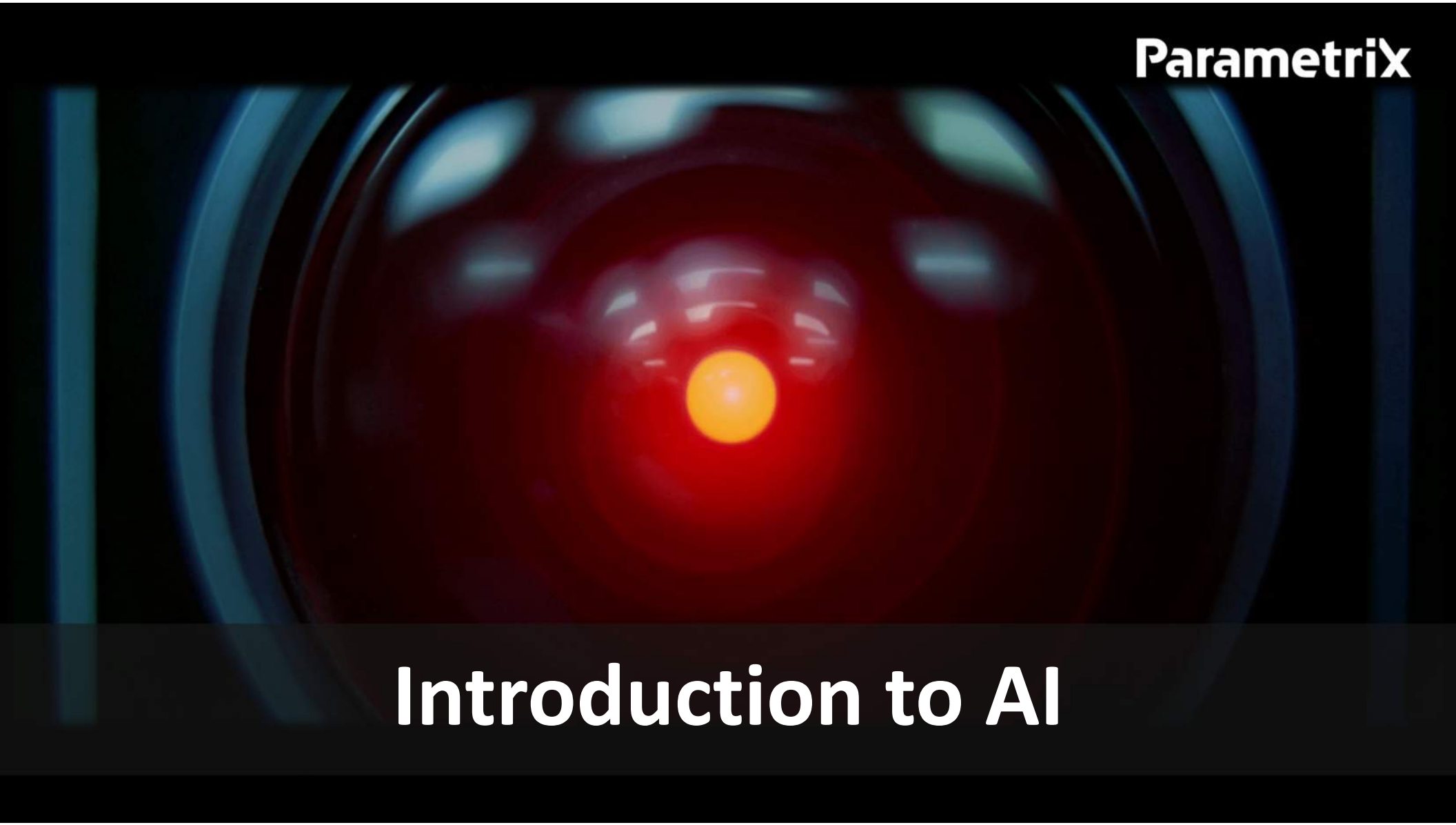
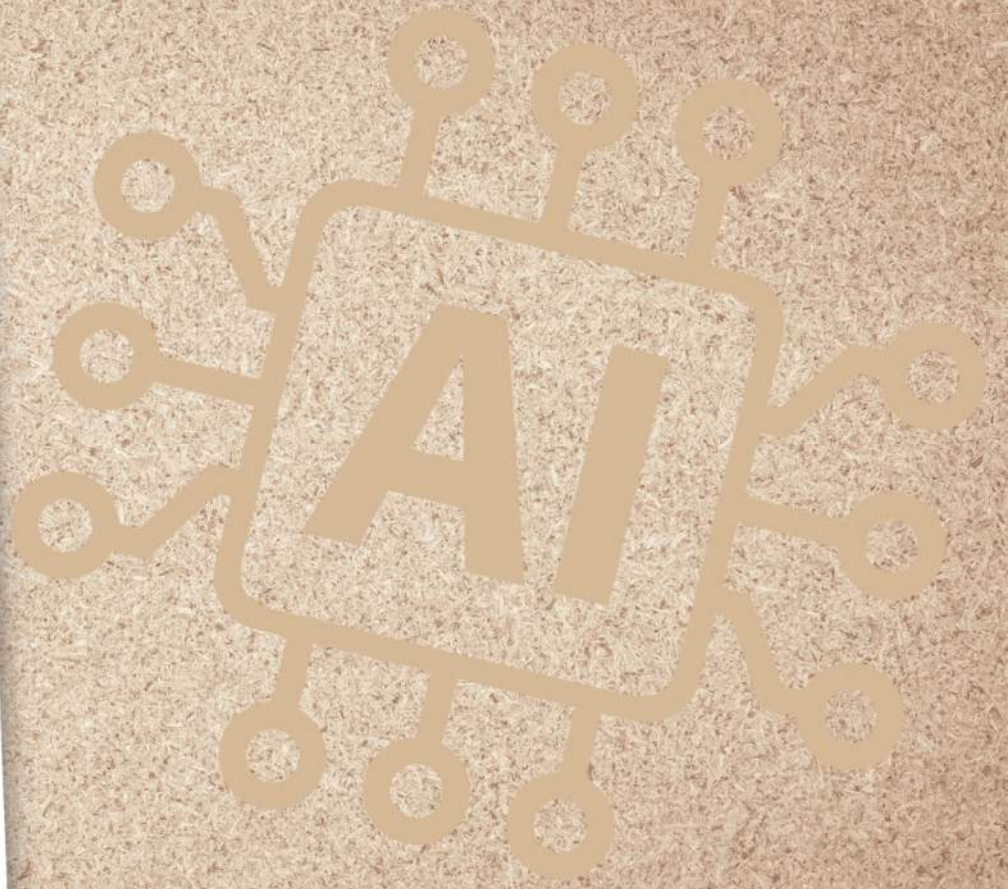


Introduction to AI

Agenda

- What Is Artificial Intelligence
- Some History
- Where We Are Today
- Some Nuts & Bolts of AI
- AI In Our Industry
- Adoption Considerations



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I’m sorry, Dave. I’m afraid I can’t do that.

What is Artificial Intelligence?

We think of
artificial humanoid

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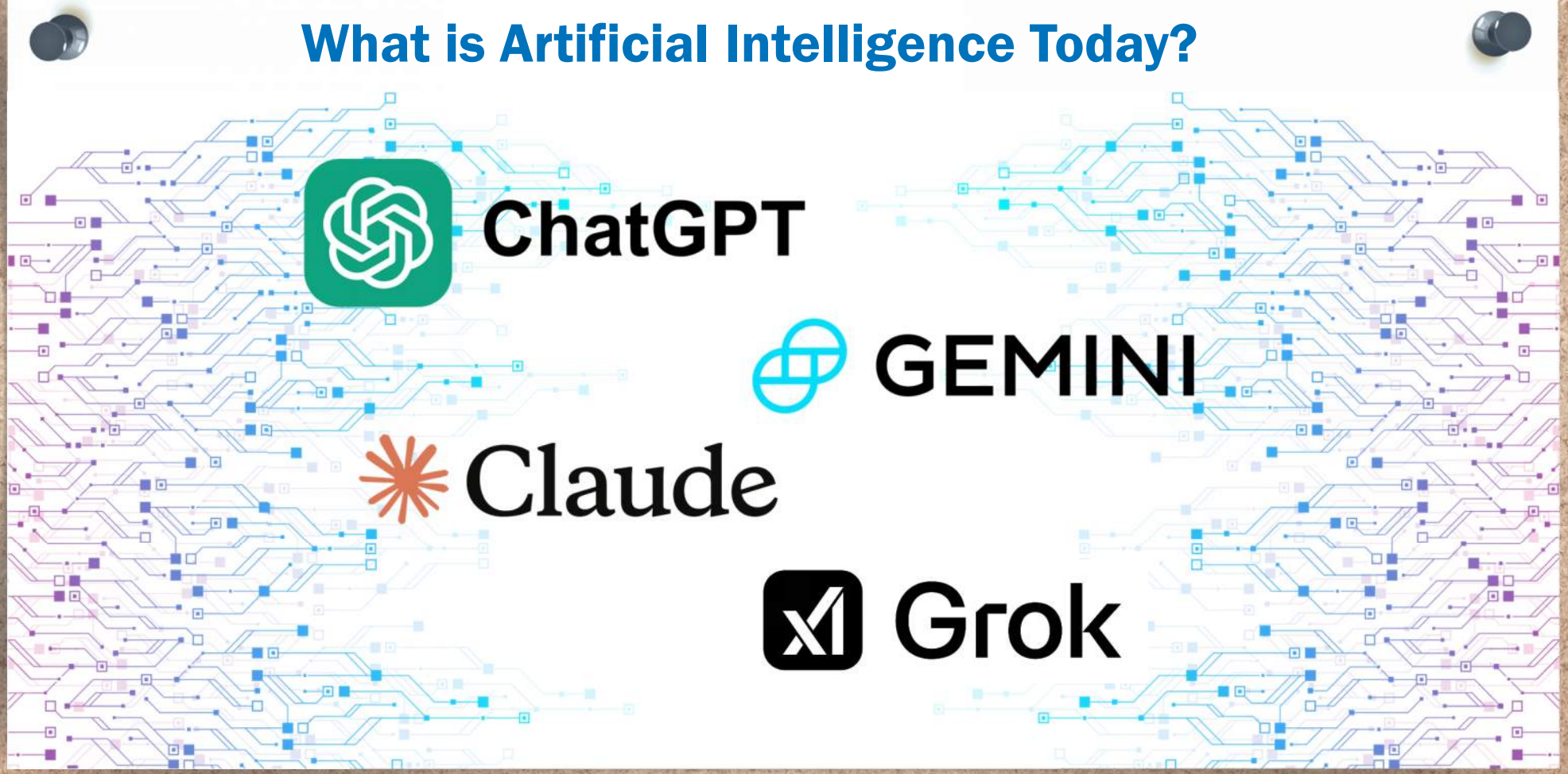
What is Artificial Intelligence Today?



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Artificial Intelligence - What Can It Do?

The ability for a computer to mimic and, in some cases, improve on human functionality.

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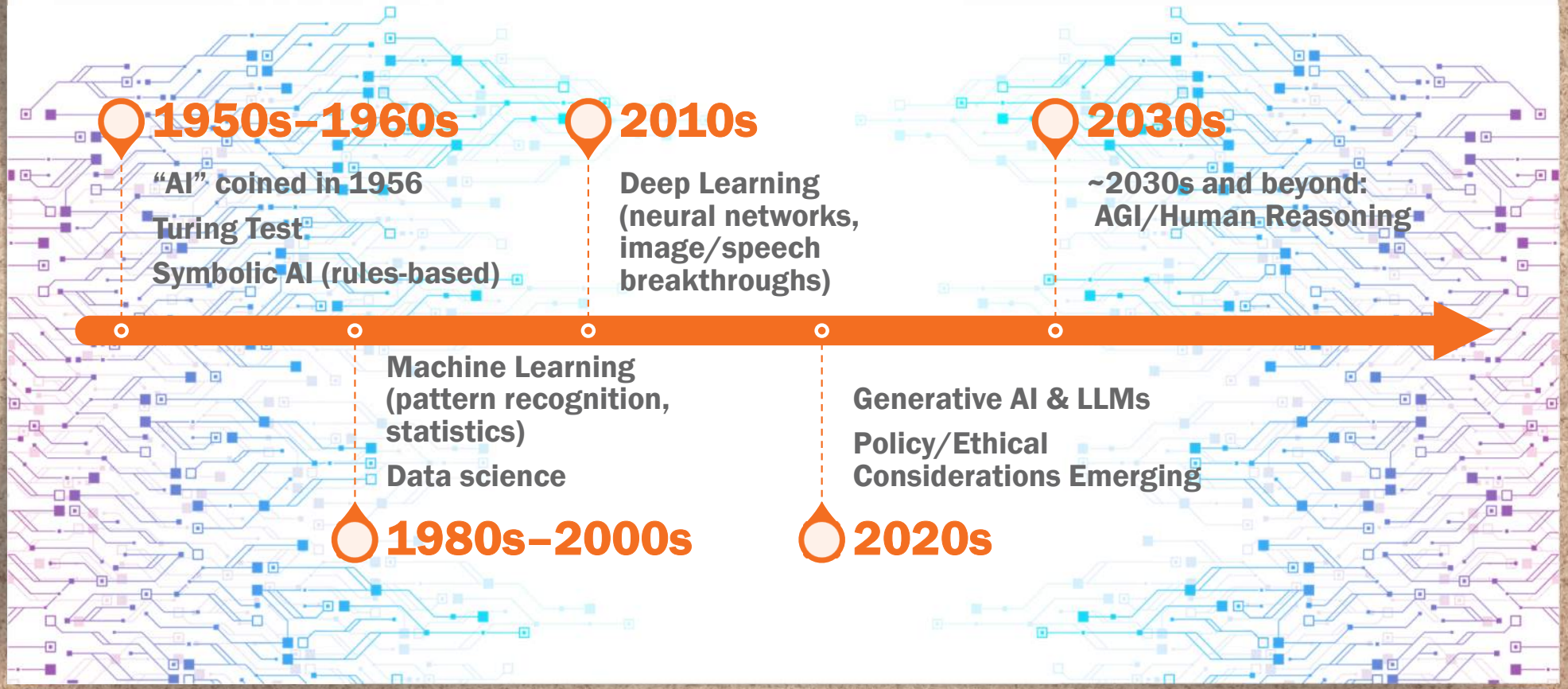
History of Artificial Intelligence



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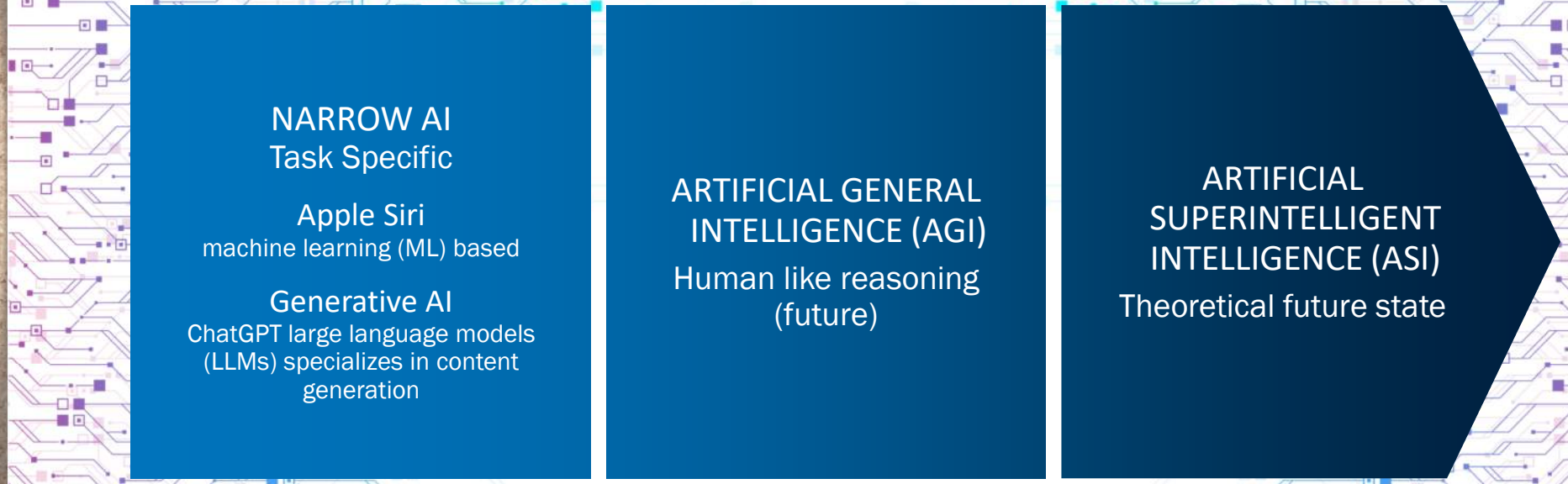
Artificial Intelligence Overview



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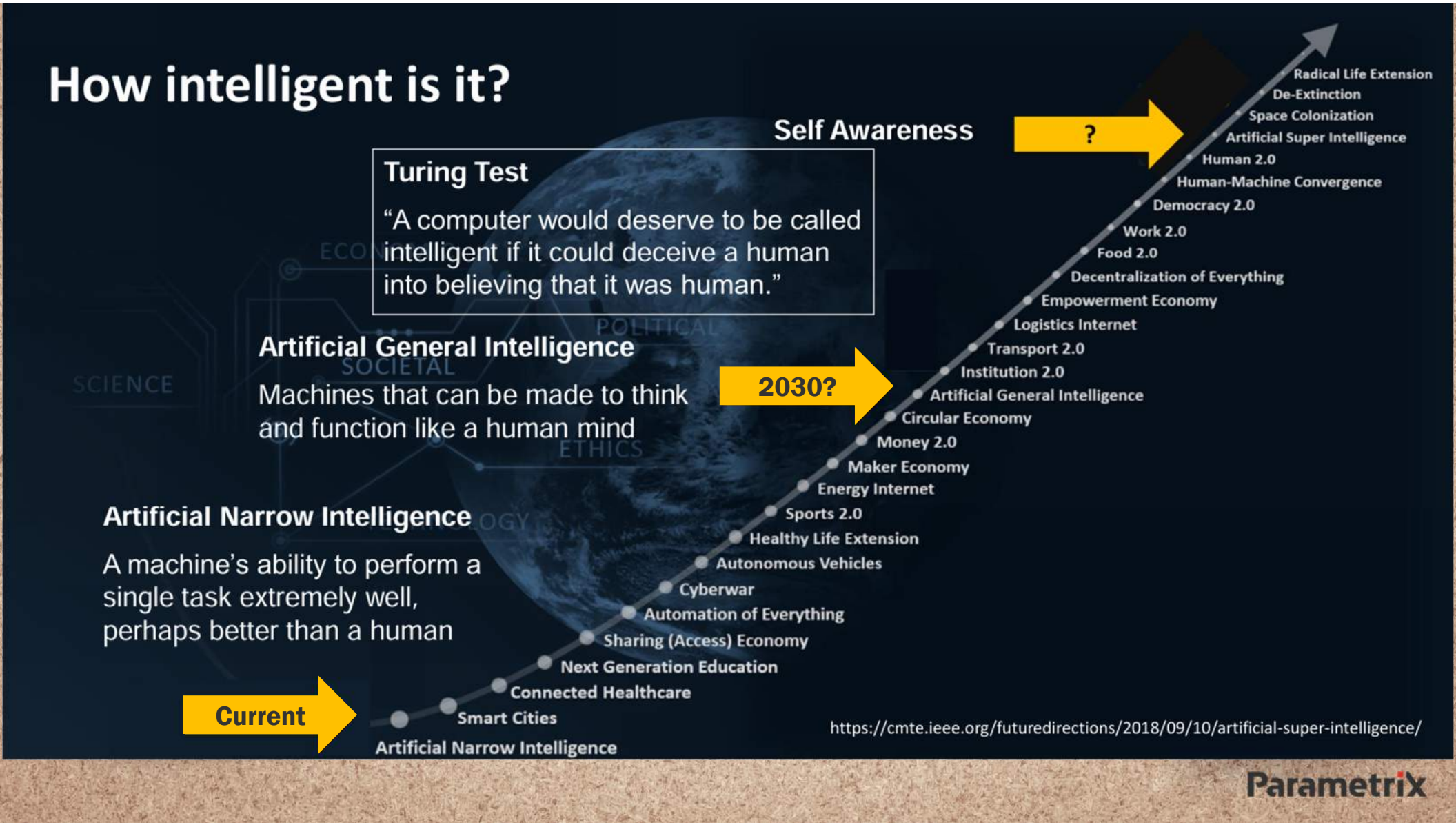
How intelligent is it?



https://cmte.ieee.org/futuredirections/2018/09/10/artificial-super-intelligence/

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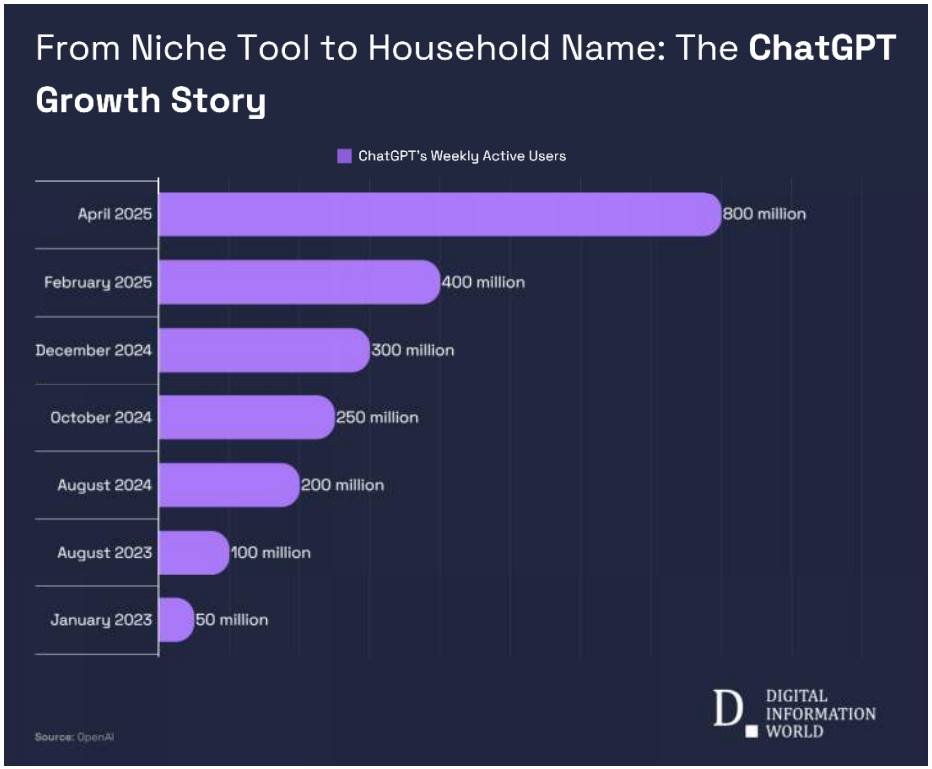
Today’s AI Adoption

ChatGPT handles over 1 billion queries every day

Thats approximately
132,400 requests per minute
29,000 requests per second.



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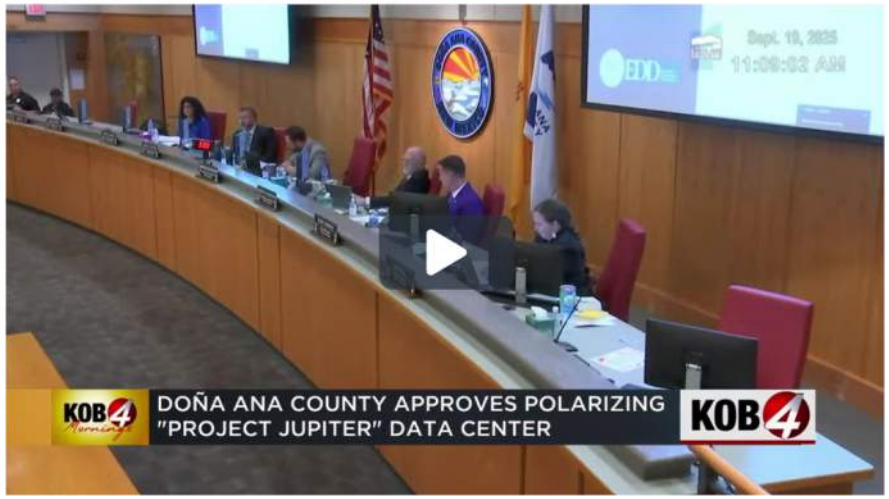
Indirect Impacts on Infrastructure

Infrastructure Machine to Support AI

Data Centers are Thirsty…



Credit: KOB.com

Credit: REUTERS/Shelby Tauber/Pool

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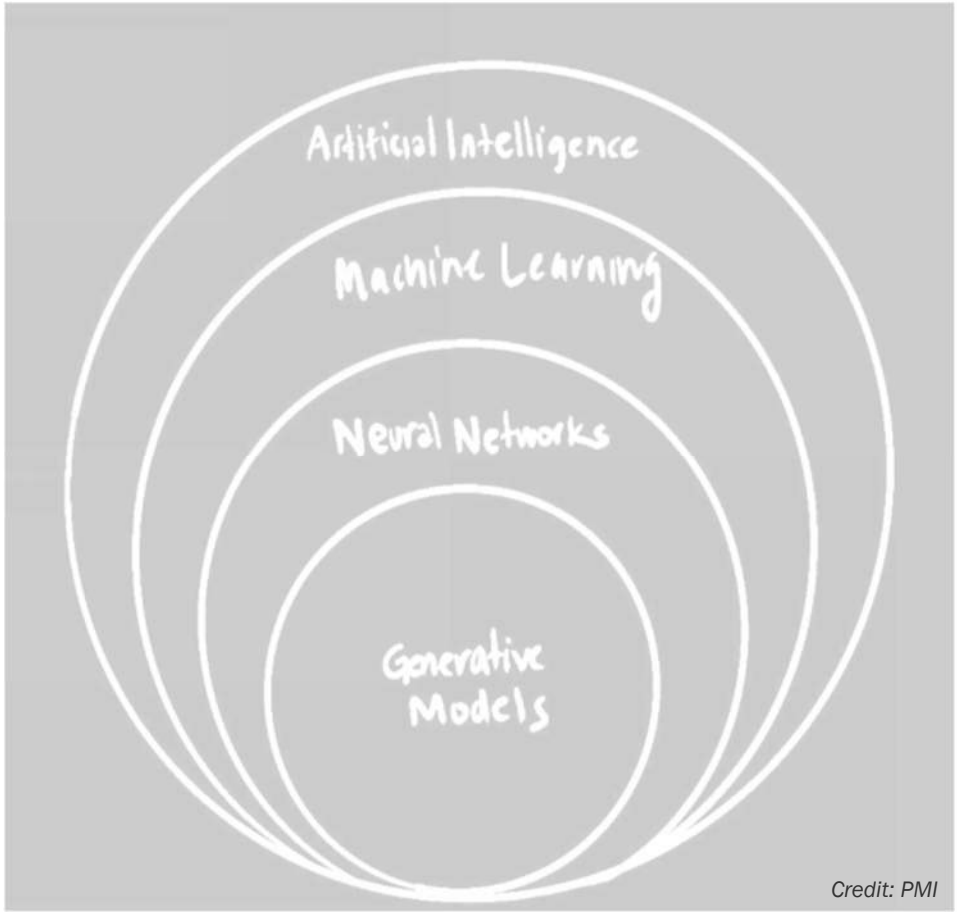
Breadth of Artificial Intelligence

ML is the foundation; LLMs are the new wave.



Credit: PMI

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Machine Learning

Algorithms learn patterns from data

Predictions

Typical example:
Regression Analysis

Three types of learning

1. Supervised
   labeled data: spam filter
2. Unsupervised
   find non-linear patterns:
   clustering risk elements
3. Reinforcement trial/error:
   robotics, condition assessment

Cons

Require large high quality data sets

"Black box"

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Machine Learning | Sub Elements of ML

Artificial Neural Networks (ANNs)

Mimics human brain structure

Recurrent neural networks (RNNs)
or Long short-term memory (LSTM)

Challenges:
Costly computational and training

Computer Vision (CV)

Interpret visual data

Structure assessment, traffic monitoring, and large area monitoring

Calibrated for specific use,
Regular updates with new data

Generative Artificial Intelligence

AI that creates text, code, images, or audio

Commonly powered by Large Language Models (LLMs)

Examples: ChatGPT, DALL·E, Copilot

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Large Language Models

Neural networks trained on massive text datasets

Learn statistical relationships between tokens (~words)

Generate responses statistically

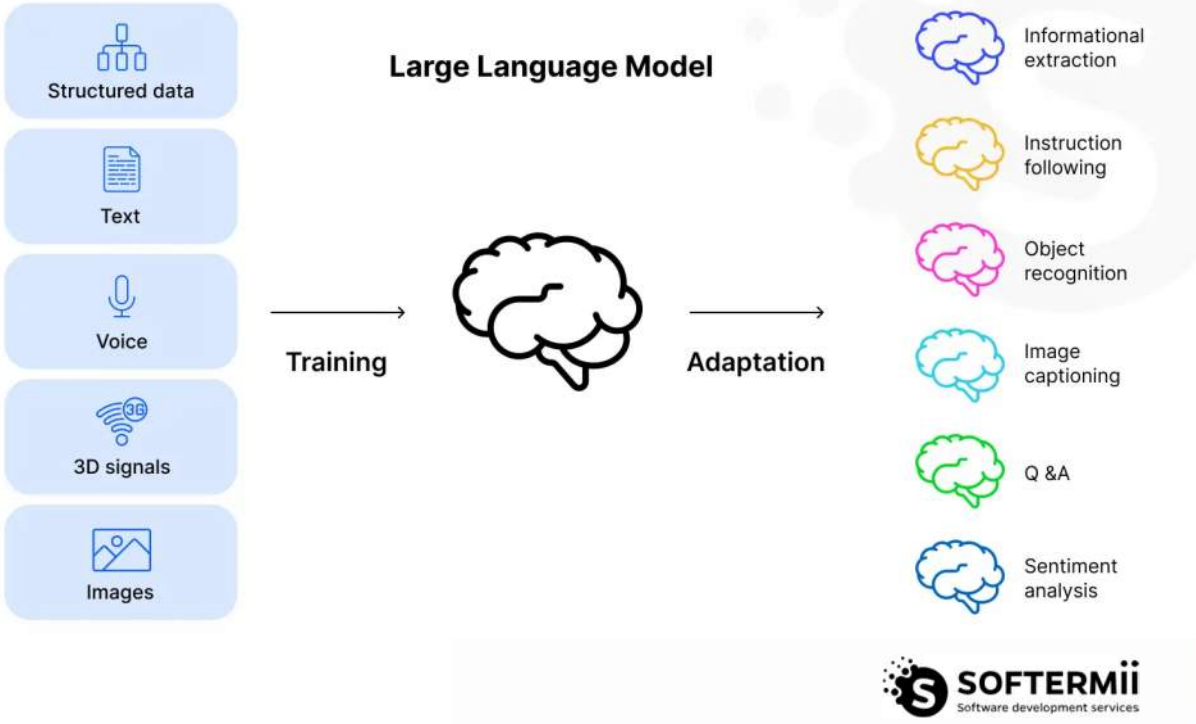
Based on

- GPT = Generative Pre-trained Transformer
- Generative: It can create new content (text, code, etc.).
- Pre-trained: Initially trained on vast amounts of data before being fine-tuned for tasks.
- Transformer: The underlying neural network architecture that enables understanding of context in language.

How to LLMs Understand Language

Natural language processing (NLP)

- Step 1: Tokenization (words/phrases → numbers)
- Step 2: Embedding (tokens mapped in vector space → context/meaning)
- Step 3: Prediction (neural net chooses next token)



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AI in the AEC Industry

Drivers for Adoption of AI – Areas AI Can Excel In

Aging Infrastructure

ASCE 2025 Report Card "C" – Aging infrastructure is vulnerable to natural disasters, inefficiencies, and failures.

Workforce Aging

The aging of workforce is leading to a need for creative solutions to replacing retiring workers.

Growth and Sustainability Pressures

Rapid urbanization and resource limitations creating need for delivering efficient and long-term solutions.

Regulatory Complexity

Regulations are getting tighter requiring more precise data and reporting.

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How is Artificial Intelligence Impacting Us

AI POWERED PREDICTIVE MAINTENANCE BUILDS RESILIENCE INTO WATER SYSTEM

Monday, 14 July 2025

Polish utility MPWiK Wrocław is using an AI-powered predictive maintenance system to manage its water and sewage infrastructure in collaboration with Amazon Web Services (AWS) and Deloitte.

Aquatech

June 13, 2025

New AI leak detection saves water utility $213,000

Oldcastle Infrastructure

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From Industry Drivers to Organizational Impact

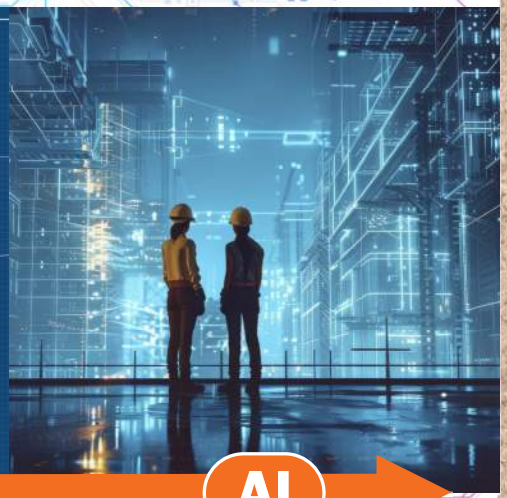
External Forces	Organizational Implications
• Aging Infrastructure	Data-driven maintenance & asset management
• Workforce Retirement	Upskilling & automation support
• Regulatory Pressure	Improved analytics & documentation
• Sustainability Goals	Predictive modeling & design optimization

AI in the AEC Industry: *Then→Now→Next*

Blueprints

CAD

BIM



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Today's AI in Civil Engineering

1. Buried Linear Condition Assessment – SewerAI, VAPAR
2. Roadway Condition Assessment – Vialytics, Pavemetrics
3. Structural Infrastructure Preventive and Predictive Maintenance – Dynamic Infrastructure (DI)
4. Construction Management – Procore, OpenSpace
5. Smart Cities/Utilities Digital Twins – iTwin AI,
6. Emerging: geotechnical hazard AI, integrated smart city management, and AI-powered generative design

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Adoption Considerations

- AI Already Here –
  Adapt or Lag Behind
- Use AI as a Partner/Resource,
  NOT a Replacement
- Stay Informed –
  Tools Continually Evolving

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Adoption ⟶ Why vs How

Strategy

- The “Why” Problem
- Engineers Deliver Solutions
- Augmentation Considerations

Tactics

- The “How” Problem
- One size fits all

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Adoption Challenges

- Technical
  - Data availability, quality, integration
- Cultural
  - Resistance, fear of replacement
- Ethical
  - Bias, hallucinations, data privacy
- Regulatory
  - Client requirements, professional liability

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Mindset Around Using AI

1. Implementation is Happening With or Without You
2. Data availability and quality
3. Transparency with “black boxes”
4. Over coming integration
5. Use it, encourage it, be careful with it

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Can My Organization Benefit From AI

Strategy

- Where can AI add value?
- Determine if AI is a realistic approach?
- Successfully design, implement, and deploy AI solutions?

Governance

- Reproduce, explain, and defend a solution's results?
- Operate, maintain, and govern an AI Program?
- How will data security be approached?

Culture

- Address the change that AI brings to an organization?

AI Policy

- ASCE Policy
  - Policy statement 573 - Artificial Intelligence and engineering responsibility
  - ASCE member of Communication on Publication Ethics
  - Relying on generative AI in scholarly work has its pitfalls
    - A Question of Ethics - March 4, 2024
- Companies/Institutions
  - If you don’t define how AI is used, your staff will.

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Responsible AI Adoption

Strategy	Readiness	Mindset	Governance	Ethics
Define the Why	Assess the What & Where	Lead the How	Manage the Risks	Sustain the Trust

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Questions?

AI is moving fast—organizations without a policy risk fragmented adoption. Start with awareness, governance, and secure tools.

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let's create tomorrow, together