AI & Simulation

What Executives Need to Know

THE AnyLogic COMPANY | eng

The Speakers

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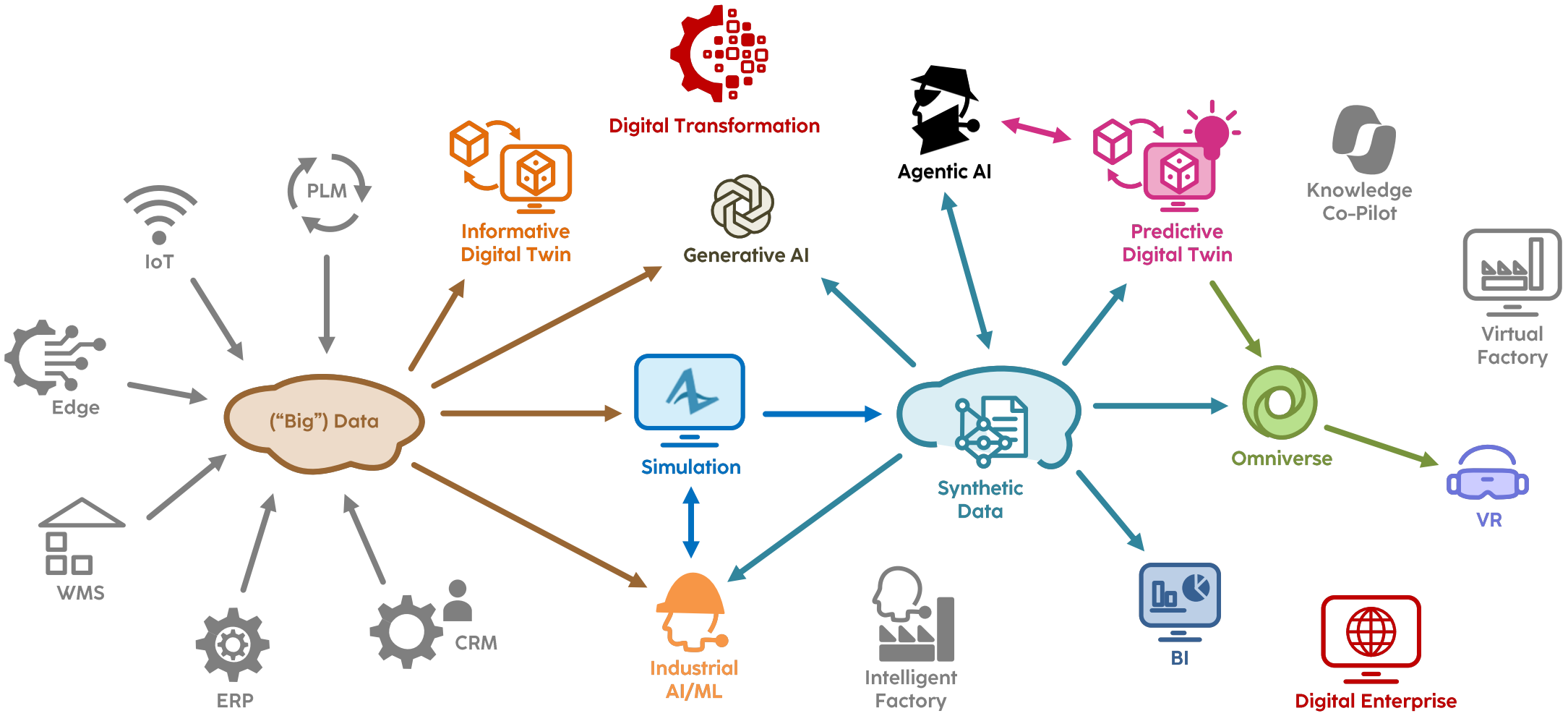
The Technology Stack of Digital Transformation



We are living one of the biggest hype ever…

…but maybe excitement (and marketing) has gone too far

Where should we apply AI and – just as importantly – where shouldn't we?

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Surely this trend is not just hype...

According to a McKinsey report, AI* adoption could deliver up to **$4.4 trillion** in global economic value annually

*Generative AI
Source: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier

AI trend must be viewed alongside demographic projections impacting high-income countries

While fears of AI replacing jobs are common, the reality shows something quite different: aging populations are leading to **shrinking workforces** and **shortage of skilled technical talent**

Rather than a threat, AI must be seen as an **opportunity to fill labor gaps** through automation, freeing humans to focus on high-level, high-value work through reskilling

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Currently AI excels in day-to-day tasks

Applied AI
AI designed to perform specific, practical tasks

- Predictive Maintenance
- Self-Driving Vehicles
- Computer Vision

Generative AI
Models generating new content based on data patterns

- Content Creation
- Product Design
- Customer Support

Agentic AI
AI agents that autonomously plan, act, and adapt to achieve goals

- Personal AI Assistants
- AI Research Agents
- Workflow Automation

AI-Driven Optimization
Finding optimal solutions within complex trade-offs

- Production Sequencing
- Workforce Scheduling
- Energy Management

In practice, AI acts as an assistant, supporting us by reducing human error, stabilizing complex routines and automating frequent, measurable tasks

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AI applications in today's business environment

COMPANY	AREA	APPLICATION
John Deere	Precision Agriculture	Its "See & Spray" tech uses AI/ML to distinguish weeds vs. crops in real-time, reducing herbicide use and improving yields.
ServiceNow	IT	AI agents streamline incident management and request fulfilment while automating tasks across IT operations. They help IT teams deliver smarter, improved service.
Salesforce	CRM	Einstein delivers personalized content, lifting click-through rates by around 34%.
BMW	Automated Optical Inspection	AI algorithms analyse high-resolution images to detect even tiny surface defects on painted car bodies, guiding robots to perform precise sanding, polishing, and repair.
JPMorgan	Algorithmic Trading	Agentic AI autonomously executes high-frequency trades, responding faster than humans.
Shell	Predictive Maintenance	Shell Scaled AI Predictive Maintenance to Monitor 10,000 Pieces of Equipment Globally

Sources: https://www.deere.com/en/sprayers/see-spray/ , https://www.servicenow.com/products/ai-agents.html , https://www.salesforce.com/news/stories/einstein-sales-agents-announcement/ , https://www.press.bmwgroup.com/global/article/detail/T0411621EN/automated-surface-processing-at-bmw-group-plant-regensburg-%E2%80%93-trio-of-digital-paint-shop-processes?language=en , https://www.ft.com/content/16b8ffb6-7161-11e7-aca6-c6bd07df1a3c , https://c3.ai/blog/how-shell-scaled-ai-predictive-maintenance-to-monitor-10000-pieces-of-equipment-globally/

AI is powerful but we can't ignore it is still a black-box we do not fully understand

EXPLAINABILITY — How can you trust AI answers?

ACCOUNTABILITY & RESPONSIBILITY — When harm occurs, where the fault lies?

HANDLING THE UNKNOWN — What do you do when you don't have data?

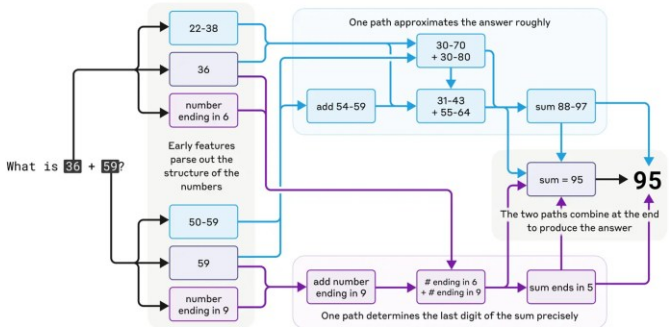
DID YOU KNOW?

Anthropic researchers asked **Claude LLM** to **explain what is 36 + 59**

CLAUDE'S EXPLANATION

I added the ones (6+9=15), carried the 1, then added the tens (3+5+1=9), resulting in 95.

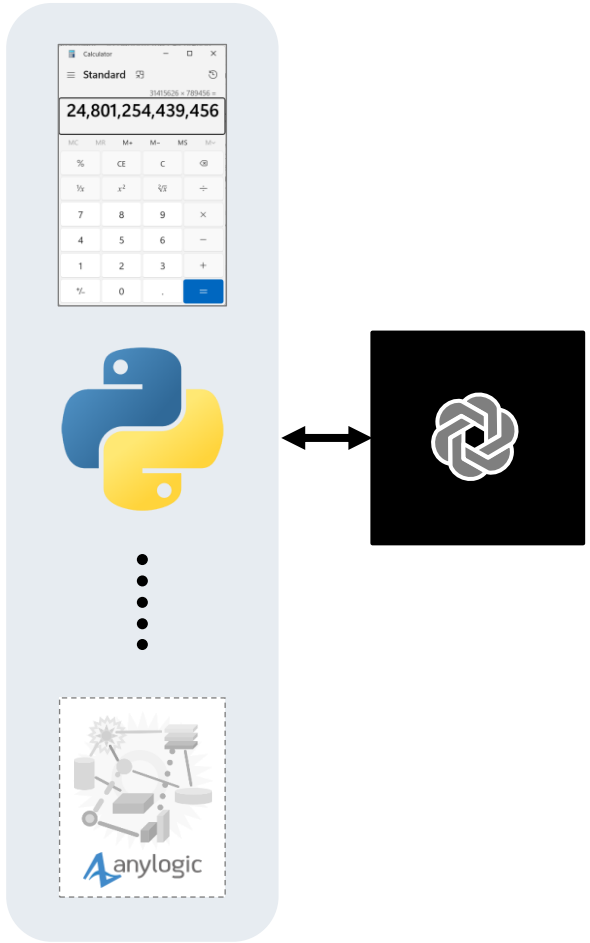
CLAUDE'S THOUGHT PROCESS



Source: https://www.anthropic.com/research/tracing-thoughts-language-model

An LLM is not a “pure AI”: it has some non-AI engines in the backyard

The Backyard



What is the product of 31,415,626 and 789,456?

The product of 31,415,626 and 789,456 is **24,801,254,439,456** ✓

This is the correct answer. How did you do it?

When you asked me to multiply 31,415,626 by 789,456, I used an internal tool – specifically a Python-based execution environment – to perform the calculation.

What would you need to fully replace a simulation tool?

To fully replace a tool like AnyLogic, an LLM would need:

- Access to AnyLogic or an equivalent simulation engine "in the backyard" = The Tool
- The ability to autonomously build models (including deep understanding of the domain) = The SME
- Model validation and testing capabilities = The Modeler

This would essentially mean integrating an LLM with a simulation platform like AnyLogic.
At the moment, I don’t have these capabilities.
However, such a combination would certainly be a game-changer for advanced simulation workflows!

:)

Strategic decisions demand deep domain knowledge and understanding, and cannot be based on belief

AI provides answers, but often decision-makers need to **explore**, **play**, and **stress-test assumptions** in a virtual, controlled and **trusted environment**

Decision-makers need to **visualize the problem** by breaking mental boundaries

Simulation matters most when understanding outweighs prediction

To make decisions in complex systems, we need **models that explain** how they work — even approximate ones

Simulation supports **causal understanding**, not just correlation-based predictions

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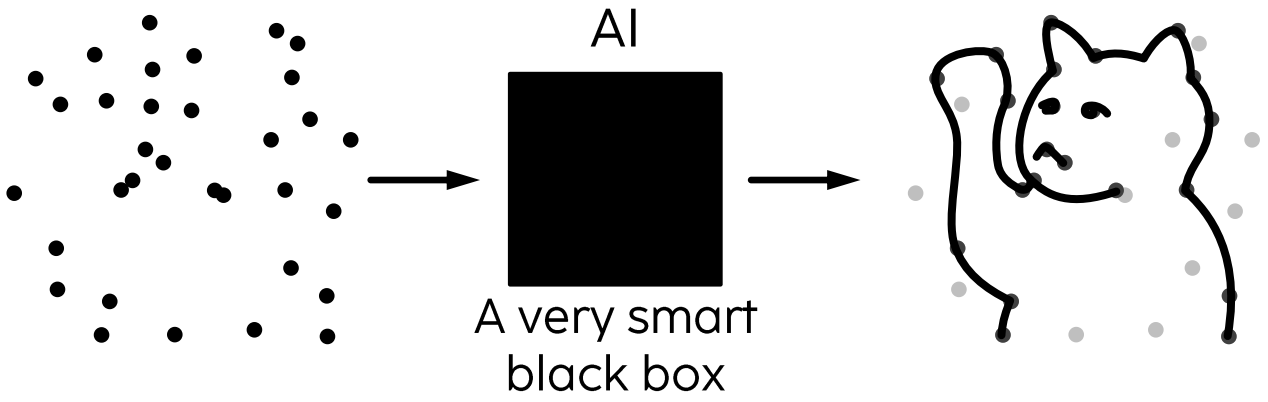
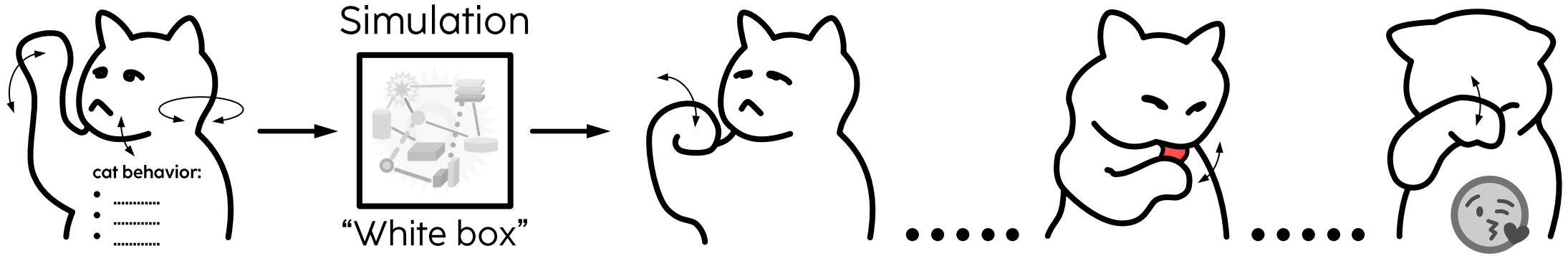
Cats, Black Boxes and White Boxes

SIMULATION AND AI SOLVE DIFFERENT PROBLEMS



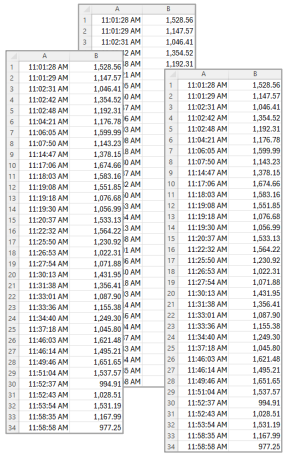
1) There is a cat!
2) Based on its pose, it might attack, so watch out!

AI is great at "connecting dots" – recognizing patterns – and makes predictions based on similar, known examples ("reference cases").



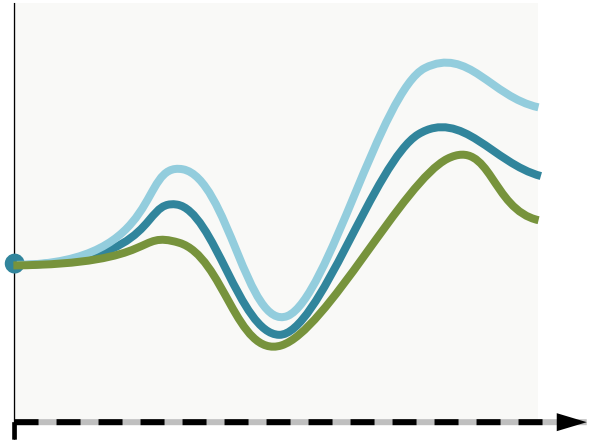
Simulation takes the system's state and behavior as input and generates possible future scenarios – including those never seen before. Simulation is transparent, it shows you how the scenarios unfold and explains why – enhancing trust and providing insight.

Simulation is great at handling uncertainty

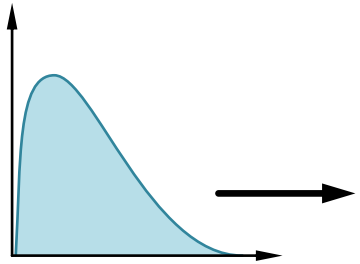


Historical Data

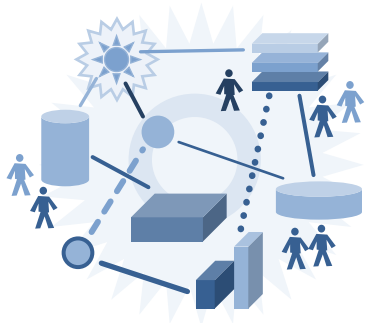
Can we rely only on what we have observed in the past?



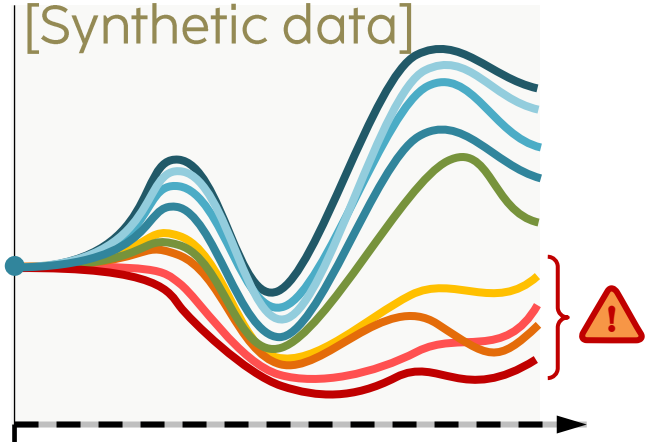
While historical data are "real", they only represent one / few scenarios observed in the past. When dealing with uncertainty, you can't limit yourself with those scenarios only – you risk missing important situations that haven't occurred yet but are still possible.



Probability Distribution



Simulation



Simulation models with probability distributions enable exploration of much broader and richer set of scenarios and are essential in evaluating the system behavior and risk management.

Simulation bridges the gap between concept and execution

We envision the promise

- Enhanced Operational Performance
- CAPEX Optimization
- Reliable and cost-effective solutions
- Quality Excellence

We make it running

We prove it works

- Quantifiable Performance Metrics
- ROI Evidence
- Alignment with Business Objectives
- Risk Assessment

Simulation also makes technical aspects clear to non-technical stakeholders by leveraging the power of visual representation

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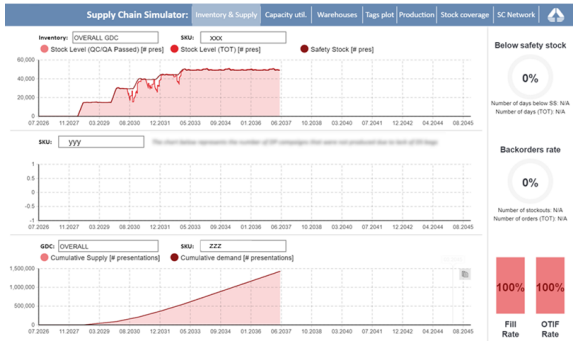
Engineering IndX applies simulation to solve industry problems

01 | Supply Chain

For a **leading pharma company**, we built a modular simulation model for **scenario-based supply chain design and planning** to support large-scale vaccine production & distribution

BENEFITS

- **Early supply chain analysis** with limited data
- Cross-functional **process understanding**
- **What-if analysis** for disruptive events



02 | Smart Manufacturing

For a **top semiconductor leader**, we developed a high-fidelity end-to-end manufacturing simulation model to support the **design of a cutting-edge smart factory**

BENEFITS

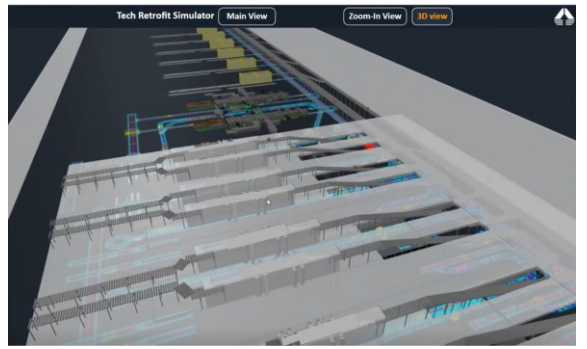
- **Virtual test** of layout, changes, automation
- Visualize **bottleneck, WIP, automation flow**
- **Predict system behavior** across configs.

03 | Resource Management

For one of the largest **online retailers and logistic leaders**, we built a simulation model to support **sustainable process transitions** and **retrofit scheduling** at a key fulfillment center

BENEFITS

- Quick compare **different retrofit strategies**
- Allow **low-impact implementation planning**
- **Reusable model** for future retrofit initiatives



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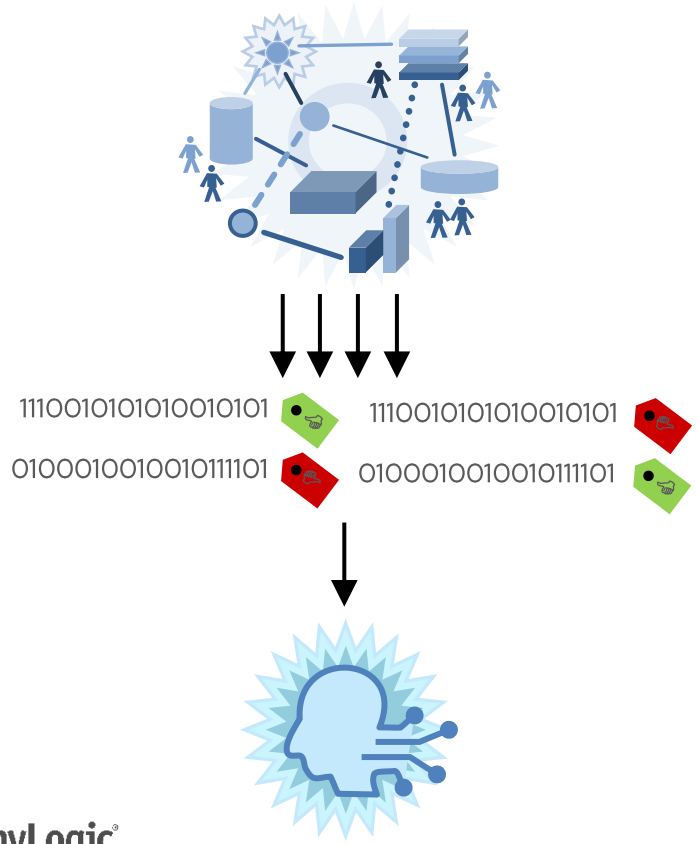
This was before the LLM era: ML + Simulation “false start”

Simulation models naturally provide powerful and realistic virtual environments that enable risk-free training and testing of learning agents.

However, this hasn't taken off at scale — and complexity is the main reason. Each project still requires too much human brainpower to become a commodity solution.

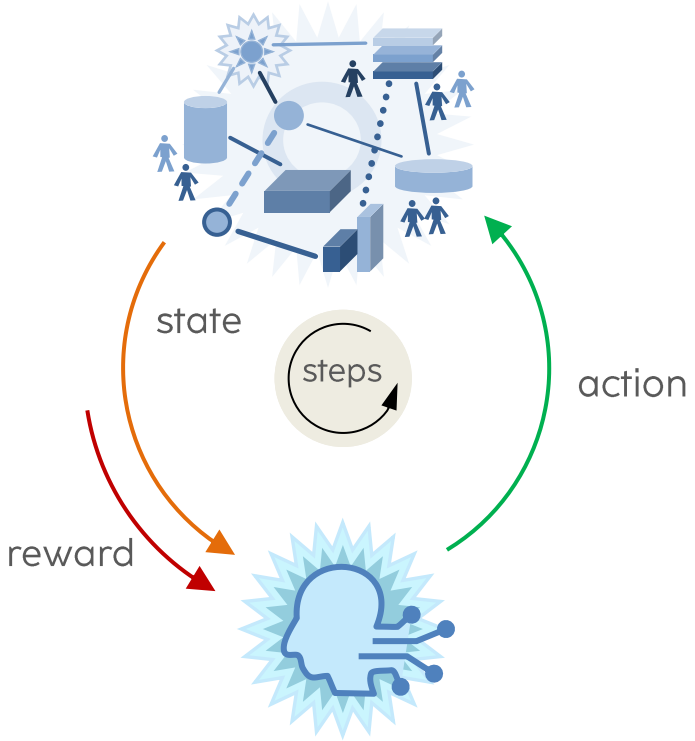
Generate synthetic data

Clean, detailed, naturally labeled, covering all possible scenarios



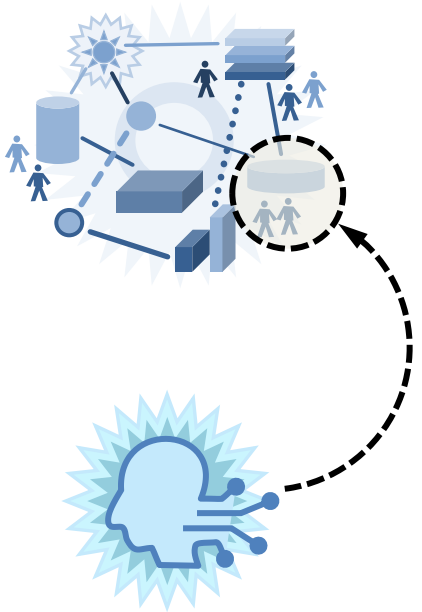
Learning environment

Cheap, risk-free, efficient virtual environment for Deep Reinforcement Learning



Testbed for trained AI

Again, cheap risk-free environment to test the effectiveness of a trained AI by integrating it into the model. Allows for comparing AI against other solutions



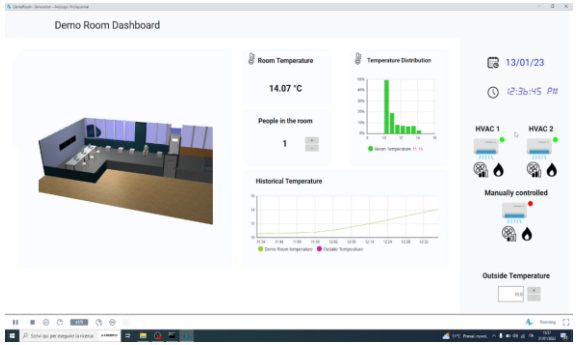
Combining AI with simulation unlocks new application frontiers

01 | Climate Control

For a **telco provider**, we built an **AI-driven HVAC control system** using **deep reinforcement learning** and **simulation** to optimize energy usage and comfort real time

BENEFITS

- **Cut energy** and **maintenance costs**
- Enhanced **comfort** and **system efficiency**
- Interactive **dashboard** for **monitoring**

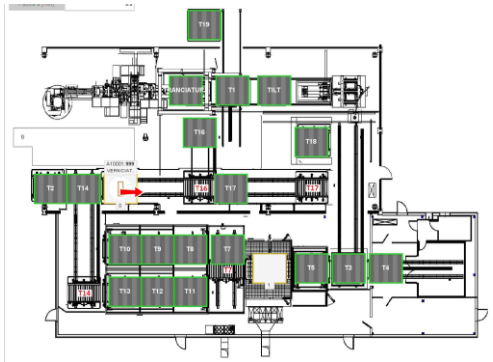


02 | Material Handling

For a **transformer core manufacturer**, we built an **AI-powered digital twin** to **optimize item flow** and anticipate **bottlenecks**, replicating the decision-making of a real production manager

BENEFITS

- **Avoid deadlocks** with AI-driven movement
- **Real-time decisions** via SCADA integration
- **What-if** analysis and **live monitoring**

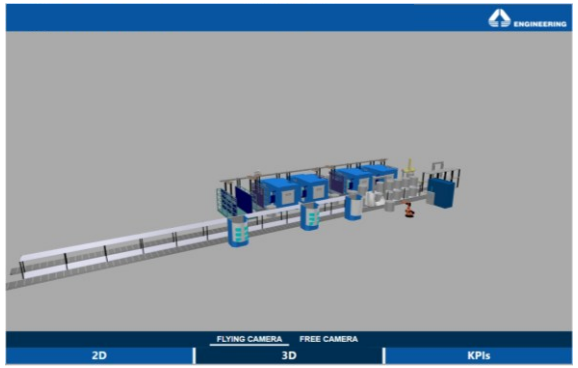


03 | Scheduling

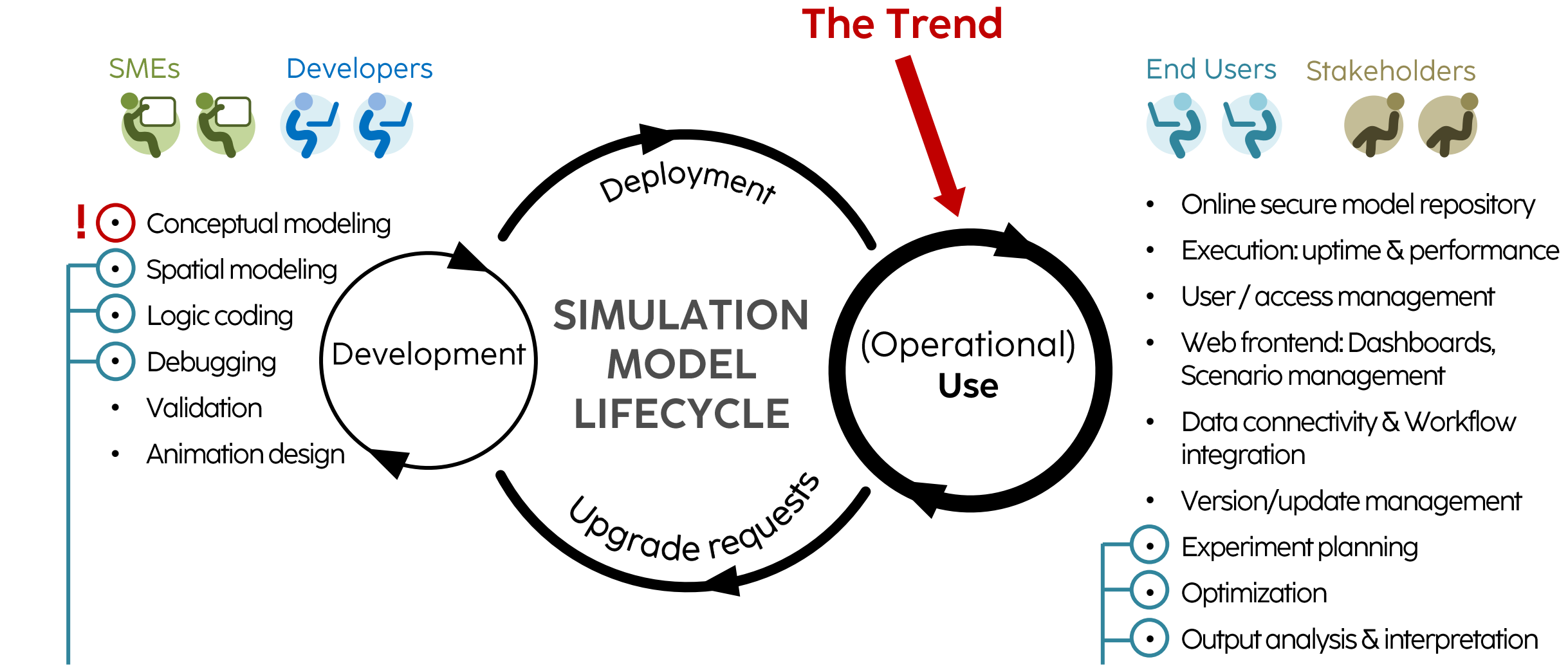
For a **precision machining firm**, we built an AI-powered simulation to optimize production order handling, from dynamic job generation to sequencing across multiple execution paths

BENEFITS

- **AI-optimized scheduling & load balancing**
- Support for **sales and virtual commissioning**
- Tool for **shop-floor evolution assessment**



Simulation today is different to what it was 5-10 years ago



And here we see even more opportunities for AI integration: AI can significantly enhance both creation and use of simulation models

We should master our toolbox

1

KNOW WHAT EACH TOOL DOES BEST

- **AI** is the **executor** for fast, repeatable, data-rich tasks
- **Simulation** is the **testbed** to challenge and plan your decisions even under **uncertainty**

2

UNDERSTAND WHEN TO USE WHAT

- Some problems need more than **execution**, they need **exploration**
- Some problems have **exact answers**, others call for **approximations**

3

LEVERAGE THE INTEGRATION

- Use a **hybrid approach** for more **confident decision-making**
- **Speed** up decisions without sacrificing **clarity**

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Eng IndX Value Proposition

- Delivering the Digital Thread for Industry 4.0
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- Product-Agnostic Consulting & Solution Engineering
- Niche & Distinctive Proprietary Methodologies
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Thank you.

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