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The future of mainframe modernization with Artificial Intelligence (AI) and generative AI

Contents

Executive summary

We have entered the age of Artificial Intelligence (AI). There are nearly limitless uses for AI, some known and many yet to be identified. Leaders are increasingly embracing the new technology, helping it to evolve through understanding and use. The impact of this revolution will be felt more rapidly than from other major technological advances.

As part of this revolution, mainframe transformation and application modernization are being accelerated with the infusion of AI technologies at all stages of the journey and across all stages of an application lifecycle. In parallel, business use of AI/generative AI also creates the need for modernization, including application and data integration across a hybrid cloud.

Some of the ways that AI can help with mainframe modernization are analyzing and documenting how applications, data and infrastructure relate, identifying how programs work and describing them, creating testcases and test datasets for applications, and improving or converting code. Using AI for mainframe and hybrid cloud management includes integrating Machine Learning Operations (MLOPs) and Large Language Model Operations (LLMOPs) to enhance DevSecOps, as well as AIOps and FinOps (leveraging Kyndryl's advanced AI-infused delivery platform, Kyndryl Bridge).

One of the largest barriers to both mainframe modernization and AI exploitation, in general, is the worldwide skills shortage. To help address this issue, one of the early uses of generative AI is to serve as assistants producing output needing to be verified and acted on by people following clear, ethical standards.

As AI gains trust, expanded automation will be the next step and AI will soon help meet the skills shortage challenge by making experts more productive by allowing them to focus on very complex issues, leaving the lower-level issues to AI engines.

Kyndryl, the world's largest IT infrastructure services provider, helps customers meet current and emerging AI requirements for all aspects of mainframe modernization (moving off mainframe to the cloud, integrating with hyperscalers, and modernizing on the mainframe platform), enabling them not only to put the right workload on the right platform but also to responsibly deploy AI.

Our leadership in the future of mainframe modernization through the use of AI/generative AI is demonstrated by our commitment to educating more than 5,000 of our mainframe professionals with new AI skills to help enable safe, ethical and effective use of AI technologies wherever they are deployed in this journey.

AI: revolution by evolution

We are constantly reminded by multiple media sources or social networks that AI represents a sea change for the future of work[1] and many other aspects of our lives.

Leaders understand the need to prepare and participate. Like a starburst, each step enables more and more people (and companies) to innovate, invent and drive the revolution.

Very few people could envision new media, social networks or smartphones at the start of the digital revolution. The impacts of the AI revolution by evolution will be felt much more quickly than past technology changes. There will be inventions and innovations, and some of those inventions and innovations will disappear, especially as people begin to use and better understand AI.

Mainframe modernization and AI

There are three key focus areas associated with AI and mainframe modernization.

→ Accelerating the use of AI for business transformation by integrating and using the applications and data hosted in a mainframe environment.

→ Using AI as a valued assistant when strategizing, planning, and implementing transformation and modernization of mainframe environments.

→ Expanding the use of AI for mainframe and hybrid cloud management.

Accelerating AI for business using the mainframe

It is easy to imagine but difficult to predict how AI will evolve and be used beyond the near term, but it is possible to recognize trends that are likely to come, and change is happening fast.

For example, businesses from banking to retail to airlines aim to use the power of AI to mine their data to distill meaningful information from it. In many enterprises, the mainframe is often the source of decades of data, holding an invaluable treasure awaiting to be tapped in its datasets, databases and tapes.

This wealth of data is an enabler for one of the early focus areas for AI which has been generating text, images and videos, and translating text into different languages from existing data. Furthermore, improving customer experiences through AI chatbots or embedded intelligent agents and recommending products are all current applications of AI.

Emerging uses include monitoring or evaluating regulatory compliance, security, business processes (such as fraud detection, dynamic pricing, and intelligent inventory management) and other similar applications. These can all take advantage of AI being able to rapidly identify patterns from very large volumes of labeled and unlabeled data and then inform humans of potential breaches or other problems.

As with mainframe modernization in general, transforming the mainframe environment for business AI applications involves optimizing, opening the mainframe with APIs or other solutions, transforming data, and enabling security capabilities for accessing the applications and data.

If the mainframe is to host applications that use AI, some extra steps may be needed, such as deploying additional tools and connecting applications and data to the AI capabilities. Moreover, if the mainframe will host the AI capabilities themselves, then further tools and processes will be required.

Given a specific business use, an assessment of the current environment, definition of the future state based on the business requirements and a gap analysis must be performed. After this assessment, the required changes must be planned, tested and implemented. A best practice is to baseline before and after execution of the business process that is the target of AI, to determine the cost effectiveness and drive decisions on the next iterative steps for AI use.

AI-aided mainframe modernization

It is easy to imagine but difficult to predict how AI will evolve and be used beyond the near term, but it is possible to recognize trends that are likely to come, and change is happening fast.

AI can help at each phase of a transformation journey and will become an accelerator for mainframe modernization as it evolves.

Strategizing and planning with AI

AI can help build understanding of the current environment, including business goals, modernization approaches, current processes and costs.

Generative AI solutions can review volumes of information, extracting what is important, aiding with gap analysis, and identifying risks, recommendations and technical requirements. Current application identification and mapping tools are being enhanced and new tools are being developed using AI to drive more completeness, accuracy and efficiency.

The base tools can do some level of end-state modeling today, but as these tools evolve and more specialized tools become available, the to-be models will become much more accurate. Eventually, simulation of different options for new environments or end-states will be possible, potentially accelerating or eliminating the need for proofs of concept.

Experts will be able to review the to-be models, easily iterate through scenarios and provide key objective information to support mainframe workload placement and application modernization approaches, and infrastructure configuration or investment decisions.

Planning for mainframe modernization is one phase of the project management of the journey. The book, "The AI Revolution in Project Management – Elevating Productivity with Generative AI"[2] outlines how generative AI can assist projects to help make them more successful during every phase, including building and implementing.

Building and implementing with AI

Performing mainframe transformation may include a lot of very labor- and knowledge-intensive and sometimes repetitive steps naturally suited to AI.

Some examples of actions that AI and generative AI can help with are mainframe program code generation, COBOL / RPG / REXX / PL/I code understanding, modernization or translation to Java or Python, building of runbooks, testing of batch job JCL or Procs and creation of the AI models themselves. In addition, complete conversion of User Interfaces (UIs) from textual to graphical, with related application code changes, will become easier with AI and generative AI doing much of the work.

Other uses include building intelligent applications identifying and generating testcases, generation of synthetic test data or extraction and redaction from existing data sources, performing some of the testing, summarizing results and making recommendations for improvements or changes.

In addition, performing light inference (making predictions based on trained models) directly on the mainframe can enable organizations to benefit from reduced latency, improved security and enhanced scalability.

What is Artificial Intelligence?

A useful and widely accepted catgorization of AI from "Understanding the four type of AI, from reactive robots to self-aware beings."[3]

Reactive AI can only respond to the current situation without using any residual knowledge.

Theory of Mind AI can understand and interact with other intelligent agents, including humans. Generative AI is a form of this.

Self-Aware AI is perhaps thankfully still a hypothetical and speculative form of AI which will have a sense of self and consciousness.

Limited Memory AI can use a limited amount of residual knowledge to improve current performance by examining previous actions, outcomes or experiences.

Managing the modern mainframe with AI

Building on a history of using advanced data analytics (known as Reactive and Limited Memory AI (see graphic: What is Artificial Intelligence) is already a staple of best-practice mainframe management and operations. AIOps and Batch AIOps integrated today through Kyndryl Bridge are examples of this. Generative AI is rapidly being incorporated to help further improve efficiency and effectiveness.

Efficient and agile DevSecOps processes are being improved through implementation of MLOps and LLMOps that enable automation assisted by AI. This can improve speed-to-market, quality and efficiency.

Security and compliance can be improved in mainframe and hybrid cloud environments using AI, including more rapid problem detection based on pattern recognition and learning.

Much like the use cases for business applications, AI can help the end-user have a better and more effective experience. Production analysts, operators, systems programmers, developers, and others in systems management roles will have AI tools that can help them perform their jobs better, more consistently and faster. With an assistant next to them that has virtually unlimited memory, and access to a broad range of data which is constantly being updated, productivity associated with actions such as problem determination, root cause analysis, performance and capacity planning and tuning, and others can increase.

Industry-wide IT skills shortages

There is a major, global IT skills gap regardless of the technology and it is only expected to continue to grow. Filling this gap is a key way in which Kyndryl can help customers.

According to a survey by Robert Half, "95% of technology managers face challenges finding skilled resources," and "69% are hiring for new positions, while 29% reported they were recruiting talent for a vacated role."[4] In another study by Forbes of 500 UK businesses, 93% reported there was a gap in IT skills in the UK jobs market[5]. Overall, IT skills are in high demand.

This is exacerbated for mainframe enterprises because many of the people who are supporting classic languages like COBOL and RPG, mainframe operations or infrastructure, are reaching retirement age and these skills are not, in general, being taught in colleges anymore.

This lack of skilled workers who can support mainframe environments was identified as a significant concern in the Kyndryl 2023 State of the Mainframe Survey Report[6]. 56% of the 500 mainframe enterprises surveyed globally lamented the fact that people entering the workforce did not have mainframe skills and 47% noted the fact that their staff with mainframe expertise were retiring.

Compounding the technology skills shortage, one of the biggest emerging demands for new skills is in AI, where new roles are constantly being identified including the need for experts in architecture, development, management and use of the technology.

Although an emerging and key driver of the IT skills gap, almost paradoxically, AI is also helping the industry meet this challenge by increasing productivity for skilled people. A cause and the cure!

Fresh perspectives on mainframe modernization

Over the last few years, most mainframe enterprises have embraced the approach of placing the right workload on the right platform and adopted a hybrid cloud model. They are basing workload placement decisions on the requirements of the workload, the characteristics of the platform, the cost of migration, the risks created by moving, and the Total Cost of Ownership (TCO) of the new environment.

Kyndryl's Mainframe Modernization Survey Report found that the vast majority of respondents are moving some workloads off the mainframe, moving on average 37% of their application portfolio off the platform.

Even if the goal of a company is to completely retire their mainframe, the project can take many years. For this reason, the best-for-purpose approach to mainframe application hosting may include some level of transformation of the mainframe estate whether as an intermediate step or as part of a final hybrid-cloud destination. This often includes optimizing the current environment and opening it up for integration with other platforms and, potentially, implementing and exploiting AI technologies.

As described earlier, AI can help overcome some of the hurdles faced when modernizing mainframe environments. This can fuel more rapid transformation and more efficient management of mainframes as standalone platforms or as part of an integrated hybrid cloud. To continue to drive this wave of change, many of the people who manage and build mainframe infrastructure, applications and data will need to become AI experts.

Machine Learning, Deep Learning, Large Language Models and the mainframe

Data is at the core of AI and generative AI driven by the ability to use Machine Learning (ML), Deep Learning (DL) and Large Language Models (LLM) to rapidly learn and improve. Effective management and use of mainframe data is key to AI/generative AI success.

ML enables controlled learning to be performed in three (3) basic ways that make it very powerful:

Ingestion and analysis of mainframe program code as part of conversion is an example of using supervised learning for mainframe modernization. Supervised learning focuses on labeled data such as images, texts or sounds, producing outputs such as classifications, regressions or translations. A business example of the application of this learning is image recognition.

Capture and use of help pages or monitoring social networks for early problem detection are examples of using unsupervised learning for mainframe modernization. Unlabeled data such as transactions, web pages or social networks, producing outputs such as clusters, associations or embeddings are the focus of unsupervised learning. Fraud detection through insights gained while monitoring transactions from online banking is an application of this learning for business.

A third type of ML is reinforcement learning through trial and error, producing outputs such as policies, strategies or behaviors. In business, this is used to help retail shopping sites by predicting and making personalized product recommendations to customers based on their reactions, sentiments and other choices. Mainframes host much of this type of data for the business, however, reinforcement learning is also used to evaluate and improve console interactions based on outcomes of actions.

LLMs are also at the core of AI and generative AI. Trained on billions or even trillions of words, they learn and evolve from statistical patterns and relationships between words, phrases and sentences. Using generative AI, they can produce contextually consistent, coherent and well-formed answers, new documents, have conversations, and act as very smart assistants. There is a reason why AI products have prefixes like "co" and end in terms like "assist." AI can help people do more and do it faster, but it will not automate away the need for human judgement and action. For example, in the mainframe environment, the smart assistant may suggest resetting the system through doing an Initial Program Load (IPL) but it will require human intervention to confirm that action.

Automated actions can be risky even when carefully programmed and thoroughly tested. With AI, making automated decisions can potentially happen much faster, often based on probability or partial answers. A solution that addresses 95% of the need may or may not help. A multi-million-dollar financial transaction either clears or does not. Some things, like computer programs, either work or do not work.

Despite the risks, the focus is shifting to automation as AI matures and establishes trust. Many of the early applications will become more automated. Already automated processes like loan applications, scheduling, logistics and similar processes will be improved through use of the human-like intelligence of AI, eventually reducing the need for as much human intervention as is required today.

Fundamental technology changes raise potential ethical challenges. Many global organizations have various recommendations related to how to ethically use AI. Kyndryl has adopted best practices as policy[7] regarding AI for ourselves and for our work with our customers.

Responsible AI at Kyndryl

Establishing ethical AI guidelines is critical to protecting our customers and our people

Transparency and Explainability

AI solutions will be designed to provide visibility into the decision-making processes underlying the models, as well as the nature, source and quality of the data sets used to train the AI models. The nature and function of AI solutions should also be explainable to establish user trust.

Privacy and Confidentiality

We require that AI usage and development comply with our Kyndryl Code of Conduct and Kyndryl Privacy Policy. We require suppliers partnering with Kyndryl on AI capabilities to comply with similar principles.

Detect and Reduce Bias

We require that when using or developing AI solutions, we consider, measure and take steps to reduce potential bias to promote fairness and minimize bias in AI design and usage.

Accountability

We have implemented a governance program to evaluate and oversee AI usage within our enterprise and with our partners and customers to contribute to a trustworthy and accountable AI ecosystem that respects human rights, the rule of law and democratic principles.

Safe and Secure

AI solutions must incorporate security by design principles and evaluate and monitor performance to protect against harm to individuals, groups of individuals, and environmental or reputational damage to our enterprise and our customers.

Education and Training

We commit to thorough training and clear guidance for those utilizing AI technologies, in an effort to ensure adherence to the above-noted principles and promote responsible innovation.

Kyndryl's industry-leading AI mainframe services

Kyndryl has built the next generation of consulting and managed delivery services for the mainframe based on new AI/generative AI tooling available in the market as well as the operational insights provided by our AI-infused open integration platform, Kyndryl Bridge.

AI and generative AI for mainframe modernization

Kyndryl can help mainframe customers deploy AI and generative AI for the following potential use cases:

→ Move workloads off the mainframe to cloud using generative AI-produced and Kyndryl-enhanced application documentation and artifacts, fast and efficient conversion of mainframe application code to more modern languages, as well as AI-based insights to realize new solutions from existing data and business logic.

→ Integrate mainframe applications and data with cloud or distributed environments through security-rich access to mainframe data used in cloud-based AI solutions, interoperability between mainframe and cloud solutions, enhanced through MLOps and LLMOps as well as real-time AI-infused FinOps to maximize asset usage.

→ Modernize workloads on the mainframe with highly optimized and automated mainframe runtime environments, as well as targeted modernization and understanding of mainframe application code.

Regardless of whether to modernize on the mainframe, move off the mainframe, integrate the mainframe with the hybrid cloud, or transform mainframe applications to intelligent applications with AI, Kyndryl can help customers decrease time-to-market when addressing new business opportunities. Whether we build and manage your mainframe applications or you do this work in-house, application developer agility can be increased through the use of common DevSecOps tools, and processes enhanced through MLOps and LLMOps, as well as AI-based insights and recommendations through Kyndryl Bridge.

Kyndryl's AI and generative AI services for the mainframe are supported by Kyndryl Consult, through expert advisory services such as design thinking workshops, assessments and rapid prototyping powered by Kyndryl Generative AI Navigator. We help customers be ready with the right data foundations through a robust data governance strategy, modern architecture and platform to enable generative AI at scale

This can help customers across any industry explore, kick-start, or scale the deployment of responsible AI across their organization.

We can follow these advisory engagements with implementation services and ultimately management of the infrastructure and applications, partnering with our customers every step of their journey.

Kyndryl Bridge makes progress a core part of every business

Value through clarity	Efficiency through intelligence	Innovate for business advantage

Deliver improved outcomes with a unified experience

Build, command, and control your IT environment through a frictionless, personalized and fully integrated digital experience

+

Optimize work with data & AI

Understand, predict, and act for better business outcomes by combining date with actionable insights, recommendations, and proactive preventions

+

Enable digital business at scale with modern capabilities

Understand, predict, and act for better business outcomes by combining date with actionable insights, recommendations, and proactive preventions

Kyndryl Expertise

30+ years mission-critical systems experience
31,000+ vendor-recognized certifications
3,200+ patents

Skilled professionals who seamlessly work with customers across industries to support big ambitions, challenge preconceptions and amplify outcomes

Why Kyndryl?

It is important for mainframe enterprises to get the help they need to fill the gaps in their own skills- whether needed to maintain their current environments, for mainframe transformation and application modernization, or to participate in the AI revolution.

Kyndryl has deep expertise in designing, managing and modernizing the mission-critical IT infrastructures that the world depends on every day.

We are committed to transforming the critical systems and infrastructure that power human progress.

Our leadership in the use of AI/generative AI solutions is enabled through leveraging decades of managing and enhancing mainframe environments, with our more than 7,500 skilled mainframe experts who hold tens of thousands of certifications in mainframe, data and cloud technologies.

We are committed to shaping the future of mainframe modernization as demonstrated by our investment in education building AI and generative AI skills for more than 5,000 of our mainframe professionals.

Kyndryl helps provide the insights and services customers need to place their workloads on the best-for-purpose platform and to optimize their overall IT environment.

We provide our AI, modernization, and managed services for every size of mainframe customer either on dedicated hardware or through our industry leading zCloud and C4i services, which are our cloud hosting solutions for IBM Z and IBM i respectively.

Our mainframe AI services are fully integrated with our overall Data and Artificial Intelligence Services which unlock value from data and AI faster to help customers scale and transform their digital business on any platform.

Services focus on helping customers by providing:

→ Generative AI Solutions with expanded partnerships with Public Cloud Providers to deliver enterprise-ready generative AI solutions.

→ Enterprise AI Services embedding AI technology into business decisions and processes, accelerating business outcomes.

→ Data Modernization Services aiding to create advanced data products for intelligent business decisions through modernized data architecture in the cloud.

As the world's largest IT infrastructure services provider, we are uniquely positioned to help our customers transform, implement, and manage their mainframe environments enabling them to take full advantage of the hybrid cloud, the modern mainframe, and artificial intelligence.

For more information

To learn more about Kyndryl's Mainframe Services, please contact your Kyndryl representative or visit
https://www.kyndryl.com/us/en/services/ core-enterprise-zcloud

To learn more about Kyndryl's Data and Artificial Intelligence Services, please contact your Kyndryl representative or visit
Kyndryl Data and Artificial Intelligence Services

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1   How AI Is Changing The Future Of Work, Maren Thomas Bannon, Forbes, 2023

2   The AI Revolution in Project Management: Elevating Productivity with Generative AI, 1st Edition, Vijay Kanabar and Jason Wong, 2024

3   Understanding the four types of AI, from reactive robots to self-aware beings, Arend Hintze, 2016 (theconversation.com)

4   The Skills Gap in Tech Is Poised to Expand. Employers, What's Your Action Plan?, Robert Half

5   IT Skills Gap Report 2023, Jo Thornhill, Forbes

6   Kyndryl 2023 State of Mainframe Modernization Survey Report

7   Responsible AI at Kyndryl, Antoine Shagoury, Kyndryl CTO and Michael Bradshaw, Kyndryl CIO

8   The Kyndryl Code of Conduct, Serving with Integrity, investors.kyndyl.com

9   Kyndryl Privacy Statement, Effective as of 20 February 2024