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MAINFRAME TRANSFORMATION JOURNEY:

Blueprint for Integrating GenAI Services Within a Cloud-Native Platform

Jim Mercer
Program Vice President,
Software Development, DevOps
and DevSecOps, IDC

Stephen Elliot
Group Vice President,
I&O, Cloud Operations,
and DevOps, IDC

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Situation Overview

Mainframe transformation has become a pressing need for organizations aiming to stay competitive and agile in the digital age. With the exponential growth of data and the demand for faster and more secure processing, mainframe systems continue to provide extreme levels of value, security, and reliability.

However, mainframe environments are notoriously complex, burdening experienced professionals with repetitive, manual tasks that prevent them from focusing on higher-level strategic initiatives. These mundane activities, often referred to as toil, take up valuable time that could be better spent driving innovation and optimizing mainframe operations.

With the emergence and interest in analytics and generative AI (GenAI) mainframe capabilities, the adoption of artificial intelligence offers promising value to some of the common mainframe challenges, such as the small and aging pools of mainframe expertise and the attraction, retention, and onboarding of new talent, while unlocking numerous benefits.

The complexity of mainframe environments combined with the departure of skilled professionals leaves organizations exposed to a significant knowledge gap, taking decades of knowledge with them. Many organizations have turned to short-term solutions such as outsourcing and cross-training staff. However, these approaches often fall short, as simply adding more people does not address the underlying complexity of mainframe systems or add skills continuity for the next generation.

GenAI services offer the potential for a "subject matter expert (SME) in a box experience," enabling easier mainframe adoption and a new way to experience, interact with, and analyze mainframe data using tuned models. In addition, site reliability engineers (SREs), developers, and operations managers can use the embedded GenAI capabilities for certain software development functions, enabling faster and higher-quality code explanation and generation.

Embedded mainframe GenAI capabilities are part of existing mainframe solutions for an AI platform, enabling users to transform the way they interact with mainframe data, adopt and learn solutions, and improve their workflows with embedded intelligence and guided recommendations and best practices. Using a mainframe AI platform can enable a new way to experience the mainframe for staff across DevOps, AIOps, DataOps, and SecOps, delivered on a cloud-native platform to provide reliability and security capabilities. A mainframe cloud-native platform could optimize mainframe application development and operations, augment insights, fortify security, and accelerate innovation, enabling a cloud-like experience. Further, these capabilities should use APIs, CLIs, SDKs, and cloud-inspired modern interfaces that take advantage of intrinsic cloud services for the mainframe architecture.

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This approach is the next evolution of mainframe transformation, and when combined with GenAI for task automation, real-time analytics, code and anomaly explanation, and enhanced defense mechanisms, organizations can achieve heightened efficiency and reliability. In addition to automating these tasks, GenAI reduces the operational burden on mainframe experts by eliminating repetitive, manual work that often consumes their time, freeing them to focus on more strategic initiatives. These next-level transformation capabilities will make it easier to attract new talent to the mainframe through modern technologies, workflows, and experiences. It also provides mainframe experts with an opportunity to have conversations across architecture teams and with SREs, prompt engineers, and AI/ML engineers to engender the mainframe as a critical element in the cloud native and GenAI conversation.

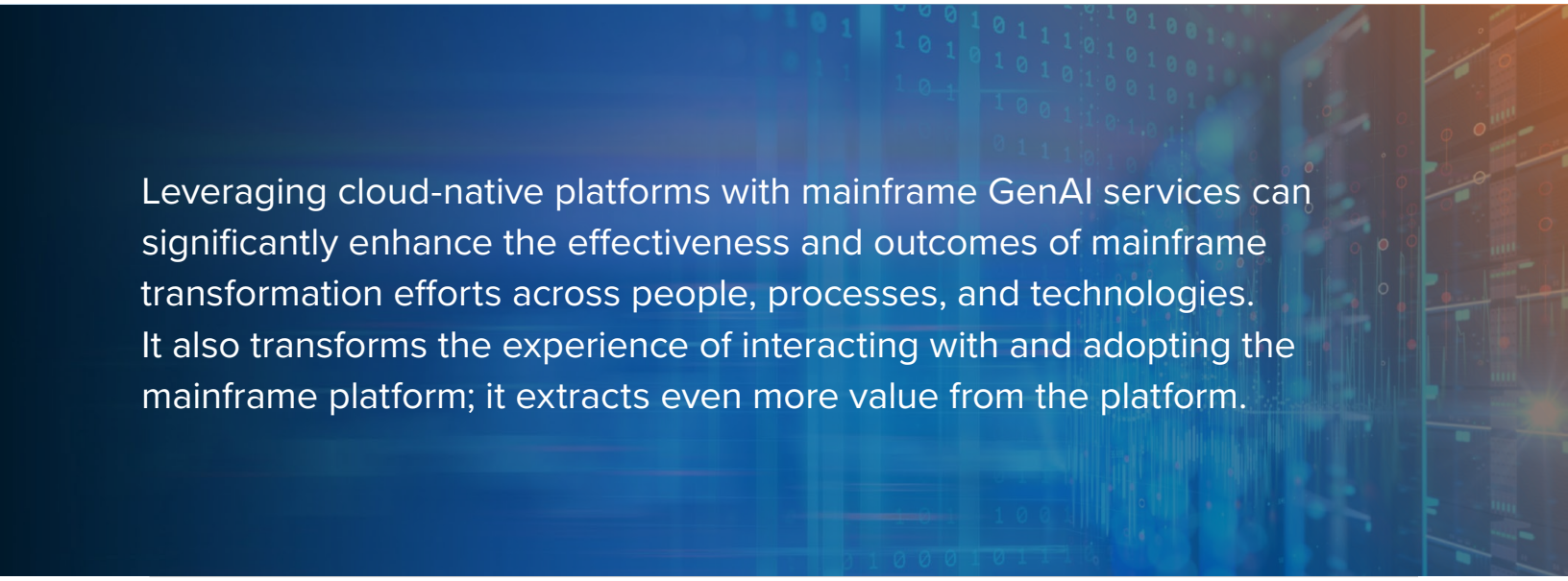
As part of a cloud-first strategy that most enterprises adopt, mainframe transformation often plays a significant and supporting role. The mainframe architecture should be a critical piece of the cloud discussion, as it supports mission-critical workloads that often traverse distributed and multi-cloud architectures. Executives have an opportunity to transform applications and deliver applications faster with less risk. Focal areas often include DevOps, CI/CD automation, IT operations, data management, and the cross-platform flow of data through testing.

Integrating Generative AI and Cloud-Native Platforms for People, Processes, and Culture

Mainframe transformation is a critical initiative for organizations seeking to modernize their IT infrastructure, improve operational efficiency, and unlock new opportunities for innovation. Leveraging cloud-native platforms with mainframe GenAI services can significantly enhance the effectiveness and outcomes of mainframe transformation efforts across people, processes, and technologies. It also transforms the experience of interacting with and adopting the mainframe platform; it extracts even more value from the platform.

Many of these discussions focus on the following use cases:

- **Developer efficiency:** GenAI can generate new code and explain existing code, making developers more productive. These new capabilities are also key to enabling mainframe programmers at any skill level to develop software for the mainframe effectively.
- **Reduction of toil:** GenAI services significantly reduce toil by automating repetitive and routine tasks, such as code debugging, refactoring, and performance monitoring, allowing teams to focus on higher-value initiatives. Further, it reduces the manual effort required for maintenance and operational tasks, streamlines workflows, and improves overall efficiency and quality.



- **Process automation:** GenAI can improve ease of use and adoption in mainframe operations, such as developer self-service, batch processing, data validation, error mitigation, and system monitoring; improve team operational efficiency; and reduce manual effort.
- **Intelligent resource allocation:** By analyzing workload patterns and resource utilization data, GenAI can optimize resource allocation in mainframe environments. Dynamic resource provisioning based on predictive analytics ensures that computing resources are allocated efficiently, reducing costs and improving performance.
- **Cognitive assistants and chatbots:** GenAI-powered cognitive assistants and chatbots can provide real-time support and guided suggestions to mainframe users, helping with inquiries, troubleshooting, and task execution. Natural language processing (NLP) capabilities enable users to interact with mainframe systems using conversational interfaces, enhancing user experience and accessibility.
- **Application modernization:** Analytic models can assess legacy mainframe applications to identify opportunities for modernization, such as refactoring, rearchitecting, or replacing outdated components. GenAI-driven recommendations and insights guide organizations in prioritizing modernization efforts based on factors such as business impact, technical feasibility, and cost-effectiveness.
- **Performance optimization:** GenAI continuously monitors mainframe performance metrics and identifies bottlenecks or inefficiencies in system operations. Prescriptive analytics recommend optimization strategies, such as tuning configurations, optimizing code, or implementing caching mechanisms to improve mainframe performance and reliability.
- **Security and compliance:** Analytic models integrated with GenAI enhance mainframe security by detecting anomalous behavior, identifying potential threats, and preemptively mitigating security risks. Compliance monitoring and auditing capabilities ensure that mainframe systems adhere to regulatory requirements and industry standards, reducing the risk of data breaches or compliance violations.

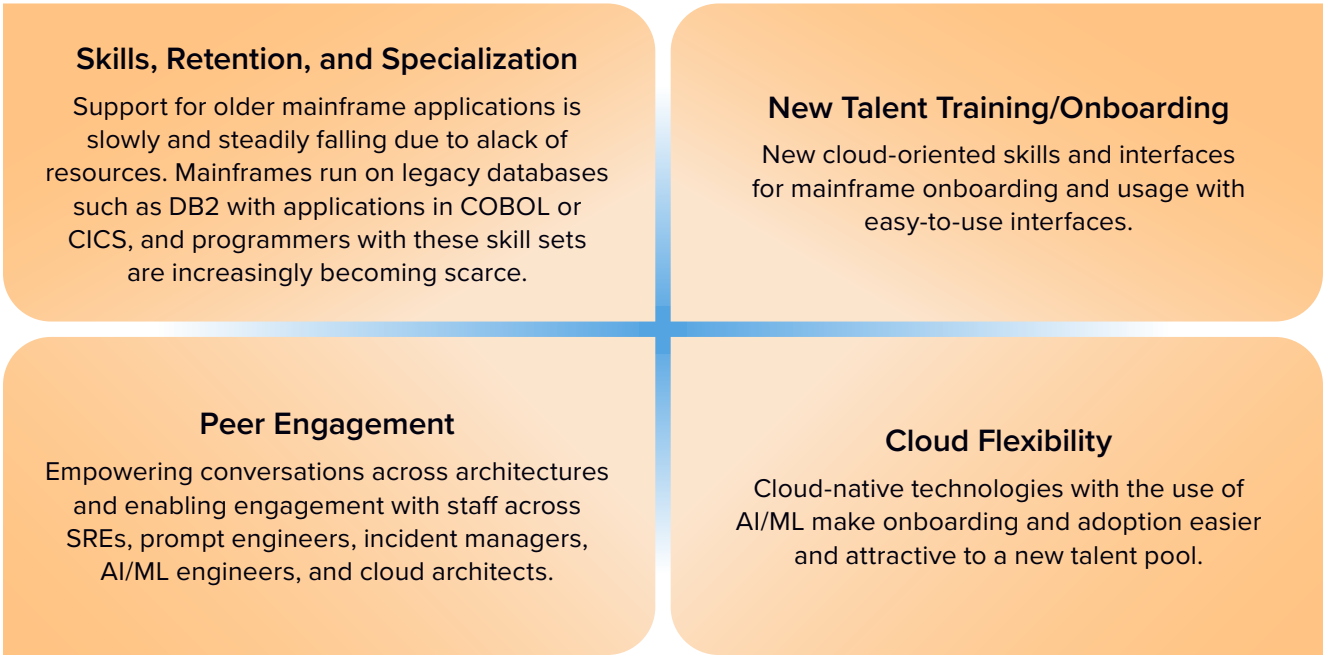
Addressing Mainframe Challenges Through Transformation

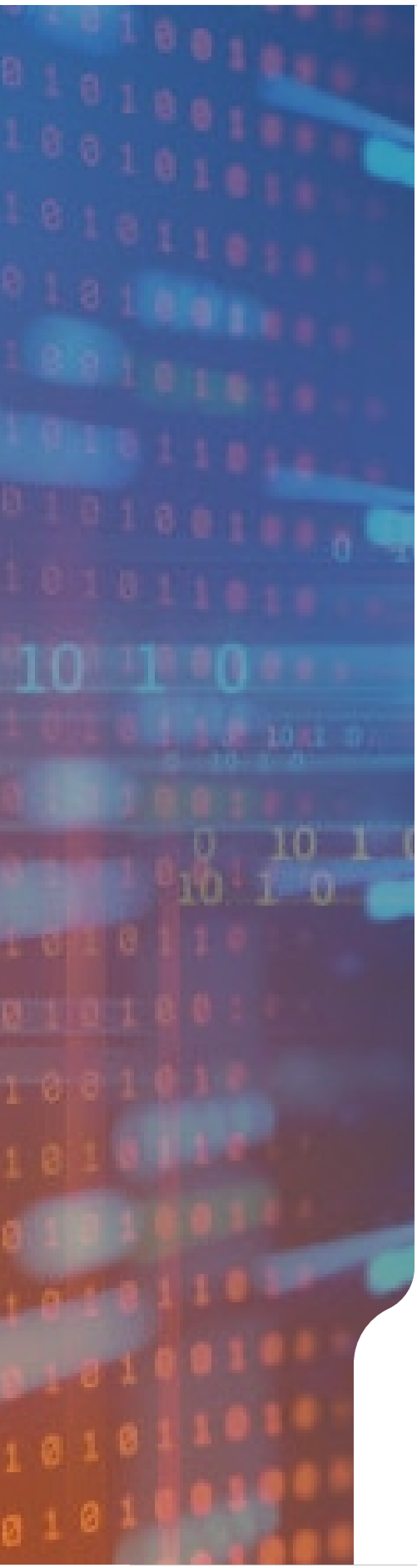
Many mainframe SMEs are moving toward retirement age, with interest rising from a new generation. Both groups are immensely important for successful mainframe operations, but they often have different expectations for the tools and engagement (see **Figure 1**). GenAI technology empowers mainframe teams to adjust to any work style, meeting teams where they are, learning new ways to analyze data, engage with the architecture, and train and onboard new talent. New interfaces enable staff to work with the mainframe in a more cloud-like experience with modern interfaces.

Finally, new technology and capabilities enable team collaboration with adjacent peers who must better understand mainframe performance and availability, such as platform engineers, SREs, prompt engineers, and incident managers. A modern approach enables these peer teams to more easily engage with critical mainframe data that completes an end-to-end view for service performance and analysis.

FIGURE 1

Transforming the Mainframe: Overcoming Challenges





Key Considerations for a New GenAI-Powered Mainframe Experience

Mainframe solutions provided on a cloud-native platform promise enhanced scalability and agility, enabling fast adaptation to evolving business needs and fostering competitive advantage. Cloud-native platforms will also make it easier to integrate mainframe applications with modern cloud-based services and applications. Additionally, by enhancing accessibility for next-generation talent, organizations bolster recruitment and retention efforts and make new team members productive faster. This comprehensive strategy, combining generative and predictive AI and a cloud-native platform, can empower organizations to effectively manage complex workloads, spur innovation, and maintain a leading edge in the digital arena.

Machine learning analytic models enable organizations to analyze vast amounts of data generated by mainframe systems in real time. Through data analysis, organizations can gain valuable insights into application resilience, system performance, user behavior, and business operations. These insights can also enable organizations to use GenAI to tap into the skills of SMEs in times of complexity. GenAI monitors mainframe performance metrics in real time, provides actionable recommendations for performance optimization, and provides a window into future performance levels. GenAI facilitates collaboration and communication among cross-functional teams involved in mainframe processes. GenAI provides continuous improvement and intelligent decision-making across teams, enabling easier adoption across mainframe, operations, and development teams to both analyze and access this critical information.

There are six key areas that customers should consider when adopting GenAI capabilities for the mainframe (see **Figure 2,** next page). These areas provide value by enabling customers to move at their own pace of adoption while maintaining their current expertise and experiences. Customers can use integrations and APIs to adopt any large language model (LLM) of their choice. The modern experience is supplemented by a unified, single point-of-entry interface for data analysis and ease of use, as well as a co-pilot type of experience that provides an "SME in a box" for assisting teams in guidance on decision-making and performance management. In essence, this new mainframe experience is agile and flexible, placing the power and pace of adoption in the hands of customers.

FIGURE 2

Modernizing the Mainframe with GenAI: Key Considerations for a New Experience

The need to integrate mainframe solutions with cloud-native tools and processes enables an end-to-end view of complex digital services. It also provides mainframe operators with the ability to use mainframe tools with other third-party tools to empower collaboration across teams, share and access critical data, and provide modern mainframe staff with a more intuitive and familiar mainframe interface and experience.

A cloud-native platform experience on mainframe solutions enables transformational opportunities as newer mainframe operators enter the ecosystem, providing an easier experience for those looking to become more efficient. GenAI accelerates experimentation and adaptation on cloud-native platforms by empowering teams to embrace change and drive innovation seamlessly. It enables rapid iteration and optimization of cloud-native applications, allowing teams to experiment confidently with new features, configurations, and architectures.

Mainframe, Cloud Native, and GenAI: Potential Benefits

The use of GenAI and cloud-native platforms offers several benefits for mainframe teams for staffing and adoption, making mainframe environments and teams more efficient, effective, and productive. Additionally, these technologies enable senior-level experts to optimize their time by automating routine tasks, allowing them to focus on more strategic, high-value initiatives.

These include:

- **Accelerated learning curve:** GenAI can encapsulate knowledge and practices via an "expert in a box" format to reduce the impact of retirements, lost tribal knowledge, and experience.
- **Simplified training:** GenAI-powered tools can assist with training new team members. For example, AI-driven documentation generation can create clear and up-to-date guides, while AI chatbots can answer basic questions and provide on-demand support.
- **Code explanation:** GenAI code explanation can enable developers who are new to mainframe code to understand existing code, improving readability, maintainability, and learning.

- **Faster code generation:** GenAI models can automatically generate code for common mainframe programming languages such as COBOL and job control language (JCL) scripting, significantly reducing development time. Code generation allows developers to focus on complex functionalities and business logic, while senior experts can concentrate on broader system strategy and architecture.
- **Testing assistant:** GenAI can assist in test case generation, execution, and the assessment of the test results, ensuring thorough testing of mainframe applications without manual effort.
- **Real-time analytics:** GenAI can analyze mainframe data in real time, providing insights into system performance and potential issues. This live understanding of a complex cacophony of operational data points allows for proactive problem-solving and optimization.
- **Reduced manual work:** By automating tedious tasks, GenAI can alleviate the burden of repetitive manual work for mainframe staff. Removing this toil can lead to increased efficiency, job satisfaction, and morale.
- **Focus on value-added work:** Freeing up time from routine tasks allows mainframe professionals to focus on higher-level activities that utilize their expertise and contribute more strategically to the organization.
- **Cloud-like infrastructure provisioning:** This enables mainframe infrastructure to be provisioned like the cloud, potentially using tools such as Terraform to compose mainframe environments.
- **Modernized work environment:** GenAI integration can modernize the mainframe development and operations experience, making it more appealing to younger generations of talent with a preference for familiar, modern, cloud-like interfaces, tools, and technologies.
- **Simplified maintenance:** GenAI-powered tools can simplify mainframe maintenance tasks, making it easier for non-mainframe specialists to contribute and reducing reliance on a shrinking pool of COBOL experts.
- **Improved user interface:** GenAI can generate conversation-based interfaces for legacy mainframe applications, improving accessibility for a wider range of users.
- **Reduced learning curve:** AI-powered solutions can offer contextual help and guidance, making it easier for new team members to learn and adapt to the mainframe environment, accelerating adoption.

Future Outlook

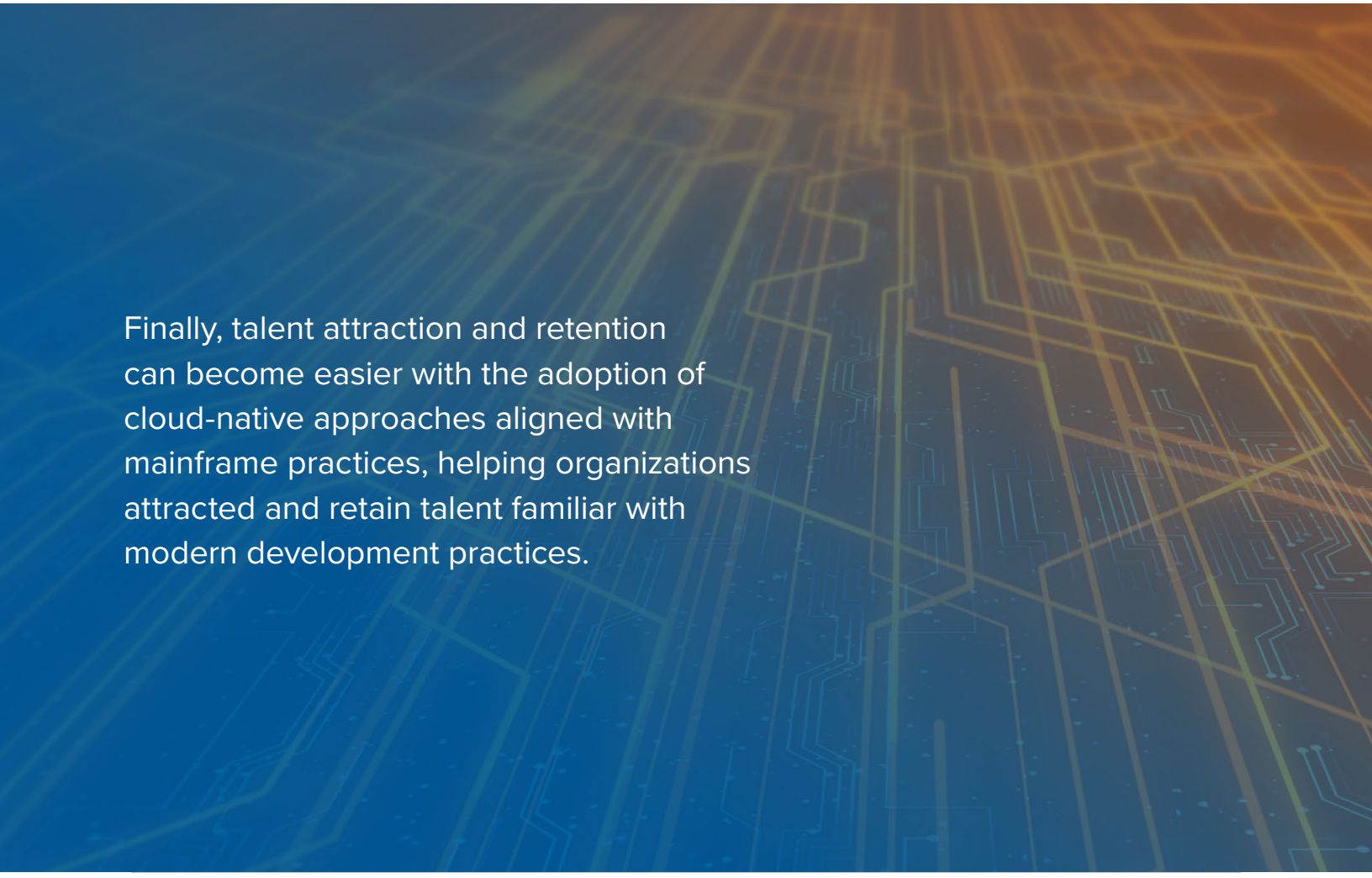
Cloud-native access to mainframe capabilities, with the use of GenAI technologies, offers significant value by transforming mainframe systems while preserving critical business objectives and architectural investments.

IDC expects the following trends to accelerate:

- **API-driven integrations:** Integrating mainframe data and applications using modern APIs enables transparent access for cloud-native applications, broadening the mainframe's value and driving innovation and new product ideation.
- **Expansion with microservices architecture:** Rethinking monolithic mainframe applications into smaller, loosely coupled services reduces management overhead and improves maintainability.
- **Containerization:** Eliminating rigid connection points between applications and hardware allows for flexible deployment options, improved portability across architectures, and improved team collaboration.
- **DevOps integration:** Enabling the continuous integration and deployment (CI/CD) of mainframe applications significantly improves development speed and efficiency while maintaining the security and resiliency strengths of the mainframe.

- **Data integration, visualization, and virtualization:** Mainframe data can be integrated with cloud environments, visualized into dashboards, and virtualized to simplify access and reduce complexity with cloud-native environments.

The value of these capabilities runs across the spectrum of business outcomes that can establish competitive advantages. Increased agility and innovation can be obtained from leveraging modern development practices such as DevOps as well as operational practices such as site reliability engineering (SRE) while preserving valuable mainframe assets. For cost optimization, a cloud-native platform approach can lead to more efficient resource utilization and improved end-to-end performance transparency between mainframe and cloud environments for complex applications. Finally, talent attraction and retention can become easier with the adoption of cloud-native approaches aligned with mainframe practices, helping organizations attract and retain talent familiar with modern development practices.



Challenges and Opportunities

Some of the key challenges executives should plan to overcome with mainframe transformation include:

Complexity: Mainframe transformation projects are inherently complex due to the interdependence of various systems, applications, and processes. GenAI integration adds another layer of complexity, requiring careful planning and execution to ensure seamless integration with existing infrastructure.

Skills gap: Implementing GenAI-powered solutions requires specialized skills in AI development, data science, and machine learning. However, many organizations struggle to find or afford the talent necessary for successful implementation.

GenAI learning curve and value realization: Many GenAI technologies are still in their infancy; executives must work on trusting the underlying technologies and their ability to create valuable outcomes as well as creating metrics that can measure and track business outcomes.

Conclusion

By adopting a cloud-native strategy for mainframe transformation, organizations can leapfrog modernization efforts, unlocking the full potential of their core business applications while gaining the flexibility and innovation capabilities of modern cloud platforms. GenAI will go from an emerging technology to an ever-present one, impacting most technology architectures, processes, and teams.

Mainframe transformation and the use of cloud-native platforms, coupled with the integration of GenAI, present significant opportunities and a strategic approach for organizations to enhance operational and team efficiency, drive innovation, and gain a competitive edge from their mainframe environments. Proactive planning, strategic execution, and a focus on responsible AI deployment can mitigate risks and maximize the benefits of mainframe modernization initiatives. Technology executives play a crucial role in navigating these complexities and ensuring the successful implementation of GenAI- and cloud native-powered solutions. Investing in teams, technologies, and processes is fundamental to a successful mainframe modernization.

By harnessing the capabilities of GenAI- and cloud-native platforms, teams can unlock actionable insights, automate processes, improve resource utilization, enhance user experience, and strengthen their security posture in their mainframe environments, ultimately positioning themselves for long-term, transformational success.

About the IDC Analysts

Jim Mercer
Program Vice President,
Software Development, DevOps and DevSecOps, IDC

Jim Mercer is a program vice president managing multiple programs spanning application life-cycle management, modern application development and trends, emerging generative AI software development, DevOps, DevSecOps, open source, PaaS for developers, and cloud application platforms. His focus areas are DevOps and DevSecOps solutions research practices. In this role, he is responsible for researching, writing, and advising clients on the fast-evolving DevOps and DevSecOps markets. Jim's core research includes topics such as rapid enterprise application development, modern microservice-based packaging, platform engineering, GitOps, application security, software supply chain security, and automated deployment and life-cycle management strategies as applied to a DevOps practice. In addition, he examines how the move to DevOps methodologies impacts enterprise use of open source and preferences for using on-premises computing and development platforms versus public cloud services. Further, he examines how organizations prioritize DevSecOps and use automation to insert security assessments into the DevOps delivery pipeline (e.g., shift left). Jim advises senior IT, business, and investment executives globally in creating strategy and operational tactics that drive the execution of digital transformation and business optimization.

More about Jim Mercer

Stephen Elliot
Group Vice President,
I&O, Cloud Operations, and DevOps, IDC

Stephen Elliot manages multiple programs spanning IT operations, enterprise management, ITSM, agile and DevOps, application performance, virtualization, multicloud management and automation, log analytics, container management, DaaS, and software-defined compute. Stephen advises senior IT, business, and investment executives globally in the creation of strategy and operational tactics that drive the execution of digital transformation and business growth.

More about Stephen Elliot

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IDC Research, Inc.
140 Kendrick Street, Building B, Needham, MA 02494, USA
T +1 508 872 8200

idc.com @idc @idc

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