Applying AI to the SDLC: New Ideas and Gotchas
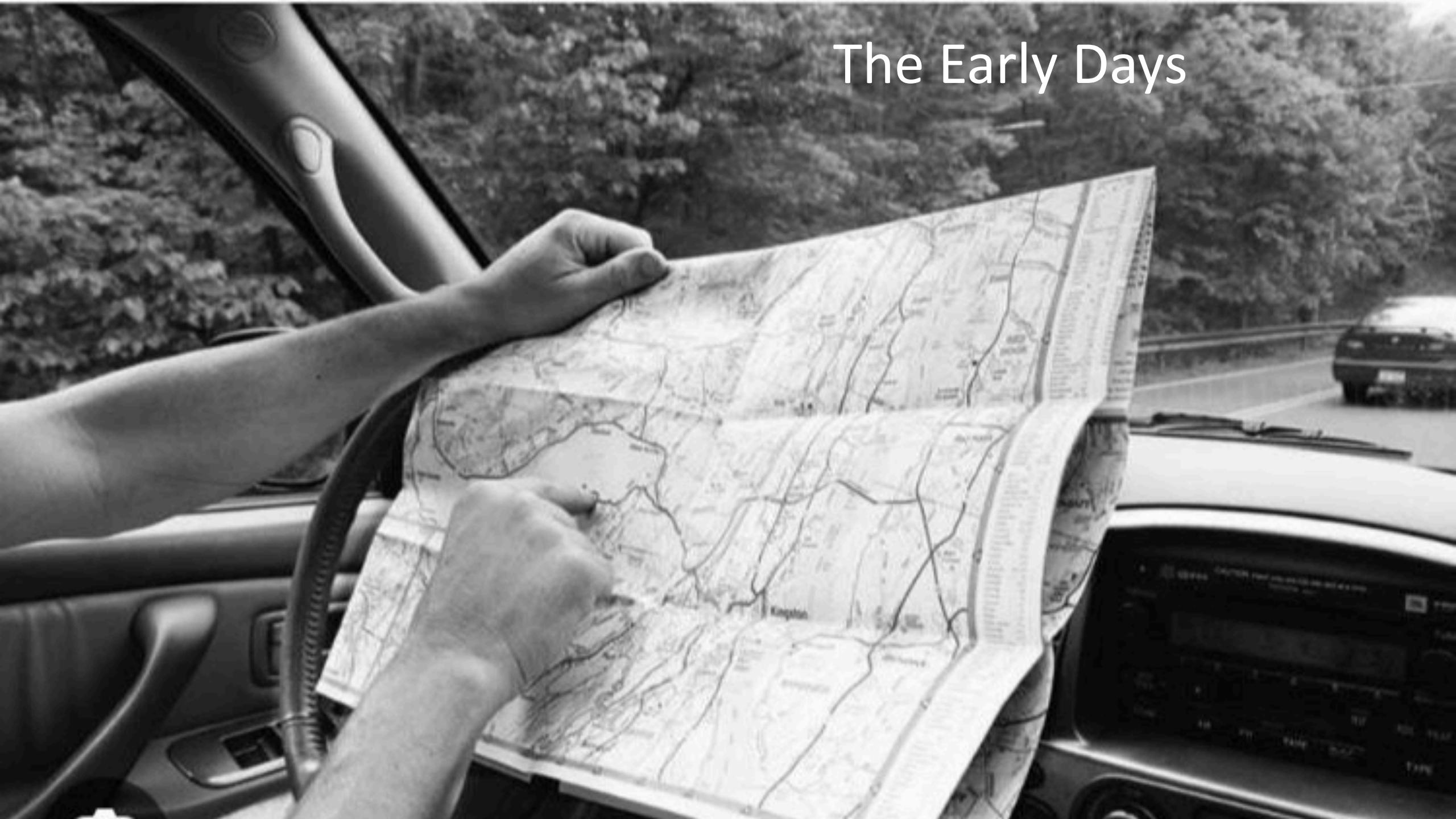
Leveraging AI to Improve Software Engineering

MITRE | SOLVING PROBLEMS FOR A SAFER WORLD®

Trac Bannon

Proliferation

The Early Days

Digital Transition

Special GPS/SatNav Units

GPS integration

Who Am I?   Tracy "Trac" Bannon

/trās/

VSM consortium
Influencer

AMBASSADOR
DevOps Institute
ADVANCING THE HUMANS OF DEVOPS

IEEE
SENIOR MEMBER

MITRE

Metrics
Value Stream Design
#OpenSource
#DevOps
Continuous Testing
#StraightTalkforGovt
Agility
#DevSecOps
#CloudNative
CALMS
Continuous Improvement
Automation
#TDM
Ruthless Prioritization
CI/CD
Building Digital Workforce
Modernization
#RealTechnologists
Digital Transformation
Immersive Learning
Community
Psychological Safety
#SomethingToNoodleOn
DoJo
Current State Baseline
Low Code/No Code
CyberSecurity
Secure by Design
Minimum CD
#DesignPatterns
Modern Software Practices
Evolutionary Architecture
AI-Assisted SDLC
Value Stream Mapping

Software architect | researcher | engineer

2023 – Quick Retrospective
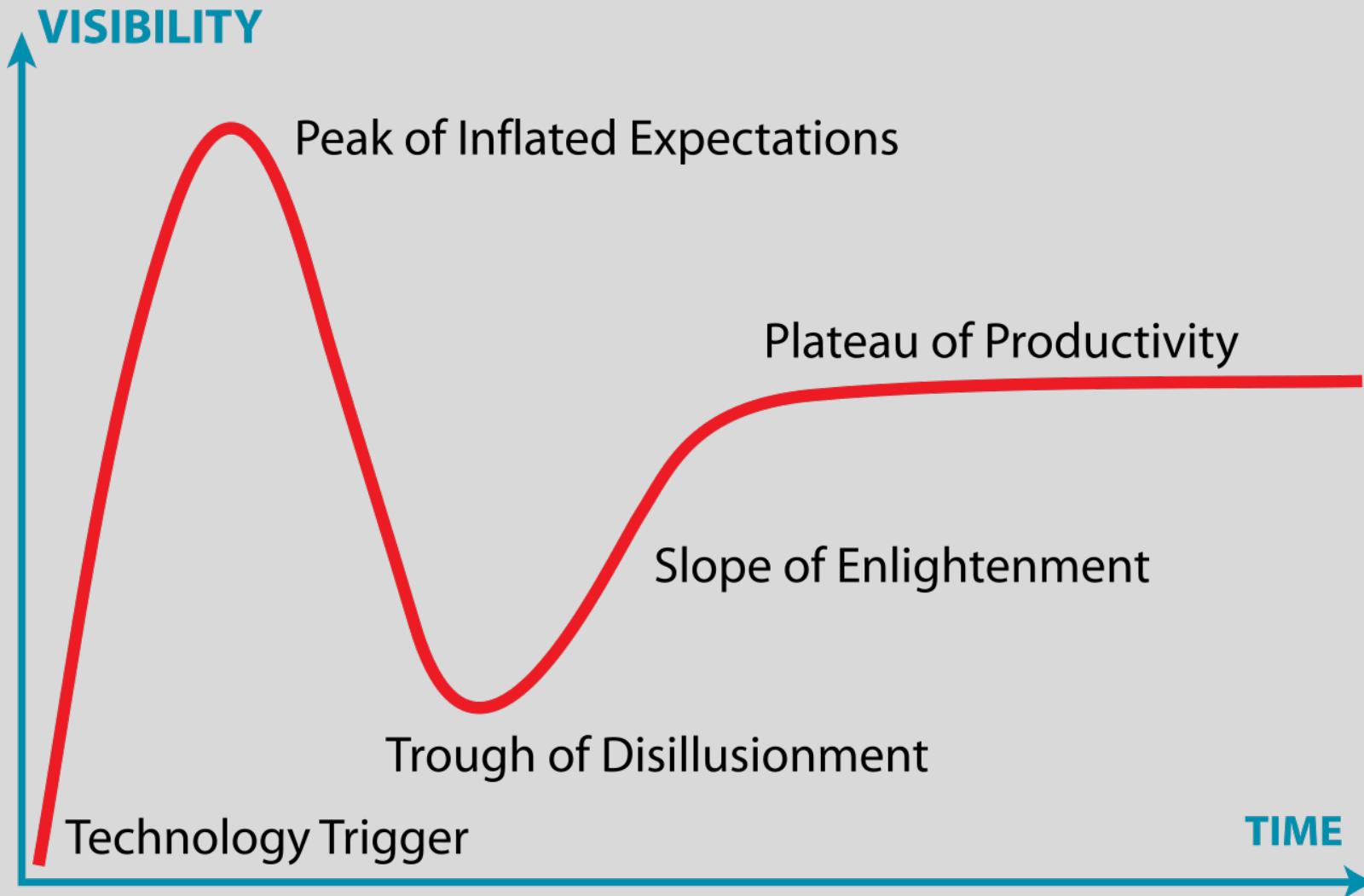
- January ChatGPT users hits 100M

- Chronic FOMO

Don't get swept away by the hype
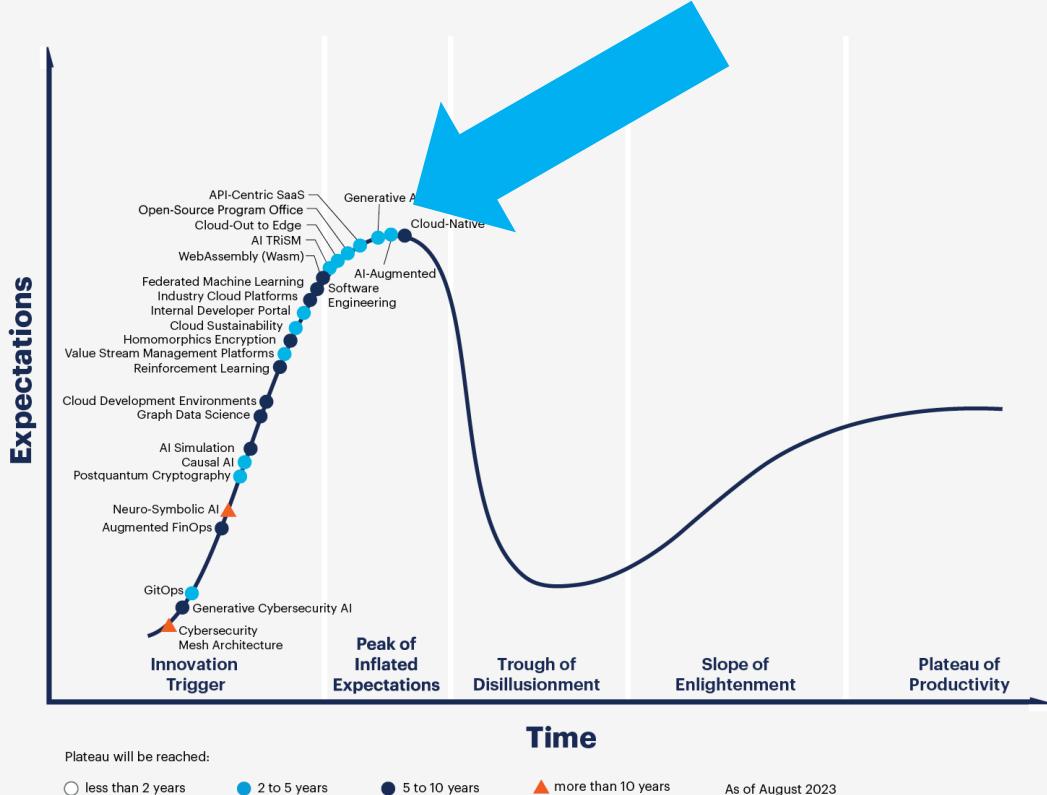
AI in SwEngineering... where are we now?

2 – 5 years to reach productivity??
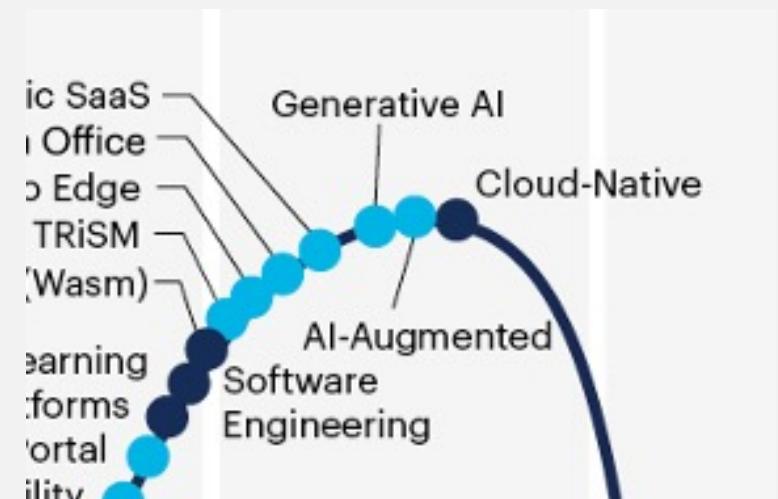
Hype Cycle for Emerging Technologies, 2023
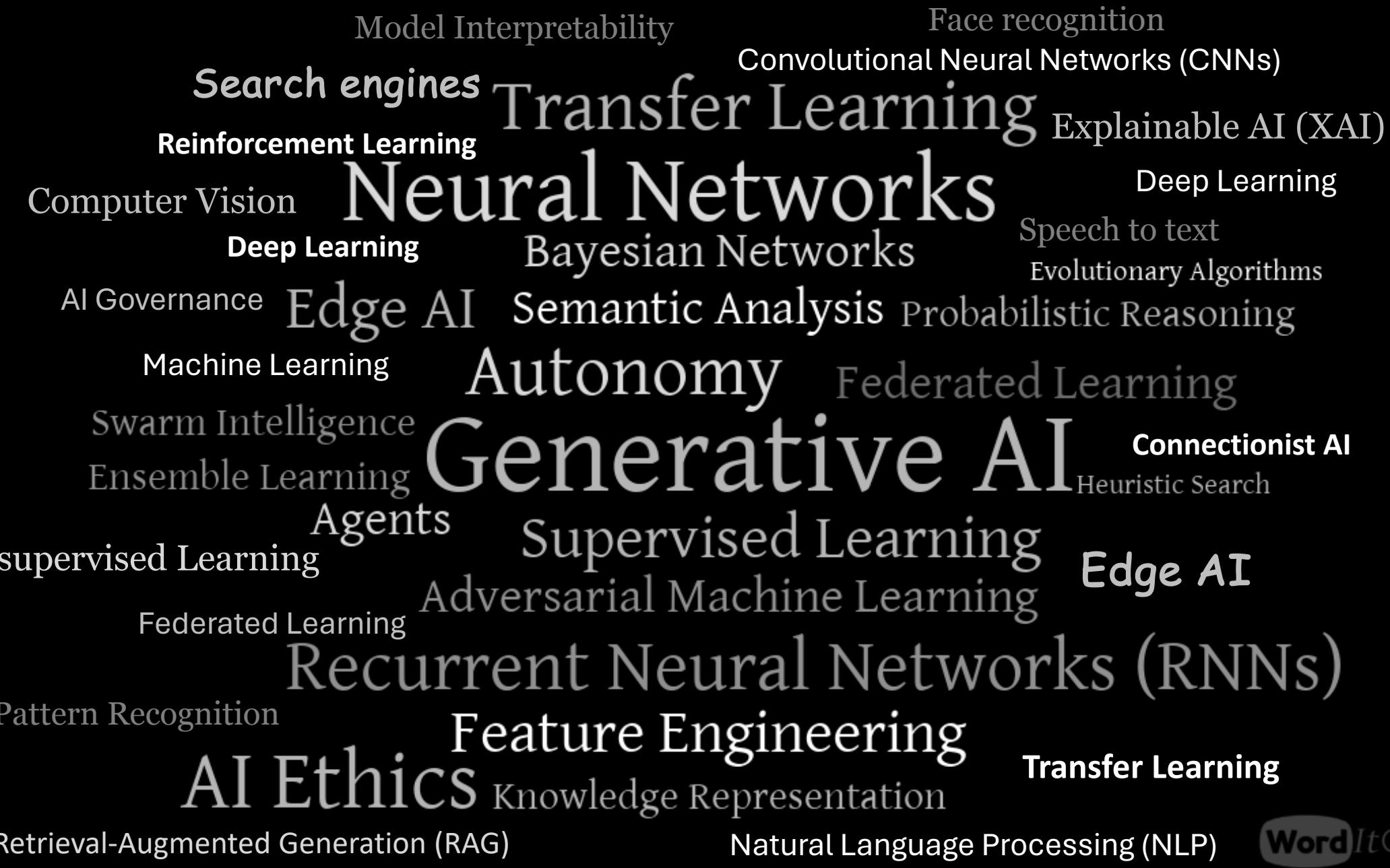
2 to 5 years to the plateau

5 to 10 years to the plateau

*"The work that software engineers do is **complex**. It consists of problem solving in a messy, non-linear environment where there is **no right or wrong answer** to a problem and where there are **multiple trade-offs to be made**."*
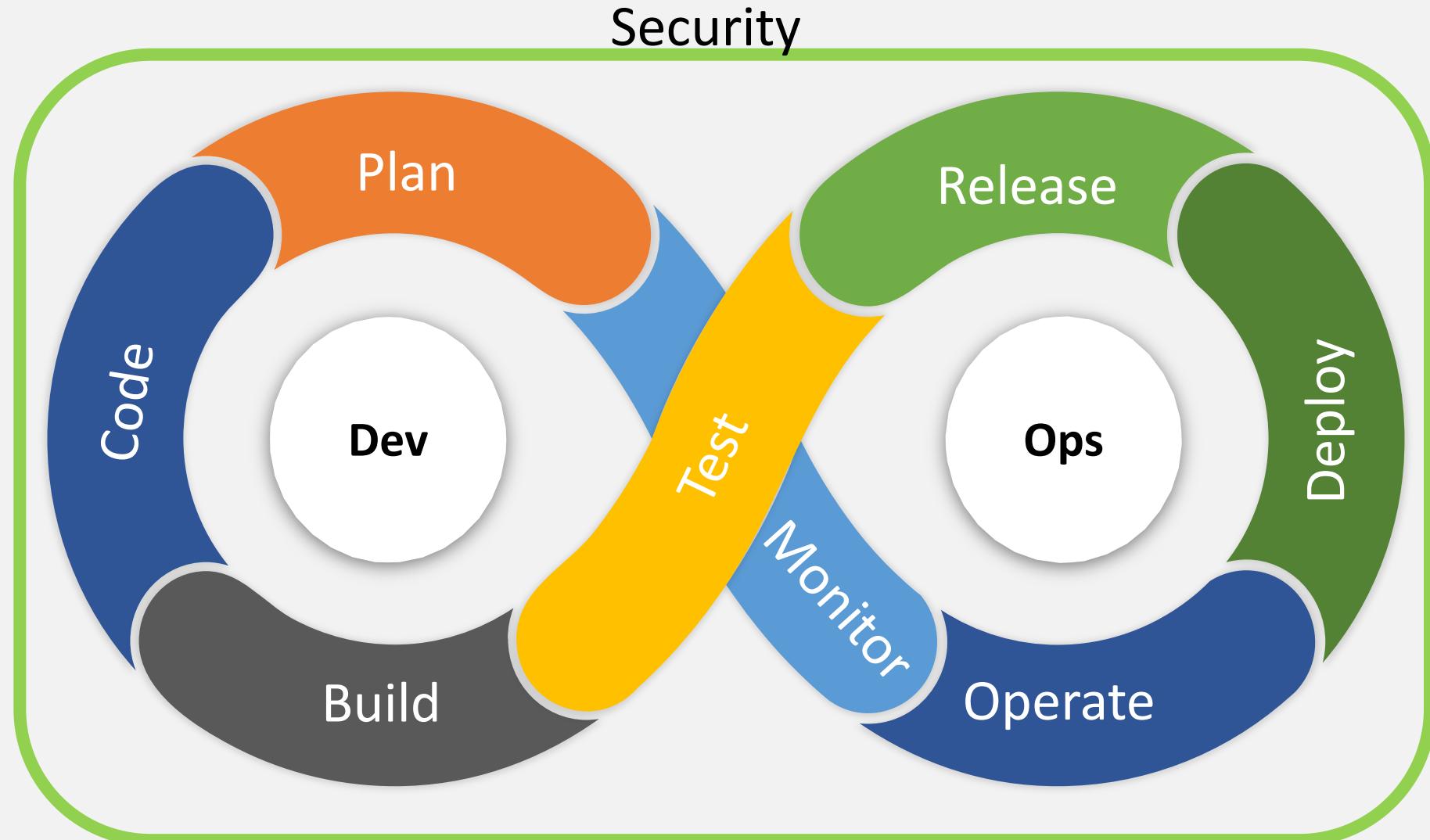
- Paul Edwards, CTO @ AND Digital

*"The entire history of software engineering is one of **rising levels of abstraction**."*

- Grady Booch, IBM Fellow

Where can AI be used with DevSecOps?

Infusing AI across the Dev*Sec*Ops Continuum

Code
- Architectural Design
- GAI based pair programming
- Code & Unit Testing Generation
- In IDE Secure Code Vulnerability Solution
- ML assisted code review selection
- AI Assisted Code Review
- AI Enabled collaboration
- Suggestive Refactoring

Plan
- Natural Language Requirements Gathering
- NLP Requirements Analysis for inconsistency and ambiguity
- GAI Epic and User Story Generation
- Effort Estimation using Neural Networks
- GAI-assisted Threat Model Policy Identification

Release
- Compliance Validation
- Reinforced Learning-based models generate deployment scripts
- AI Enabled Failure Analysis
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- AI Driven CI/CD workflow automation

Deploy
- Dynamic Environment Provisioning and Deployment Optimization
- Realtime Rollback
- AI-assisted Log Aggregation
- ML Anomaly Detection
- GAI Deployment Scenario Simulations

Security
Is infused into all actions and activities

AIOps engines provide correlation and predictive monitoring

Build
- Aggregated Merge Request Impact Analysis
- GAI-based identification of security vulnerabilities
- ML algorithm optimized build times
- AI-Assisted Security Vulnerability Detection
- Software Composition Analysis

Test
- Natural Language Test Case Generation
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- E2E Functional Test Execution
- Intelligent Failure/Self Healing Testing
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- Intelligent Test Execution

Monitor
- Event Correlation
- False Alarm Filtering
- Self-Healing Techniques
- Root Cause Analysis
- Observe system performance
- Usability Patterns
- Monitoring

Operate
- Deterministic AI based ticketing and support allocation
- AI Based Self Healing Decision
- LLM Integration for Virtual Assistance
- GAI/GPT powered Knowledge Bases

Dev

Ops

Plan

Code

Build

Test

Release

Deploy

Monitor

Operate

Treat GAI like a young apprentice...

Always pay close attention!!

Does Generative AI contradict DevSecOps principles?

Where are people using GAI today?

- Documentation
- Requirements Analysis
- Debugging
- Code Completion
- Test Case Augmentation

Source: 2023 StackOverflow Developer Survey
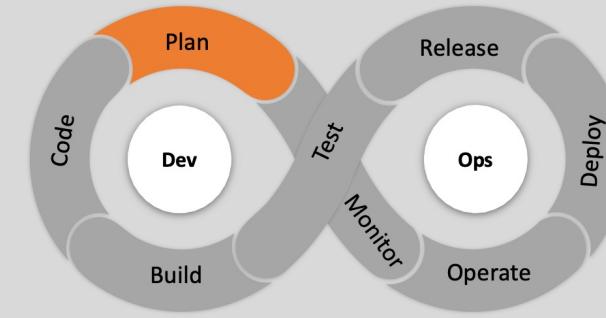
AI-Assisted
^
Requirements Analysis

Use Case:

- Requirements generation via text analysis

- Analyze user transcripts

- Include crowdsourced survey

Considerations:
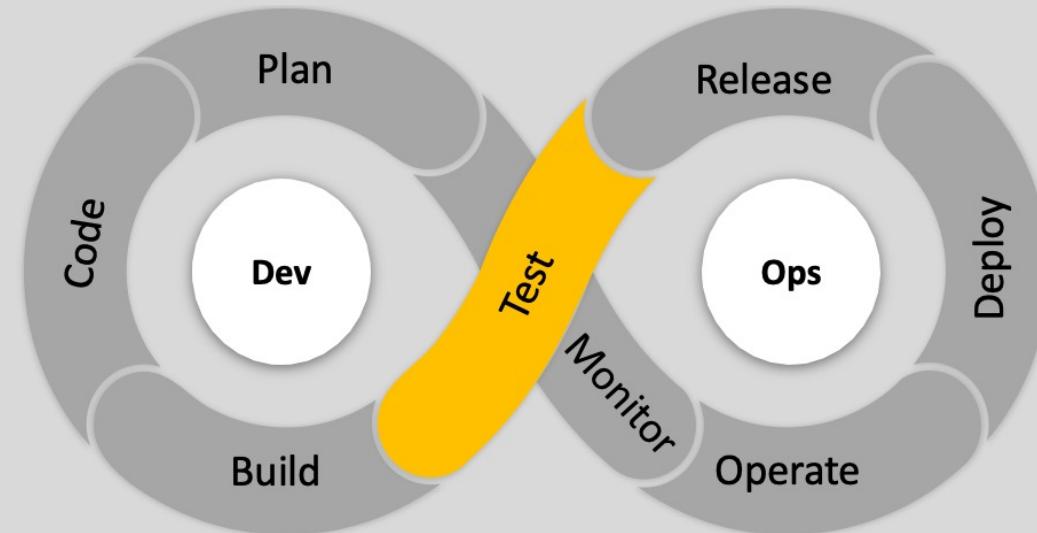
- Version control GPT prompts ++

- Diverse Datasets

- QA = rigorous testing + humans in the loop

^ Testing Use Cases
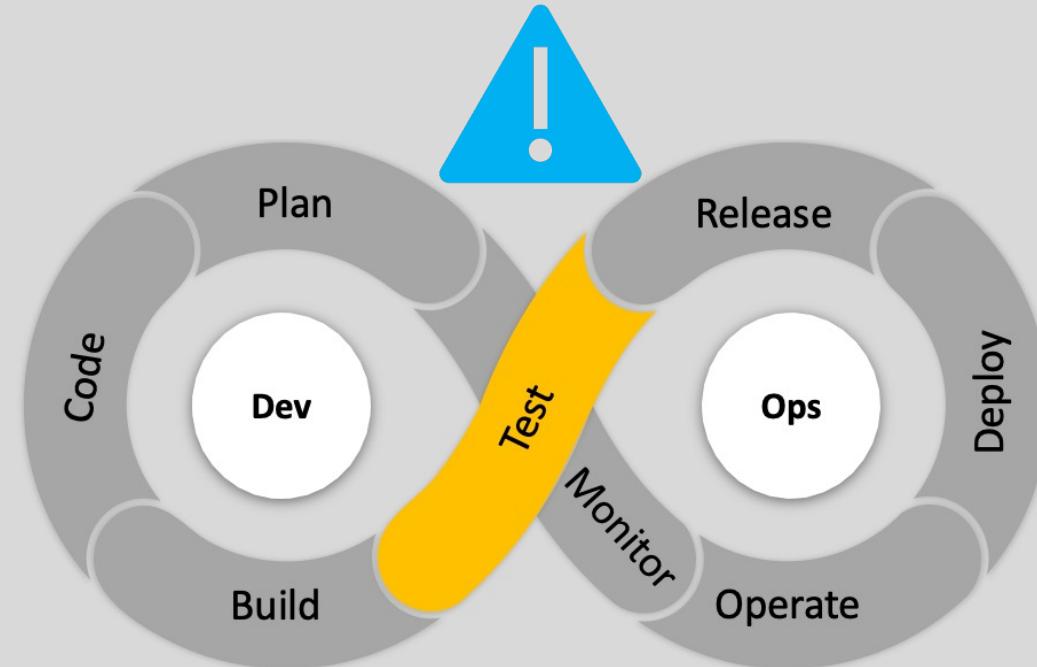
- Increase test coverage

- Brainstorming

- Synthetic Test Data Generation

^ Testing Considerations

- Data Privacy & Integrity

- Beware of Irrelevant Tests

- Transparency and Explainability
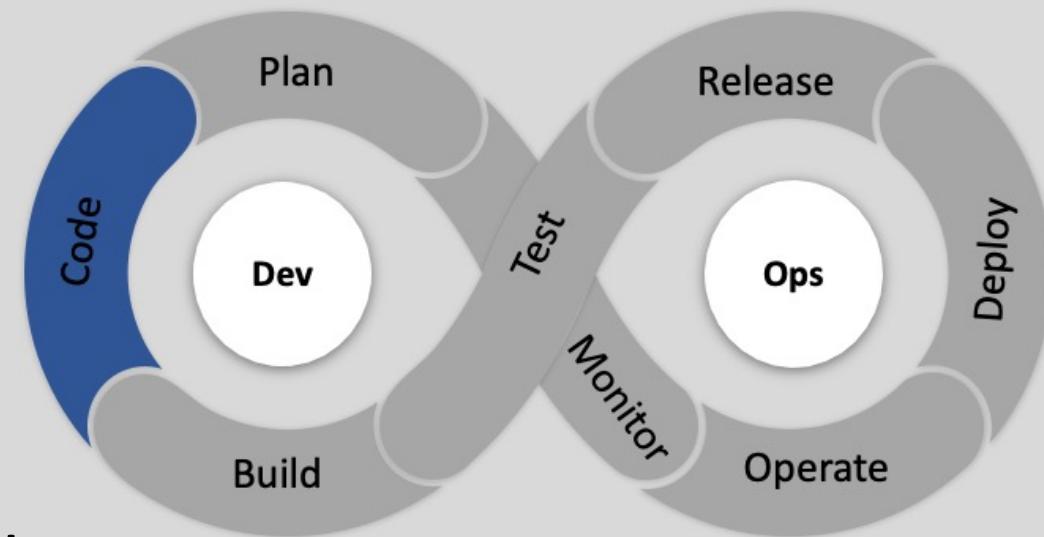
The elephant in the corner....
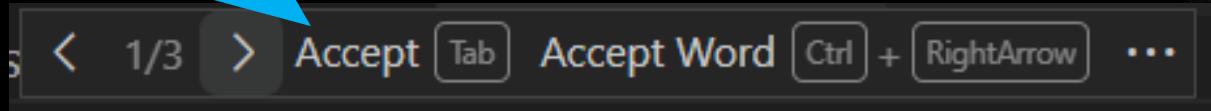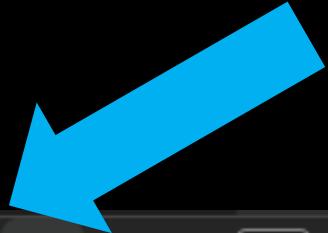
^ Coding

- Code Completion over Code Generation

- Great for explaining existing code

- Generally, well-structured and well-formatted

In IDE Help
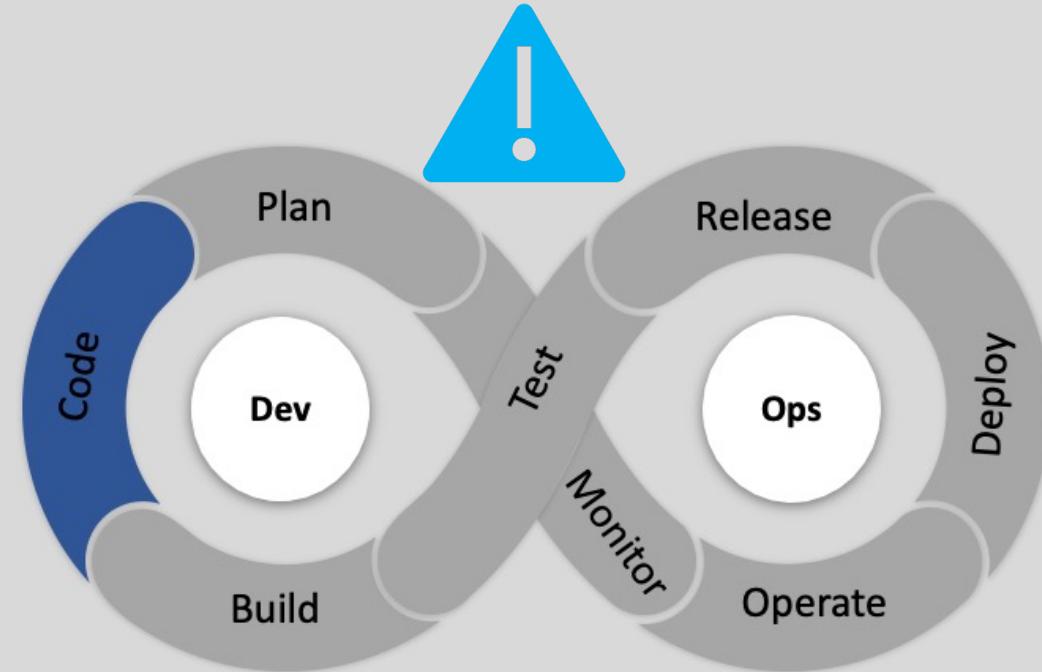
```python
def max_sum_slice(xs):
    """Return the maximum sum of a slice of xs."""
    max_sum = 0
    for i in range(len(xs)):
        for j in range(i, len(xs)):
            this_sum = 0
            for k in range(i, j + 1):
                this_sum += xs[k]
            if this_sum > max_sum:
                max_sum = this_sum
    return max_sum
```

AI-Assisted
^ Coding Considerations

- Unequal productivity gains

- Code Churn

- Less Secure Code

- QA = rigorous testing + humans in the loop

GAI can be unreliable.
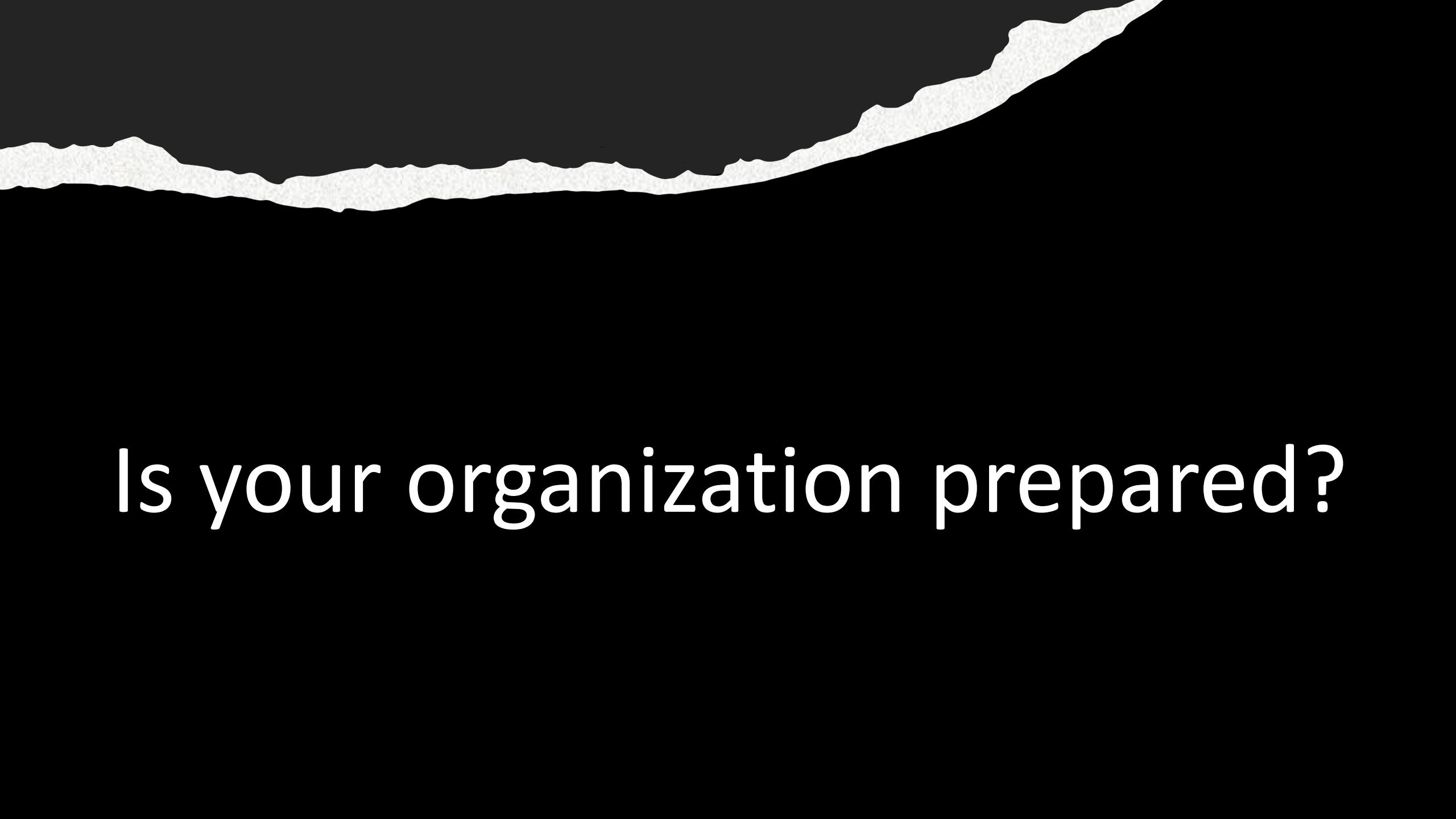
Pay close attention!

Don't generate code and tests

- Lack of Independent Verification

- Bias and Blind Spots

- Overfitting

Is your organization prepared?

Fix your SDLC first

- Address existing issues

- GAI can magnify existing problems

Back to the basics…

"Do the Minimum"
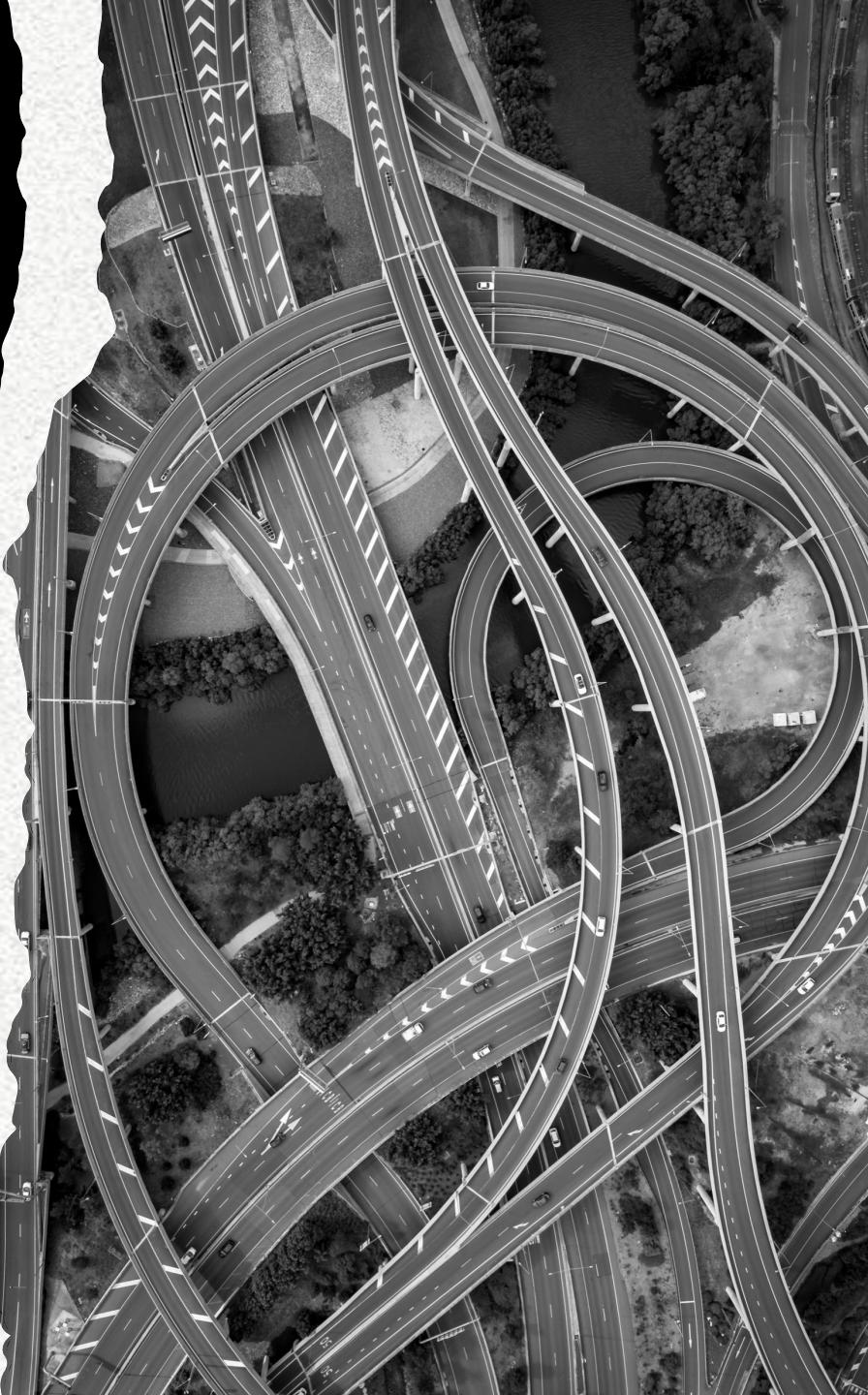
Gotchas to avoid

Adaptation to New Workflows

- Measurements and metrics will waiver

- Training is a must

- Humans resist change

What about productivity?

- Perceived productivity

- Team productivity *not* Individual productivity

SPACE as a Starting Place to Measure Productivity

- **S**atisfaction
- **P**erformance
- **A**ctivity
- **C**ommunication and Collaboration
- **E**fficiency and Flow

The Importance of Context

- AI requires a massive corpus of data
- If you subscribe to a service, you must provide context
- Are you okay with sharing?

Keep your packages up

☑ Snyk Code

Snyk temporarily clones the repository or uploads your code. Snyk caches your code for a maximum of 24 hours.

Analyze your source code for issues and vulnerabilities ⓘ

Keep Humans in the Loop!

The Big Picture

Adding AI to the Enterprise

Parts of an AI Strategy

- Needs Assessment
- Pilot Programs
- Skill Development
- Governance
- Monitoring and Feedback Loop
- Thought Leadership

Choose when and where to start

Designing Your ^AI-Assisted^ Software Engineering Tool Chain

Leading Practices of AI-Assisted Development

- Keep humans in the loop
- Everything in source control including prompts
- Secure your vulnerabilities
- Don't provide your private info/IP into public AI engines

Governance and Managing Risk

What Questions Should You Ask?
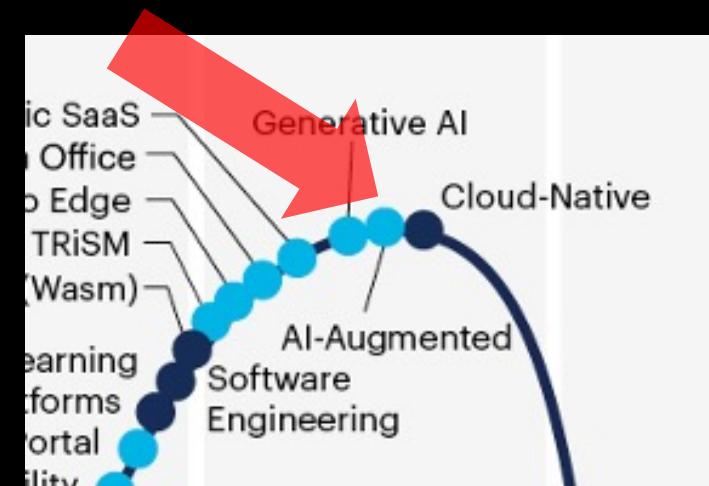
Looking Ahead

Near-Term AI-Infused Software Engineering
AI, ML, or Generative AI

- GAI is just now being incorporated and experimented with

- Continuous testing is currently the most impacted

- AIOps is on the rise enhancing observability and ConMon

- Shift Left Security needs **humans in the loop**

- Release anomaly prediction is improving rapidly

What does the SDLC look like over the next 12-24 months?

Plan
- Natural Language Requirements Gathering
- NLP Requirements Analysis for inconsistency and ambiguity
- GAI Epic and User Story Generation
- Effort Estimation using Neural Networks
- GAI-assisted Threat Model Policy Identification

Release
- Compliance Validation
- Reinforced Learning-based models generate deployment scripts
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- Release Risk/Success Prediction
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- Usability Patterns
- Monitoring

Operate
- Deterministic AI based ticketing and support allocation
- AI Based Self Healing Decision
- LLM Integration for Virtual Assistance
- GAI/GPT powered Knowledge Bases

Plan

Release

Build

Operate

More data silos, slower flow, more quality issues...?
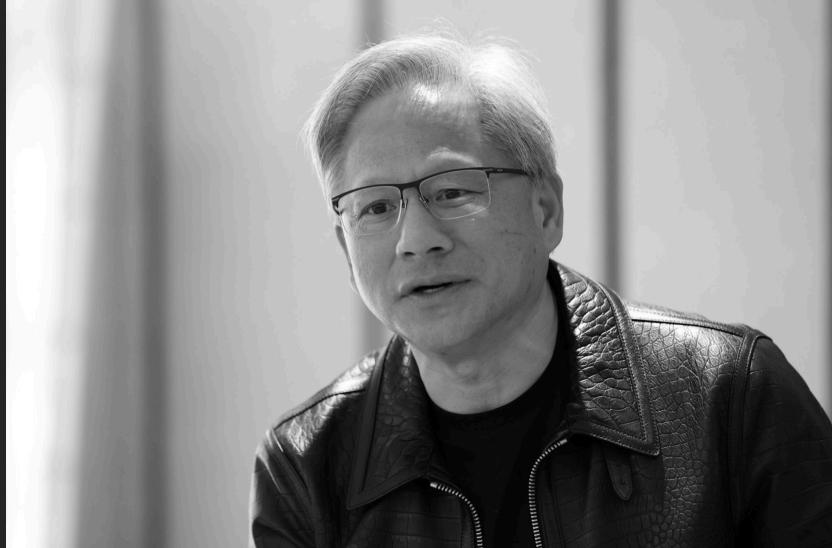
Increased need for Platform Engineering

- Making it hard for humans to make mistakes

- Codify leading practices

But what about this...
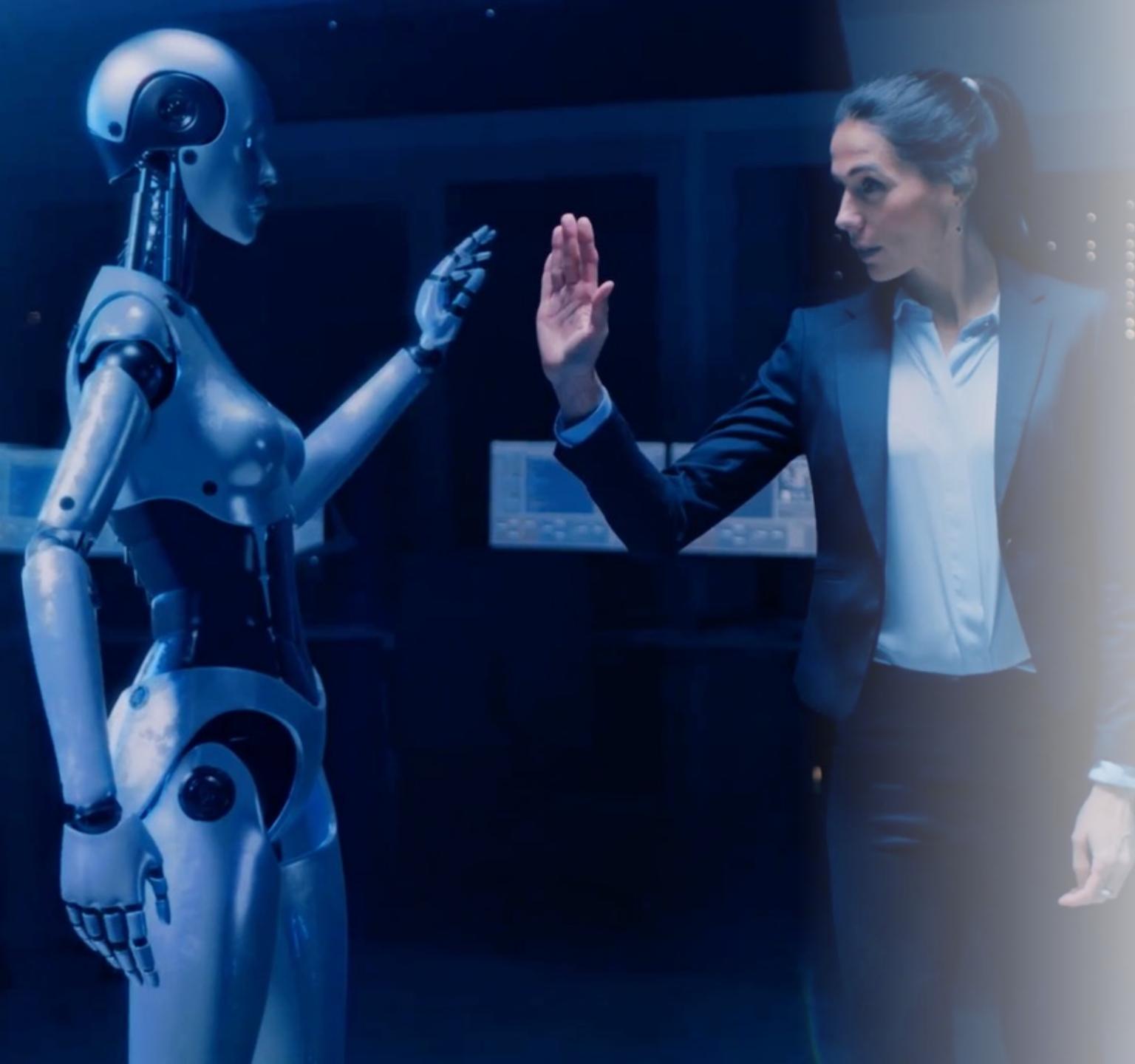
Is the future of coding dead?

Scott Wu, CEO / Cognition AI
Human Software Engineer

Will Devin, the AI SwEngineer, join our teams?

AI/Human Teaming

Who will we optimize for? Humans? AI Agents?

We can't put the genie back in the bottle

- Prompt engineering as a discipline
- Ethics of prompts
- Who owns the generated outcomes
- Human-Machine teaming
- Software team performance
- Trust and reliability in software outcomes
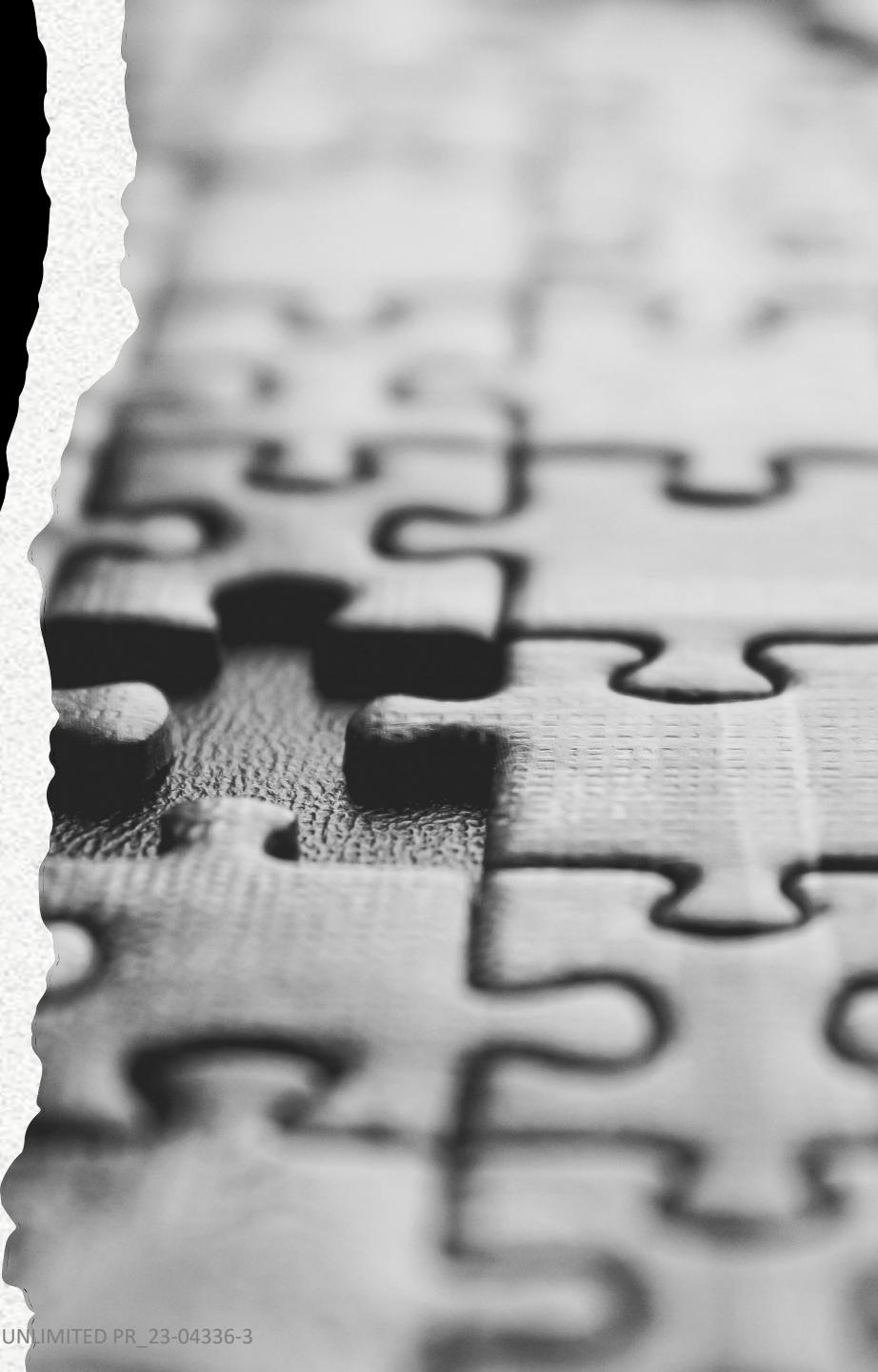
Call to Action – Your Next Steps

- Pulse your organization to see if and how AI is being used

- Enable research and discovery for GAI usage

- Make Cybersecurity as your highest priority

- Establish on reasonable guardrails

- Connect with your providers to ask model quality and security questions

- Ask your platform providers about their AI roadmap

What I need from you…

- How do you think the SDLC will change?

- How is your organization preparing?

- What are you **personally** focusing on?

- Share your organization's story and lessons learned

- Share out new use cases and new tools

What matters are the humans.

tbannon@mitre.org | alt: Trac@tracybannon.tech

https://www.linkedin.com/in/tracylbannon

@TracyBannon

https://tracybannon.tech

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Please vote and leave feedback!

Remember to vote and share feedback on the QCon App. Any questions?

QCon by InfoQ

GenAI Provider Questions – Set 1

1. How does the platform ensure the security and privacy of data used by the generative AI models?
    Importance: Understanding the data handling policies and practices of the vendor helps ensure that sensitive information is not inadvertently exposed or misused during the AI model's training or application.

2. What measures have been taken to prevent the AI model from generating malicious or vulnerable code?
    Importance: Ensuring that the AI model does not introduce new security vulnerabilities or promote insecure coding practices is crucial for maintaining the overall security of the applications built on the low-code platform.

3. How does the platform manage and control access to the generative AI models and their generated outputs?
    Importance: Proper access management is essential to prevent unauthorized access to the AI models, which could lead to unauthorized modifications, data breaches, or other security risks.

4. How does the vendor handle AI model updates, and what steps are taken to evaluate and maintain the security of the generative AI models over time?
    Importance: Regular updates and security assessments of the AI models are necessary to ensure that they continue to provide a secure and reliable foundation for low-code development as new vulnerabilities and security risks emerge.

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GenAI Provider Questions – Set 2

1. What are the pricing options and licensing terms for using the generative AI features?

2. Are there any hidden costs or usage limitations we should be aware of?

3. How does the tool handle edge cases or unexpected inputs?

4. Are there any built-in fail-safes to prevent the generative AI from producing harmful or problematic code?

5. Can the generative AI model be fine-tuned or customized to our organization's specific coding standards and practices?

6. Is it possible to extend the model's capabilities to address our unique requirements or use cases?

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Slide 49 - Slide 16 - *DevOps Infinity Loop Inspired by SlideEgg*

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Slide 52 – Cognition AI

Slide 53 - Getty

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