much as performance tuning is needed for today's workloads, most existing tools leave much to be desired. Good luck if you need to make sense of those indecipherable graphs and metrics you find on a dashboard. If there's an actual problem, you might face the laborious job of figuring out the systems responsible, the root cause, and the threshold to use for metrics. All of this information is a prerequisite before you can even begin searching for a solution. Also, each workload change means manual tuning and time-consuming trial-and-error guesswork. Finally, context-aware intelligence about your specific environment is missing.

HPE InfoSight, though, is an exception among those lackluster tools. Part of HPE InfoSight's competitive advantage is the sophistication
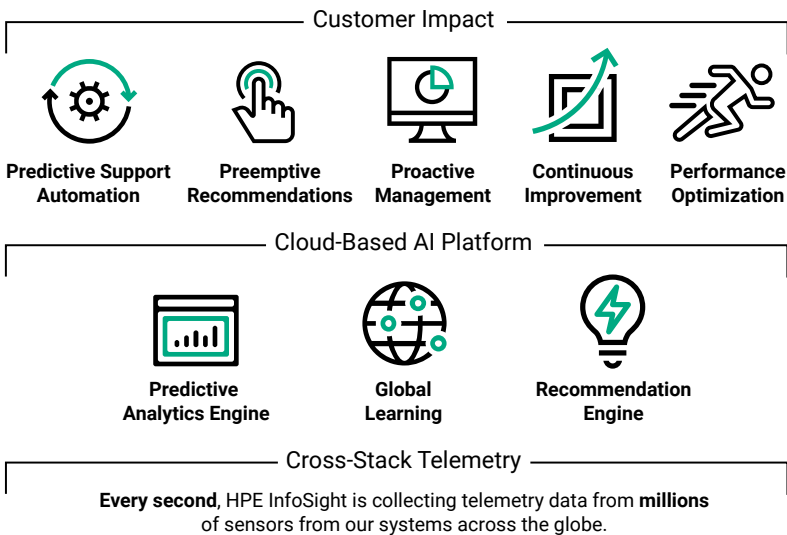
Customer Impact

Predictive Support Automation **Preemptive Recommendations** **Proactive Management** **Continuous Improvement** **Performance Optimization**

Cloud-Based AI Platform

Predictive Analytics Engine **Global Learning** **Recommendation Engine**

Cross-Stack Telemetry

Every second, HPE InfoSight is collecting telemetry data from **millions** of sensors from our systems across the globe.

Figure 3: In addition to performance optimization, HPE InfoSight offers preemptive recommendations, continuous improvement, and more. Telemetry data flows into the recommendation engine and other components of HPE InfoSight's AIOps platform.

of its performance optimization and recommendations. Customers have likened HPE InfoSight to having a personal performance analyst onsite 24/7. By leveraging AI in IT operations (AIOps), HPE InfoSight monitors time, data points, and interactions and then incorporates much-needed context so that users can apply the recommendations. Collecting comprehensive real-time telemetry data across the infrastructure stack from a global installed base, and then using community learning are key differentiators for HPE InfoSight. See **Figure 3** for a high-level view of the process and customer impact.

Salient Features of HPE InfoSight

As an enterprise technology engineer, you know that manual performance tuning your infrastructure is time-consuming, tedious, and often full of guesswork. Here, the "right" performance tool can be an invaluable resource to you and that's where HPE InfoSight excels.

1. Automate the Narrative of What, Why, and How to Fix Infrastructure Problems

HPE InfoSight can deliver the symptoms, diagnosis, and solution and add customer-environment contextual details wherever possible. Importantly, you also deserve prescriptive actions in plain English. Those prescriptive actions are worthless if you can't understand them enough to implement the recommendations.

2. A Tool Is Only As Useful As Its Coverage and Accuracy

By offering a multitude of performance recommendations, HPE InfoSight can help countless customers, including you. Even for the rare, more time-consuming issues, robust performance tools support heterogeneous platforms across product lines. By coupling professional services (like HPE Pointnext Services), experts can provide beneficial recommendations based on insight and experience supporting thousands of environments. You leverage the breadth and depth of their experience to optimize your environment.

3. User-Centric Is More Than a Nicety

Tools should be flexible and responsive to the users' priorities. False positives distract busy ITOps teams. By allowing you to tune overall sensitivity, teams can minimize the noise and focus on the work. Performance tuning should also allow users to narrow the window of interest to specific periods and specific objects. Lastly, feedback loops enable the refinement of both the product and support processes.

Tools evolve with feedback, but progress takes time and iterations. HPE InfoSight's robustness and sophistication is over 10 years in the making.

An AIOps Evolutionary Journey Trailblazed by HPE InfoSight

Let's walk through the phases HPE InfoSight went through to become one of the industry's most advanced AIOps platforms.

Phase One: A Tale of Three Axes

CPU utilization, cache utilization, and capacity utilization are three axes of storage performance automation and intelligence. Users would get alerted when a storage array exceeded available resources on one of the three axes. The benefit of this alerting system was that users could tell whether a system was the right size. But tools in this early phase wouldn't suggest how to resolve the CPU or cache problems or why the spike happened.

Phase Two: Too Much Information; Too Little Context

Granular diagnostics provided the ability to focus on an exact minute in time. This info was hard to interpret, and different metrics told conflicting stories, leaving it to the user to apply context and discern what was valid.

Phase Three: Flawed Sliding Window Analysis

Similar to the preceding phase, accuracy wasn't the strongest suit of this correlation-based model approach. Sliding window analysis and forecasting led to not so accurate predictions. Also, not all correlations were related. Users were once again left to make sense of it.

### Phase Four: Mature ML and AI Take HPE InfoSight to the Next Level

This phase is where all of HPE InfoSight's ML AI work comes together. Predictions improve 10x. With peer training, HPE builds ML models sophisticated enough to predict when customers will notice performance problems. Global visibility across a diverse install base provides rich data that enables HPE InfoSight to find corner case scenarios and tag them for later training. Using semi-supervised loops to retrain on those corner case scenarios, HPE InfoSight can create fingerprints that fuel predictions and prevention. The Contextual Insights feature minimizes the fatigue and burden caused by too many alerts.

Now that we've laid out how HPE InfoSight became the performance tool that it is today, it's only befitting to cover how HPE's performance optimization looks.

Performance Optimization in Action

Performance tuning your infrastructure manually is often fraught with debilitating steps that waste valuable time. If only you could have a performance analyst onsite to help you maximize the value of your infrastructure! HPE InfoSight comes close. It's a scalable AIOps platform that provides performance tuning, optimization, and more for infrastructure, using advanced ML to provide predictive analytics and recommendations. Its mature ML takes HPE InfoSight to the next level, part of the reason customers have likened HPE InfoSight to having a performance analyst onsite.

Primera: HPE Intelligent Storage for Mission-Critical Apps
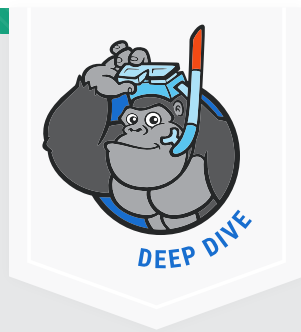
No mention of HPE InfoSight's performance optimization would be complete without delving into Primera, HPE's most intelligent storage for mission-critical apps. On this storage platform, extreme resiliency and performance reign supreme. Workload saturation issues, which are often hard to pinpoint, can be easily assessed on Primera arrays using HPE InfoSight's global intelligence to compare similarly configured arrays. Here, HPE InfoSight provides a consolidated metric for saturation. It also delivers a profound baseline against which to formulate insights and advice, and against which to compare the impacts of recommendations once enacted.

In addition, HPE InfoSight optimizes performance in Primera by moving background I/O, such as deduplication and compression, to time windows where it's unlikely to affect performance. HPE InfoSight presides over workload servicing and resource sharing on the array so it can be optimized over time and make best use of available resources, especially when otherwise underutilized or idle.

To enable more timely actions and decision making, Primera uses StoreServ Management Console (SSMC) to bring predictions and intelligence on-premises. SSMC, powered by HPE InfoSight, allows for more timely actions. Integration with cross-stack analytics for VMware gives HPE InfoSight more intelligence about what is happening through the entire stack running your workloads.

Based on workload patterns, HPE InfoSight Recommendation Engine identifies opportunities to improve your infrastructure's performance. Mature ML and AI behind the scenes makes this possible. Sometimes a rogue workload causes storage slowness. HPE InfoSight can identify

those instances and the affected volumes. Detecting unusual load and latency, HPE InfoSight can identify performance outliers and hotspots. And beyond detection, HPE InfoSight can proactively prepare mitigation plans to restore performance, thereby freeing ITOps teams from all of the guesswork that goes into manual performance tuning.

As you continue your quest to optimize and maximize your infrastructure, performance tuning and optimization remain pivotal. Any path to optimization will be much more seamless and efficient with the right tools.

Evolve Your Workloads with HPE InfoSight

As you've learned throughout this Gorilla Guide, great performance tools are not developed overnight, and not all solutions are created equal. It took over a decade for HPE InfoSight to evolve into what it is today, and it's still evolving. HPE InfoSight is a scalable AIOps platform that provides performance tuning, optimization, and more for infrastructure, using advanced ML to provide predictive analytics and recommendations. HPE InfoSight enables you to modernize and transform management of the most critical pieces in your environment with the industry's most advanced AI for infrastructure.

In fact, HPE InfoSight provides the information and insight that organizations need to establish a proactive wellness approach to their IT infrastructures. Not only through baselining local consumption, behaviors, and performance in the organization's reach, but also by comparing with other, similar IT environments running around the globe, organizations can understand what's normal and what's healthy. They can work to improve overall health, and use that understanding to take faster, more appropriate actions when issues start to show themselves, rather than waiting for acute performance issues or outright failures to spur them into action. HPE InfoSight helps organizations acquire, use, and understand AI-driven insights and information to get more from, and do more with, their IT infrastructure investments.

Your journey doesn't end here—in the next chapter we look at how HPE InfoSight can help transform the management of your environment.

CHAPTER 4

# Transform the Management of Your Environment

In This Chapter:

- Demystifying artificial intelligence, machine learning, and deep learning
- Data analytics and predictive analytics
- How artificial intelligence and machine learning make a difference

As we've explored in the first four chapters, from a more forward-leaning perspective, predictive analytics can also provide powerful insights to drive resource planning, capacity forecasting, and to drive optimal workload positioning and timing to make best use of available resources. Equally important, a deep and thorough understanding of performance metrics means an ability to establish a dynamic baseline, with automated responses to deviations therefrom related to latency from edge-to-core. The same metrics-driven analytics can also identify underutilized or unneeded resources, and provide immediate insights to drive troubleshooting and performance tuning.

HPE InfoSight provides a powerful toolset that lets organizations deploy and use AIOps for hybrid cloud environments. In fact, HPE InfoSight helps organizations apply AI insights to the ways and means they manage their computing environments and the underlying infrastructure. And as that infrastructure grows increasingly distributed and ever more complex, HPE InfoSight allows organizations to advance

Artificial Intelligence (AI)

Programming a computer to reason as a human being might. Modern AI narrows its focus to specialize in specific areas of thought or action, such as virtual personal assistants (Siri or Alexa), autonomous vehicles, or automatic photo tagging in Facebook.

Artificial Intelligence

Machine Learning
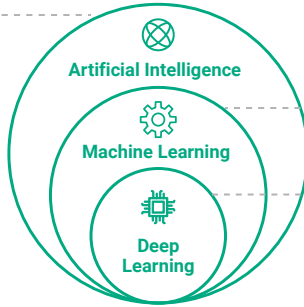
Deep Learning

Machine Learning (ML)

Uses algorithms so computers can learn from examples (training data sets) without specific programming to drive selections and strategies.

Deep Learning (DL)

An area of ML that relies on data-driven neural networks to provide models so that programmers need not distinguish and engineer features and functions.

Figure 4: Comparing and positioning deep learning and machine learning within artificial intelligence

beyond a hands-on approach to ensure non-disruptive availability for applications, automated optimization for rapidly changing workloads, infrastructure tuning to benefit performance and user experience, and a proactive, predictive approach to anticipating and avoiding capacity, access, and performance problems. With so many different applications running on various clouds and data centers, organizations need the benefit of a "big picture" view that shows how infrastructure and IT are working as a whole.

Demystifying Artificial Intelligence and More

Two major approaches to AI have emerged in the 21st century: ML and deep learning (DL). Their relative location in the overall field of AI is shown in **Figure 4**.

Machine Learning

ML takes some kind of basic model about how things work in a particular field of data, and applies algorithms that learn as they dig ever more deeply into the data they encounter. This learning gets cycled back into the model to improve its representational ability and accuracy, along with the insights and understandings it can convey. ML doesn't rely on
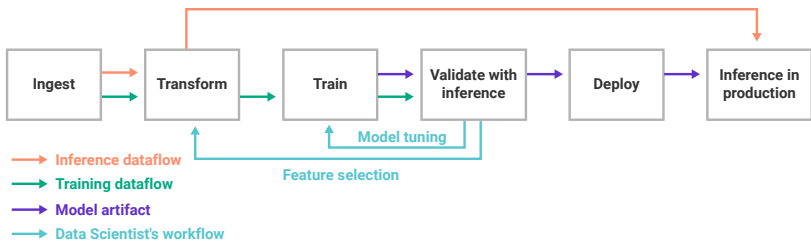
Figure 5: Dataflow for machine learning

detailed instructions as normal programs do; instead, its algorithms compare results obtained by using specific methods and making specific choices. Over time, by consistently choosing methods and choices that produce good results, the model evolves and improves.

ML usually starts off with a training phase, using special data sets constructed to emphasize chosen features and specific data. These "training data sets" are used iteratively to create and refine understanding and selection logic. ML is subject to the pitfall that is it easy to overfit existing observations or demographics, so that while the resulting model may fit the training data very well, it may not fit the real data as well as it should. Thus, it essential to ensure that the model remains relevant and accurate in analyzing real, production data.

A typical ML dataflow appears in **Figure 5**. It shows how ML works in training mode to build the associations and patterns it needs to make recommendations (light blue). It also shows how ML works in production mode, as it takes inputs, works with its various data sets, and uses available data to make recommendations by inference.

Digging into Deep Learning

Where ML uses algorithms and data sets to create and refine self-created data selection methods and techniques, deep learning layers multiple complex hierarchical models designed to reflect or capture human thought processes. Thus, for example, deep learning can mine enormous data sets to offer personalized buying recommendations

Supervised vs Unsupervised vs Semi-Supervised ML

In a supervised model for machine learning, an algorithm works from a labeled dataset. It provides an explicit answer key that the algorithm uses to evaluate its accuracy in working with the training data. By comparison, unsupervised machine learning uses unlabeled data. The algorithm tries to make sense of that data by extracting features and patterns by itself.

Semi-supervised ML strikes a balance between the unlabeled and labeled approaches. It starts with a small infusion of labeled data in order to analyze and interpret a larger set of unlabeled data. Over time, its accuracy and effectiveness should increase as it incorporates and accommodates what it learns from the unlabeled data.

based on some target buyer's prior purchase history and expressed interests, as well as huge volumes of aggregate buying data for a large population, filtered to narrow in on other buyers whose choices, selections, and interests are shared with the target buyer. Such collections of data are used to continually drive the neural networks that power deep learning. Companies with multi-million customer bases such as Netflix and Newegg, among many others, use deep learning every day with their customers. Deep learning is even more subject to overly close fitting to historical data, and also needs constant "reality checks" to make sure it is accurate. Deep learning does not work for many data sets that HPE InfoSight uses, though it may be called upon from time to time for certain data sets when a good fit for deep learning is known to exist.

Data Analytics and Predictive Analytics

In general, data analytics describes a large and complex set of statistical, inferential, and pattern recognition tools. These tools typically derive a variety of interesting and sometimes counterintuitive insights from analyzing and looking for trends and patterns in the data they ingest and analyze.

Predictive analytics takes the insights that data analytics can deliver one step further—into the future, as it were. That is, predictive analytics uses data gathered from currently active and in-use IT environments as its basis, along with historical data, to anticipate potential issues, performance bottlenecks, and other looming problems before they actually manifest and cause real trouble. In particular, HPE InfoSight uses predictive analytics so organizations can recognize and fend off impending signs of trouble before they start affecting performance, access, availability, or security.

In October 2018, IDC published a whitepaper[1] entitled "Cloud-Based Predictive Analytics Becoming a Critical Source of Vendor Differentiation in Enterprise Storage." The focus has turned from raw, hardware-based performance to designing and driving an improved customer experience. According to IDC, among the areas where vendors are working to improve their customer experience, "cloud-based predictive analytics (CBPA) figures prominently …" This whitepaper identifies three key features for such systems, including data sharing, scope of monitoring, and use of AI/ML to drive autonomous operations. It specifically calls out HPE InfoSight as "the most mature cloud-based predictive analytics platform in the industry."

[1] https://www.hpe.com/us/en/pdfViewer.html?resource=/content/hpe/country/us/en/resources/storage/cloud-based-predictive-analytics-becoming-a-critical-source-of-vendor-differentiation&parentPage=/us/en/solutions/infosight&timestamp=1601587209312&isGated=true

Why and How AI/ML Makes a Difference

Ultimately, what makes AI/ML relevant and valuable is its ability to automatically and pro-actively recognize IT infrastructure issues, allowing HPE InfoSight customers to manage their IT infrastructures and resources efficiently and cost-effectively. In fact, AI/ML in HPE InfoSight excels at dealing with virtualized infrastructures to optimize workloads, eliminate unused or underused VMs, fix resource hogs, and identify and address major storage consumers and instances of high latency. HPE InfoSight users do not need to have a deep understanding of AI/ML—or an existing AI/ML practice of their own in-house—to take advantage of HPE InfoSight's AI/ML capabilities. Nor need they take any role in labeling data for HPE InfoSight's consumption (either manually or automatically).

How HPE InfoSight Uses AI/ML

HPE InfoSight excels in providing guidance for situations where simple "if A, then B" rules don't apply (or work). This usually involves complex interactions among or across multiple systems (compute, storage, networking, and infrastructure) where simple "if A, then B" prescriptions simply don't apply. As an example, "if A, then B" prescriptions are insufficient when correctly identifying an issue, which requires identifying signals from several quantitative measurements simultaneously, some of which come from multiple, separate subsystems (such as storage and networking). HPE InfoSight is particularly adept at identifying contributing factors to latency, CPU contention, and other performance or access problems.

In general, the proper use of analytics depends on reliable access to accurate and unambiguous metrics to monitor and manage systems and performance. HPE InfoSight focuses intently on measuring performance, availability, latency, bandwidth, and errors to provide clear and intelligible guidance in its predictive analytics. It does so by sticking strictly to quantitative measures, without falling into qualitative gradations and possibly questionable "judgement calls."

Where HPE InfoSight Has Helped, Illustrated

In certain circumstances, HPE InfoSight users have observed that performance analysis yields outsized payoffs and benefits. Thus, for example, HPE InfoSight ties into the company's global telemetry and data ingestion. This provides a viewpoint based on global peer learning from aggregate observations across all participating customers, as well as from specific data points and metrics present at a particular customer site or installation.

Case in point: HPE InfoSight offers users a Latency Severity Score that contextualizes latency based on how likely it is for that latency to noticeably impact application performance. This is accomplished by translating raw latency measurements in an interpreted Latency Severity Score using an ML model trained based on I/O activity from other customers, or customers in the aggregate.

In the same vein, HPE InfoSight also uses Symptom Severity Scores (which examine individual latency factors such as application response times, storage latency, network latency, and so forth) to quickly zero in on root causes and describe potential fixes. In fact, HPE InfoSight handles the interpretation of such scores, so that users need not interpret them directly. This allows organizations to address common causes of latency quickly and accurately: Whereas latency analyses from scratch can take hours or days, HPE InfoSight offers information to get to root causes in minutes.

Another example of how HPE InfoSight can provide relief from a difficult problem depends on targeted, semi-supervised ML capabilities. This technique has allowed the solution to automatically diagnose even uncommon performance issues. One of the earliest examples of this was an issue with access to high-speed flash memory devices (SSDs) that occurred only when I/O demand swamped the bandwidth of the channels through which a few of those devices were accessed. Normally, this kind of problem can be fiendishly difficult to diagnose because there is no single measurement that can conclusively identify

the issue. By using semi-supervised learning to initialize and then re-fine an ML model to identify this scenario, HPE InfoSight was able to include this signature in its performance diagnostics automation. In this way HPE InfoSight removes the need for others to manually identify additional instances of this issue, anywhere in HPE InfoSight's customer base.

When Big Data Makes a Difference

HPE InfoSight is particularly helpful in assisting its users in sizing storage and virtualization resources to keep up with planned growth and emerging growth trends. It provides inputs to help customers prepare for such growth and expansion, while allowing extra headroom for unanticipated spikes in use or demand.

HPE InfoSight also helps customers to identify and perform the right diagnostics to assist with troubleshooting, root cause analysis, and mitigation strategies. Its capabilities are particularly able to address and tease apart latency- and IOPs-related issues, where multiple factors can combine to mask or obscure what needs fixing—usually as soon as possible—to set things back to rights.

And, finally, HPE InfoSight is especially adept at optimizing workload placement, priorities, and resource allocations. This comes from its abilities to capture and evaluate the factors that govern application performance and user experience. By optimizing where workloads run, and what kinds of resources are provided to them, HPE InfoSight can give users the best possible experience, while also optimizing resource utilization and costs.

In this chapter, we provided a big picture view of how data analytics gain insights and valuable guidance through judicious and targeted use of AI/ML for problem solving, resource allocation, and use, and deciding when and where to position workloads in an IT infrastructure. These are all real-time, here-and-now concerns that are of great value to current IT operations.

In the next chapter, we lean forward into the future and explain how such tools and techniques can help with planning for IT growth and expansion, including adding resources, scaling-up and scaling-out infrastructures, and forecasting capacity and capability needs.

CHAPTER 5

HPE InfoSight for IT Planning

In This Chapter:

- Understanding HPE InfoSight Resource Planner
- How Resource Planner makes predictions
- Capacity forecasting for new applications or workloads

Today's problems are too often all-consuming and all-absorbing. Fortunately, the same tools and techniques used to deal with current issues and concerns have the ability to forecast, project, and predict what kinds of change, growth, and capacity will likely be needed in the future. That's because a sense of history that leads the past into the present also provides valuable trending information about where things are headed in the future. This supports planning and scheduling, and forms the focus for this chapter.

In fact, HPE InfoSight offers organizations the opportunity to totally transform how they manage their IT infrastructures. HPE InfoSight uses AI and ML to examine, analyze, and improve an infrastructure's behavior and performance. It collects and analyzes data from a huge number of systems around the world, and uses the intelligence it gains thereby to make all systems smarter, more reliable, and more self-sufficient. Overall, HPE InfoSight delivers AI-powered autonomous operations to ensure that an organization's IT infrastructure is highly available, always running optimally, and always improving on past capabilities and performance.

Understanding HPE InfoSight Resource Planner

HPE InfoSight Resource Planner helps to establish optimal workload placement within an organization's IT infrastructure. Working with HPE Nimble storage technologies, Resource Planner uses simulations of the impact of new workloads on storage array resources in combination with existing workloads to determine optimal workload placement. HPE InfoSight uses these simulations to predict capacity requirements, as well as cache and CPU needs.

HPE InfoSight's simulations and predictions help answer the following questions, which are often encountered in production IT environments, and which must be answered (correctly!) to achieve the best results and the most successful business outcomes:

- What infrastructure do I need to expand my application?

- Will the expanded application fit on my existing storage arrays? If not, which new arrays should I buy?

- What infrastructure do I need to deploy a new application?

- How will adding a specific application workload to storage impact performance?

- How much does any specific workload contribute to the total storage workload?

- Which workloads are most storage- and resource-intensive?

Resource Planner stands ready to answer these questions for your organization—answers that are essential to proper planning and budgeting for growth and expansion of IT resources.

Figure 6: HPE InfoSight makes it easy to play with time frames, workload and capacity multipliers, and more

Planning More Optimal Deployments and Outlays

Because it's continuously analyzing similar workloads across a broad range of customer environments, HPE InfoSight is able to identify specific cause-and-effect relationships while doing "what if" analysis. Thus, for example, the effect of data deduplication on CPU usage across different array models is known and well-understood. In turn, this informs the simulations used to predict future needs for specific collections and combinations of storage arrays. This is what gives Resource Planner the ability to modify an existing workload, for which the tool lets you select a specific time frame for analysis, add a multiplier for workload or capacity, and turn deduplication off or on. These options appear in **Figure 6**, straight from the HPE InfoSight UI.

Achieving Possibilities Through 'What-If?' Scenarios

Organizations can use the HPE InfoSight Resource Planner tool to examine the consequences of possible upgrades, replacements, and additions to their existing IT environment to estimate costs associated with specific multipliers and usage scenarios. This means they can "what if" their way into growth planning, and determine how much it will cost to accommodate certain specific levels of growth. They can also easily examine the costs and consequences of deliberately under- or overshooting certain targets. Thus, if an organization's business activity includes certain periodic or seasonal spikes (end-of-quarter, end-of-year, or holiday shopping are all typical examples), such time frames can help guide workload modeling to predict the future impact of spikes on existing versus new hardware.

Such a modeling approach makes it easy for IT planners to weigh costs against capability, and then to involve business stakeholders and upper management to explore the value of possible expenditures against opportunity costs (or gains) for planning actual budgets and outlays. They can game their way into stakeholder buy-ins by showing those stakeholders upsides and downsides from budgeting decisions that otherwise might be purely dollar-driven, and thus neither aggressive nor optimistic enough to match demonstrable "what-if" projections.

How Resource Planner Makes Predictions

Behind its easy, user-friendly menu- and selection-driven interface, Resource Planner uses careful analysis of a huge volume of data about system activity, behavior, performance, reliability, and issues or errors encountered to deliver intelligence to inform IT infrastructure

management. This intelligence also enables HPE InfoSight to provide predictive support that uses current metrics from the customer's own environment, combined with similar metrics from many other instances and viewpoints, to anticipate potential bottlenecks or problems and propose mitigations or workarounds before they can cause trouble.

The same analytics that permit predictive support also help inform AI-driven operations to optimize storage allocation and use, as well as optimal workload placement and prioritization. This is based on a deep understanding of existing workloads in the customer's own environment in light of information about workloads running in countless other customer environments. The simulation approach noted in the preceding section helps organizations predict whether their current storage resources can handle expanded workload or capacity, if called upon to do so. Thus, it not only supports planning for future growth, it also warns of potential resource shortfalls sufficiently in advance to head them off before they happen.

Application-specific analysis relies on time-tested, AI-informed data science models to analyze CPU and cache usage on storage arrays. These permit Resource Planner to tag and save application workload characteristics to show that, for example, it's more challenging to de-dupe and compress Microsoft SQL environments than virtual desktop infrastructures (VDIs). In the same vein, HPE InfoSight knows that Microsoft Exchange is likely to make more sequential reads, whereas virtual desktops reads are more random. Resource Planner packs this kind of understanding and modeling into its application categories, all of which are available from its convenient dropdown menu for application selection.

This is what allows Resource Planner users to model the impact of adding an Exchange workload to workloads already running on a chosen storage array, as shown in **Figure 7**.
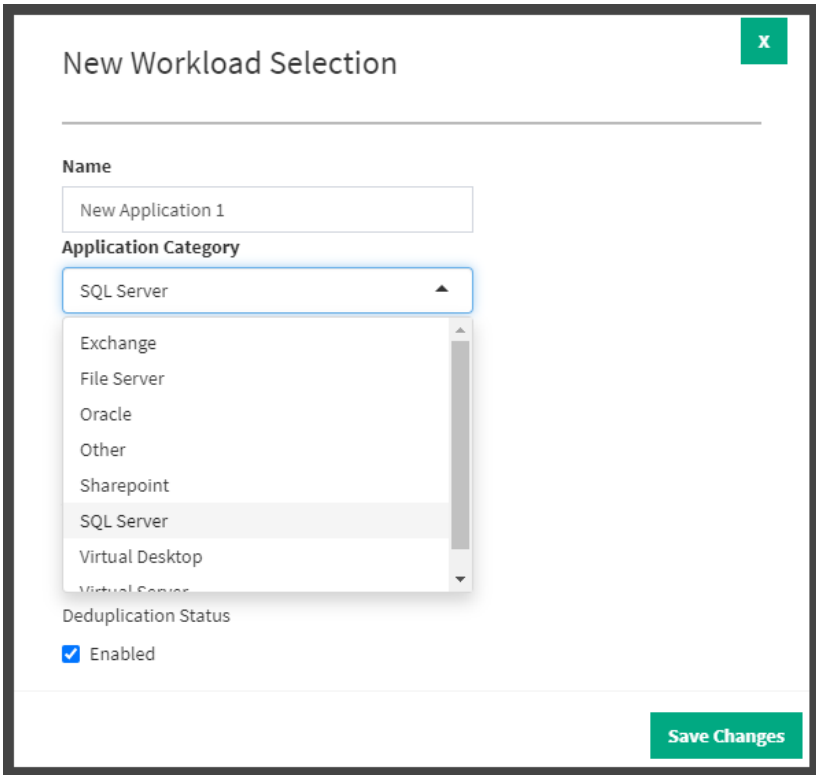
Figure 7: In addition to Microsoft Exchange, Resource Planner can model a great many other applications, including those shown in the Application Category list dropdown

Other customizable options for application workloads in Resource Planner include total dataset size, max IOPs, bursty or sustained workload, and again, a toggle for data deduplication. Such selections make Resource Planner's predictions more accurate across the board, including CPU and cache needs, based on characteristics that come from the HPE InfoSight analytics engine. Ultimately, this wealth of data is what makes Resource Planner an excellent modeling tool, and what makes its predictions uncannily accurate, even given the variability of complex workload properties that include compressibility, VDI consistency versus the highly variable behaviors of databases, Exchange and SharePoint servers, and so forth.

Capacity Forecasting

HPE InfoSight Resource Planner is a remarkably powerful and capable tool. For managing existing installations and environments, Resource Planner helps users optimize their current workloads across a range of resources. But its simulation tools—especially multipliers for workload levels and capacity—enable Resource Planner to help users decide if they can add new applications or workloads to current arrays based on existing workload characteristics. This is a way to "what if?" current environments with planned additions or up-scaling.

In fact, Resource Planner's predictive modeling lets organizations accurately estimate future resource needs. Then, they can use Resource Planner to decide if they want to upgrade existing equipment, make new purchases, or combine upgrades and new equipment to meet future computing needs. In such a mix of activity and forecasting, capacity planning is particularly important. That's because it can head off otherwise painful "running out of space" scenarios that might hamper business growth and levy painful opportunity costs.

As HPE InfoSight addresses common storage and IT administration issues, three questions prove particularly relevant to good forward planning:

- How has my data usage trended?

- When will I run out of capacity?

- What upgrades or new equipment do I need, and when?

Through its various simulation and sizing tools, HPE InfoSight can predict upgrade and new equipment needs. Current usage trends coupled with known upcoming spikes—and their typical or usual multipliers—provide the data needed to reveal when capacity will run out and how much additional capacity will be needed. In turn, this lets organizations know when to purchase upgrades, or if new equipment will also be needed (or needed instead).

Making the Most of HPE InfoSight's Capabilities

HPE InfoSight and Resource Planner gain insights and recommendations from three important HPE sources of data:

- Intelligent, AI-driven use of the storage industry's largest data lake

- Broad and capable data collection software on infrastructure components that provide clear, valuable metrics to establish detailed tagging and characteristics for hardware and software systems, applications, and server/storage environments

- An agile approach that delivers ongoing improvement to data science modeling, based on years of experience across a broad range of customer scenarios, industries, and runtime environments

The same well-analyzed, well-understood ocean of data at HPE's disposal is, of course, what enables HPE InfoSight to also deliver predictive maintenance and support to its customers. This ensures reduced downtime and troubleshooting effort, along with improved application reliability and user experiences. Equally important, Resource Planner's insights into current capacity usage trends, coupled with user knowledge about projected growth and upcoming spikes, make Resource Planner an outstanding tool for capacity planning, as well. Ultimately, in fact, Resource Planner helps organizations achieve reduced total cost of ownership for their storage assets, and better overall IT planning and management.

Working one's way from a current IT operations environment to its bigger, better future counterpart is often a matter of showing how planned and budgeted outlays leads to improved revenues following deployment and use. In a world of increasingly complex, distributed and hybrid cloud IT infrastructures, it's even more important to see the big picture across the entire enterprise (and into the cloud). This is another area where HPE InfoSight excels, and provides the focus for

the next and final chapter. Namely, using HPE InfoSight tools and an-alytics to put its AI/ML-driven insights to work to improve availability and reliability, automate optimization to make best use of resources, and deliver best-in-class user experiences, and to carry proactive and predictive approaches to management into the clouds.

Manage Your Complex Infrastructures

In This Chapter:

- Understanding cross-stack analytics
- Optimizing workloads through the infrastructure stack
- Attributing causes for latency: host, storage, and network

When certain IT experts use the term "cross-stack analytics," they do so with a particular emphasis on obtaining a holistic view of what underlying metrics and statistics can tell them about an organization's IT infrastructure and operations.

Understanding Cross-Stack Analytics

Cross-stack analytics is essentially a means of correlating statistics across multiple infrastructure resources (or infrastructure stacks)—including storage, compute, networking, and infrastructure elements—within the context of a single, comprehensive analytical tool (or toolset).

Cross-stack analytics offers noteworthy benefits beyond the convenience of obtaining a cohesive and comprehensive view of an organization's IT infrastructure and operations. Access to cross-stack analytics also means that users need not fire up and run multiple tools

for each stack layer or element—which might entail one or more tool for each typical application resource. Users might even need one set of such tools for each stack element in each private or public cloud environment incorporated into the organization's IT assets, applications, services, and so forth. Thus, simplification and unification appeal greatly to admins, architects and designers.

Cross-stack analytics also takes the drudgery out of correlating observations across and among those stack elements. It can automatically construct a general dependency graph to show how individual elements combine and interact. Such a graph shows which elements depend on others to get their work done. An understanding of application dependencies is essential, because it shows the organization which elements are most important (and most used). Then they can focus optimization and protection efforts where they'll provide the biggest benefits and best payoffs. Understanding dependencies also helps when triaging issues. Take, for example, a situation where different IT administrators are responsible for different layers of the infrastructure stack—let's say a storage admin for HPE Nimble Storage, and a server admin who handles a collection of HPE ProLiant servers. Triaging the problem with an initial investigation will quickly show which admin should dig deeper, and get problem analysis and resolution underway.

Among other capabilities, HPE InfoSight excels at providing organizations with the benefits and insights that cross-stack analytics can provide. In the sections that follow, you'll see some examples of how HPE InfoSight's end-to-end holistic view can help organizations get better value, performance, and use from their IT environments and infrastructures.
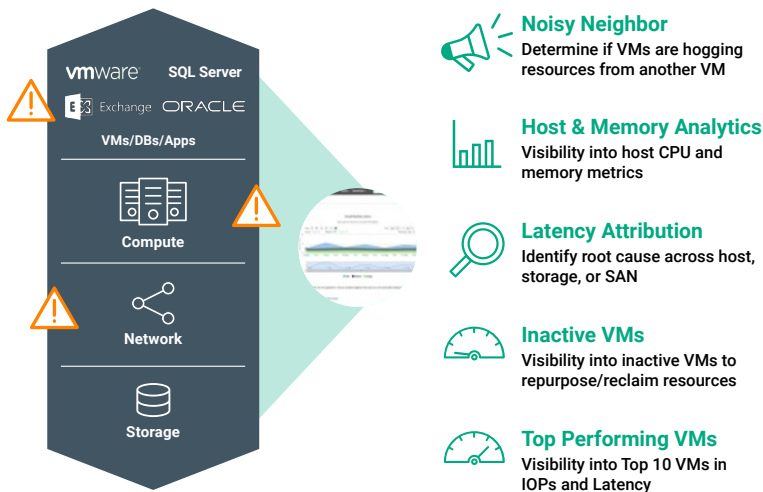
Figure 8: HPE InfoSight cross-stack analytics for VMware environments

Optimizing Workloads Through the Infrastructure Stack

IT infrastructures often involve highly virtualized runtime environments such as VMware and Microsoft Hyper-V. These hypervisors permit organizations to configure, launch, and use virtualized services, platforms, and entire infrastructures based on powerful automation and intelligent allocation, use, and positioning of workloads. HPE InfoSight lets users measure and manage performance of VMware and Hyper-V workloads, and migrate those workloads to make best use of underlying physical systems, storage, and networks. HPE InfoSight can examine hosts, VMs, datastores, and storage pools to perform local diagnostics on a per-VM basis (**Figure 8**). It can also follow connections to look for issues that may arise from application dependencies, as when an application may be blocked as IO waits on a degraded or overloaded storage device.

Workload optimization covers a broad range of capabilities. These include making sure enough virtual resources are available to meet demand (growing and shrinking the resource pool to keep matching demand over time) and balancing workload distributions within virtual infrastructures to make best use of their resources. In the same vein, HPE InfoSight employs near-real-time metrics for latency and user application end-to-end communications. This helps guide workload migration within a data center (or into the cloud) as necessary to deliver the best end-user experience currently available.

Noisy Neighbors: When VMs Hog Local Resources

HPE InfoSight is particularly adept at examining patterns for resource consumption within groups of VMs. This lets the tool seek out potential (or actual) resource hogs. Not only could such VMs be consuming excessive amounts of resources, those consumption patterns may adversely affect other VMs running on the same shared resource. HPE InfoSight can automatically identify and flag when this occurs, while providing recommendations for remediation.

Putting Performance Metrics to Work

Analytics can provide powerful insights into performance metrics like CPU and memory allocation and usage. Because HPE InfoSight takes a statistical and analytical view of how such key server resources are consumed, it has a quantitative understanding of how such metrics relates and contribute to performance issues. Thus, HPE InfoSight allows users to investigate and triage circumstances quickly to manage resource allocations and priorities.

Attributing Causes for Latency: Host, Storage, and Network

HPE InfoSight also provides the broad view necessary to understand the causes of latency in complex virtualized environments. HPE InfoSight's metrics allow it to assess factors that contribute to higher VM latency attributed to hosts, storage systems, and the network. Thus, it can quickly narrow in on where delays originate by tracing dependencies and observing exactly where in the dependency chain latency values are outside their normal bounds.

In addition, HPE Infosight can correlate its metrics and observations with underlying resources and prevailing and typical consumption patterns. This helps it focus in on excessive resource consumption, which can introduce additional delays. Such delays can be remedied by managing resource allocations and priorities to make more of the necessary resource (or resources) available. Often, this reduces latency to acceptable levels. But if not, HPE InfoSight can identify where latency-hampered workloads might be moved or where additional hardware resources could be added to deliver a better user experience.

Identifying and Dealing with Inactive VMs

Inactive or underutilized VMs still consume resources, increasing costs and possible performance impacts on active, properly utilized VMs. HPE InfoSight can recognize inactive and underutilized VMs, identifying for users where resources can be reclaimed.

Identifying and Characterizing the Top 10 VMs by IOPs and Latency

HPE InfoSight offers a "Top 10" view that shows the VMs currently manifesting high levels of I/O or latency. These VMs are those most actively using storage resources and devices. Examining the members
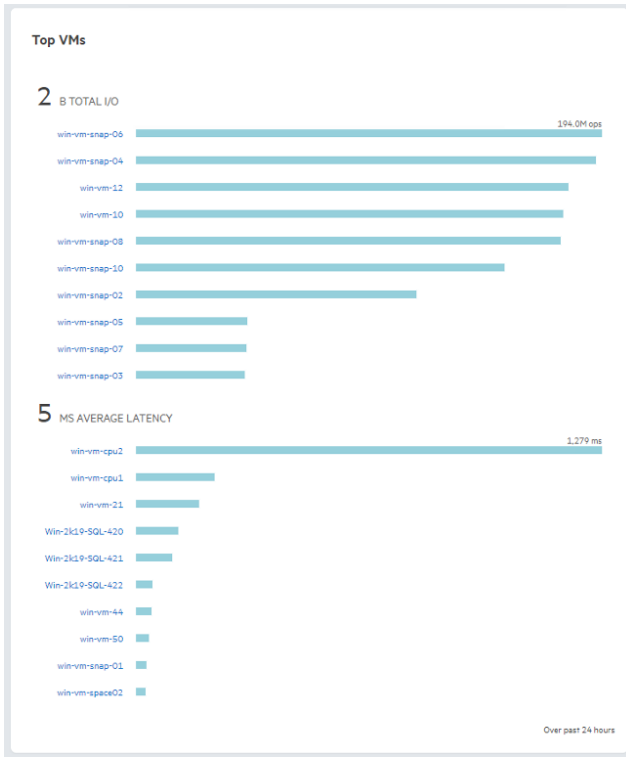
Figure 9: The Top 10 list ranks VMs that emit the most I/O (top) or experience the highest latencies (bottom)

of the "Top 10" latency list helps users recognize when critical services are experiencing performance issues. In this particular view, HPE InfoSight identifies those VMs most likely to benefit from tracing latency issues back to root causes, through another feature called InfoSight performance recommendations. Conversely, the "Top 10" I/O list helps users recognize when less important processes are consuming more resources than they deserve. For HPE Nimble Storage customers, the list can contain VMs from both Microsoft Hyper-V and VMware if configured, as shown in **Figure 9**.

In general, HPE InfoSight provides helpful tools and visualizations to identify top offenders that let admins zero in quickly on potential

resource hogs and slow VMs. Drilling down into the resource consumption and performance characteristics of those VMs then helps to resolve underlying issues and get them off whichever Top 10 list they occupy. That said, it's important to remember Jerry Weinberg's famous "Rudy's Law of Rutabagas," which is best rendered in this case as "As you take one VM off the Top 10 list, another VM pops up to take its place." Ideally, then, any VM on any Top 10 list won't be outside (or at least, not too far outside) acceptable norms for IOPs and latency, and its time there will be transitory.

A Single, Logical View

In this Gorilla Guide, you've seen the real benefits of HPE InfoSight come from its context-sensitive, data-based approach to presenting and prioritizing performance metrics, utilization rates, and resource

status information. Because data history is also part and parcel of how it presents and contextualizes those things, users see it in the context of where it has been, what it is doing, and where it might be going in the future. In addition, HPE InfoSight's ability to consolidate metrics, rates, and more across all systems and sites means it offers a holistic view of the organization's IT infrastructure under a single, logical view. More than anything, this supports proper positioning and timing of workloads, and dynamic responses to changes in demand and geography needed to optimize user experiences and ensure best use of infrastructure resources.

If these capabilities sound interesting, it's because they can deliver profound value to their users. You can learn more about HPE Infosight online,[2] or try out the demo[3] to dig more deeply into its benefits and value.

Thanks for reading, and stay safe out there!

[2] https://www.hpe.com/us/en/solutions/infosight.html

[3] http://www.hpe.com/demos/infosight

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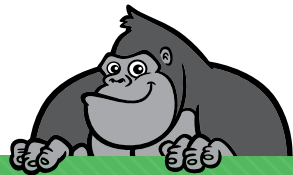
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