Intelligent IT infrastructure services automation

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Executive summary

For enterprises today, digital transformation—implementing innovative technologies like cloud, AI and automation—has become more critical than ever. As global events change and shape the very nature of work, the capabilities of a cognitive enterprise can be the difference between prolonged disruption or sustainable growth. Enterprises around the world are accelerating their digital strategy and transformation to meet the challenges of a changing business landscape.

In this white paper, we'll explore industry trends and client challenges that accelerate enterprise transformation, as well as our approach to intelligent automation and ways IBM can support your digital transformation and beyond.

Industry trends

The demand for digital technologies and advanced cognitive capabilities grows every year. Research suggests that the market for automated infrastructure management solutions will grow at over 13% compound annual growth rate (CAGR) through 2025.[1] By 2024, today's diverse automation options across those infrastructure automation solutions are expected to co-evolve and converge into features within existing independent software vendor suites or into broad platforms that combine digital workers and event-based, integration-centric orchestration.[2]

There are three key trends driving enterprises to transform their IT.

– **Enterprises are modernizing virtual machine (VM)-based applications** to container-based, cloud-native applications and they are demanding more self-service, agility and quality at lower cost.
– **Large-scale adoption of hybrid cloud is increasing** due to the prevalence of mixed IT environments and architectures from different service providers and manufacturers.
– **IT professionals increasingly require end-to-end visibility** and better management strategies for these mixed IT environments.

Effective digital transformation and modernization strategies integrate automation as a foundational component. Automation helps enable improved service quality, stronger security and faster time to innovation. As enterprises move to hybrid cloud, they're also modernizing IT infrastructure—from traditional data centers and VM-based applications to container-based, cloud-native infrastructure and processes—which is creating new levels of IT complexity. At the same time, they're experiencing a rising need for more flexibility, greater agility and more robust security with higher-quality IT services—all at lower costs.

An evolving IT landscape
An organization's ability to get the most value from automation is impacted by the level of technology heterogeneity across the IT estate, as well as the variability of workload cloud readiness. Automation needs to apply to all types of workloads in the IT environment for an enterprise to extract full value.

There are four types of workloads that run in the IT environment: traditional, cloud hosted, cloud enabled and cloud native. As an enterprise shifts its workloads to cloud over time, the mix of workloads becomes more cloud enabled and cloud native; however, traditional workloads continue to exist.
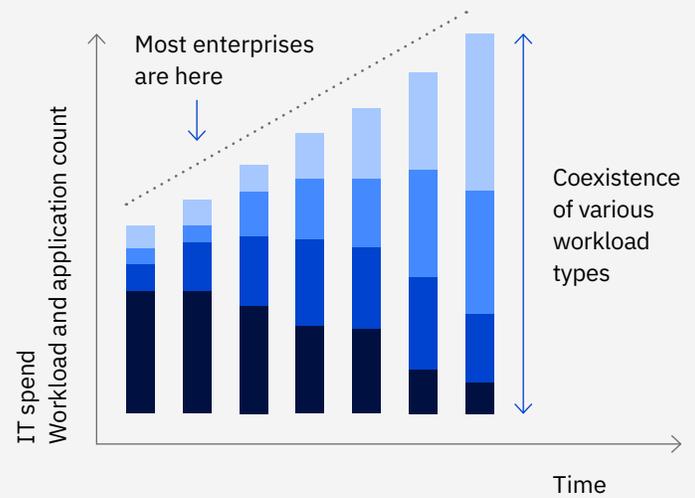
Types of workloads

Cloud native: Container-based applications—either newly developed or significantly refactored to adhere to chosen microservices model—that are resilient and deploy at scale

Cloud enabled: Refactored or containerized applications, encapsulation with APIs

Cloud hosted or cloud ready: Land and expand workloads running on standardized VMs with adoption of cloud features, such as horizontal scaling
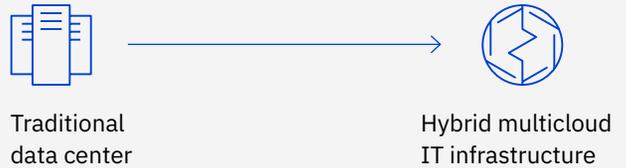
Traditional: Monolithic applications running on established infrastructure that is heterogeneous and largely customized

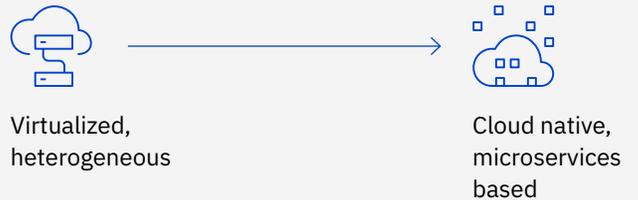*Figure 1. The evolution of IT workloads to cloud*

Concurrent with this evolution of the IT landscape across workload types is how IT itself is deployed and managed.

- **The deployment environment is shifting** from a traditional data center model to a hybrid, multicloud IT infrastructure. Workloads are migrated to private and public clouds with an increasing pivot to the public cloud. Network and storage capabilities are redesigned to be more agile and software defined.
- **Workloads are changing** from virtualized and heterogeneous to cloud native and microservices based. Application modernization continues, refactoring to adopt container and serverless technologies with clean separation of stateless and stateful microservices. Enterprises are adopting a twelve-factor methodology for a DevSecOps approach to developing software as a service (SaaS) with agile iterations for increased portability and resiliency, including fault tolerance.
- **IT operations are transforming** from traditional Information Technology Infrastructure Library (ITIL) processes—with specific domain silos of management—to an agile environment with integrated DevSecOps. This shift helps increase the use of AI operations (AIOps) for real-time, insights-based operations with infrastructure as code (IaC). For example, a transformed agile, DevSecOps environment can enable real-time release management for development, as well as for change, incident and compliance management. And powered by increasingly AI-driven operations, the transformed IT operation enables proactive IT health, problem determination and fault prediction. Self-service capabilities can process requests with zero human touch. Continuous compliance and enterprise policy enforcement can now be enforced in continuous integration continuous delivery (CICD) pipelines.
- **IT roles are evolving** from system administrator to site reliability engineer (SRE). IT operators who previously performed individual functions to ensure stability are now being replaced with SREs who are informed by AI-based insights and able to diagnose and develop solutions to root cause issues. The traditional IT roles are changing from single-function to all-inclusive, end-to-end support roles with deep technical skills and an application-centric focus.
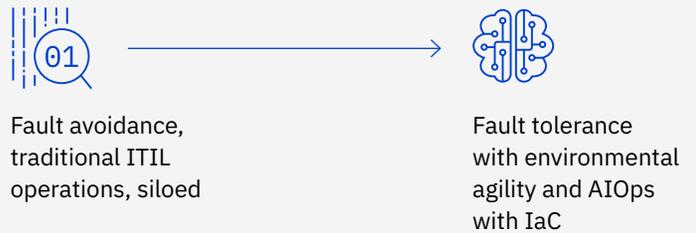
Deployment environment

Traditional data center → Hybrid multicloud IT infrastructure

Workload paradigm

Virtualized, heterogeneous → Cloud native, microservices based

Operations

Fault avoidance, traditional ITIL operations, siloed → Fault tolerance with environmental agility and AIOps with IaC

IT roles

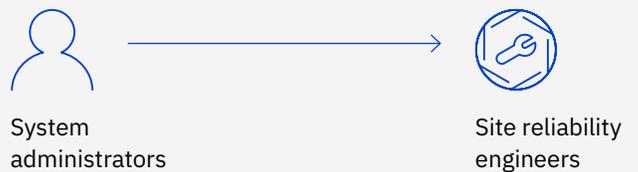System administrators → Site reliability engineers

Figure 2: Areas of transformation in the IT environment

Client needs and challenges

The journey to cloud requires enterprises to shift from traditional data center environments to hybrid cloud IT infrastructure and from virtualized to cloud-native workloads. Automation becomes essential throughout this shift, delivering significant benefits.

– Scan millions of pieces of data in a fraction of the time it would take a human.
– Drive autonomous decision-making and continuous process improvements.
– Balance human and machine tasks to build the optimal collaborative workforce.
– Identify previously unseen opportunities for automation to have the greatest impact.
– Transform from traditional ITIL operations to self-service, zero-touch processing with predictive insights for improved service quality.

IBM approach and capabilities

As enterprises evolve from traditional and VM-centric data centers to container-based and cloud-native environments, the automation landscape is evolving, too.

Principally, there has been a shift from procedural changes with scripted deployment actions on operationally running systems to declarative state deployments as a full application stack. As an example, patching of OS, middleware and applications is a carefully planned and executed in-place activity on operationally running instances in traditional IT environments. Alternatively, in the cloud-native or container-based paradigm, the full application stack is redeployed with an updated declarative state, ensuring that the desired configuration state is maintained throughout the full stack lifecycle. Similarly, response to incidents affecting application health are addressed by targeted actions, such as restarting a hung system service or daemon. These actions are performed by system administrators who have privileged access on operationally running instances instead of automatically stopping and restarting containers with updated configurations.

Before deciding on automation, it's important to understand the various types of service domains and activities in IT management, which are categorized into Day 0, Day 1 and Day 2 activities. These activities, and the corresponding automation, change considerably as the workload paradigm transforms from VM-centric to cloud native, as shown in Figure 3.

– **Day 0** focuses on environment setup. It may also include cloud-readiness analytics.
– **Day 1** focuses on application deployment. It may also include activities related to cloud migration.
– **Day 2** focuses on steady-state management, where AI-based analytics and insights will be pervasive.

Environment setup is essentially incorporated into public cloud platforms and a considerable number of activities move into the DevSecOps pipeline instead of being performed on operationally running systems. Automation in DevSecOps and in the cloud helps enable increasing levels of self-service across the environment. System administrators and operators evolve into SREs who are focused on proactively managing application health, including resolving the root causes of problems. AI-based insights, with increasing automation sophistication, help move processes toward zero-touch operations.

With one of the largest installed client bases and corresponding IT infrastructure estates, IBM is shaping the future of intelligent automation and IT infrastructure services.

Intelligent IT infrastructure automation from IBM

– Hundreds of client accounts with AI-based services delivery insights
– 400,000 servers with Red Hat® Ansible® Automation Platform performing thousands of automation actions per day
– More than 20 million robotics process automations performed per year[3]

	Activity	Traditional	Cloud-hosted/cloud-ready		Cloud-enabled		Cloud-native	
		Win/Linux/Unix	Private cloud	Public cloud	Private cloud	Public cloud	Private cloud	Public cloud
Day 0	Build hypervisor environment	✓	✓	(Platform)	✓	(Platform)	✓	(Platform)
	Set up network	✓	✓	(Platform)	✓	(Platform)	✓	(Platform)
	Set up storage	✓	✓	(Platform)	✓	(Platform)	✓	(Platform)
Day 1	Provisioning of environments	✓	✓	✓	✓ Clusters	(self-service)	✓ Clusters	(Self-service)
	Provisioning of OS	✓	(Self-service)	(Self-service)	(Self-service)	(Self-service)	(Self-service)	(Self-service)
	Deployment of middleware	✓	✓	✓	(DevSecOps)	(DevSecOps)	(DevSecOps)	(DevSecOps)
	Deployment of application	✓	✓	✓	(DevSecOps)	(DevSecOps)	(DevSecOps)	(DevSecOps)
Day 2	Operational tasks	✓	✓	✓	✓	✓	✓	✓
	Backup and restore	✓	✓	✓	✓	✓	✓	✓
	Security and compliance	✓	✓	✓	✓	(DevSecOps)	✓	(DevSecOps)
	Patching OS	✓	(Deploy new)	(Deploy new)	(DevSecOps)	(DevSecOps)	(DevSecOps)	(DevSecOps)
	Patching middleware	✓	(Deploy new)	(Deploy new)	(DevSecOps)	(DevSecOps)	(DevSecOps)	(DevSecOps)
	Patching application	✓	✓	✓	(DevSecOps)	(DevSecOps)	(DevSecOps)	(DevSecOps)
	Infrastructure management	✓	✓	✓	-	-	-	-
	Application management	✓	✓	✓	✓	✓	✓	✓
	Problem root cause and management	✓	✓	✓	✓	✓	✓	✓
	Service request, change fulfillment and management	✓	✓	(Self-service)	✓ (Self-service)	(Self-service)	✓ (Self-service)	(Self-service)
	Configuration management	✓	✓	✓	✓	✓	✓	✓
	Performance and capacity	✓	✓	✓	✓ (Self-service)	✓ (Self-service)	✓ (Self-service)	✓ (Self-service)
	Financial (cost, charge)	✓	✓	✓	✓	✓	✓	✓

Figure 3: IT workloads across a range of service activities and domains for Day 0 (environment setup), Day 1 (application deployment) and Day 2 (steady-state) operations. This list is meant to be illustrative and is not a complete list of service activities in IT management.

✓ Assisted activities that may be manual or automated, but do not include client self-service

(...) Deflected activities such as self-service, DevSecOps or platform

IBM Cloud automation community framework

A key differentiator in our approach to intelligent automation for IT operations is the IBM Cloud® automation community framework. Based on the Red Hat Ansible Automation Platform, our approach provides a common, open framework to address use cases across the range of service activities for the various workload types in a hybrid cloud landscape. The framework is supported by a community model with tools and processes to enable community creation and deployment of automation content by client account delivery teams. This community model helps address client-specific use cases that are also available for broader use and scalability across IBM client accounts worldwide.

The automation framework is also designed to be scalable—from large, shared, multitenant instances, to regional instances, to dedicated deployments for specific client accounts. The need for a flexible deployment model is driven by the heterogeneous nature of our client infrastructure estate, which is governed by regional regulations as well as client-specific contract requirements. We typically deploy the framework on the IBM Services® Platform with Watson® solution, which is built on IBM Cloud with value-add services for client connectivity, enterprise security and compliance controls. Alternatively, the automation framework can be deployed natively on IBM Cloud or in environments where even greater isolation is required directly on VMs in client data centers.
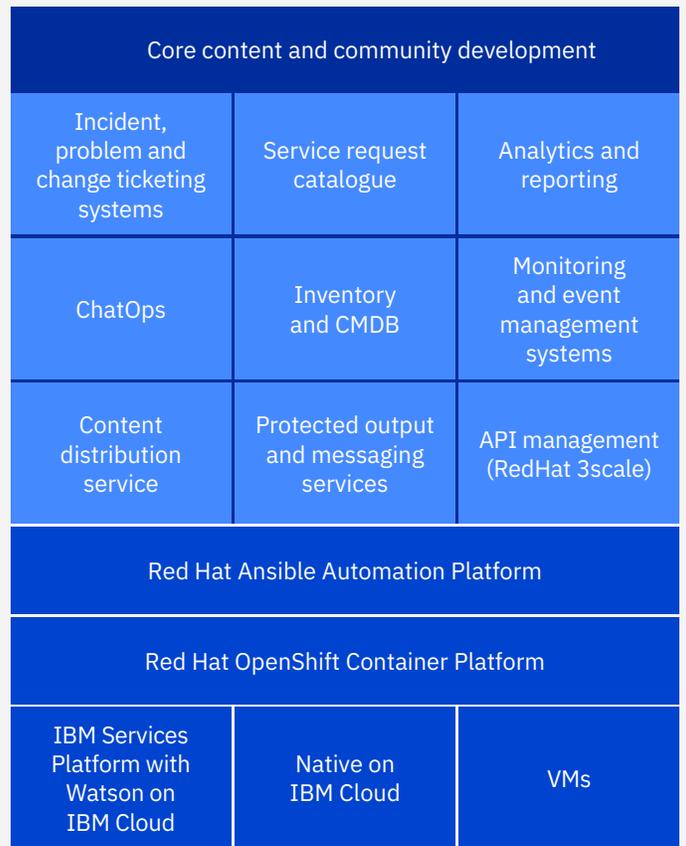
Core content and community development		
Incident, problem and change ticketing systems	Service request catalogue	Analytics and reporting
ChatOps	Inventory and CMDB	Monitoring and event management systems
Content distribution service	Protected output and messaging services	API management (RedHat 3scale)
Red Hat Ansible Automation Platform		
Red Hat OpenShift Container Platform		
IBM Services Platform with Watson on IBM Cloud	Native on IBM Cloud	VMs

Figure 4: IBM Cloud Automation Community Framework

Intelligent automation for an integrated digital experience
The next level of automation comes in the functional layers above operations, primarily with orchestration, delivering a front-end digital experience that represents an integrated platform for IT services delivery. This integration is especially important in hybrid multicloud environments, where traditional, virtualized systems coexist with containerized public and private cloud environments.

Figure 5 depicts the IBM® Multicloud Management Platform (MCMP) offering, which allows for seamless provisioning, orchestration and management of complex IT infrastructure.

There are three layers within the IBM MCMP. The first layer provides IT operations management. As described in the previous section, the community-supported automation framework is used to provide self-service capabilities in the underlying clouds. The second layer focuses on orchestration of IT services through an integrated service catalog that's accessible from the third layer. This third layer performs business management for traditional and multicloud consumption, as well as cost governance. IBM MCMP also provides a single, integrated portal that enables centralized self-service management of multicloud consumption, AIOps, orchestration and cost governance consoles for client-accessible, intelligent and actionable insights. These insights are powered by a data lake and AI-based insights platform to provide end-to-end visibility across the IT hybrid multicloud environment.
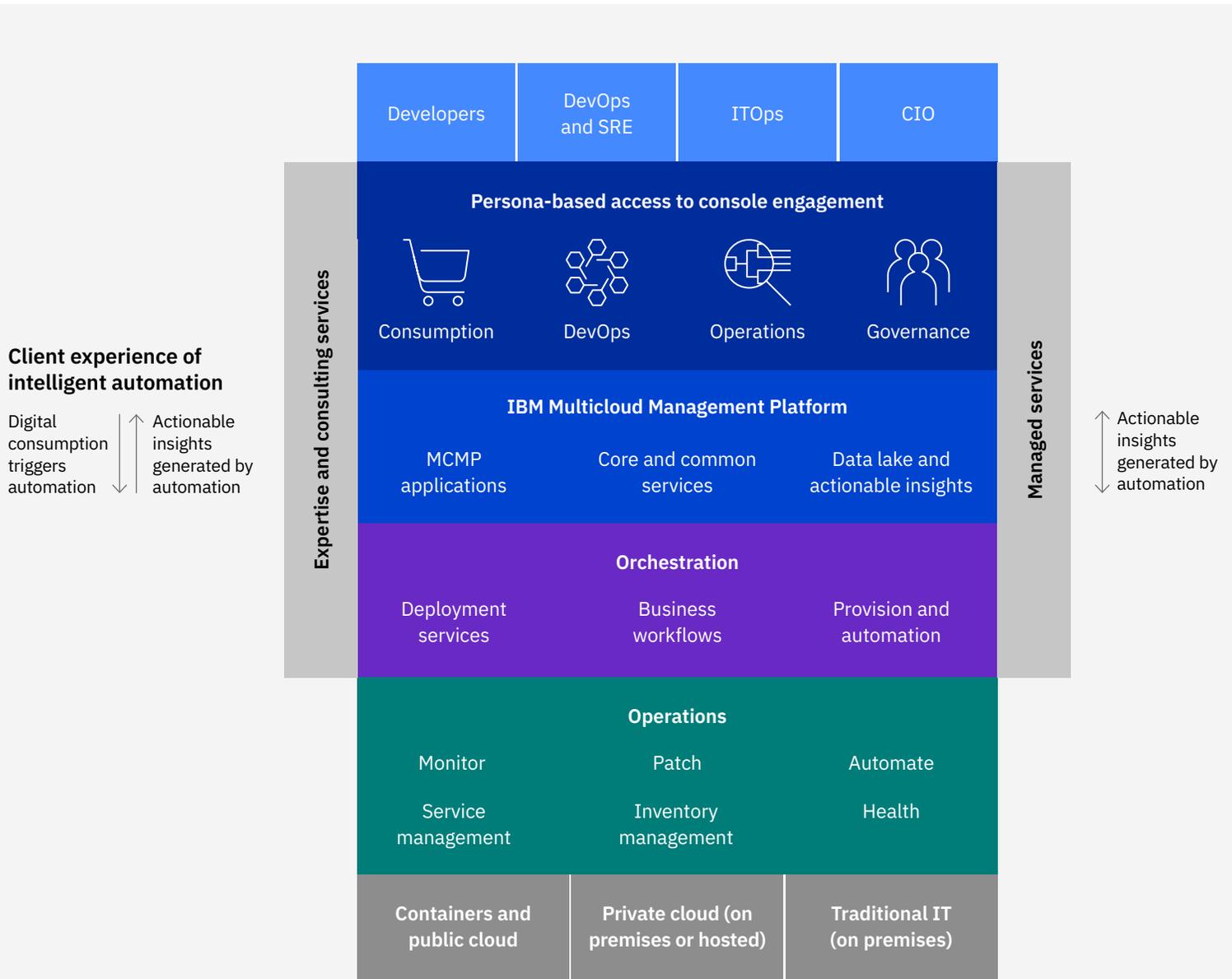

Figure 5: IBM Multicloud Management Platform

Intelligent automation from IBM

Intelligence in automation is pervasive in our approach to automation for Day 0, Day 1 and Day 2 operations, including workload migration and modernization across the IT landscape. Figure 6 depicts examples of AI-based analytics, which form the core of this intelligence.

Automation intelligence relies on insights generated by machine learning, where data is gathered from running enterprise IT systems and combined with the experience of skilled IT professionals. Intelligent, AI-based automation can operate inline and be incorporated directly as analytics, driving the execution of zero-touch operations. Alternatively, such automation can operate as an assist, using insights to inform SREs working on complex situations, as well as helping to build additional automation as part of the continual service improvement cycle.

AI-based insights are used to guide actions in either mode—inline or as an assist—in automation frameworks, robotic process automation (RPA) systems and specialized systems like batch job control and security and compliance management.

Chatbots and virtual agents have become ubiquitous in service desk operations, as well as in ChatOps, which provide a collaboration environment for SREs to address complicated situations with the support of contextually relevant information, insights and integrated action launchers.

We use the IBM MCMP suite of tools to manage the hybrid multicloud lifecycle across the infrastructure, employing more extensive capabilities of AI-based insights. These capabilities include predictive anomaly detection, risk levels for changes, security and compliance, and more from the AIOps module—plus cost optimization insights through the governance module.

To help our clients identify areas that will help accelerate their enterprise digital transformations, the IBM Cloud Garage® Method Kit and suite of integrated tools and assets are designed to get results quickly. The toolkit provides a scalable, flexible architecture that's supported by an analytics engine and automation that helps modernize processes and technologies along the transformation journey to cloud. This toolkit uses extensive ecosystem alliances to support and automate cloud migrations. The end-to-end cloud transformation spans advisory, discovery, analytical insights, automation and traceability.

Day 0 environment setup

– Cloud-readiness analytics
– Workload identification

Day 1 application development

– Cloud migration optimization
– Application modernization
– Capacity optimization

Day 2 steady state management

– Predictive insights and anomaly detection
– Complex event analytics
– Root cause determination analytics
– Service desk virtual agent
– Service management analytics
– Actionable insights and automation opportunity analytics
– Capacity management analytics
– Batch job analytics
– Change risk analytics
– Cognitive catalog chatbot
– DevSecOps pipeline efficiency
– Security and compliance risk scoring

Figure 6. IBM AI and advanced analytics combined with automation

Conclusion

Every business needs to become a smarter business. Digital reinvention is at the core of transforming your business to sustain differentiation and profitable growth. Intelligent IT infrastructure automation services from IBM can help your enterprise accelerate digital transformation while delivering important benefits as you shift from traditional IT operations to container-based, hybrid multicloud environments. Our automation framework is based on Red Hat Ansible software and supported by a community model that enables self-service and workload-specific automation content creation. The automation framework spans your end-to-end IT infrastructure and integrates critical automation capabilities to drive greater flexibility, agility and extensibility while strengthening security.

Why IBM?

IBM has a heritage of investing in innovative technologies that deliver real business value that keep our clients at the forefront of their respective industries. We draw on the lessons we've learned from thousands of cloud migrations and client engagements to expand our library of automation assets and support our clients' digital transformation. Our broad portfolio of intelligent IT infrastructure automation technology and services can support you as your enterprise transforms and shifts from a traditional virtualized environment to container-based, cloud-enabled and cloud-native hybrid and multicloud environments. Our robust ecosystem of collaborators helps us deliver trusted solutions. IBM is committed to investing in and innovating with AI-based infrastructure services automation to continue driving successful outcomes for our clients.

For more information
To see what intelligent IT automation services from IBM can do for your organization, schedule a consultation with a representative: ibm.com/services/expert-advice/index.html

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Bridget is the Global Managing Director of IBM Global Markets, and previously Global Chief Technology Officer and VP of Global Technology Services®. She has more than 25 years of experience developing and supporting advanced technology solutions, using AI, automation, cloud, security and open-source technologies that deliver exceptional digital transformation with improved quality and increased efficiency while reducing costs and enabling ongoing modernization.

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1. Global Market Insights, "Automated Infrastructure Management (AIM) Solutions: Competitive Market Share & Forecast," October 2019

2. Forrester, "Prepare For The Coming Automation Convergence," December 2020

3. Based on IBM client data, actual results may vary

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