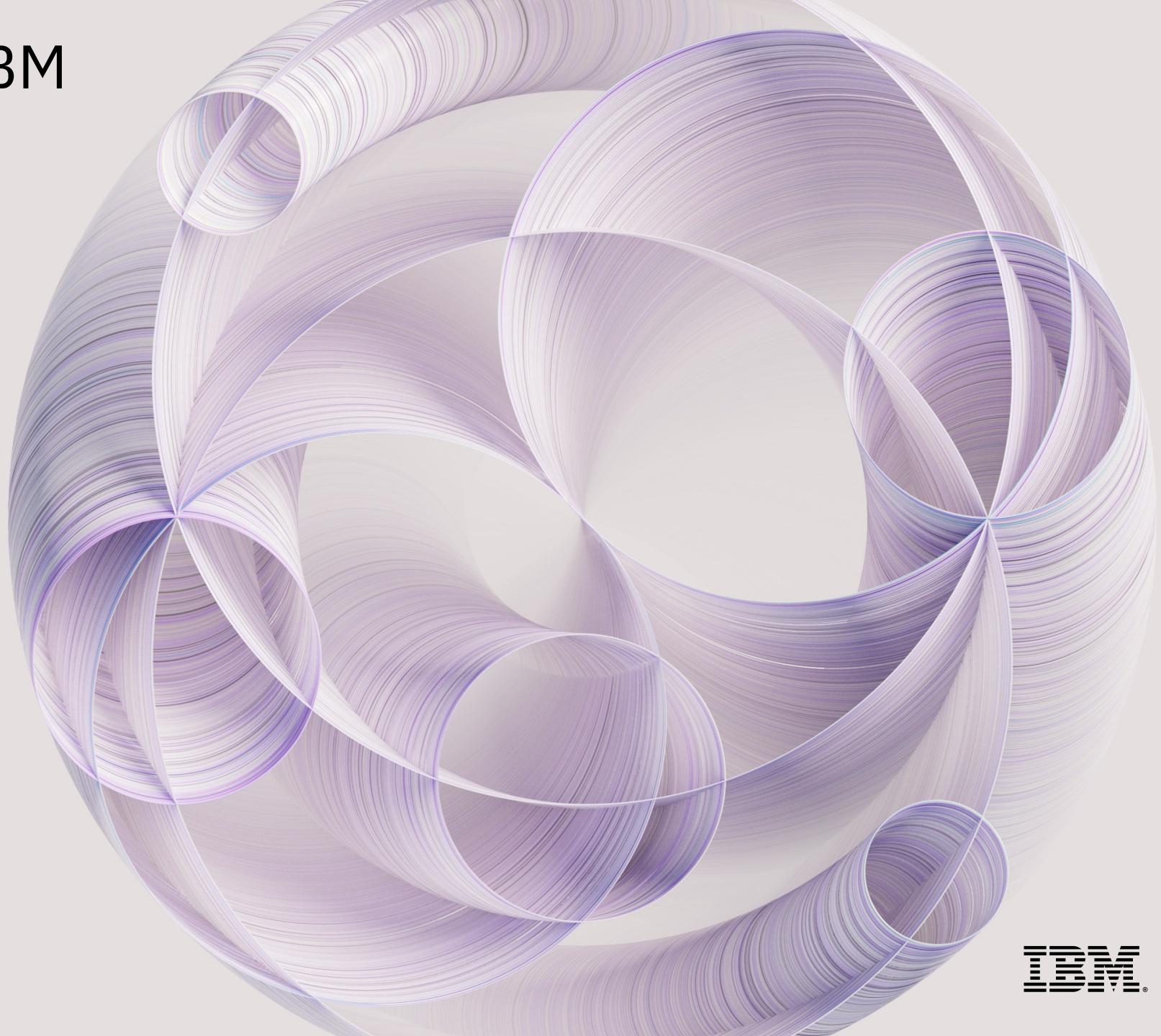# Optimizing Asset Operations with Generative AI

Thirumal Nellutla, Sustainability Solutions Leader – Americas

nellutla@us.ibm.com
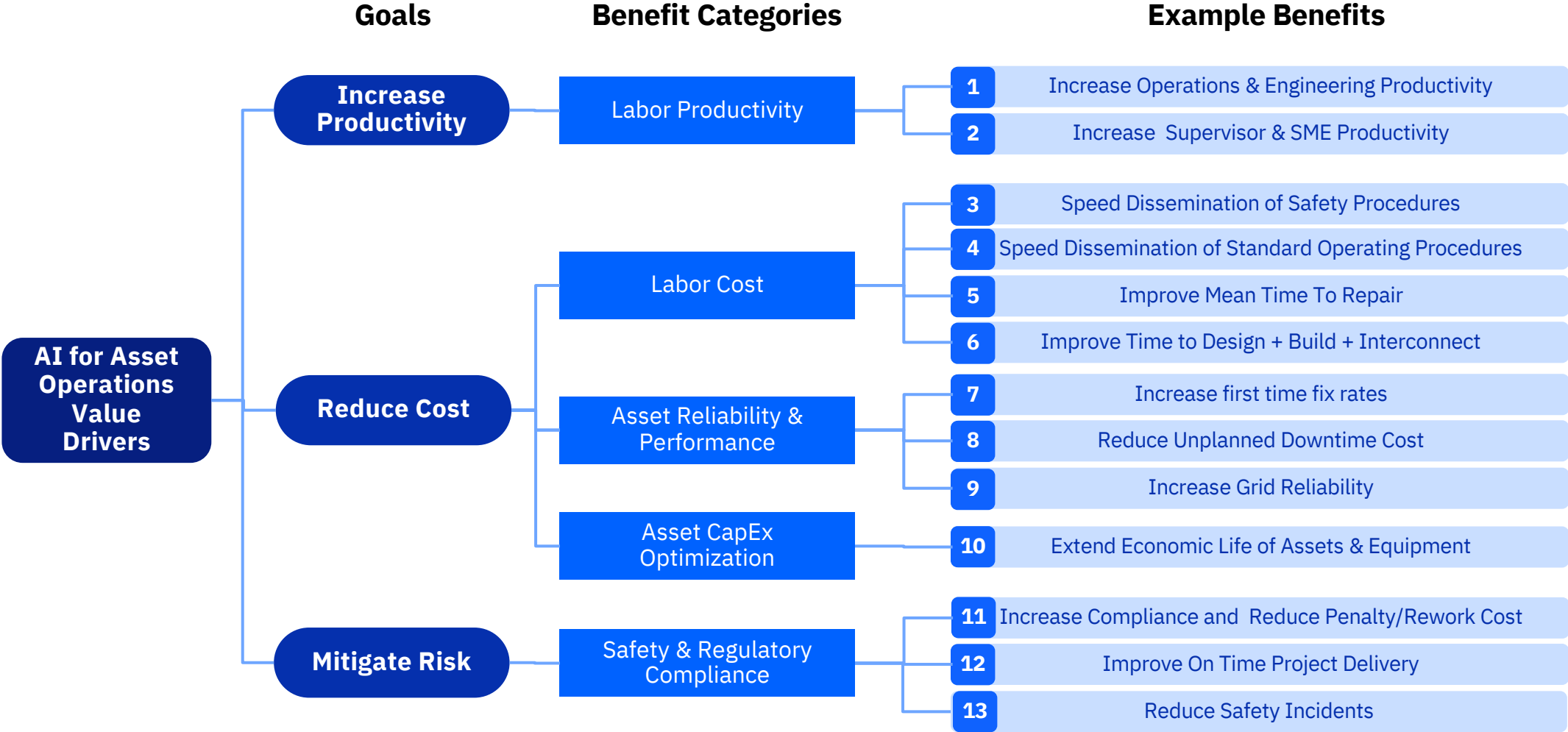
AI for Business with IBM

Agenda

- AI for Asset Operations – Drivers

- Proven AI Case studies
  Client examples

- The impact of Generative AI:
  watsonx - Use cases

- Reinventing how work gets done with
  Maximo
  From +AI to AI+; Accelerating Time to
  value is the biggest impact

- What IBM offers:
  Open, trusted, targeted, empowering
  solutions to transform your enterprise,
  powered by watsonx

IBM

AI for Asset Operations – Typical Benefit Areas

Goals

Benefit Categories

Example Benefits

AI for Asset Operations Value Drivers

Increase Productivity

Labor Productivity

| 1 | Increase Operations & Engineering Productivity |
| 2 | Increase Supervisor & SME Productivity |

Reduce Cost

Labor Cost

3	Speed Dissemination of Safety Procedures
4	Speed Dissemination of Standard Operating Procedures
5	Improve Mean Time To Repair
6	Improve Time to Design + Build + Interconnect

Asset Reliability & Performance

7	Increase first time fix rates
8	Reduce Unplanned Downtime Cost
9	Increase Grid Reliability

Asset CapEx Optimization

| 10 | Extend Economic Life of Assets & Equipment |

Mitigate Risk

Safety & Regulatory Compliance

11	Increase Compliance and Reduce Penalty/Rework Cost
12	Improve On Time Project Delivery
13	Reduce Safety Incidents

Woodside Energy (Oil and Gas)

Client: Australia's largest independent Oil and Gas company

Business Challenge:
- Aging workforce and heavy reliance on historical context and procedural information.
- Employees spent 80% of their time researching problems and 20% fixing it. Need for easy access to detailed answers to highly industry specific questions in remote locations
- Access to prior project documentation to incorporate valuable insights into current projects

Solution:
- Watson absorbed over 600,000 pages of documentation, from reports to correspondence regarding drilling equipment
- Maintenance teams now have the ability to obtain immediate access to years of knowledge and experience to deliver and build enhanced products based on prior work
- Increased knowledge about prior projects results in the application of best practices and more satisfied customers

Business Value: Time spent on researching responses reduced by 75% which equates to about US$10 million-worth of time savings
Safety procedures are shared with all employees, including new hires

Video trailer link here

AI-Powered Steam Turbine O&M Assistant (Energy and Utilities)
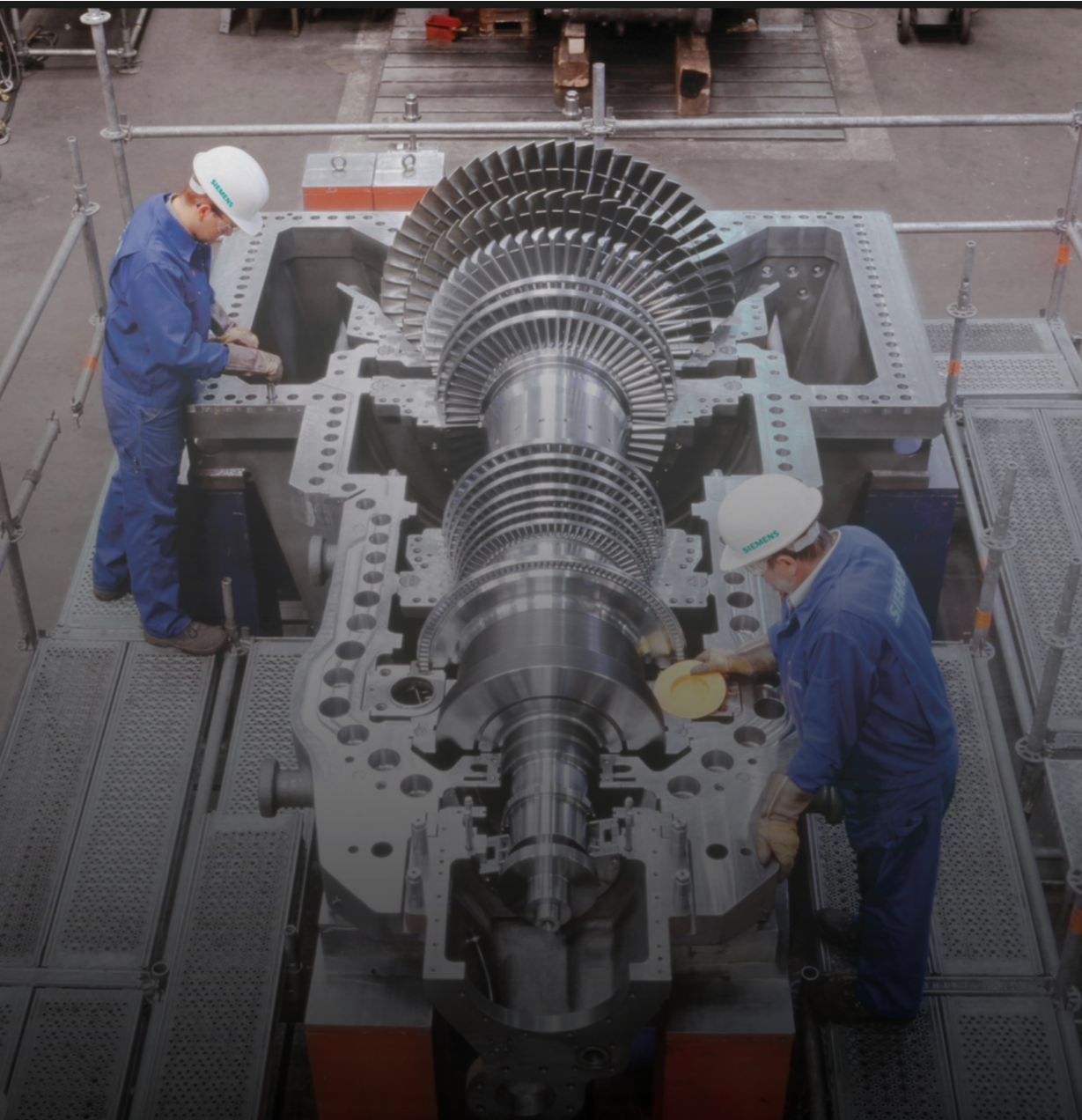
Client: Italian multinational energy company and one of world's leading electricity operators

Business Challenge:
- Limited understanding of health score of steam turbines and predicting when they were going to fail
- Lack of know-how on how to perform operational and maintenance procedures on steam turbine

Solution:
- Watson was trained on predictive fault codes, engineering and technical reports, site logs, system drawings, equipment specifications, engineering documents, and company maintenance standards
- Watson was used to offer a virtual assistant to provide response to questions performed by technicians as they operated or performed maintenance on equipment

Benefits: Reduced time to action

Energy Northwest

Business Need:

Energy Northwest has a Condition Review Group (CRG) process that involves the submission and review of condition reports (CRs). At the onset of the engagement, the agency was looking for ways to:

- Increase the accuracy of report prioritization

- Reduce the severity of CRs

- Accelerate the classification of reports, thus allowing more time for issue resolution

- Increase the consistency of determinations by the CRG and reduce disagreements among members

To support its goals, Energy Northwest sought a powerful cognitive solution.

Solution Benefits:

By joining forces with IBM Data and AI Expert Labs and Learning to implement a cognitive solution based on IBM Watson software, Energy Northwest improved the efficiency of its CRG process. The client indicates that the solution increased the accuracy of report prioritization by 92 percent and reduced the severity of its CRs by 80 percent. Further, the solution helps accelerate report categorization while increasing the consistency of CRG determinations. Based on its positive experience with the project, the agency has recently reached out to the IBM team for assistance with another cognitive use case.

Solution components

Watson Studio
Data and AI Expert Labs
Watson AI Assistant
Watson Knowledge Studio
Watson Natural Language Understanding

92%

increase in accuracy of condition report prioritization

North American
Energy Company

Challenge

Highly Regulated Industry requires that Natural Gas infrastructure adhere to national and local codes

Field Engineers and Contractors are required to follow regulations contained in the **Federal Code** and as outlined in the company's *difficult-to-navigate* **~1000 page Gas Standards Manual.**

Corporate Knowledge is concentrated in a small number of *retiring-soon* employees, who are *frequently consulted* by field personnel when they have questions or issues.

Outcome

» **Virtual Agent** offloads the burden of handling the many questions asked by Field personnel and provides backup for the SME team.

» **Quick Access** to the right location in standards documents saves time needed to lookup answers and procedures.

Solution

Shift the burden of handling field inquiries from current staff using a **self-service Virtual SME powered by Watson Assistant and Watson Discovery** to **simplify search and document navigation**, as well as field calculation intents, *handholding* users through *dialog flows* to provide **engineering calculations** to field personnel.

Components

❑ JumpStart from Expert Labs + Garage
❑ Watson Assistant
❑ Watson Discovery
❑ Watson Busines Solutions
   ❑ Virtual Agent (Expert Assist)
   ❑ DB2 on Cloud
   ❑ IBM Cloud Foundry / Kubernetes Service

German Energy Service Provider

Empower your employees by leveraging AI to structure and search regulations efficiently. Uncover inconsistencies between documents saving money on fines and time.

Business Challenge

There is a vast number of regulations and restrictions regarding maintaining, running and expanding power grids and gas networks.

The constantly increasing quantity of information in a wide variety of IT systems was making it difficult for the client's employees to efficiently find the right information.

Due to multiple document versions in different data sources, it was impossible to be sure about having the most recent and most relevant document. This caused a delay in applying the regulations.

Solution "Regelpedia"

IBM supported the delivery of an AI solution that could easily structure and search all the regulations using a machine learning algorithm

The solution uses a natural language "search user" interface to find the right information for the client's field technicians and engineers.

It also includes a "watchlist" feature that easily uncovers inconsistencies in and between documents.
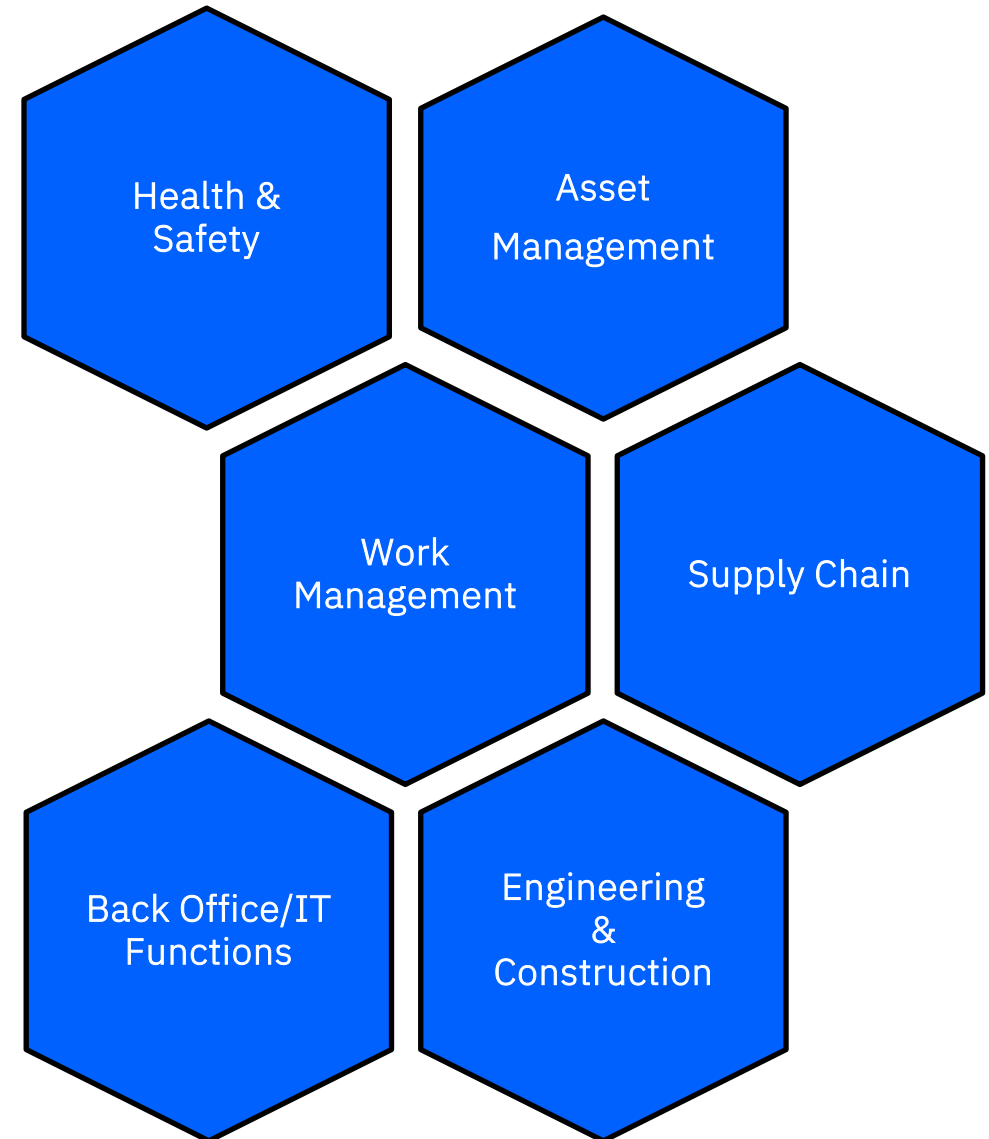
Outcome
- Correct regulations located within seconds
- 85% of searches return the regulation needed within top 3 results
- Inconsistency detection drives error reduction
- User-friendly interface
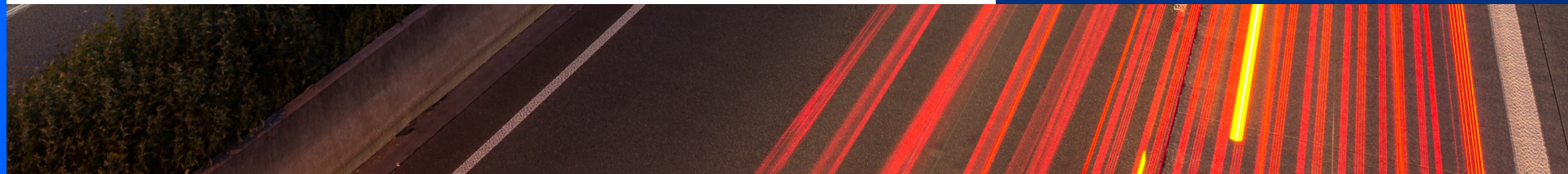
Gen AI Infused Asset Operations to Achieve Better Performance

watsonx Use Cases:

- Equipment Maintenance Advisor
- Regulation Advisor for Engineering & Construction
- Engineering Standards Advisor
- Asset Reliability Analysis Advisor
- Condition Report Classification
  - Prioritization Work
  - Assign Job Code/Plans
- Safety Advisor
- Interconnection Advisor for Distributed Energy
- Environmental Regulation Advisor
- Standard Operating Procedures Advisor
- Regulatory Processes & Filings Advisor

Health & Safety

Asset Management

Work Management

Supply Chain

Back Office/IT Functions

Engineering & Construction

IBM

Key elements and data sources to fuel intelligent operations

Asset Data

- Equipment technical manuals
    - Owner's manual
    - Engineering manual*
    - Equipment Specifications
- Engineering Diagrams and technical drawings
- Equipment location
    - Geolocation impacts on design
    - Weather impacts on operation
- Inspection Reports
- Work Order & History
    - Specific to the asset
    - Specific to like assets at other locations
    - Failure history/descriptions
    - Operator/Maintenance Log Files
    - Parts/Tools
- Condition Reports
- Metadata associated to Equipment being serviced
    - Equipment service history
    - Failure modes
    - Location
- Scada/IoT Sensor Data

Standards & Procedures

- Standard Operating Procedures
- Safety Procedures and Guidelines
- Maintenance & Repair Standards
- Engineering Standards
- Construction Standards & Regulations
- Interconnection Standards
- Environmental Standards & Regulations
- Other Regulatory Standards/Requirements

Other sources of Knowledge

- Emails
- Technical Help Desk
    - Knowledge base
    - Knowledge Worker Experience
- Engineering knowledge base
    - Root-Cause Failure Analyses (RCFA)
    - Failure Modes & Effects Analyses (FMEA)
- Online Sources: Journals / Magazines / Intranet and Internet

Active Foundation Model projects for Sustainability

ESG

Asset Management

EIS

Geospatial Foundation Model
- Above Ground Biomass Estimation
- Fire and Flood Event Detection
- Land Use / Land Cover Change

Weather Foundation Model
- Forecasting and Downscaling
- Outage Prediction

Envizi
- Activity-based Scope 3 Estimation

Image-based models ⟷

Time series models ⟷

Language models ⟷

MVI/MCI
- Transformer for Object Detection & Segmentation
- Transformer for Anomaly Detection
- Visual Prompt Tuning
- Pre-trained Civil Infrastructure Models

Health/Monitor/Predict
- Time Series for Anomaly Detection
- Time Series for Event Prediction

Manage / Health
- FMEA Content Understanding
- Work Order Intelligence

Embedding AI Intelligence into Maximo processes

MVI Anomaly Detection

- Maximo Visual Inspection is currently based primarily on open-sourced convolutional neural network models. These models can lack accuracy for "Few-Shot" anomaly detection.
- We are building a transformer-based foundation model that will fill these gaps
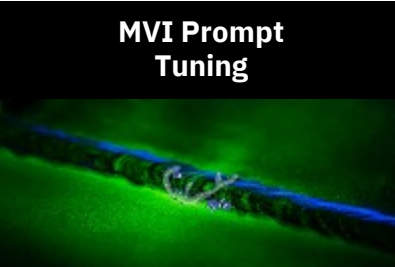
MVI Prompt Tuning

- Maximo Visual Inspection uses the classic ML pattern of labeling data, training the model and deploying the model to provide capabilities.
- We are using foundation models and prompt-tuning to dramatically reduce the effort required to effectively train the model

Assist: Technician Assistant

- Technicians have a difficult task diagnosing and fixing issues across a wide array of equipment.
- IBM is using an AI assistant trained on service manuals and previous work orders to help technicians easily access the latest asset service info and generate repair workflows.

Health: Time series prediction & anomaly

- There is a wide variety of sensors and asset behaviors that must be analyzed to understand an asset's health
- We are using Gen AI to create sensor-level models, trained on a small sample of sensor data. This greatly speeds time to value for asset health prediction.

Failure Mode Understanding

- Often the quality of the failure data available for reliability analysis is inadequate. Understanding how assets fail is crucial for effective preventative maintenance.
- Maximo is building a gen AI model to classify asset failure modes derived from work order data.

Work Order Automation

- Enabling the automatic processing of work order through business flows based on recognizable patterns can save valuable time over manual review.
- Maximo is building both ML and generative foundation models to provide automated recommendations to assist users in managing work order process flow.

Ticket Automation

- Clustering of tickets and assignment will ensure work is aligned to the right resource, and drive solutions to enable users to solve more of their own issues.
- Maximo IT is building both ML and generative foundation models to deliver ticket deflection through ticket grouping and assignments and pushing effective solutions to end users.

MAS Onboarding Assistant

- Maximo Application Suite is a complex product that needs integration with other client systems
- We are training an LLM model to help answer questions that arise in its implementation that can guide clients and answer questions about costs, effort and risks.

Failure Mode Context Understanding

Identify common failure points and paths to failure for new assets to improve predictive maintenance and reliability programs
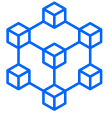
Challenges

- Understanding how assets fail is crucial in providing preventative maintenance and reducing asset downtime.
- Failure Mode and Effects Analysis provides key insights into this area
- However, FMEA data is not available for many different kinds of assets and it can take time to acquire

Solution

- Train a generative model of FMEA data to understand failure points and modes on common assets
- Use the generative model to produce data for assets that we have not worked with in the past
- Auto-populate FMEA rules and maintenance strategies in Maximo Manage for new clients
- Identify new tags that can be used for anomaly detection and failure event analysis

Products and Technology:
Maximo Manage, Maximo Health, Maximo Predict, Maximo Monitor and watsonx.ai

Benefits

- Reduced time to value for asset classes where we have less experience
- More accurate failure assessments and preventative maintenance plans
- Automated creation of maintenance strategies for new assets & clients
- Improved Anomaly Detection and Event Prediction capabilities in Maximo Health and Predict
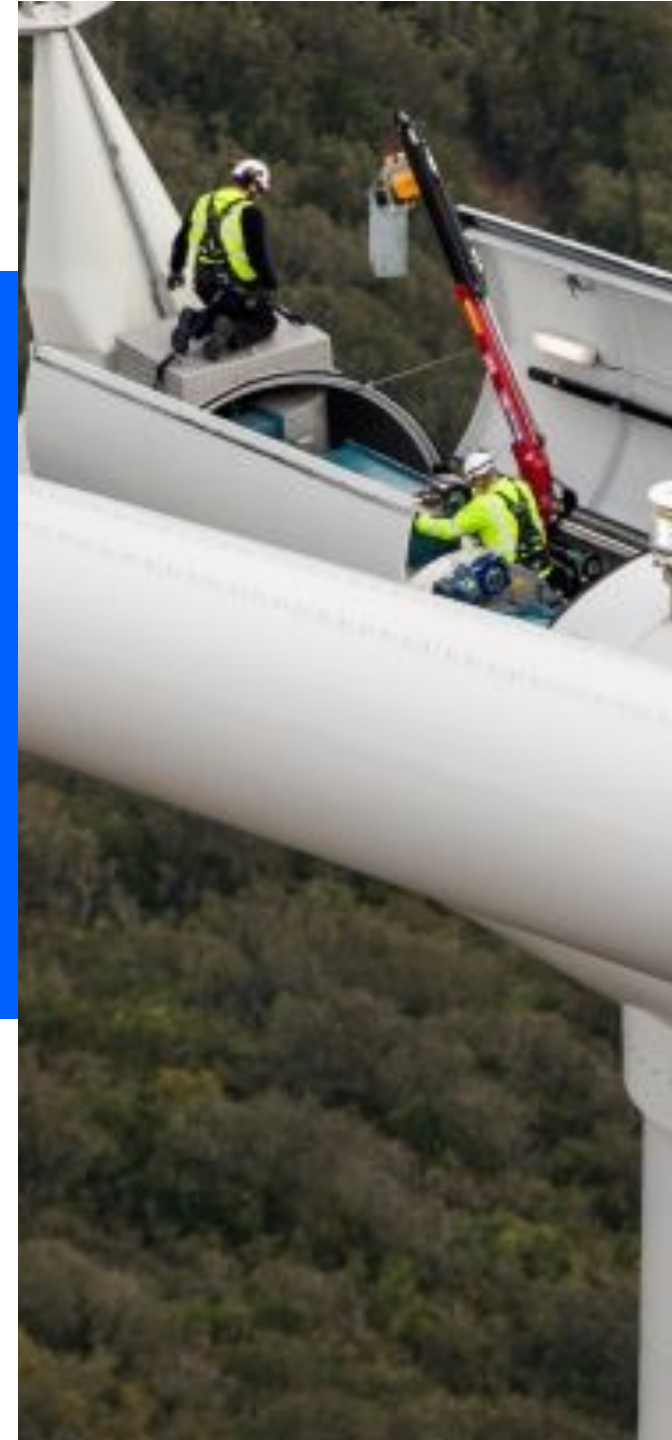
Work Order Intelligence

Automatically identify and correct inaccurate failure codes in Maximo work orders
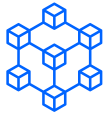
Challenges

- Understanding why a work order was created is key in finding patterns and in optimizing operations
- The collection of failure mode information in work orders is typically manual and very error prone.
- Clients often do not collect data for all of their asset classes and it can take a significant amount of time to build up an adequate history of failure data

Solution

- Train an LLM to classify and recommend work order failure codes
- Use that model to verify, correct or suggest the **proper failure code** for a given work order
- Find **similar** work orders to identify near-duplicate items and understand first time fix efficiency
- Enable automatic **approval** of work orders based on work order characteristics

Products and Technology:
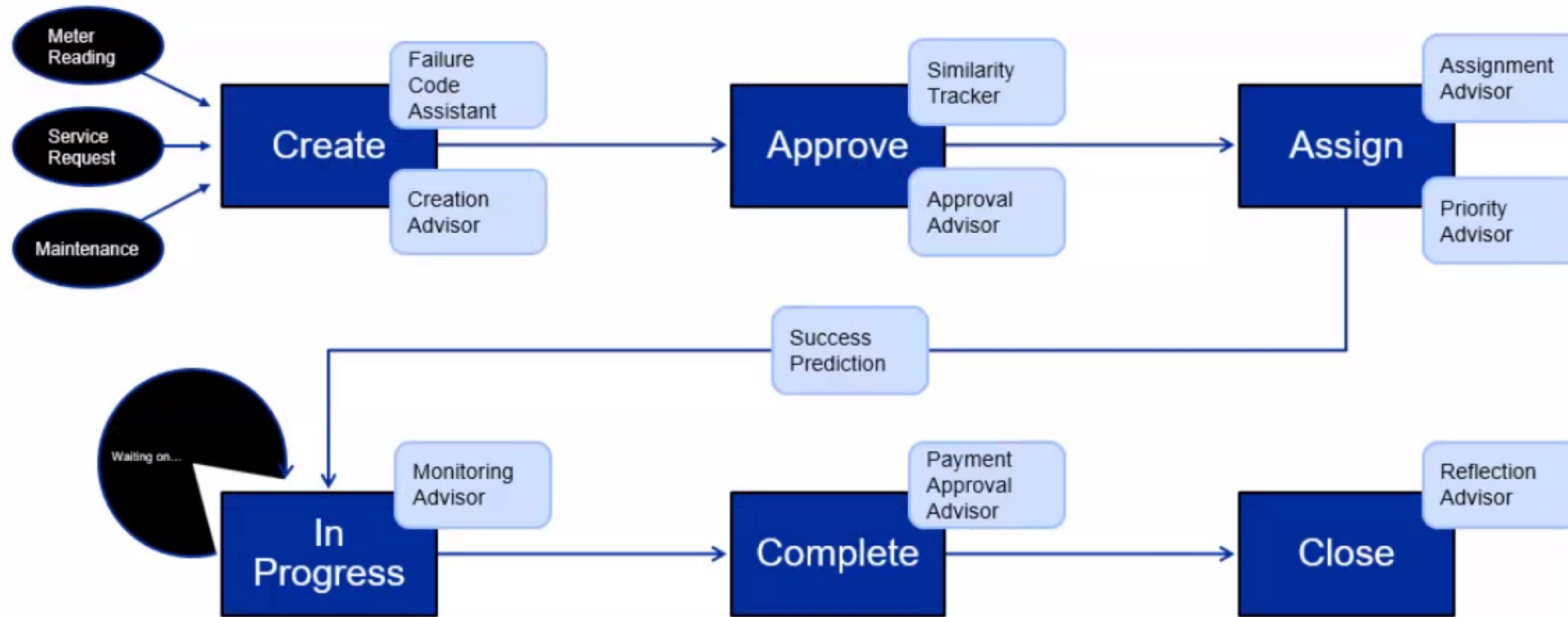Maximo Manage, watsonx.ai

Benefits

- Dramatically reduce the effort required to capture and maintain accurate failure code data
- Better understanding of the patterns of failures and potential problem parts
- Automatic approval of typical workorders enabling technicians to focus on solving the problems
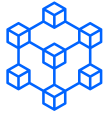
MAS Onboarding Assistant

Reduce the risks, costs and effort involved in making the migration to Maximo Application Suite

Challenges

- Maximo Application Suite as an enterprise product generally needs to be tightly integrated with other client systems
- Many implementations are also heavily configured
- MAS is delivered with new Licensing and Technology
- There is a significant amount of information available through various channels on MAS and it's not always easy to find relevant content.
- This is creating barriers with clients in understanding the costs and benefits of migrating and in the process of the migration itself

Solution

- Train an LLM model help answer questions that arise when a client is considering the migration that can guide them through the decision-making process and answer questions about costs, effort and risks.
- Provide a second assistant that has been trained on product documentation and support tickets to guide them and answer questions that might come up during the migration/onboarding process

Products and Technology:
Maximo Application Suite, watsonx

Benefits

- Enable clients to understand the benefits and costs of moving to Maximo Application Suite, reducing the uncertainty and risk
- Enable a seamless upgrading and onboarding experience for our clients

MVI Foundation Models

Leverage foundation models to dramatically improve the anomaly detection capabilities in Maximo Visual Inspection and Maximo for Civil Infrastructure
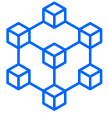
Challenges

- Maximo Visual Inspection is currently based primarily on open-sourced convolutional neural network models
- We have seen that these models are not very accurate for Few-Shot Anomaly Detection problems for visual inspection use cases.
- The current models are also not as performant as they could be in production environments

Solution

- Migrate from CNN-based models to Transformer-based foundation models for anomaly detection

Products and Technology:
Maximo Visual Inspection, Maximo for Civil Infrastructure, watsonx.ai

Benefits

- Increased adoption of MVI supported use cases
- Improved ease of use when creating a detection model
- Time to Value – removes the need for a large sample of training data for specific defects
- "Wow" factor with few-shot learning support for PLG

MVI Visual Prompt Tuning

Reduce the effort and training time required to produce a model for Maximo Visual Inspection
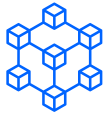
Challenges

- Maximo Visual Inspection uses the classic ML pattern of labeling data, training the model and then deploying the model to provide its capabilities
- Even though it does use transfer learning, it still requires several labelled examples for each type of defect that the client wants to detect
- Labeling these examples is time consuming and requires expert knowledge

Solution

- Use a combination of foundation models and prompt-tuning to dramatically reduce the effort required to effectively train the model

Products and Technology:
Maximo Visual Inspection, Maximo for Civil Infrastructure

Benefits

- Significant cost savings to customer in terms of reduced time of experts spent of data labelling
- Ability to use the same foundation model as a basis for prompt-tuning models for other assets and other types of defects
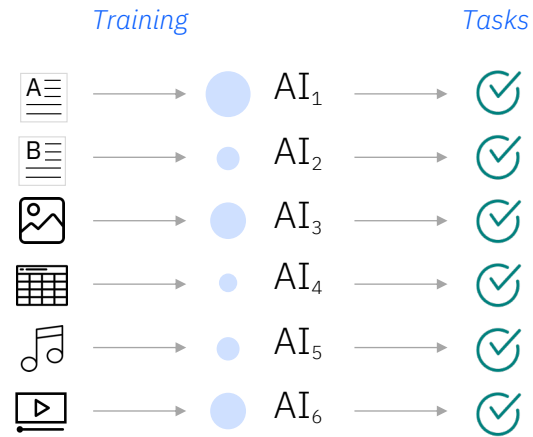
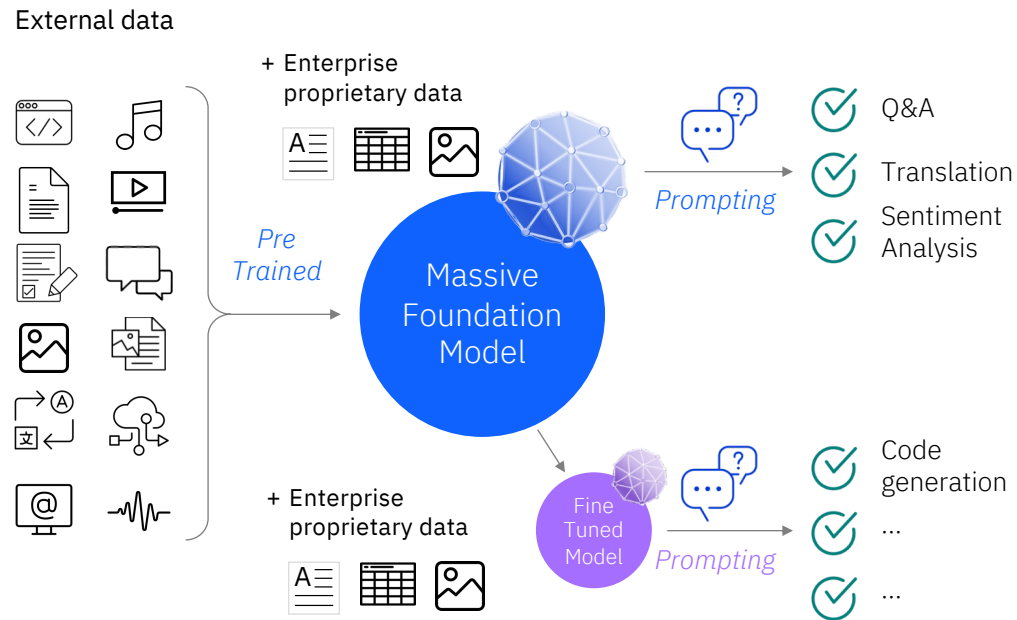# Let's collaborate for achieving your success

Foundation models establish a new paradigm for AI capabilities

Traditional AI models

Training   *Tasks*

AI_1
AI_2
AI_3
AI_4
AI_5
AI_6

- Individual siloed models
- Require task specific training
- Lots of human supervised training

Foundation Models

External data

+ Enterprise proprietary data

Pre Trained

Massive Foundation Model

Prompting

Q&A
Translation
Sentiment Analysis

+ Enterprise proprietary data

Fine Tuned Model

Prompting

Code generation
...
...

- Massive multi-tasking model
- Adaptable with minimized training
- Pre-trained unsupervised learning

Enhanced capabilities

- Summarization
- Conversational Knowledge
- Content Creation
- Code Co-Creation

Key advantages

- Lower upfront costs through less labeling
- Faster deployment through fine tuning and inferencing
- Equal or better accuracy for multiple use cases
- Incremental revenue. through better performance

up to 70% reduction in certain NLP tasks