THE CIO GUIDE
to
AUTONOMIC IT
“Without change there is no innovation, creativity, or incentive for improvement. Those who initiate change will have a better opportunity to manage the change that is inevitable.”

- William Pollard
IT Trends are Increasing Complexity

Organizations are adopting cloud computing to accelerate service delivery. Some try to deliver cloud economies of scale in their private data centers with the mantra “automate everything,” a philosophy often simpler in theory than practice. Others have opted to leverage public cloud resources for the added benefit of the pay-as-you-go model, but are finding it difficult to keep costs in check. Regardless of approach, cloud technology poses the same challenge IT has faced for decades: how to assure application performance while minimizing costs.
Within this new territory, however, a number of trends take addressing this problem to new levels of complexity and difficulty:

- **Cloud computing and the self-service portals** it delivers increase the speed, frequency, and volume of changes to a given environment. A recent report by McKinsey found that cloud-savvy leaders can provision x86 servers in a private cloud within 60 minutes, or in a public cloud within 30 minutes. Gone are the days where a lead time of days or weeks was acceptable.

- **Containers and microservice architectures** allow (with extensive automation) development teams to push small, but numerous changes to parts of their applications rapidly and repeatedly. Netflix, for example, has enabled its developers to launch hundreds of software changes a day. Enhanced speed is made possible, but with it come exponentially more moving pieces in the environment.

- **Multiple technologies are a given, and multiple clouds will soon follow.** “Heterogeneous” is no longer just about multiple hypervisors, databases, or storage flavors in an environment, but multiple environments, whether on-premises, in a cloud, or across multiple clouds. RightScale’s 2017 State of the Cloud Survey found that 85 percent of enterprises have a multi-cloud strategy. Can your organization afford to have a different approach for performance-cost management for every workload and every cloud?

---

**Cloud technology poses the same challenge IT has faced for decades: how to assure application performance while minimizing costs.**
It quickly becomes apparent that the self-service enabled by cloud computing and the microservice application architectures made possible by containers create highly dynamic environments with more moving parts. At the same time, the industry offers a multitude of technologies for IT to service their business. Every organization is different and with that their choices about what technologies are best suited for them. IT is now managing more heterogeneous environments than ever—and naturally that heterogeneity extends to clouds.

Enterprises are becoming technology companies as a matter of competitive advantage, thus putting greater pressure on IT. These trends make assuring application performance while maximizing efficiency considerably more challenging. What’s more, this challenge is ushered in by an era in which enterprises are becoming technology companies as a matter of competitive advantage, thus putting greater pressure on IT to both facilitate and support this development through turning to cloud technologies. In fact, Cisco’s Global Cloud Index predicts that cloud workloads will more than triple from 2015 to 2020 (see above) – illustrating the order of magnitude with which this change is occurring.
The complexity of infrastructure management has been increasing exponentially since inception. Virtualization pushed it to new limits. Today, cloud and cloud native technologies do the same, but at even greater scale.

Below, as IT organizations adopted virtualization across their environments, scale and complexity increased. With cloud and cloud native technologies, scale and complexity grow exponentially.

Given the undeniable criticality of IT to the business, the CIO that cannot deliver predictable performance while minimizing cost, puts their business, and their job, at considerable risk. As they strive to adapt to the trends outlined above, these leaders are realizing the limitations of traditional approaches; monitoring, alerts, schedulers, scripting, and orchestration cannot assure performance alone. They risk human error and operate in a break-fix loop that only corrects errors once they have already occurred.

It is time for CIOs to rethink their approach to IT.

This document is for the CIO that seeks to transform their business through better and faster IT service delivery. It will discuss five stages of IT maturity and how—no matter where an organization exists today—adopting an autonomic approach that allows workloads to self-manage on any infrastructure or cloud can help.
Organizations today vary in their level of IT maturity. The ability to adopt new technologies and processes, pressure from the business, as well as the beliefs and aspirations of CIOs all play a role in how and why organizations mature differently. The remainder of this document describes five stages of IT maturity and what each entail, to enable CIOs to understand where their organization is today and where they can aspire to reach. The stages are as follows:

1. **Aware**: Collect and review performance and cost metrics
2. **Proactive**: Proactively make changes to assure performance and control cost
3. **Automated Management**: Continuously assure performance within cost constraints
4. **Demand Aligned**: Auto-scale apps and infrastructure based on real-time demand
5. **SLA Delivery**: Deliver differentiated service levels within cost and business constraints

Key performance metrics make it possible to quickly identify where an organization is in terms of IT maturity. These KPIs include ratio of VMs per admin, percent virtualized, and time to provision to workloads. Determining where your organization resides is the first step towards progress.
No matter the stage in which an organization exists, the performance-cost challenge that the industry has grappled with since its beginning can only be solved by software that enables environments to self-manage. As environments scale and become more complex, the need for self-sustaining and autonomic infrastructure increases.

Adopting an autonomic approach to IT requires a change in mindset across the organization. But whatever their stage of IT maturity, CIOs and their organizations can benefit from the value that autonomic technology provides.
STAGE 1: AWARE

For organizations residing in the first stage of IT maturity, performance is a matter of uptime and cost is the common language between IT and the business. CIOs want their teams to resolve issues as quickly as possible, and they demonstrate value to the business primarily through cost-cutting.

Aside from the fire drill, these CIOs do not yet feel pressure from the business to move rapidly. Often, services are defined on an annual basis, changes are planned weeks in advance, and infrastructure is budgeted for peak allocation. Administrators will manage 250 - 300 VMs, while typically less than 75% of the environment is virtualized. Provisioning a new VM can take three or more weeks.

When considering ways to improve, these organizations aspire to reduce troubleshooting and increase infrastructure density. They look for ways get insights about the environment to enable administrators to make more informed resource decisions, and these administrators rely on monitoring everything in the environment to balance resources and troubleshoot performance issues. When making resource allocation decisions, administrators act based on historical peaks or app owner demands.

For many organizations, this approach has always been the way to manage IT. But enlightened CIOs are challenging the status quo, realizing the operational necessity of avoiding performance degradation altogether and the potential efficiency gains to be made from provisioning resources based on real-time demand. Addressing performance degradation after the fact, i.e. troubleshooting, is an operationally inefficient exercise that quickly spirals into a multi-team blame game. Meanwhile, allocation-based approaches that take no account of real-time demand are antithetical to density improvements because they inevitably result in overprovisioning. These limitations may have seemed unavoidable in the past, but with advancements in software, they no longer are.

Today, IT can not only get full-stack, multi-cloud visibility into their environment, but actions that explain the current performance and/or efficiency risks and how to avoid them. With a holistic understanding of their environment and the software-derived answers for how to optimize it, organizations can mature beyond break-fix, allocation-based approaches that do not scale. Through the adoption of autonomic intelligence, these organizations can operate more proactively and increase efficiency, both in terms of people and infrastructure.
CIOs of proactive IT organizations prioritize maximizing infrastructure ROI and staff productivity. Furthermore, they believe addressing performance issues before they occur is necessary to those ends and that software does a better job of it than their people. Organizations at this stage plan based on known cyclical changes, implement changes during agreed upon windows, and budget based on historical utilization. As they support different business units, they will have show-back/charge-back policies in place, as well as uptime SLAs. Administrators will manage up to 500 VMs in an environment that is more than 75% virtualized, and provisioning a new VM now takes up to a week.

By leveraging an autonomic platform, these organizations can realize even greater performance and efficiency gains. When workloads self-manage, they make placement, sizing, and provisioning decisions based on the resources they need, when they need them. Administrators of proactive organizations will diligently execute those decisions, freeing themselves from monitoring, balancing the environment, and troubleshooting. Individuals can manage 10 times more workload and provisioning time can be reduced by nearly 80%. And because the platform’s decisions are based on real-time resource demands, administrators avoid the overprovisioning that comes with allocation-based approaches, while improving performance. Resource utilization increases by at least 20% and workload performance improves upwards of 20-30%.

**Autonomic Snapshot**

**TRIBUNE MEDIA**

**Industry:** Conglomerate (television broadcasting)

**Challenge:** In 2014, Tribune split its two main business units into two separate companies, Tribune Media and Tribune Publishing. IT needed to divide the virtual environment and also had to plan for a full data center move from Chicago to Raleigh, NC.

**Scope:** Turbonomic manages 100% of the environment, including storage (NetApp and Pure Storage) and 250 virtual desktops.

**Automation:** vMotion

**Savings:** Estimated $400,000 in savings and consolidated 1,300 VMs to 800 VMs.

“We used Turbonomic throughout the move for a number of projects, including planning and running what-if scenarios to ensure we had the right resources in our new data center, as well as to ensure our applications didn’t suffer from the changes we were making.”

Michael Cannella
Enterprise Cloud Architect
Manual execution of placement, sizing and provisioning actions increases FTE productivity while avoiding performance risks. However, though this approach is proactive, it is limited by the dependence on people being continuously available to execute. In the third stage of IT maturity, CIOs that achieve automated management across their organization look to offload non-value-added tasks to automation, enabling teams to manage many more workloads without adding FTE resources.

Typically, at this point, the IT organization has automated more than 25% of changes made to the environment, which is at least 75% virtualized. VM Total Cost of Ownership is known and maintained, multi-tier apps are managed holistically, and performance is measured in more than 20% of apps. Administrators use standardized deployment templates to spin up VMs on request in less than a day, while managing over 1000 VMs each.

During this stage, engineers can claim greater levels of process automation in deployment and maybe even ongoing placement of VMs. But the operational lift in defining automation policies or thresholds for every new workload remains significant. With many CIOs prioritizing self-service as a means of speeding up delivery and enabling development teams, their organizations are under pressure to do so without risking performance or adding FTEs. Be it private cloud or public cloud, more frequent deployments increase changes to the environment, putting performance at risk as operational resources are stretched thin.
With an autonomic platform, organizations at this stage can automate continuous placement and initial placement decisions to lighten the load. Team productivity improves upwards of 20-40%. Familiar with the limitations of simple process automation outlined above, these organizations want the performance gains made possible when software makes decisions in real-time. Through taking this approach, they can safely increase the speed of delivery by more than 75%, knowing that the environment will self-adjust and optimize with any new workload and change in resource demand. However, if the goal is to truly keep up with business and application team needs, IT cannot stop at automating placement decisions.

Autonomic Snapshot

**EDF RENEWABLE ENERGY**

**Industry:** Renewable Energy

**Challenge:** Inability to guarantee performance of mission-critical applications; inefficient use of virtual and human resources through manual management.

**Scope:** Turbonomic operates across 3 data centers and 40 remote sites.

**Size:** ~1,300 VMs

**Automation:** Ongoing VM Placement

**Results:** 80% reduction in manual management

"In our Corporate environment, Turbonomic’s automation has been crucial. It handles workload migrations between our hosts, and corporate datastores. We’ve seen an 80% reduction in the need to manually move and balance hosts; this is time we now use to make actual engineering decisions versus daily clean up."

Matt McColm
Senior Data Center Engineer
As an IT organization matures, it becomes more critical to more parts of the business. As dependencies expand, more apps, more users, and more workloads increase the frequency and magnitude of changes in the environment. Out of necessity, CIOs with an organization that reliably and rapidly delivers IT services at minimal cost have completely removed people from day-to-day infrastructure management. These IT leaders have aligned and educated operations teams, deployment engineers, and application owners on the benefit of autonomic IT to the organization. As such, their teams leverage an autonomic platform to automate real-time resizing and scaling decisions, in addition to placement. In other words, the environment completely self-manages to assure performance, while minimizing cost – no manual intervention necessary.

Organizations at this stage can seamlessly on-board new services without change windows. Minor, inevitable failures are assumed, but the infrastructure has been designed to rapidly and resiliently recover. Typically, more than 20% of the apps are architectured to horizontally scale and, as such, the infrastructure has been engineered to auto-scale as needed, using traditional policy/threshold approaches. In most cases, public cloud resources are leveraged for their speed of self-service and/or elasticity. As such, provisioning a new VM takes less than an hour, while administrators are able to manage more than 5,000 workloads. These workloads can reside on-premises, in a public cloud, or across multiple clouds, while the costs differentials between varying environments are considered as workloads are placed and scaled.
The benefits of leveraging decision automation software have operational, performance, and cost implications. Letting software dynamically optimize the environment based on real-time demand, not only assures the performance of applications, but improves it by as much as 60%. At the same time, organizations can fully exhaust the elasticity of public cloud resources, while reducing the infrastructure footprint on-prem by 40-60%. Meanwhile, engineers are freed from the cumbersome process of tweaking and creating auto-scale policies and thresholds for new and existing applications.

A fully self-managing environment allows the business and application teams to get IT services when they need them. The CIO has transformed how IT operates, and rapid delivery has been accomplished. Existence in this stage is an undoubtedly great success, but performance and efficiency opportunities remain.

Autonomic Snapshot

**DIZZION**

**Industry:** Renewable Energy

**Challenge:** Dizzion had created their own cloud environment from the ground up to deliver the most robust and rapid virtual desktop solutions available. While in a period of hyper-growth, Dizzion saw more than 100% year-over-year growth. Their great success made it more difficult to ensure high-performing services and accurately scale their infrastructure.

**Scope:** 8 cloud environments across the globe

**Automation:** Ongoing VM placement and sizing

**Results:** Reduced purchasing lifecycle from eight new servers every two months to eight servers every two quarters, allowing Dizzion to efficiently scale at a critical time in its growth.

“Turbonomic knows exactly where to place and how to size our workloads so that our customers are having the best possible experience. This allows us to be hands-off with the management of our infrastructure, and to focus on continuing to give our customers the flexibility and quality experience they’ve come to expect from Dizzion.”

Rob Green
CTO
STAGE 5: SLA DELIVERY

The most mature IT organizations understand that the customer is king and the business benefits from differentiated service levels based on an application’s criticality. Latency in revenue-generating applications has expensive consequences compared to, for example, corporate back-office applications.

These organizations have achieved rapid service delivery and now strive to deliver on sophisticated SLAs. They can dynamically provision new services based on application or developer demand, in some cases provisioning new apps in less than an hour via a PaaS model. Organizations in stage five manage costs for public and private cloud infrastructure, with some dynamically bursting to public cloud or on-demand infrastructure. In such cases, typically more than 40% of their workloads are cloud/infrastructure agnostic. In particularly advanced scenarios, they could also be re-architecting the infrastructure for “server-less” computing to enable further abstraction geared towards greater agility. Finally, through extensive automation, administrators in these organizations can manage 10,000 workloads or more.

In this stage, however, these organizations rely on segregating the environment to deliver differentiated quality of service (QoS) across applications and adhere to SLAs. This approach inevitably results in wasted resources. Traditionally, CIOs will justify this cost given the business criticality of certain applications—customer satisfaction is paramount. At scale, however, the losses can be untenable.

Here, the complexity of achieving differentiated services levels while flattening the infrastructure to maximize efficiency necessitates autonomic IT. Only software can simultaneously ensure rapid service delivery, app-specific QoS levels, reliable performance and maximum efficiency across heterogeneous environments. With an autonomic platform, administrators can simply define QoS levels for an application and the environment self-adjusts in real-time to meet those SLAs while abiding by cost constraints.
CONCLUSION

The holy grail of IT is to simultaneously achieve rapid service delivery and unparalleled performance—both in terms of speed and reliability—while minimizing costs. Every CIO is leading their organization on a journey in pursuit of this goal, and every route is different. No matter where you and your teams are in terms of IT maturity, however, leveraging software to enable environments to self-manage has benefits from day one and as you progress towards IT service excellence, transforming the experience of leaders, administrators, and end-users alike.
The Turbonomic Maturity Model was developed in partnership with over 1,700 leading organizations that have trusted Turbonomic to enable them to assure performance while minimizing costs.
Turbonomic’s Autonomic Platform enables heterogeneous environments to self-manage to assure the performance of any application in any cloud or infrastructure. Turbonomic’s patented decision engine dynamically analyzes application demand and allocates shared resources in real time to maintain a continuous state of application health. Matching supply to demand results in concrete actions that the system takes constantly such as: workload sizing and instance templating, placement, and provisioning, as well as horizontal autoscaling of applications. Generally, the larger and more complex a customer’s environment and the greater the pressure to cut IT costs, the greater the need for self-managing infrastructure and cloud.

Customers automate decisions progressively as their proficiency with the platform increases. VM placement, for example, is the most common first step in decision automation. Then, customers may automate storage motion or vertical and horizontal scaling. With each level of automation, they realize measurable performance and efficiency benefits.

To learn how Turbonomic can help you and your organization, contact sales@turbonomic.com or visit turbonomic.com.
ABOUT THE AUTHORS

Charles Crouchman
Chief Technology Officer, Turbonomic

Prior to joining Turbonomic, Charles held senior executive positions at several technology startups including Cirba, Mformation Technologies, Opalis Software, and Cybermation, spanning product development, operations, and engineering. He brings 20 years of experience in the IT infrastructure and cloud automation industry.

Asena Woodward
Senior Product Marketing Manager, Turbonomic

In her seven years prior to joining Turbonomic in 2015, Asena worked with various early-stage startup and adolescent tech companies. She specializes in understanding new markets and educating customers on transformative technologies.