# Put AI to work for application modernization
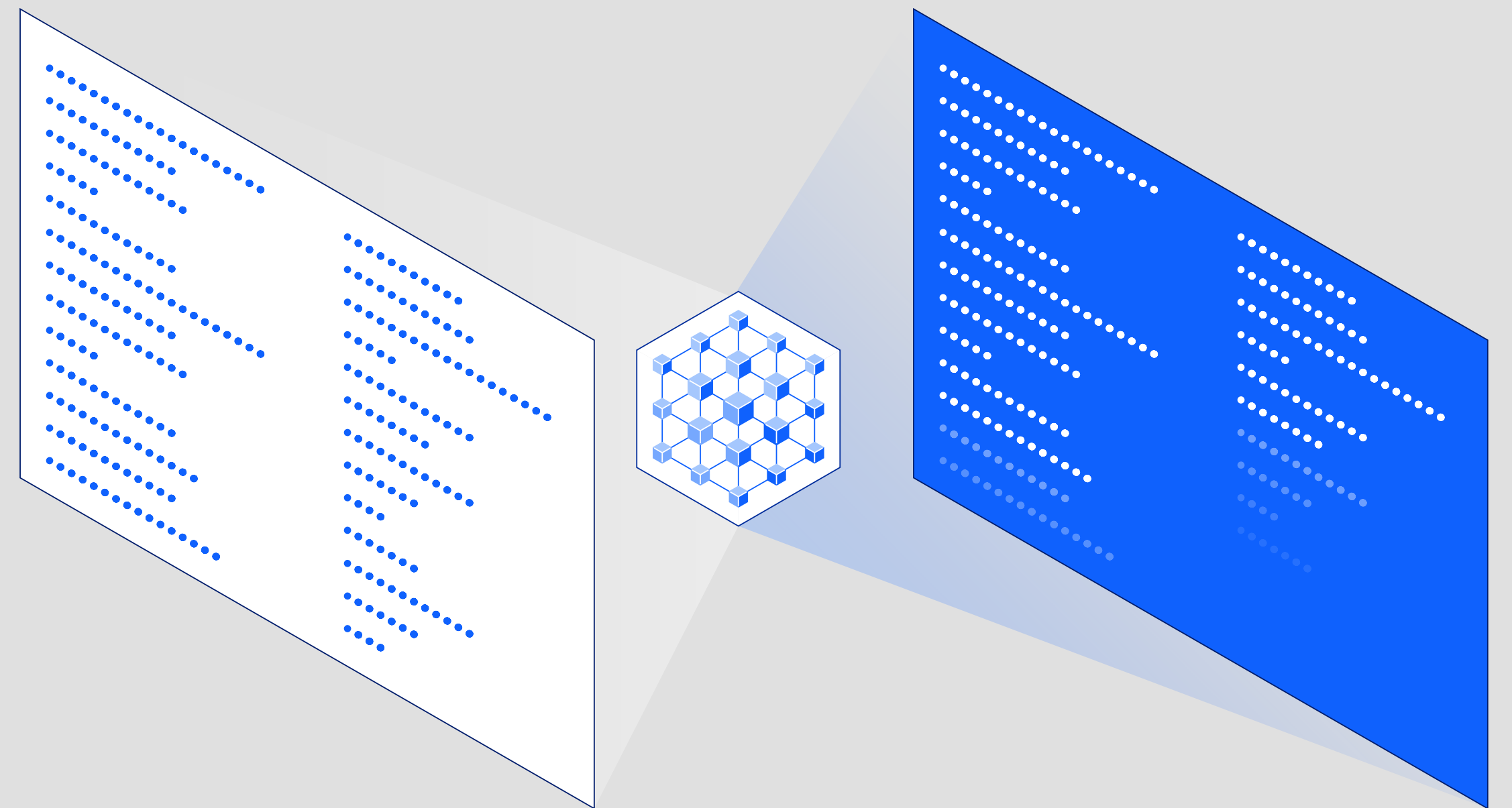
# Contents

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# Application modernization in the age of AI

The human urge to modernize. It's what has driven us for centuries to build new worlds—roads and bridges and cities—and invent new technologies. It's what's driving us today to update and optimize our digital infrastructure, because modernization offers the promise of more.

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Only 27% of the executive respondents state that they've modernized many of the necessary workflows, including the related applications, systems and data, across their organizations.[1]

For enterprises, that promise can mean more agility and efficiency in their digital infrastructure, and more productivity from their developers—in some cases, possibly more profitability.

Through application modernization with a hybrid infrastructure, which combines on-premises and cloud solutions, enterprises have the potential to update existing application capabilities to meet current technology standards, achieve faster time to market, improve customer satisfaction, create new business value, and capture new business opportunities. These are the reasons why application modernization is a key business imperative for many enterprises.

According to a recent study from the IBM Institute for Business Value, 83% of responding executives agree that modernizing applications and data is central to the business strategy of their organizations.[1]

The promise of modernization isn't without its challenges. In a rush to meet urgent business and customer needs, many organizations are dealing with siloed cloud or multicloud strategies that have led to increasingly complex IT environments. Due to this kind of hybrid-by-default approach, the modernization process is often slowed and seldom in lockstep with business needs.

In the same study, only 27% of the executive respondents state that they've modernized many of the necessary workflows, including the related applications, systems and data, across their organizations.[1]

From technical debt accumulated over years to a need for diverse skills escalated by siloed computing platforms, the barriers to application modernization can be many. So, how can business leaders, CIOs in particular, address these challenges to succeed in their modernization efforts at a higher rate? Two words: generative AI. Generative AI—a generational leap forward in AI technology—draws from deep learning neural networks known as foundation models and uses powerful transformers to produce high-quality content—such as text, images or code—from data.

To drive transformational success and take full advantage of Gen AI, leaders must first focus on addressing their IT weaknesses by adopting a by-design approach to their hybrid architecture. This strategy pivots from determining business limitations due to technology to purposefully building an architecture that's ready for innovation. An intentional multicloud approach, better aligned to business outcomes, can help supercharge modernization efforts and maximize ROI.

Let's explore *why* generative AI is key to application modernization and *how* CIOs can implement it with a hybrid-by-design approach, to simplify, de-risk, and accelerate their modernization journeys.

An intentional multicloud approach, better aligned to business outcomes, can help supercharge modernization efforts and maximize ROI.

## What's hindering application modernization projects?

Today, CIOs like you have mandates to accelerate business outcomes, drive business agility and create new revenue streams through digital transformation. For you, application modernization isn't just an IT buzzword, but a business imperative that can help you achieve your goals. But there are several challenges—including an increasingly complex IT landscape, rising technical debt, aging applications, limited skills, high costs, security risks and more—that can slow down your modernization efforts and stop you from realizing your business goals. Understanding these challenges is the first step toward overcoming them.

Modernize process
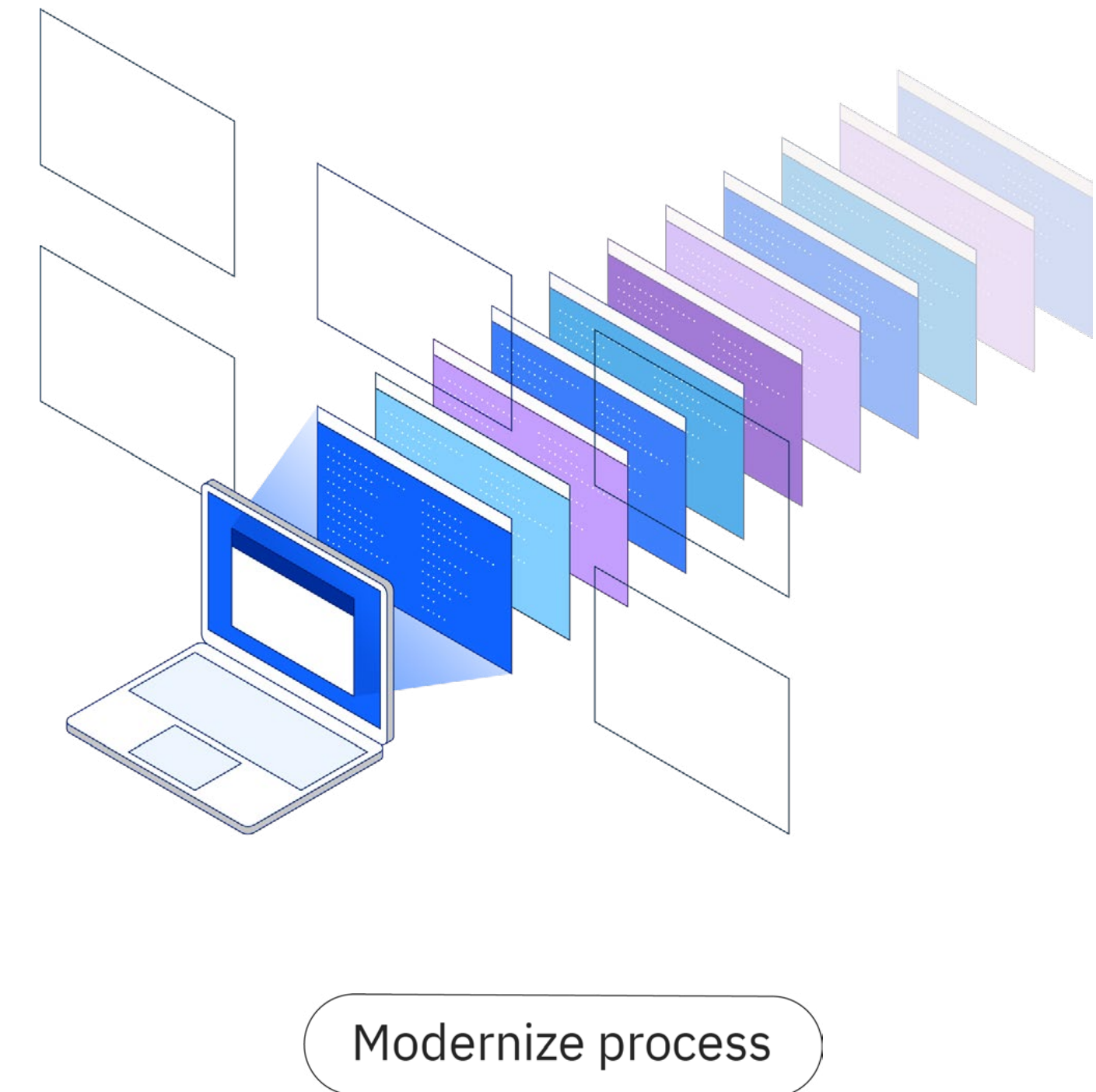
# Why application modernization projects fail, according to respondents[1]

Fortunately, AI provides capabilities to help you ease these challenges. From increasing developer productivity to accelerating application modernization and operational optimizations across your infrastructure, you can address many strategic outcomes in your modernization projects by adopting an AI-first strategy.

## High Costs

57% of executives say they're challenged by financial factors

## Technical debt

51% say they're challenged by technical factors

## Skills gap

45% say they're challenged by expertise factors

# Putting generative AI to work for application modernization

While the benefits of AI are too often mythologized, there's no denying that it's one of the most revolutionary technologies of our time. It's at once transformative and disruptive, holding the potential to both unlock immense economic value and bring about irrevocable changes in our lives and work.

The introduction of generative AI has driven up that potential—and exponentially so. Many enterprises are already working with or planning to adopt generative AI. With wide-ranging capabilities that span different business processes and operations, not to mention industries, it's not hard to see why enterprises are readily embracing generative AI.

But how do you successfully apply generative AI for business?

You do so by choosing the right foundation models: enterprise-grade, domain-specific foundation models over consumer-focused, general-purpose models.

These models—they could be large language models (LLMs), IT automation models, and many more—are typically trained on a wide variety of business data and tuned to perform business-specific tasks. With enterprise-grade AI, you can bring these models to life to implement new capabilities, such as semantic search, code generation and knowledge management, to not only enhance automation and increase efficiency in different processes, but also help augment your staff's skills and knowledge.

Generative AI, with its capacity for automating tasks and generating code, seamlessly integrates into this infrastructure, enabling greater productivity or teams.

To run those models smoothly, you'll want to ensure you're building an intentional hybrid architecture, which allows you to both modernize and place applications effectively on the best infrastructure—private or public—to optimize the application portfolio. Generative AI, with its capacity for automating tasks and generating code, seamlessly integrates into this infrastructure, enabling greater productivity for teams.

There's one caveat to keep in mind while using generative AI to extend developer skills. Just as writers oftentimes need to edit content after using autocorrect, your developers will still need to review and refine their work. As always, they can make the call on whether the code, for example, should be accepted as is, modified or completely rejected.

Scaling AI across the
enterprise, safely

Despite the widespread enthusiasm for
using generative AI for business, especially
from board members and investors, many
business leaders still have concerns about
generative AI adoption.

In a recent study,
the IBM Institute
for Business Value
found that responding
executives have four
top concerns about
generative AI adoption.[2]

# 61%

of executives surveyed have concerns
about data lineage or provenance

# 57%

have concerns about data security

# 53%

have concerns about the constraints
introduced by regulations and compliance

# 45%

have concerns about data privacy

## Scaling AI across the enterprise, safely

How your organization succeeds with generative AI is influenced by how you select, govern, analyze and apply data across it. Huge volumes of data from different sources are used to train generative AI models, so implementing governance, management and ethical frameworks that operate end-to-end is key if you wish to safely and responsibly adopt AI.

A hybrid model also enhances security measures by enabling organizations to establish consistent security practices across IT estates (including core, edge and cloud). Businesses can implement tailored security protocols and compliance standards, ensuring data integrity and regulatory adherence throughout the modernization process.

IBM has long followed core principles grounded in commitments to trust, transparency and fairness to guide how we handle client data and insights—and how we develop and deploy new technologies. To continue this practice in the age of AI, IBM has developed a multidisciplinary, multidimensional approach that embeds ethical principles into AI applications and processes. With IBM's Principles for Trust and Transparency and Pillars of Trust as the foundation for our AI ethics initiatives, we are helping people and organizations adopt AI responsibly, and with clear purpose.

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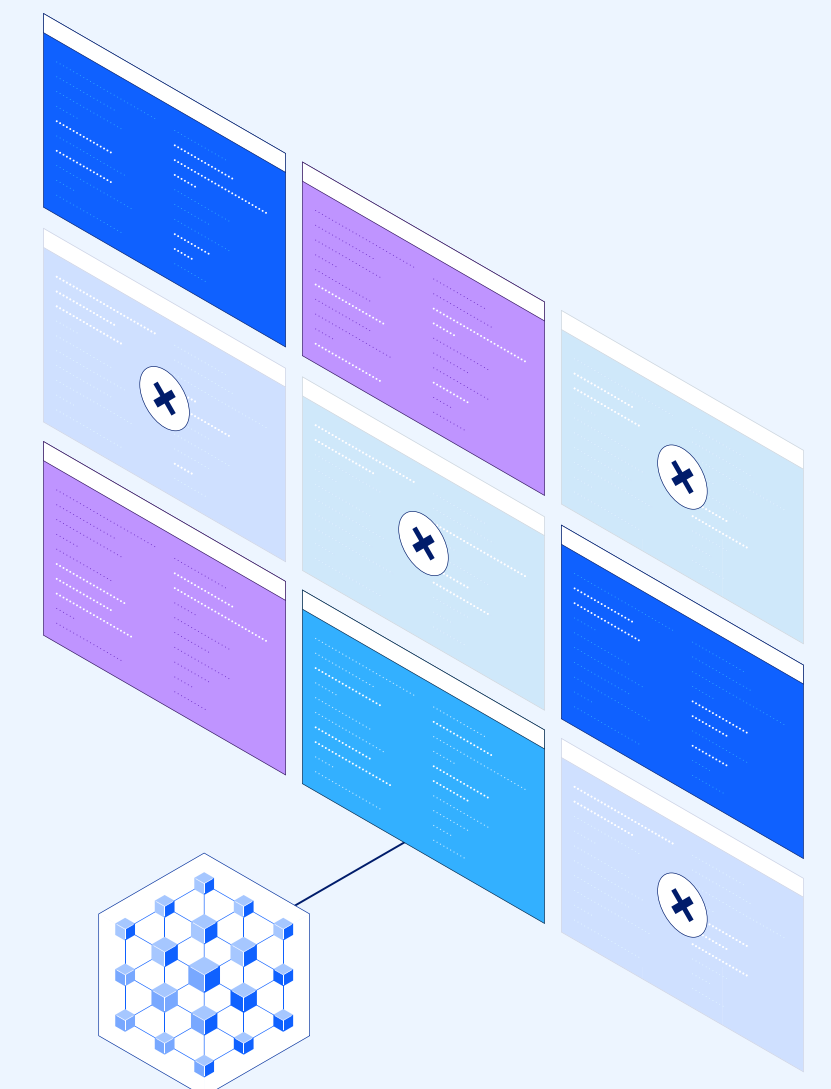
## IBM's guiding principles for AI ethics
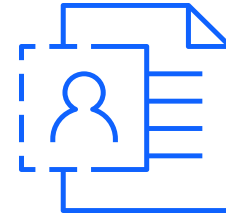
### Principles for Trust and Transparency

**The purpose of AI is to augment human intelligence**
We believe that AI should make all of us better at our jobs, and that the benefits of the AI era should touch the many, not just the elite few.

**Data and insights belong to their creator**
Clients' data is their data, and their insights are their insights. We believe that government data policies should be fair and equitable, prioritizing openness.

**Technology must be transparent and explainable**
Companies must be clear about who trains their AI systems, what data is used, and what goes into their algorithms' recommendations.

### Pillars of Trust

**Explainability**
Good design does not sacrifice transparency in creating a seamless experience.

**Fairness**
Properly calibrated, AI can assist humans in making fairer choices.

**Robustness**
As systems are employed to make crucial decisions, AI must be secure and robust.

**Transparency**
Transparency reinforces trust, and the best way to promote transparency is through disclosure.

**Privacy**
AI systems must prioritize and safeguard consumers' privacy and data rights.

## What does generative AI mean for traditional AI?

In the past, enterprises have approached AI as an add-on, with the end goal being cloud modernization and digital transformation. Now, AI is becoming the centerpiece of business transformation—75% of business leaders surveyed believe competitive advantage will depend on who has the most advanced generative AI.[3]

But harnessing the potential of AI to fundamentally transform application modernization requires a mix of vision and technology. Enterprises need to put AI to work at the strategic core of the business—not just add it on to existing systems—to solve challenges and help achieve their business objectives. It's time to move from applications +AI to AI+ applications.

So, does this shift in technology mean you need to replace your traditional AI solutions with the latest generative AI for application modernization? IBM AI leaders say no.

Traditional AI models that use conventional machine learning (ML) and rules-based models have different capabilities and serve different functions: predictive analysis, security and compliance, automation, and more. Generative AI models, on the other hand, use foundation models to autonomously generate content based on the data they were trained on. Generative AI and traditional AI are in fact complementary technologies; use them together to help accelerate and achieve your modernization goals.

Generative AI and traditional AI are in fact complementary technologies; use them together to help accelerate and achieve your modernization goals.

## What does generative AI mean for traditional AI?

As a CIO, you may already recognize the obvious merit in adopting generative AI to progress your many mandates. If not, now is the time to embrace a new perspective and learn why generative AI could be the solution to your modernization challenges.
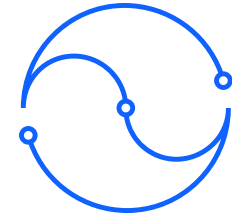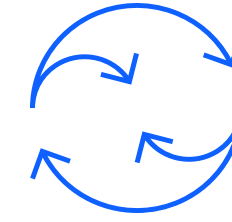
**Traditional AI**
Applies predefined rules and algorithms to specific sets of data to solve problems, make predictions and automate tasks.

Potential application modernization tasks using traditional AI:
– Capacity planning
– Resource utilization
– Cost optimization
– Performance monitoring

**Generative AI**
Generates new content based on patterns learned from the data it was trained on.

Potential application modernization tasks using generative AI:
– Code generation
– Best practice recommendation
– Context-sensitive automation
– Code debugging

## Why use AI for application modernization?

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# 79% of responding executives say using generative AI in app modernization projects will increase business agility.[4]

Propping up existing systems with modern applications can compound the complexities in the IT environment. Using generative AI instead to tackle modernization issues can help simplify and accelerate the entire application modernization journey. Through generative AI-powered code conversion, code generation, code reverse engineering and transformation planning, you can help address common modernization challenges, improve employee productivity and reduce costs.

**Tackling technical debt with generative AI**
When technical debt accumulates across various aspects of your IT infrastructure, such as code, architecture and documentation, identifying, prioritizing and resolving the complexities can become a Herculean task. This is not the case with generative AI.

When you use it to take on technical debt, you can accomplish tasks and achieve outcomes that were otherwise impossible. Enterprise-grade AI provides capabilities that improve issue classification, generate code for issue resolution and set up context-sensitive automation—to help significantly cut down the time your developers spend fixing code.

With AI-enabled automation, the developers can also reduce the time they spend provisioning cloud infrastructure, applying patches and performing maintenance. From implementing faster code debugging and enabling better document generation to driving automation efforts, generative AI is designed to help reduce your technical debt and accelerate your modernization efforts one prompt at a time.

## Why use AI for application modernization?

**Bridging the skills gap with generative AI**
The shortage of traditional technical skills is a real challenge many CIOs must address today. But with technology evolving faster than ever, it's equally important that you acquire modern skills— including ones related to generative AI and the new disciplines it's creating, such as prompt engineering.

The solution to this problem may seem simple enough: reskill, automate and adapt. But is it still simple if it costs you time? Make use of the code generation capabilities of generative AI and provide your teams a new, faster way to work with a variety of skills and languages.

With these capabilities, your teams are positioned to translate code from one language to another or create refreshed code, even when they don't know the specifics or syntax of a language.

Additionally, they can easily summarize existing code—typically older code, which may have been poorly documented—and provide the necessary context without any assistance from the original developers who may no longer be around. They can also write automation playbooks with AI-generated recommendations.

Make use of the code generation capabilities of generative AI and provide your teams a new, faster way to work with a variety of skills and languages.

# Generative AI in action

The IBM CIO Organization, as "client zero," used IBM® watsonx™ Code Assistant for Red Hat® Ansible® Lightspeed in a technical preview and experienced firsthand the benefits of putting AI to work for application modernization.

IBM Consulting™ also leveraged the technical preview of IBM watsonx Code Assistant for Red Hat Ansible Lightspeed and improved developer productivity with generative AI.
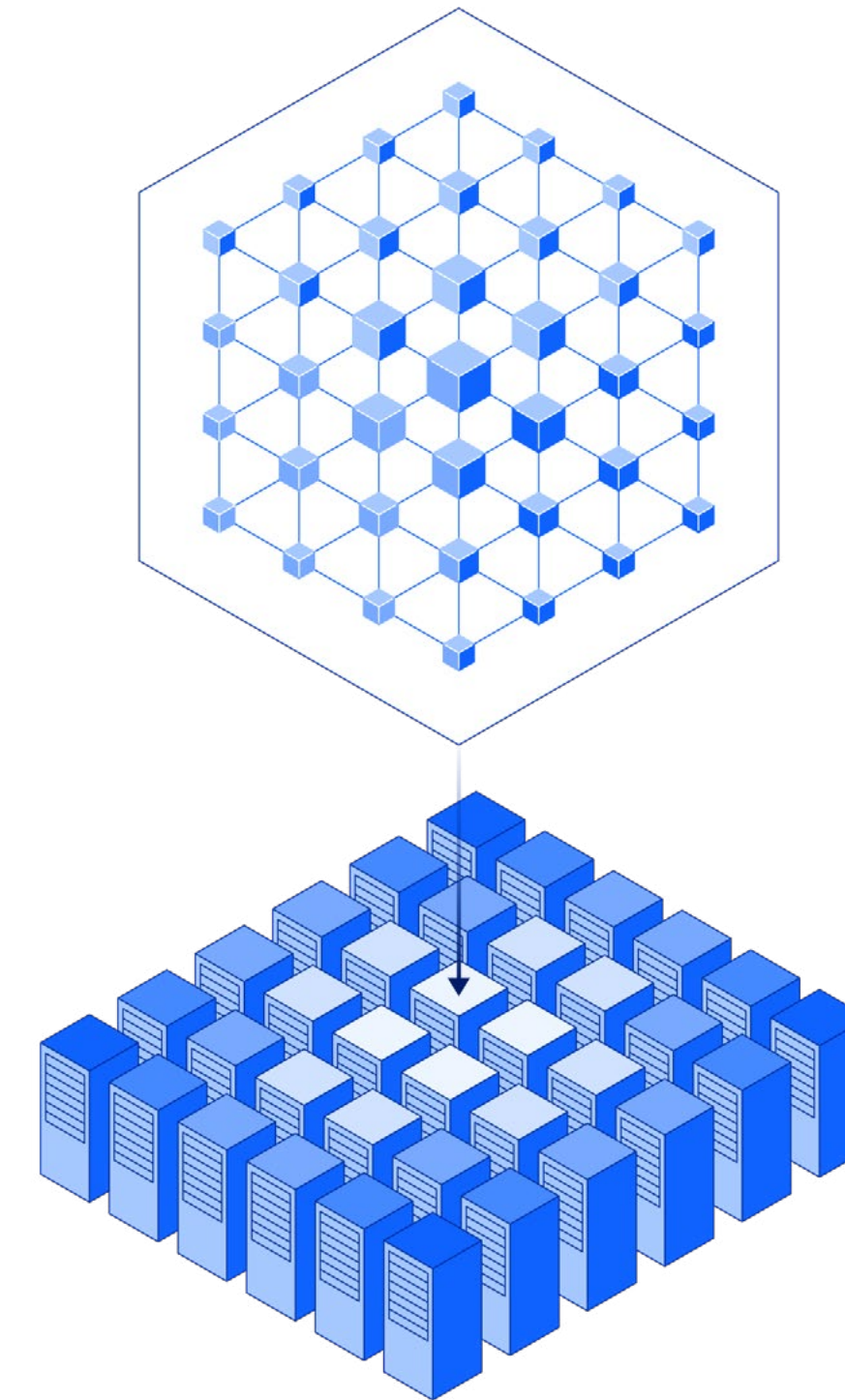
## 50%

reduction in playbook development effort

## 10x

expected increase in the number of people who can help produce Ansible Playbooks going forward

## 60%

of Ansible Playbook content automatically generated

## 30%

reduction in Ansible Playbook development effort while maintaining quality, complaince, resiliency

Transformation planning with AI

## How to use AI for application modernization

As with any complex IT transformation project, application modernization also happens in phases. We can broadly categorize them as advisory, planning, transformation and testing. These phases include critical workflows that present fitting opportunities for applying generative AI.

**What are workflows?**
Workflows are processes and tasks that occur in a sequential order, from start to finish, through which people and enterprises accomplish their work. The workflows discussed in this section are instances where generative AI can be infused into an application modernization process to standardize and optimize outputs, enriching what teams can achieve.

**Application modernization phases and workflows in brief**

| What happens in these phases? | Which key workflows align with these phases? |
|---|---|
| **Advisory**<br>You assess your application landscape and ecosystem landscape to create the modernization roadmap. | Transformation planning |
| **Planning**<br>You develop the project plan and set the modernization milestones. | Transformation planning and code reverse engineering |
| **Transformation**<br>You modernize the applications and migrate them to newer platforms and architectures. | Code generation and code conversion |
| **Testing**<br>You validate the modernized applications to ensure they are fully functional and meet the performance and security requirements of your organization. | Code generation and code conversion |

Teaming with IBM Consulting gives you access to services that help your organization prepare for its transformation journey, meeting you where you are—whether it's creating a custom strategy, modernizing business-critical applications, or developing and managing new applications.

Let's look at the 4 main generative
AI workflows for application
modernization

**1. Transformation planning**
Determining the transformation strategy,
including ROI estimation, should take place
during the advisory and planning phases.
This is when the modernization approach
is defined based on both business and
technical aspects of applications. Today,
you likely rely on extensive rules encoded
in spreadsheets and other tools to do the
planning. But when there are hundreds of
servers and applications to modernize,
how do you manage the complexity?

Throughout the industry, technical
leaders are considering how generative
AI can be adopted to radically streamline
transformation planning.

Generative AI might:
– Help accelerate discovery and disposition
  by processing hundreds of documents and
  summarizing the documents if required.
– Help create modernization roadmaps with
  detailed transformation plans and target
  architecture designs to achieve a hybrid-
  by-design ecosystem.
– Help generate reference architecture,
  including diagrams and documentation
  that can be converted into Terraform
  code to create a landing zone for the
  transformed applications.
– Help to understand the overall application
  to make informed modernization decisions.
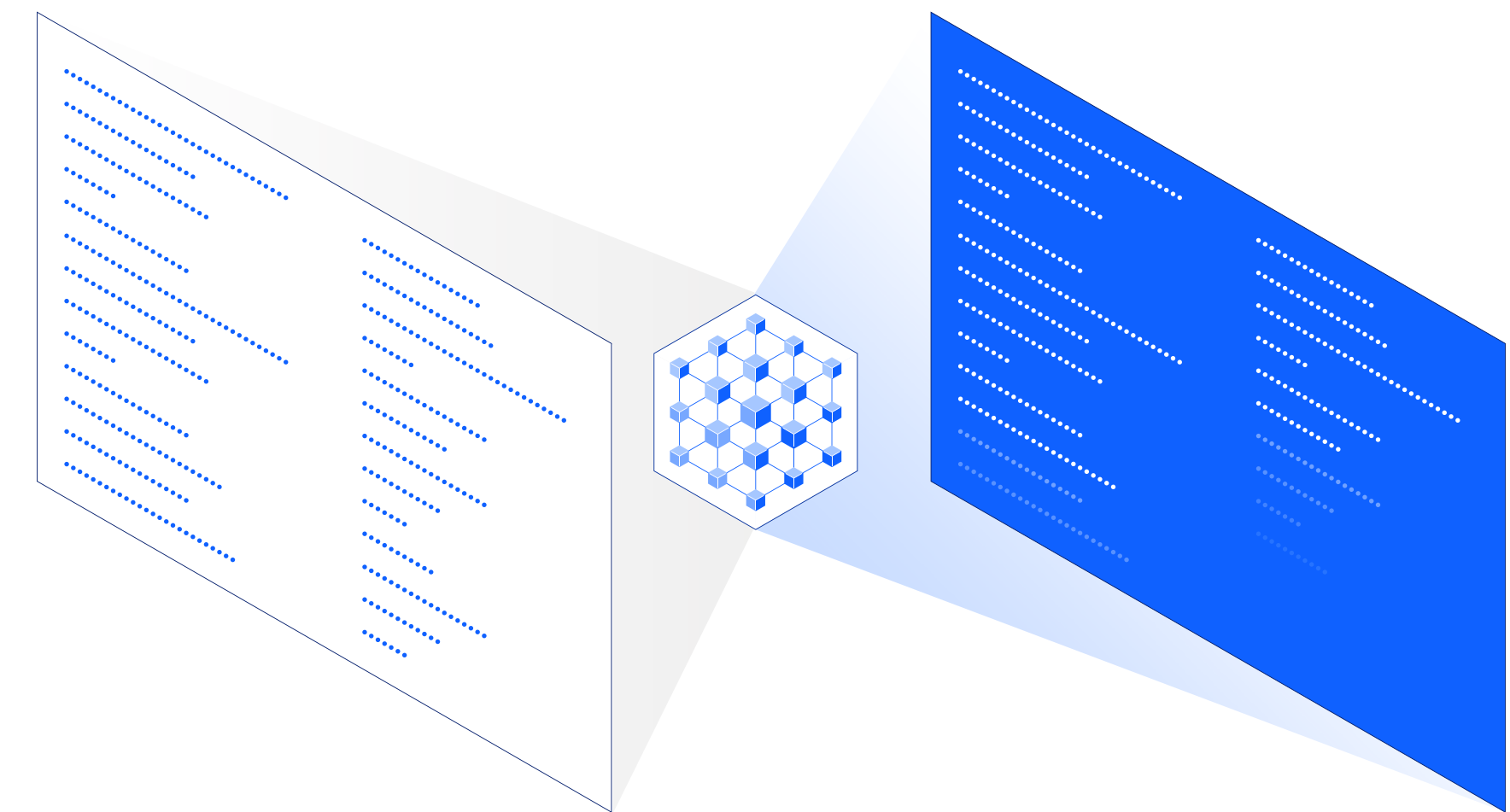
## 2. Code reverse engineering

In the planning phase, you perform reverse code engineering to analyze the business logic that's embedded in the existing code. It helps you understand the codebase, its architecture and any dependencies.

With generative AI, technology experts are exploring ways to summarize the code and analyze existing applications to generate phased modernization plans based on code dependencies and historical project sequencing.

– Help extract business rules by analyzing and summarizing code.
– Help uncover domain models by analyzing code and identifying domain-specific entities.
– Support monolith-to-microservices transformation by analyzing monolithic applications and generating microservice recommendations.
– Help optimize application refactoring and containerization by identifying refactoring opportunities, generating refactored code and suggesting containerization configurations.

Generate new code
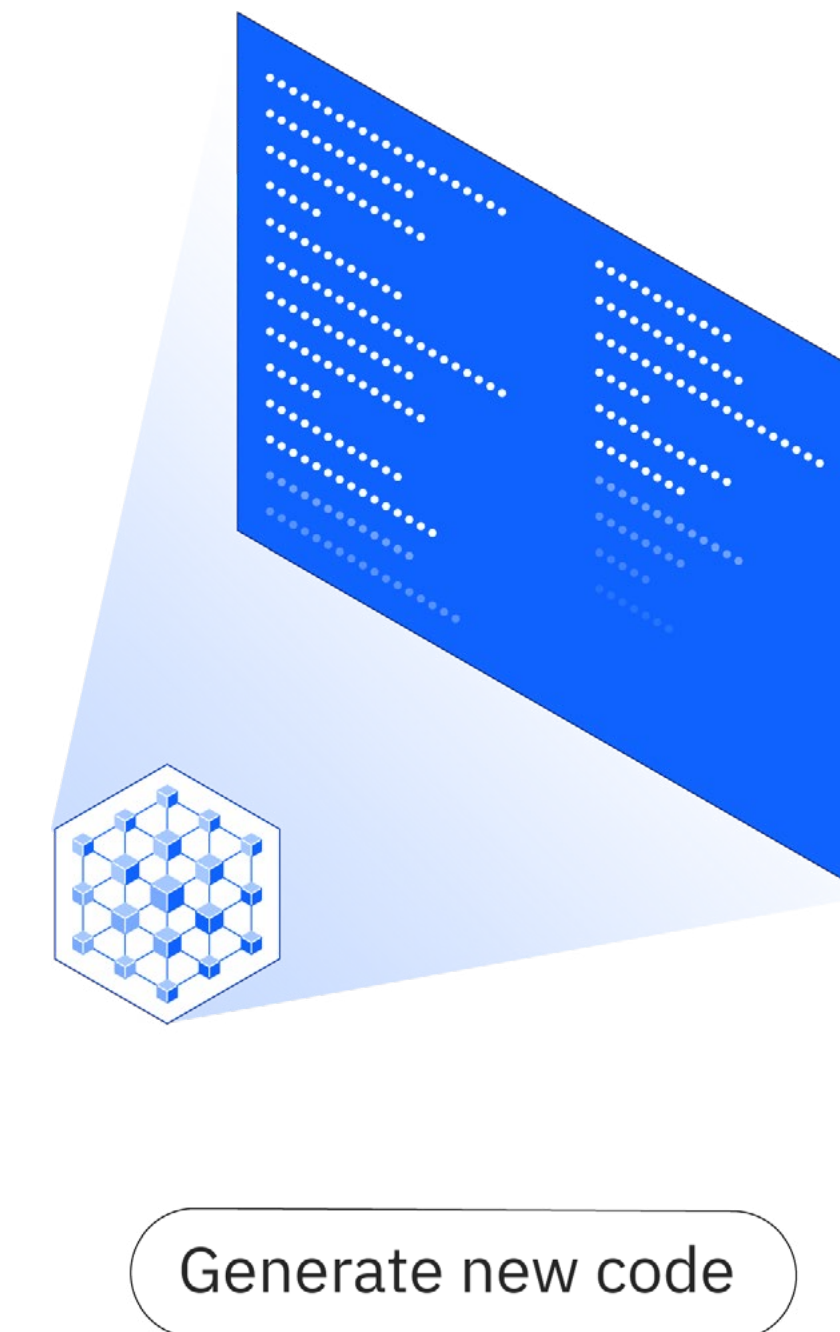
### 3. Code generation
You focus on code generation in the transformation and testing phases. But what if you are plagued by developer team fatigue, too many repetitive manual tasks, poor code quality and constant customization challenges?

Generative AI lets you create code very quickly, enabling you to accelerate code development with just natural language prompts.

– Write cloud-native code in Java, Quarkus, Spring Boot and more.
– Optimize and document COBOL Code.
– Build UI code, including back-end for front-end (BFF) patterns, by analyzing images to generate code compatible with the UI design.
– Generate infrastructure code for Terraform and configuration code for container platforms such as Red Hat OpenShift®.
– Develop serverless code for serverless functions using Knative.
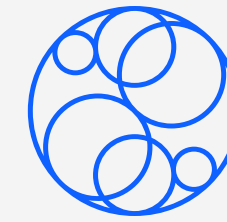
IBM offers you enterprise-grade code generation capabilities through IBM watsonx Code Assistant—a generative AI-assisted solution purpose-built to help you accelerate development with multiple highly relevant uses cases. Your developers will still play the valuable role of refining their code when using both IBM watsonx Code Assistant for Z and IBM watsonx Code Assistant for Red Hat Ansible. While generative AI can help accelerate the development process, the final approval of the code rests in the hands of human experts.

IBM watsonx Code Assistant is built on IBM Granite, state-of-the-art models designed for code and trained on 116 programming languages. Granite is geared to help IT teams create high-quality code using AI-generated recommendations based on natural language requests or existing source code.

IBM watsonx Code Assistant for Z helps equip your developers, regardless of their skill levels, with the ability to write code through AI-generated recommendations for mainframe application modernization. With IBM watsonx Code Assistant for Z, you can help reduce the burden of understanding applications with huge technical depth by generating code documentation with a purpose-built AI assistant, thus helping to manually write more modular and optimized COBOL business services.

**4. Code conversion**
In the transformation and testing phases, you also engage in code conversion to translate or migrate code from one format to another. Maybe you have existing applications that aren't compatible with new platforms, but you still need to retain them. What if your developers don't have the bandwidth or the expertise required for code conversion from existing applications?

Generative AI can help you automate this conversion process and enable it for many languages. For example, convert code from COBOL to Java by generating Java code that matches the functionality of the original COBOL code.
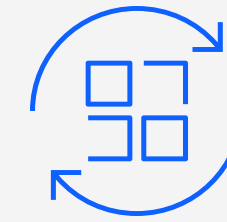
For code conversion, start with IBM watsonx Code Assistant for Z—an AI-assisted mainframe application modernization solution—and enable your developers to incrementally modernize COBOL business services and selectively convert them to high-quality Java code while automatic equivalence testing. Watsonx Code Assistant for Z provides the flexibility to deploy its large language model either on-premises or as-a-service. It is enabled by a 20-billion-parameter LLM for code, which is on target to become one of the largest generative AI foundation models for code automation.[4]

# Taking the next step

Applying generative AI to application modernization can accelerate your transformation journey and set in motion a sustained cycle of growth.

However, scaling generative AI across the enterprise is still a challenge for many CIOs. And doing it with a focus on trust, compliance and security is an even bigger challenge.

Here are 7 recommendations for CIOs to successfully adopt generative AI for application modernization.

# 01

**Ensure the right infrastructure is set up with the necessary security, privacy and resiliency controls to support the right AI use case for your organization.**

An effective AI journey starts with an intentional hybrid approach. Choose an open, hybrid cloud platform empowered by Red Hat OpenShift. This allows for deployment across different locations and offers a consumption-based model for both on-premises infrastructure and cloud-delivered services.

Do not over invest or over provision infrastructure for AI; instead, align the right infrastructure to the right AI task at hand. Make sure the infrastructure meets your organization's standards for security, privacy and resiliency.

By integrating AI capabilities within hybrid environments, organizations can enhance their application modernization efforts, ensuring efficient data management and robust security protocols.

*IBM's IT infrastructure solutions—from servers and mainframes to storage systems and software—have been designed to help support the next generation of AI technology and follow a clear set of build guidelines.*

# 02

**Start with a clear roadmap and develop a well-articulated plan before you implement the modernization and migration journeys.**

Understand how the applications are aligned to your business and discover any dependencies to ensure your transformation strategy doesn't disrupt the business.

*IBM Consulting can help you discover your entire landscape—from the platform, operating systems and middleware you use to the different applications you run—to define your AI roadmap and tailor it to your transformation journey.*

# 03

**Grab low-hanging fruit by applying generative AI to applications that have already been modernized.**

Seize the low-risk, high-visibility opportunities. Applying generative AI to already-modernized applications can help you more readily highlight its benefits.

# 04

**Go after opportunities that were previously off-limits such as applications and processes in core systems.**

Direct your efforts toward core business systems where generative AI can deliver bigger, more strategic results. Focus on past initiatives that represented the most business value but were abandoned due to cost or complexity.

*IBM Consulting can help you rethink your strategy and modernize with purpose. With a focus on AI and hybrid cloud, we can implement and scale advancements to reinvent your organization's workflows.*

# 05

**Track and measure the impacts of generative AI on developer productivity.**

Measure and reward fast cycles of modernization made possible by generative AI. Use this data to demonstrate the value of generative AI to other business unit leaders and drive consistent and accurate automation adoption across your organization.

*IBM watsonx Code Assistant for Red Hat Ansible Lightspeed can help novice developers to write Ansible Playbooks and automate tasks while removing the burden of low-level task creation from more experienced automators.*

# 06

**Seed new teams with experienced talent to serve as cross-functional guides and advocates.**

Extend generative AI modernization to opportunities across the organization. Close the gap between IT and business and form new partnerships that drive technology modernization and business performance, irrespective of roles.

# 07

**Take a strategic approach to AI ethics, ensuring that platform policies are based on the principles of transparency, trust and fairness.**

Establish, publish and enforce organization-wide policies, practices and guidelines for employees using the technology.

Instill a culture of ethics and AI governance to enable holistic, end-to-end management of AI solutions.

*IBM can help you deploy the right AI technology in the right business area, designed for maximum impact, with governance and security guardrails built into the process.*

# Ready to begin?

**Register for a discovery session with IBM AI experts today →**

IBM has both the technology and the expertise to help you get started with generative AI for application modernization.



**AI platform**
IBM watsonx is IBM's data and AI platform, native to hybrid cloud, that is designed to enable you to train, tune and deploy generative AI across your organization, using your critical, trusted data wherever it resides.

**AI assistant**
IBM watsonx Code Assistant is powered by state-of-the-art models designed for code, which helps your developers to generate high-quality code and content using natural language prompts or existing source code, enabling your developers to expand their skills and optimize their bandwidth. The result can be an acceleration in code development and an increase in developer productivity throughout the application modernization lifecycle.

**AI expertise**
IBM Consulting can help you strategize, modernize, build and manage applications with the power of AI and hybrid cloud. IBM has formed a Center of Excellence (CoE) for generative AI, specialized in applying watsonx and IBM ecosystem partner technologies, to rapidly create coherent strategies and accelerate how we solve business problems. The CoE complements more than 21,000 IBM data and AI consultants with a strong track record in AI who are already collaborating with thousands of global clients and partners to shape the future of AI.

**Infrastructure to power it all**
IBM's Hybrid Cloud can help you realize business outcomes and maximize ROI. IBM leverages Red Hat OpenShift, cloud-native AI stacks, and efficient hardware utilization to ultimately accelerate and scale the impact of AI across the enterprise with the unique expertise of IBM Consulting bringing it all together.

1. Modernizing applications on hybrid cloud, IBM Institute for Business Value, 4 May 2023.

2. The CEO's guide to generative AI: Platforms, data and governance, IBM Institute for Business Value, 1 August 2023.

3. CEO decision-making in the age of AI, IBM Institute for Business Value, 27 June 2023.

4. IBM unveils watsonx generative AI capabilities to accelerate mainframe application modernization, IBM Newsroom, 22 Aug 2023.