Hands-on AIOps

Best Practices Guide to Implementing AIOps

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Dedicated to family, friends, mentors, and
Almighty God who has been there right from the beginning,
giving strength and skill.

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—Gaurav

Preface

Before starting our AIOps journey, let's briefly discuss automation and how it has evolved over the last decade.

Automation in the technology domain is defined as a system where a process or task can be performed with minimal human supervision and action. Humans have been automating tasks forever, and eventually mechanical machines that reduced human effort and increased efficiency were invented to reduce human effort. Today things such as manufacturing, which were partly automated earlier, are moving to 3D printing, which completely automates the process of manufacturing; however, designing what to manufacture is still in the human domain.

Thus, automation reduces human effort and uses machines or software to complete definable, repeatable tasks.

In the IT domain, there are various tasks that humans perform, including envisioning a new product or application, developing the software that translates these requirements into working software, and deploying infrastructure and applications and keeping them updated through their lifecycle.

IT teams have used automation extensively in every area, from software development to operations; however, this has largely been siloed and done without a formal system or method to automation. IT teams have used scripts, runbook automation tools, job scheduling systems, and robotic process automation systems to automate their tasks. These tools have resulted in increased efficiency and reduced the human requirement to operate IT environments.

With the increased adoption of cloud computing and DevOps principles, the provisioning of infrastructure-as-a-service and platform-as-a-service environments has also been automated, as has the deployment

of applications. This has resulted not just in automating the tasks and increasing efficiency but also in agility and speed, which provides businesses with the support to pivot and adapt to changing market needs by quickly changing the functionality and features based on customer and market feedback.

IT runs on three pillars: process, people, and technology. To be able to automate, one needs to be aware of the inter-relationships between these pillars. People use defined processes to work on technology, and with automation we are essentially automating the current processes that people are using to operate an environment. However, with the changing technology landscape and increased adoption and maturity of AI and machine learning capabilities, we can now look at the current processes and formulate new ones to leverage the transformational capabilities provided by these technologies. The current processes were set up with state-of-the-art technology at that point in time, and these processes then defined how humans should operate within that process to execute tasks to accomplish a goal; however, with a drastic change in the technology landscape, the processes need to change and adopt. As an example, with the cloud becoming prevalent, the IT processes need to change and adapt, and the sequential, nonautomated processes need to change to cater to the new capabilities such as autoprovisioning. In 2013, I talked about how capacity management would drastically change in the cloud computing world and that new procedures for cloud cost management would be required. Some of these concepts have been expanded to cover the entire financial operations piece under the umbrella of *cloud FinOps*.

Similarly, IT operations automation had existed in siloes for all this while. People used scripts, monitoring tools, runbook automation, configuration and deployment automation, and RPA tools and automated service management processes using ITSM tools. However, all that was happening under different domains, all getting integrated with siloed integrations.

On the technology front, AI and machine learning technologies became mainstream and were being used heavily in all aspects of business-facing and customer-facing applications from websites to search engines to collaboration and communications tools. AI took over the world of IT quickly; however, IT was late to adopt these technologies. While IT teams were using these technologies to create new applications with AI capabilities to customers, their own internal systems were still using older technologies and worked on processes and systems that had largely remained untouched for the past decade.

Through the DevOps and Agile movements, that transformational change had already transformed the way applications were being built, tested, and deployed, and most of the tasks in the development value stream were automated and integrated, resulting in organizations moving up to continuous delivery and continuous deployment. Similar to the transformation seen with DevOps, with AIOps gaining traction, we are going to witness a transformational change that will drastically change the way IT operations has been run in the past. Old processes, systems, tools, and ways of working will give way to the AIOps way of operating and help realize the vision of NoOps, where operations work seamlessly without disruption in an automated way without human supervision and intervention.

Enterprises today are at various levels of maturity when it comes to automation. Most are yet to achieve a high level of maturity in automation, partly because changing processes, breaking down walls of organization structures, and deploying new technology are complex, time-consuming tasks. In some organizations, where digitization and cloud computing programs are a part of large-scale transformation; AIOps and associated technology and process changes are enabling a complete transformation of digitization. One key factor in adopting AIOps has been a lack of comprehensive process and technology guidance in this domain. There is limited guidance available, and most of it is focused on products that vendors are trying to sell as a one-stop solution, which will leapfrog an

organization to the next level. With this publication we are aiming to provide hands-on pragmatic guidance on how an organization can adopt these changes in the origination and what the pitfalls are to be avoided. Implementing AIOps is not about deploying an event correlation tool; it is about infusing AI and algorithms and automating all aspects of operations.

Most organizations today are at a level where they have automated individual tasks and have automated certain processes. Some have also achieved automation of complex end-to-end processes. However, an end-to-end self-sustaining model for automation is still missing. Automating a few processes versus automating everything that can be automated is a change that people haven't yet initiated. Automating a few processes and then scaling the automation across teams, functions, and departments is still work in progress in most organizations.

AIOps is not just a technology or process change; it is a cultural change where humans and AI work together in tandem supporting and augmenting each other's capabilities to achieve efficiencies and scalability, which IT teams have only wished for but have been unable to achieve. The promise of NoOps has failed to materialize because organizations have not been able to take a holistic and end-to-end approach to AIOps and instead have relied on quick fixes in the form of siloed tools that are deployed.

In enterprises that have moved up the maturity curve in automation, most activities that can be automated fully or partially are automated, and AI drives decision-making rather than humans using a dashboard and analytics to arrive at the next steps. It is a mindset change where humans have to accept the supremacy of the AI systems in certain areas and let go of the control mindset inherent in our species. IT teams are used to certainty and rule-based systems that have dominated the IT landscape for decades. AI-based systems are probabilistic and not definitive; thus, some enterprises have deployed AIOps systems but configured them in a manner where they are nothing but rule-based systems. Accepting probabilistic systems rather than step-by-step rule-based systems is a mindset change, and one needs to accept the risks that come with

implementing such systems and controls to ensure best practices for running AI-based systems; human control on some of the actions is incorporated as part of the process changes.

Enterprises are also evolving to change their operating models to align with Agile principles; they are starting to integrate applications and infrastructure teams and are adopting new practices such as site reliability engineering to make operations support highly reliable and high-availability mission-critical systems and Internet-scale applications. AIOps is a key pillar in site reliability engineering–based operations. The book *Hands On Guide to AgileOps* published in 2021 by Apress provides hands-on guidance on how to adopt Agile for IT operations.

This book will take you through all aspects of AIOps including AI and machine learning algorithms and demonstrate how some of the features in AIOps are implemented in enterprise AIOps platforms. You will be able to leverage the capabilities provided by AIOps processes and platforms and take your organization to a higher level of maturity in operations. We will continue to provide updated content and guidance on the companion website, `www.AgileInfraOps.com`, where you will find articles and best practices as processes and technology continues to evolve.

Introduction

This book is a hands-on guide to understanding AIOps in detail and assisting in implementing its technologies and processes in the organization.

The book explains the IT industry's need for AIOps, its architecture, and the technologies that contributed to its evolution. Readers will be able to grasp the core theoretical concepts around AIOps as well as go deeper by implementing hands-on examples and exercises that leverage machine learning techniques to implement AIOps. The book also provides guidance on how to set up AIOps in an enterprise and what pitfalls to avoid to complete a successful implementation. The book also explains the role of AIOps in the SRE and DevOps model and provides a detailed explanation of the enablement of key SRE principles by AIOps.

This hands-on book also provides an implementation of multiple AIOps use cases and provides sample code that you can run to better grasp some of the underlying principles and technologies that form the core of AIOps.

This book shares the best practices, processes, and guidelines to establish AIOps practice and systems in enterprises and the methods to measure the outcomes and continuously evolve.

CHAPTER 1

What Is AIOps?

This chapter introduces artificial intelligence for IT operations (abbreviated as AIOps). In today's rapidly transforming application and infrastructure landscape and adoption of cloud-native technologies, organizations are finding it difficult to provide 24/7 operations that can scale and meet the needs of businesses that now want much higher availability and agility to change based on customer and market feedback. This chapter also provides details on the benefits that AIOps brings to the table and how it supports the digitization journey of enterprises.

Introduction to AIOps

AIOps is a buzzword in the operations world and was coined by Gartner in 2016. As mentioned, it means implementing artificial intelligence for IT operations. AIOps refers to a transformational approach to running operations using AI and machine learning technologies in various operations domains such as monitoring, observability, event correlation, service management, and automation. With the exponential growth seen in application and platform diversity, including the movement to microservices and cloud architectures, there is an enormous amount of data being generated in operations. The operations teams are overwhelmed with this vast amount of data and the diversity in applications, platforms, and infrastructures in the environment. Most enterprises today are rapidly migrating and adopting new technologies such as cloud and microservices architecture, and thus the rate of

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change in infrastructure and platforms is unlike anything seen before. The challenge in IT operations is to run steady-state operations without disruption and also support this agility and migration and bring new services into operations. These disruptions and changes are putting an enormous strain on the operations teams. Processes and systems that have worked in the past are not working anymore, and the new digitalized world with rapid changes both in applications and infrastructure is resulting in newer challenges. Thus, AIOps has evolved over the last few years as a potential solution to the operational challenges of the new model.

The huge amount of data getting generated from monitoring and observability systems is one of the sources of data that is fed into AIOps-based systems, and then AI and machine learning techniques are used to make sense of the data and filter the noise from critical events. This results in automating most of the tasks that were manual before and that relied on human judgment and tribal knowledge. The events that can cause disruption in business operations and are the root cause are efficiently identified using analytics techniques and thus provide immediate notification to the groups that are resolving them. Without AIOps this process will be difficult to run with changes in technology happening at a rapid pace; relying on older systems and tribal knowledge would mean operations is not scalable and predictable.

All of this is enabled by the emergence and maturity of artificial intelligence and machine learning technologies, which are the foundation of AIOps.

Artificial intelligence has transformed the way systems are developed and business processes are run. AI is everywhere from the image processing in your phone to recommendation engines on Amazon that provide you with new product recommendations based on your preferences. Face recognition and image beautification on phones are examples of applications that people are consuming every day without even knowing that artificial intelligence is powering these applications. Natural language processing advancements have transformed the way

we interact with applications. Today voice assistants like Alexa, Siri, and Cortana are changing the way we communicate with content.

Information technology has leveraged these technologies to solve varying business problems in the areas of building recommendation systems, predictive systems, image recognition, voice recognition, text extraction, and natural language understanding systems.

However, when it comes to solving IT problems using artificial intelligence, enterprises and technology companies have yet to embrace this fully.

Finally, the AI technologies that IT teams have used to deliver exciting new applications for consumers and businesses are now finding their way into monitoring and managing the IT technologies. Thus, a new class of systems that are using algorithms to run IT operations was born.

AIOps is a term Gartner invented to describe a general trend of applying AI techniques to IT operations data sources to provide additional insights. AIOps is essentially a feature or set of features to analyze, combine, and collect data.

According to Garner, "By 2023, 40% of DevOps teams will augment application and infrastructure monitoring tools with artificial intelligence for IT operations (AIOps) platform capabilities." AIOps platforms are platforms that "utilize big data, modern machine learning and other advanced analytics technologies to directly and indirectly enhance IT operations functions with proactive, personal and dynamic insight."

Figure 1-1 defines the various areas in IT operations that are included in AIOps. These include monitoring, event analytics, predictive and recommendation systems, collaboration and engagement, and reporting and dashboarding technologies.

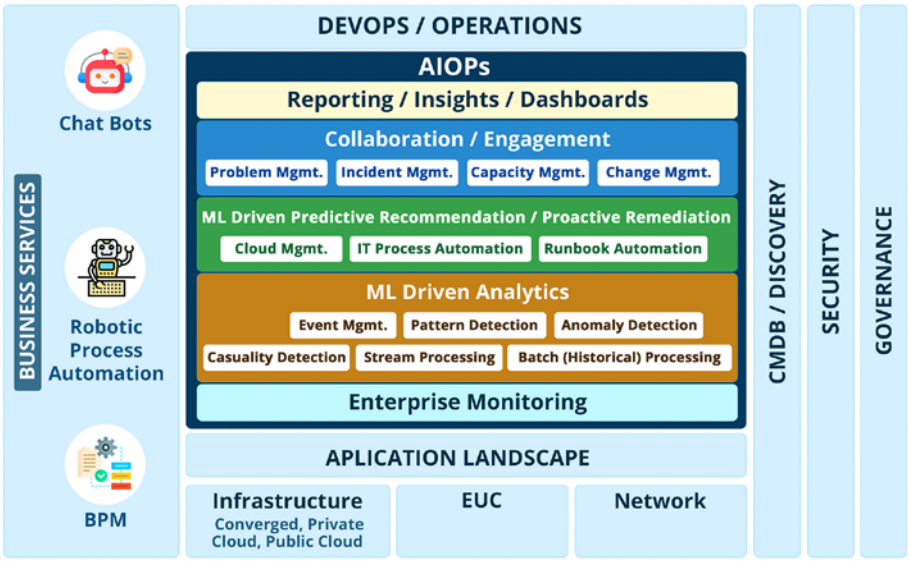

Figure 1-1. *AIOps in the IT operations landscape*

AIOps covers various layers of information technology. From the network to the endpoints, everything in IT can use AIOps technologies to reap the benefits that AIOps provides.

Enterprise monitoring provides a real-time data feed to the AIOps system to perform ML-driven correlation and analysis using various techniques to detect patterns and anomalies, as well as perform causal-impact analysis. This is one of the most important stages as this analysis needs to consider both real-time streaming data as well as historical data to provide predictive recommendations or proactive remediations, which then get executed using IT process or runbook automation tools. The recommendations for resolution help the organizations in achieving end-to-end automation by resolving problems without human intervention.

The reporting and dashboard layer provides views for different IT teams and stakeholders to collaborate and manage incidents, capacity, change, and problems to further support business by providing KPIs and SLAs that are driven by insights and provide an element of predictive analytics to make operations more proactive.

AIOps systems leverage a Configuration Management Database (CMDB) to improve the quality of correlations and accuracy of predictions and recommendations, but organizations usually struggle in maintaining the accuracy of the CMDB and discovery data due to the ever-changing infrastructure landscape. With cloud computing, it is practically impossible to update the CMDB using traditional tools and processes. An AIOps system solves this problem by automatically populating the required missing data in the CMDB. This well-oiled engine of AIOps has to work within organizations' security policies defined under their governance framework. Various compliance needs like GDPR, data classifications, etc., should be considered at each layer of the AIOps engine while they are being integrated or set up. Once AIOps systems get up and running, they learn patterns, anomalies, and behavior using data over a period of time. Gradually, based on maturity, the AIOps system gets consumed by other technology or business units such as ChatOps, robotic process automation, business process automation, etc. More complex business process workflow or chat responses can be triggered based on the AIOps system recommendations.

Just like in software engineering, continuous integration and continuous deployment integrates different activities of development, testing, and deployment of applications and shares feedback for improvement. Similarly, AIOps is something that provides seamless integrations between various operations components and provides feedback for continuous service improvement.