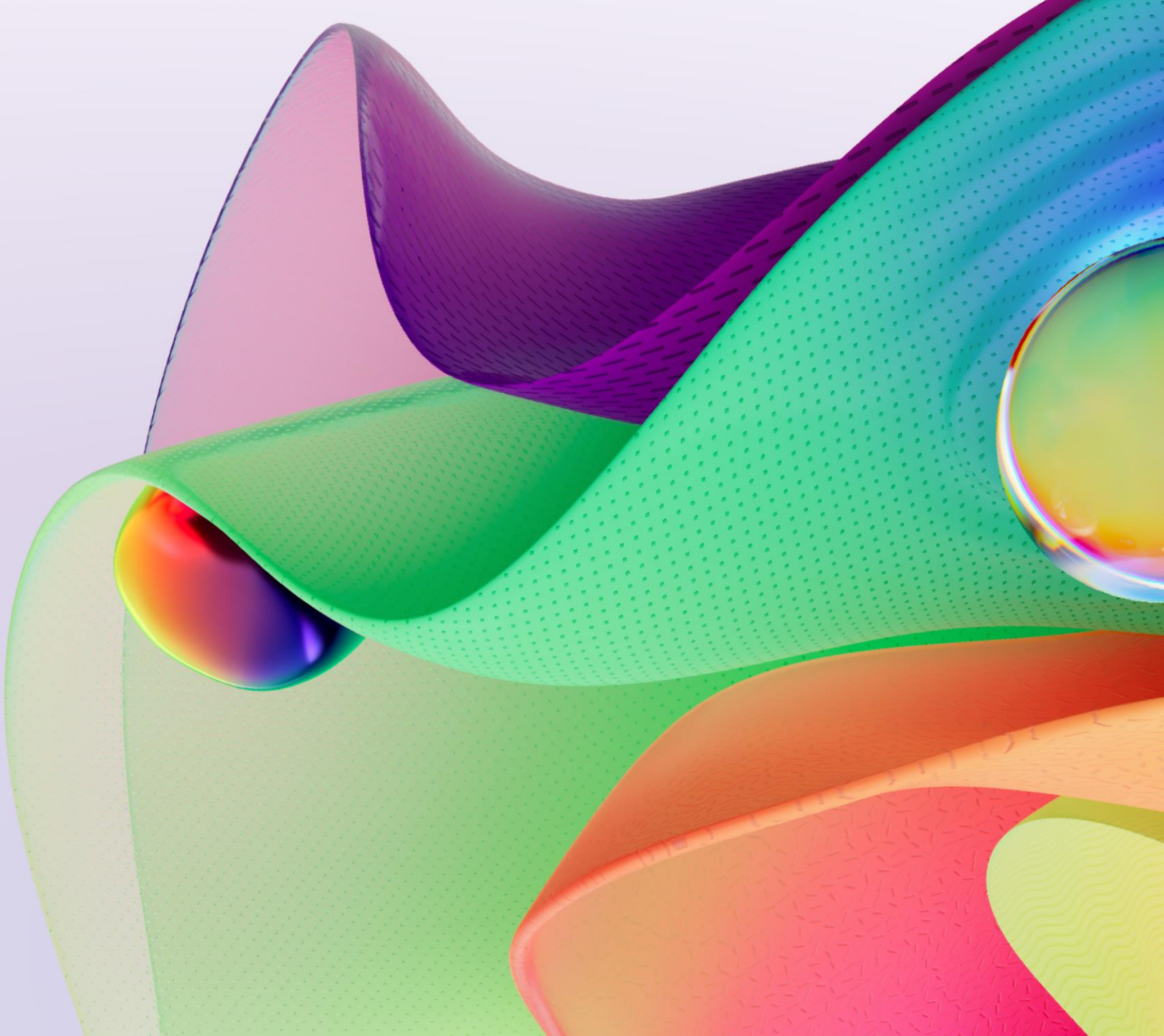
Microsoft

# Microsoft AI Tour

In partnership with NVIDIA.



Microsoft

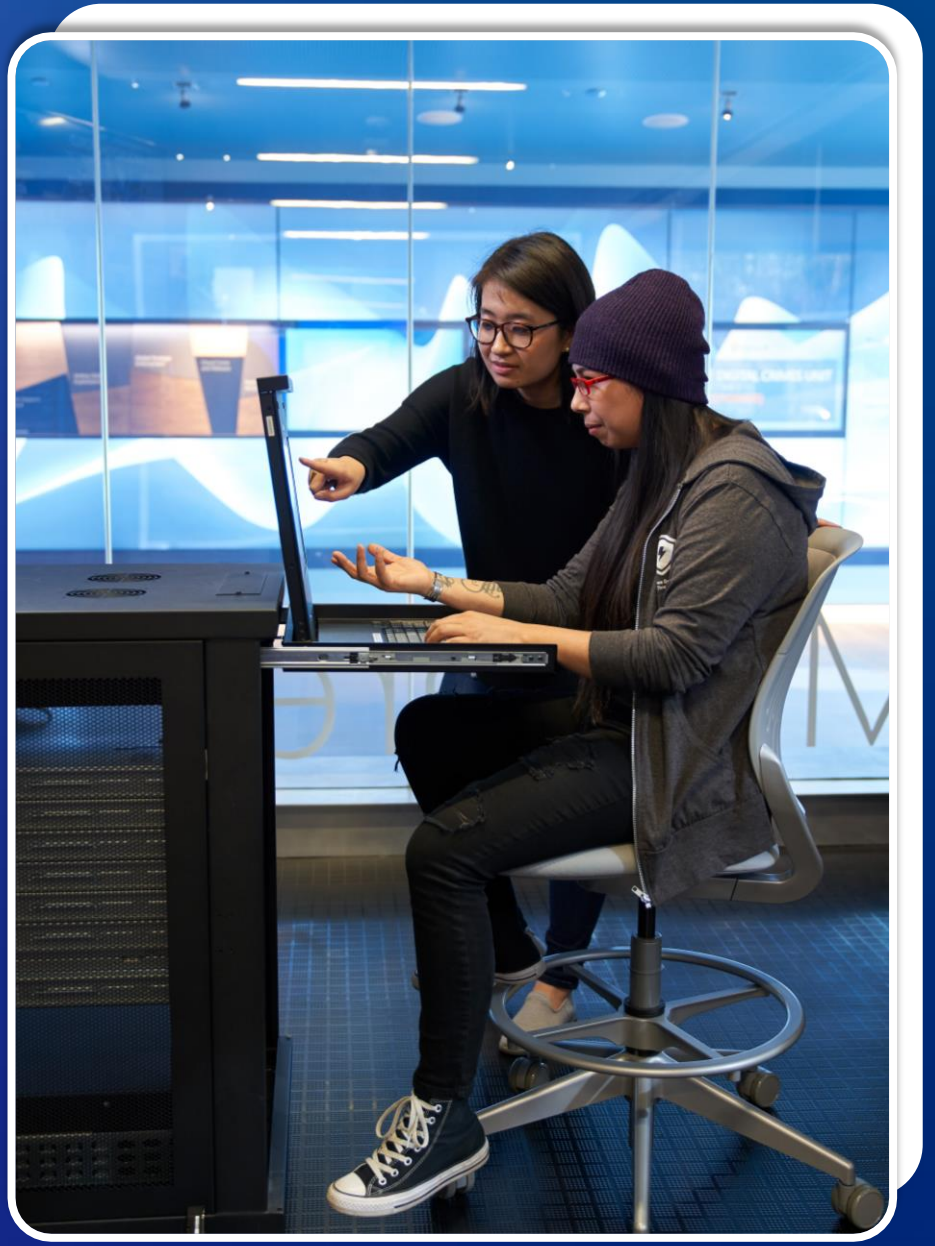
# Securing Generative AI Applications

Rod Trent
Senior Program Manager, Microsoft

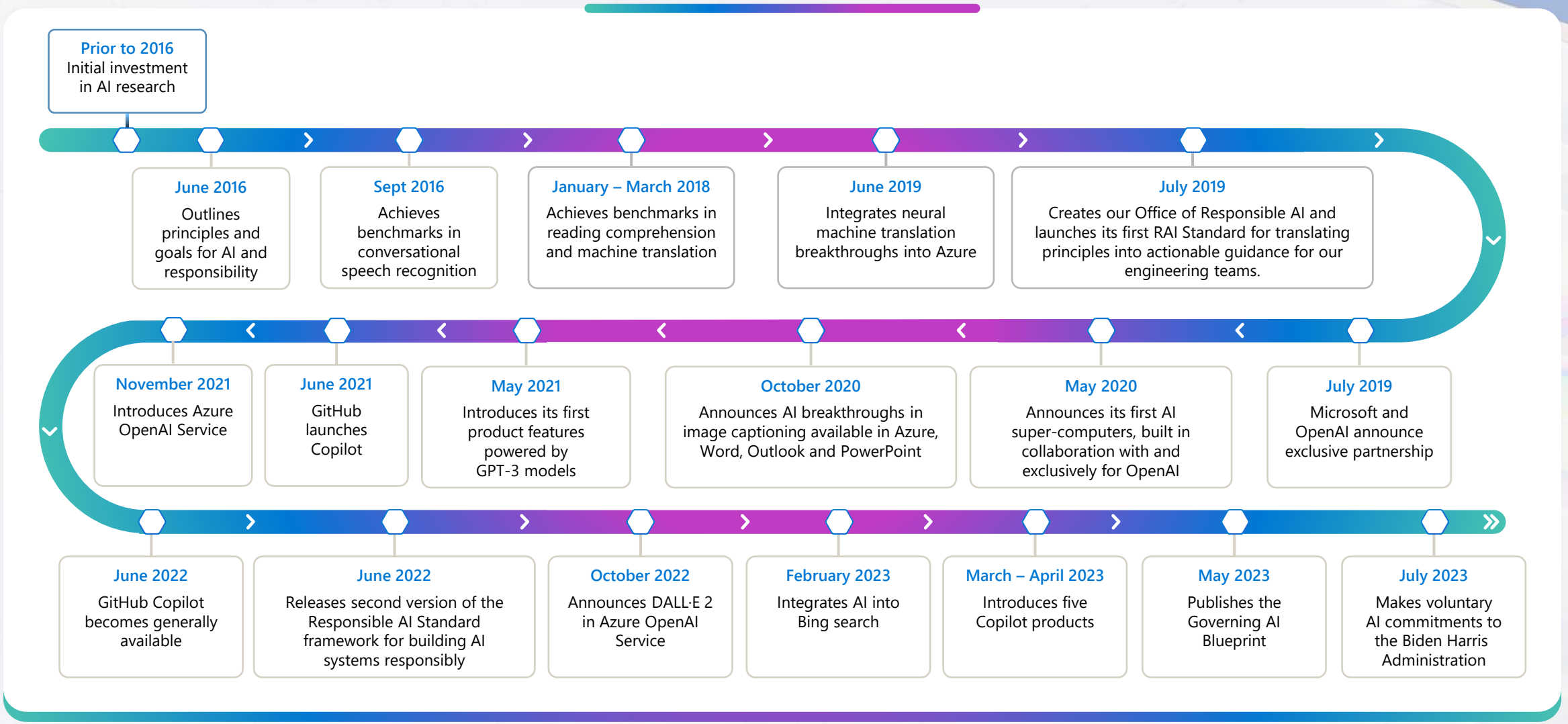
# Agenda

- Introduction
- Understanding AI architecture in a security context
- The AI security threat landscape
- How Microsoft secures AI platforms
- Security controls for developers building AI-enabled applications

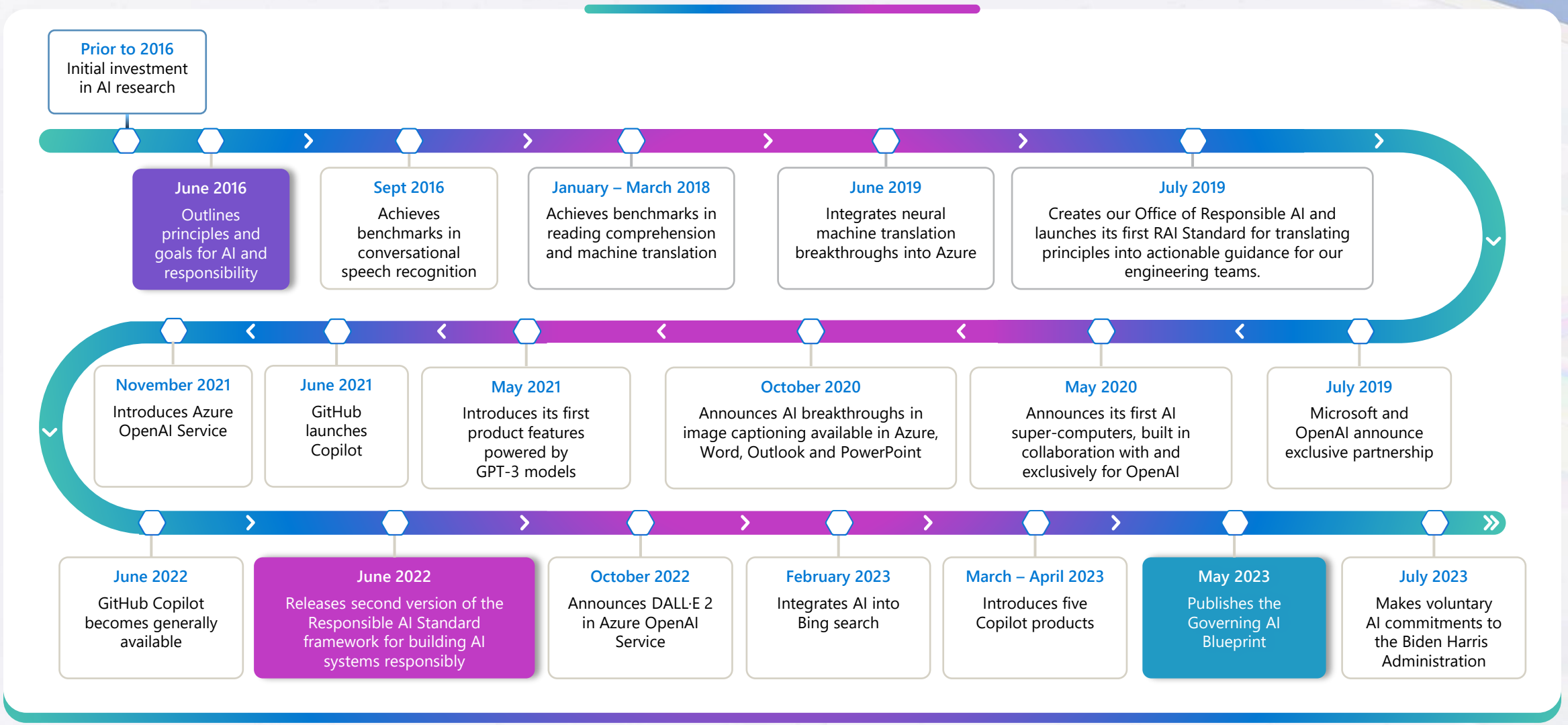
# Introduction



# Microsoft's Journey in AI



# Microsoft's Journey in AI



# Microsoft's Responsible AI Framework

| Fairness | Reliability & Safety | Privacy & Security | Inclusiveness | Transparency | Accountability |
|---|---|---|---|---|---|
| AI systems should treat all people fairly. | AI systems should perform reliably and safely. | AI systems should be secure and respect privacy. | AI systems should empower everyone and engage people. | AI systems should be understandable. | People should be accountable for AI systems. |

## Learn More

https://www.microsoft.com/en-us/ai/responsible-ai

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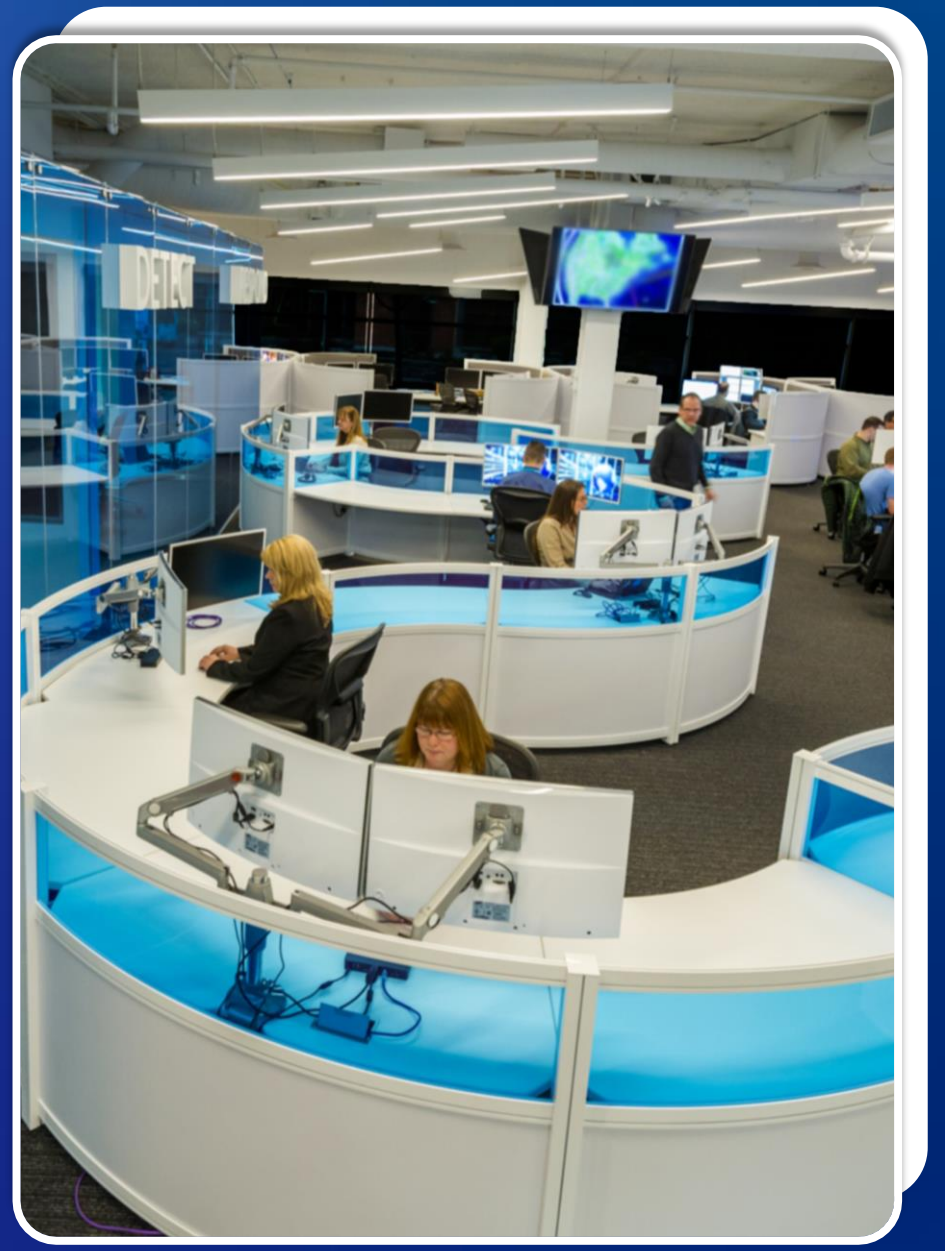
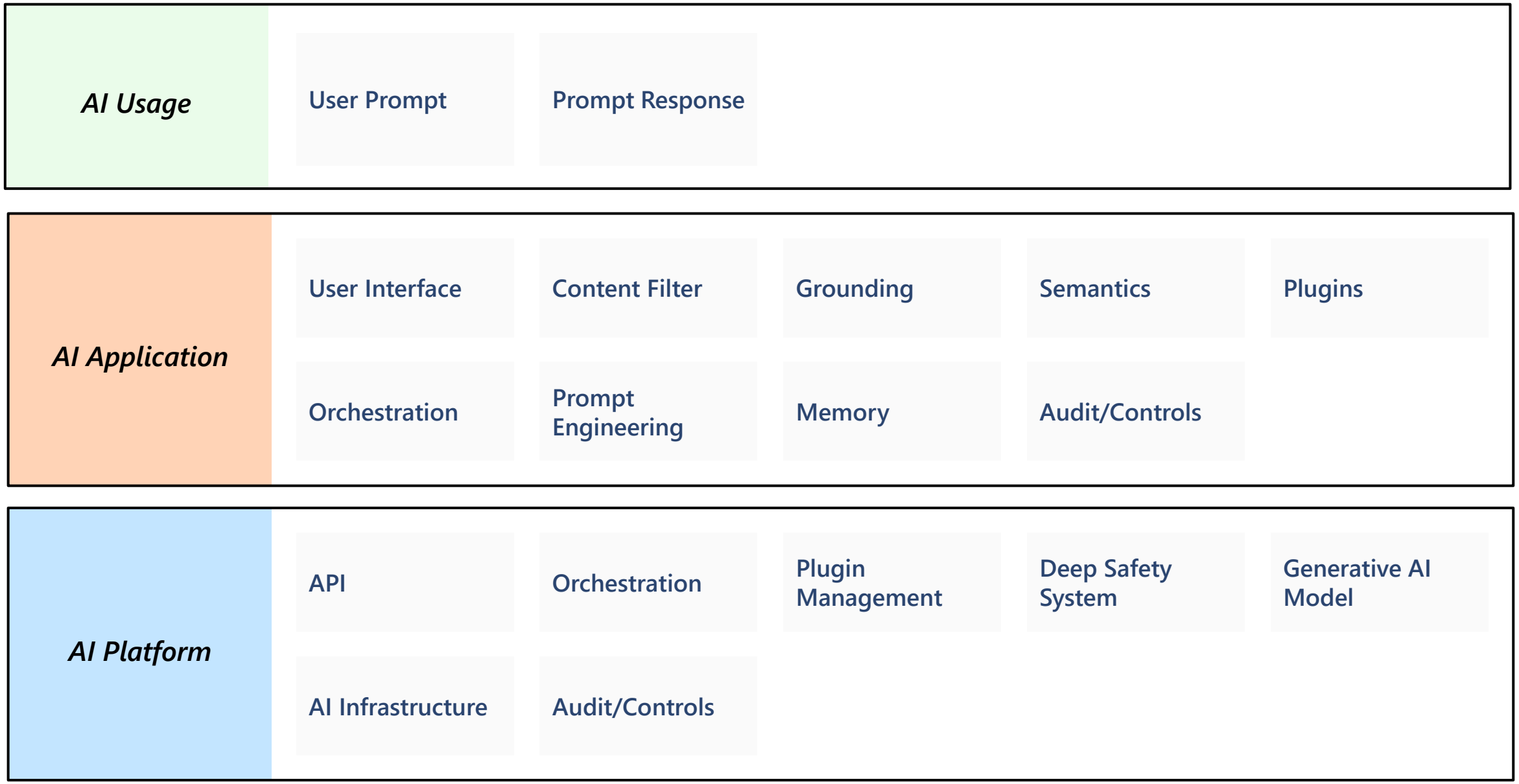
# Understanding AI architecture in a security context



# AI Architecture Overview

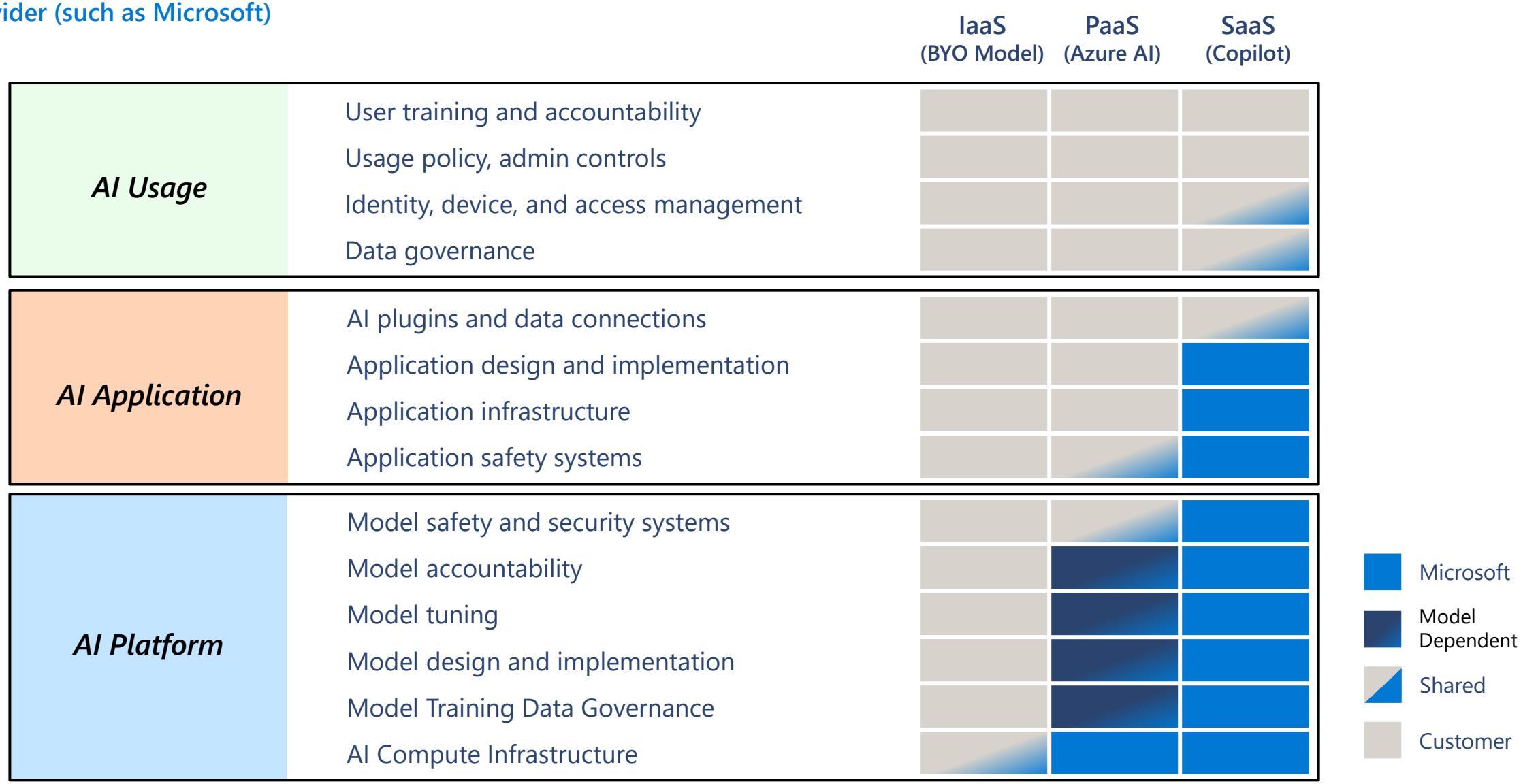
| | | |
|---|---|---|
| ***AI Usage*** | This layer focuses on the user interaction with the AI interface, either standalone or built into existing application UI. | **Current Examples:**<br>• Public Access (Bing Chat/ChatGPT/Bard)<br>• Code Development (GitHub Copilot)<br>• Microsoft Copilots (Office, Viva, Windows) |
| ***AI Application*** | Development of an AI-integrated application through secured software development practices (SDL). Additional plugins are enabled to provide specific functions and controls. | **Current Examples:**<br>• Microsoft development of Copilots<br>• Customers developing their own products<br>• 3rd party solution offerings running on Azure |
| ***AI Platform*** | Access to traditional and generative AI models to build your own AI-integrated solutions, running in your compliance boundary on secure and reliable cloud infrastructure. | **Current Examples:**<br>• Azure ML Model Catalogue (Hugging Face, Llama 2)<br>• Azure OpenAI Service (GPT4, ChatGPT, DALL-E) |

# Detailed AI architecture breakdown



# AI Shared Responsibility Model

Illustrates which responsibilities are typically performed by an organization and application developer and which are performed by their AI provider (such as Microsoft)



# AI Pain Points

## Integration

New technologies and design decisions introduce new risks and vulnerabilities.

User training needs to be adapted to the new capabilities of the AI solutions selected for use by the organization.

## Data & Privacy

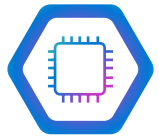
Sensitive data access and processing via AI systems creates new risks.

Transparency and control needs to be established and maintained through out the lifecycle.

## AI Supply Chain

Increased focus on potentially vulnerable or malicious code or 3rd party components.

Lack of compliance standards and rapidly developing best practices.



## Trusted AI

Very similar to the early days of BYOD: Employees likely already using GenAI to achieve their tasks.

Leaders must establish a trusted pathway to GenAI integrated applications to protect the organization.

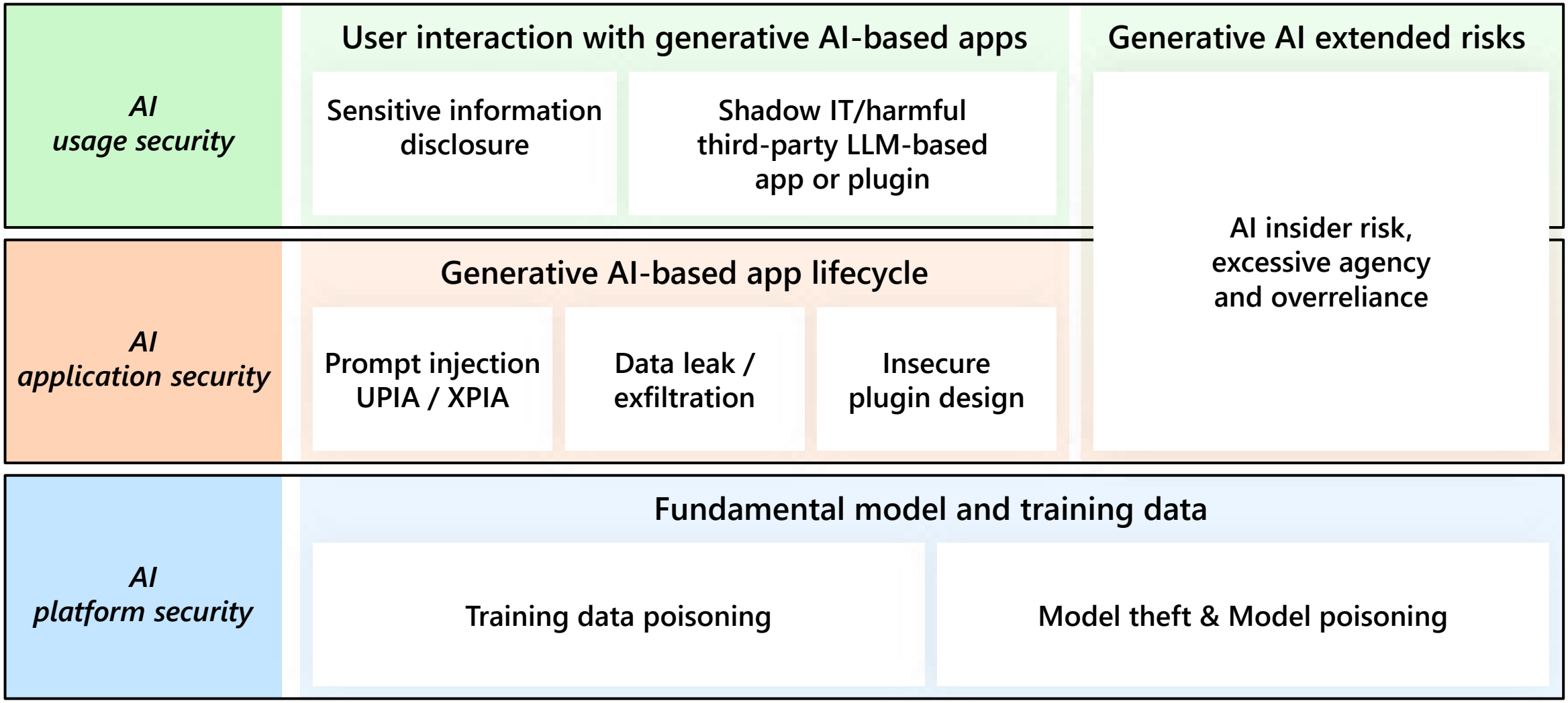
## The Unknowns

GenAI is new and brings unique challenges such as AI Hallucinations.

Exciting prospects of the potential, the ROI is not yet proven in real-world scenarios.

# The AI security threat landscape

# Generative AI threat map



## The cybersecurity bell curve

Basic security hygiene still protects against 98% of attacks[1]


### Enable multifactor authentication

Make it harder for bad actors to utilize stolen or phished credentials by enabling multifactor authentication. Always authenticate and authorize based on all available data points, including user identity, location, device health, service or workload, data classification, and anomalies.

### Apply least privilege access

Prevent attackers from spreading across the network by applying least privilege access principles, which limits user access with just-in-time and just-enough-access (JIT/JEA), risk-based adaptive polices, and data protection to help secure both data and productivity.

### Keep up to date

Mitigate the risk of software vulnerabilities by ensuring your organization's devices, infrastructure, and applications are kept up to date and correctly configured. Endpoint management solutions allow policies to be pushed to machines for correct configuration and ensure systems are running the latest versions.

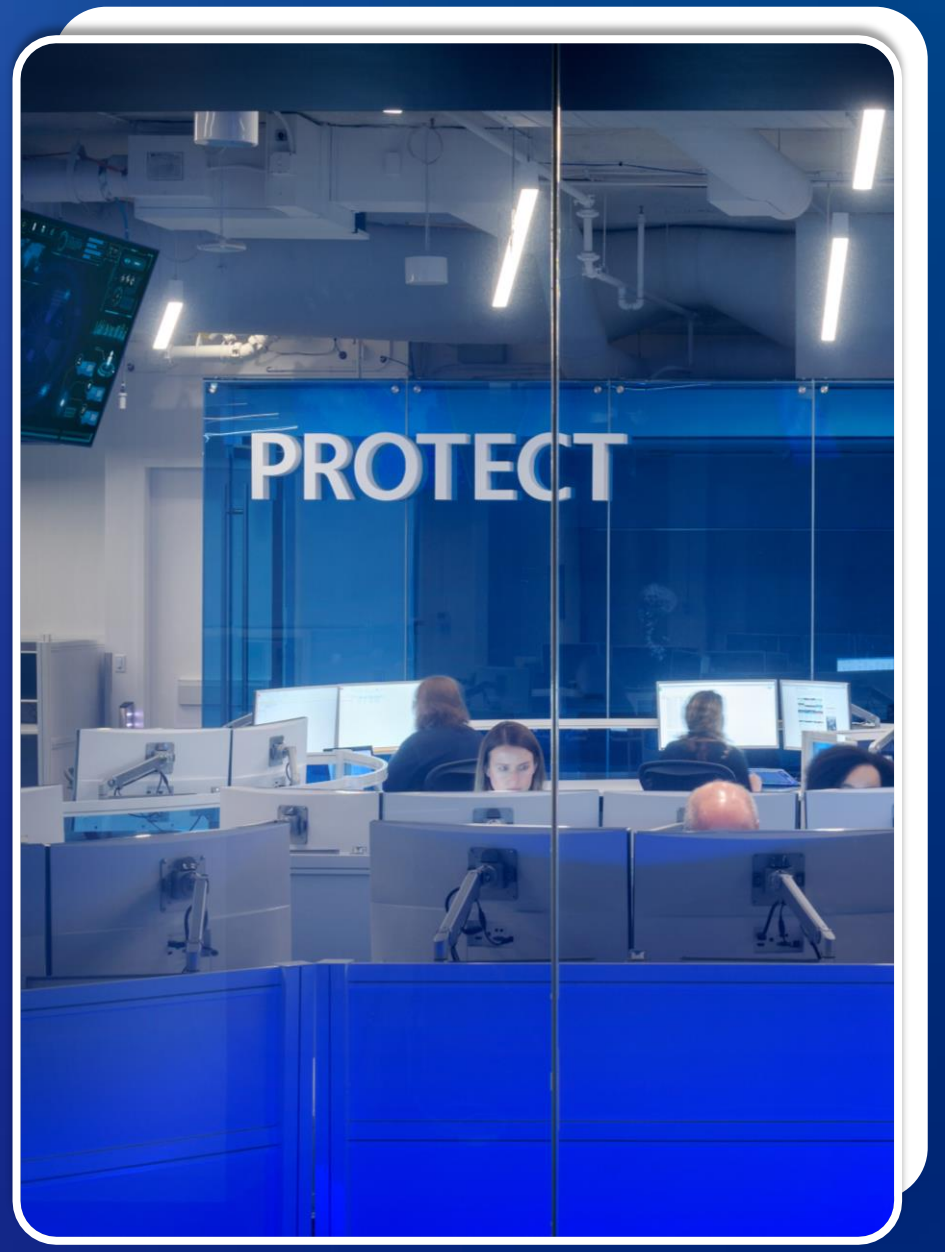
### Utilize antimalware

Stop malware attacks from executing by installing and enabling antimalware solutions on endpoints and devices. Utilize cloud-connected antimalware services for the most current and accurate detection capabilities.

### Protect data

Know where your sensitive data is stored and who has access. Implement information protection best practices such as applying sensitivity labels and data loss prevention policies. If a breach does occur, it's critical that security teams know where the most sensitive data is stored and accessed.

# How Microsoft secures AI platforms



# Building new principles for AI security

## Ensure your data is *your* data

Microsoft will not use customers data to train the foundational AI models, without explicit consent. Data governance is a shared responsibility.

**Customer:**

Protect your data as a top priority. Ensure it remains private and controlled, end to end.

## Be secure by design

The Microsoft AI stack is designed and built on decades of secure software practices, and a strong supply chain of partners, following mature SDL tools and processes.

**Customer:**

Ask for transparency in every AI system you connect to your data, for the whole AI supply chain.

## Secure by intention and in practice

Microsoft grounds its efforts to advance AI in strong principles that govern the technology's implementation and use: Positioning people at the center of the equation.

**Customer:**

Strong Zero Trust, and Data Governance programs will matter more than ever.

# How does Microsoft address risks from attackers?

Microsoft's Security Development Lifecycle

AI-specific impact assessments, threat modeling, internal compliance review

Security reviews of open-source AI libraries

AI-specific red teaming

# How does Microsoft address risks from the use or misuse of AI?

## Example: Overreliance

Using AI to justify a viewpoint or action

Assuming the AI must fair or accurate

AI doing something that the user can't meaningfully check.

User is simply too busy to check it carefully

## Microsoft Approach

Ground on authoritative data sources

Provide greater transparency and explainability

Design UX interfaces to mitigate overreliance

*Bing is powered by AI, so surprises and mistakes are possible.*

# How does Microsoft address risks from the use or misuse of AI?

## Example: Hostile Misuse

Hostile misuse  involves using AI system to intentionally to cause harm including circumventing safeguards.

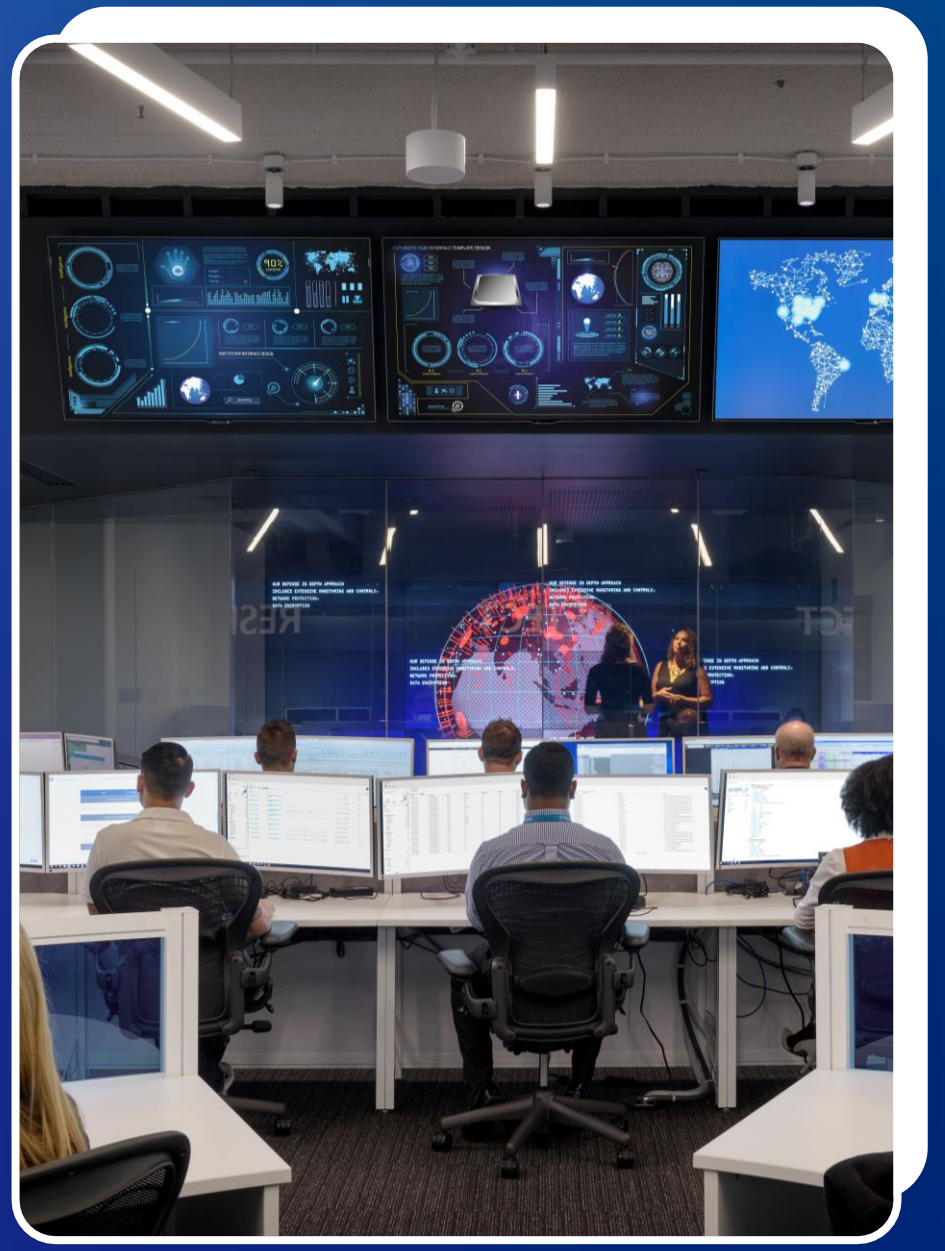
| | |
|---|---|
| **Generating malicious code** | **Asking instructions for harmful purposes** |

## Microsoft Approach

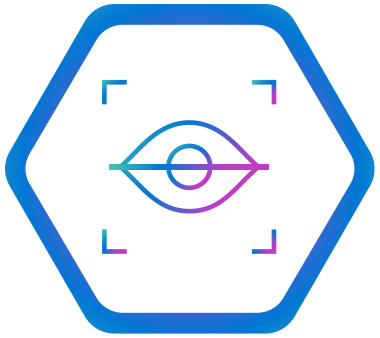
Microsoft has invested heavily in a defense in depth approach including a deep safety layer that provides security by default to disallow the AI to perform tasks that are harmful or dangerous to the user, intentionally deceptive, or likely to adversely affect the public interest

**Acceptable Use Policy governs AI usage**

# Microsoft's AI Red Teaming Approach



# Security Community view of Red Teaming

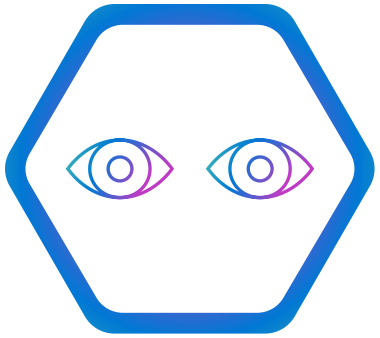


Double Blind

Emulate real world adversaries

Mature toolkit and processes

# RAI Community view of Red Teaming

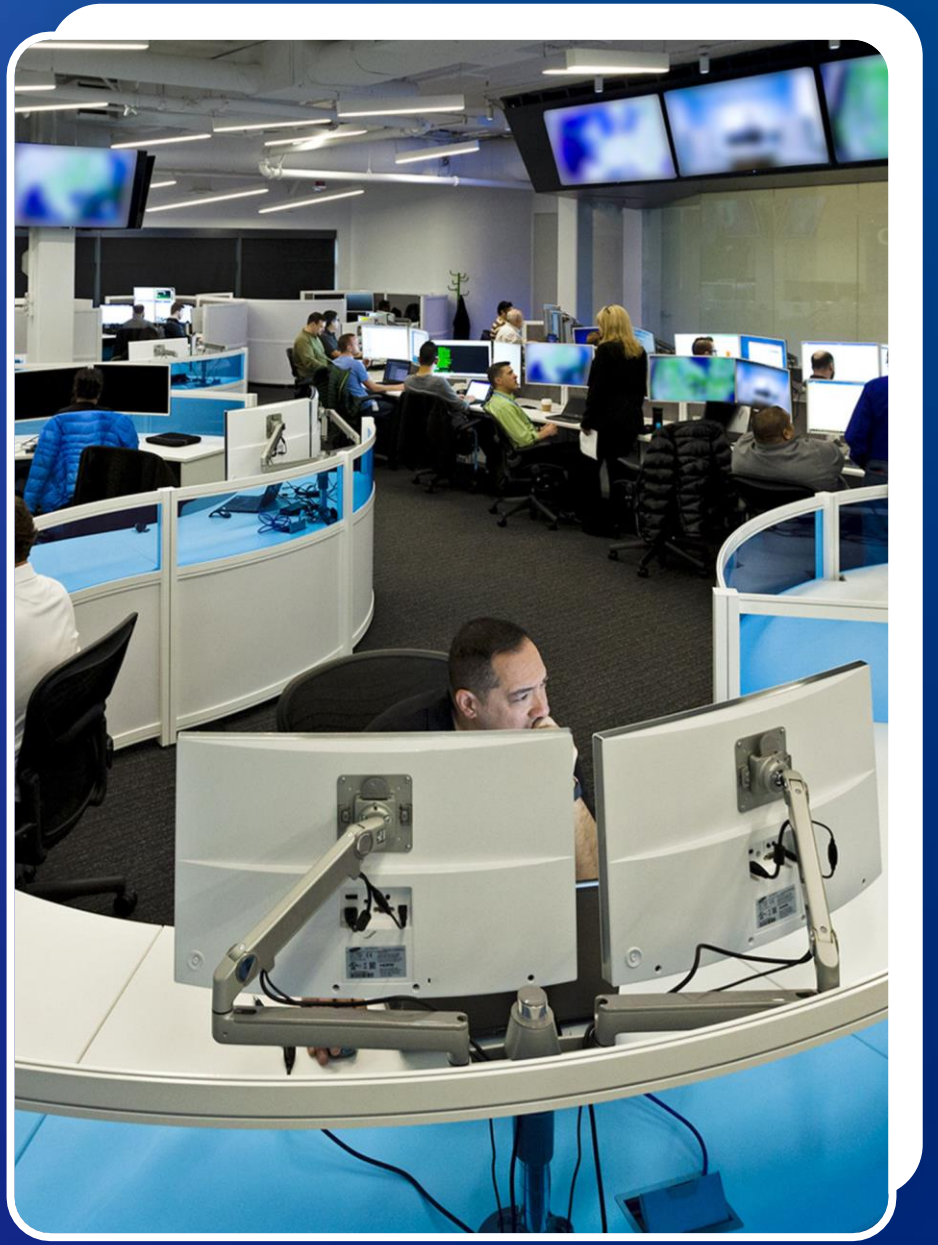


Generally single blind

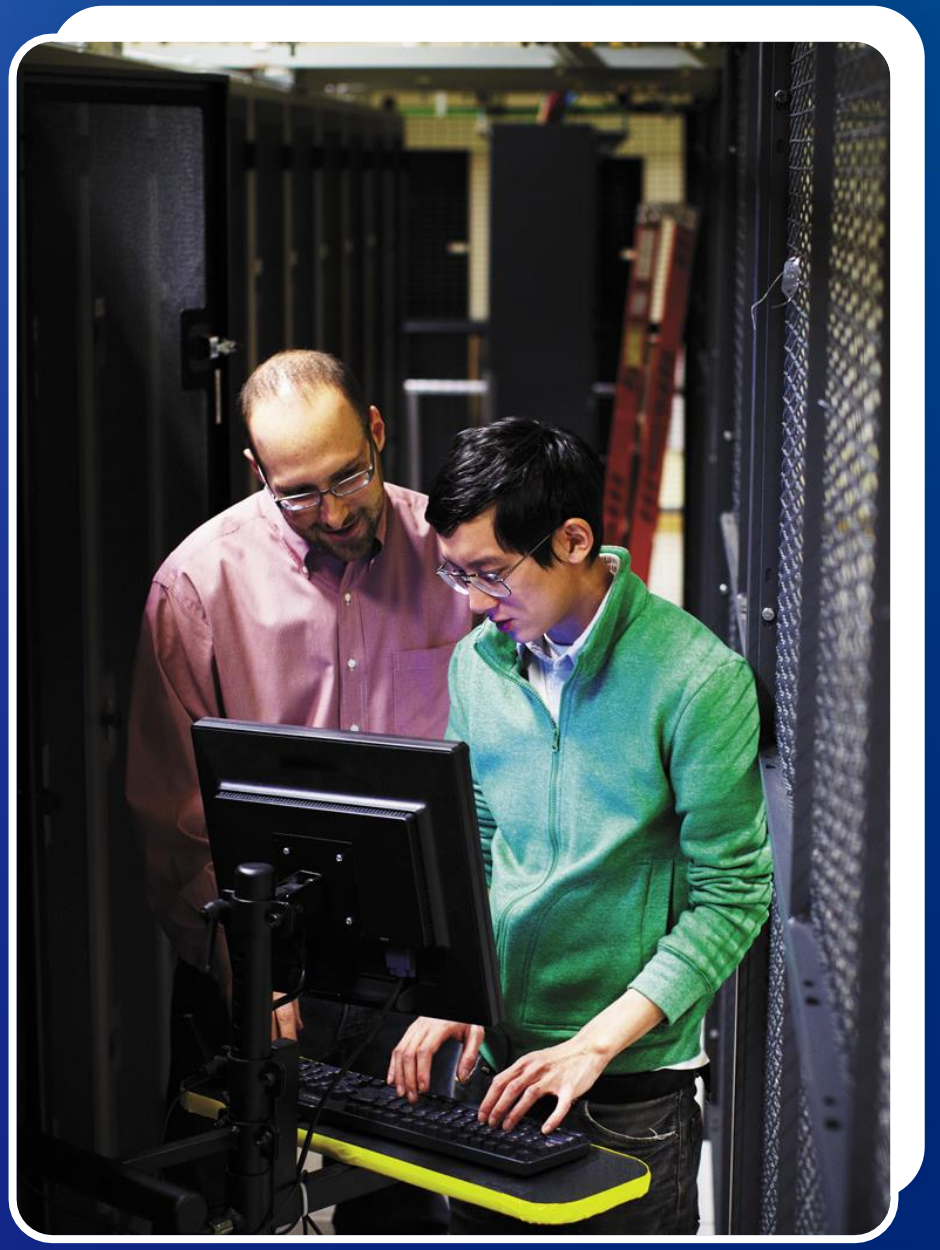
Adversarial and Benign

Rapidly Evolving Tools and processes

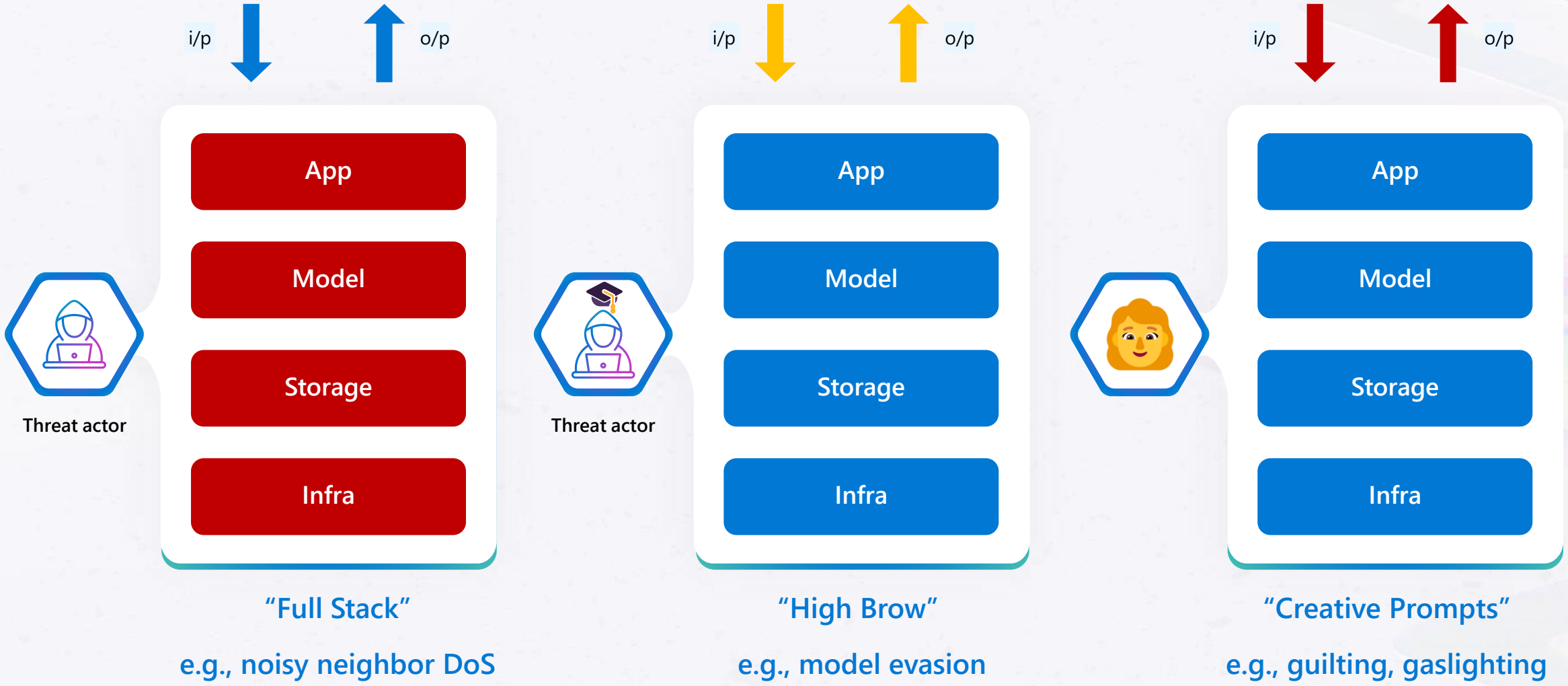
# AI Red Teaming combines the best of both worlds



# AI Red Team = Probing for Security + Responsible AI Harms



# Three Flavors of AI Red Teaming



# Three Flavors of AI Red Teaming

Threat Actor

## Full Stack

Focusing on the entire AI stack

Leveraging Traditional Security skills

Threat Actor

## High Brow

Focus only on the i/p and o/p

Leveraging Adversarial ML skills

## Creative Prompt

Focuses on the i/p and o/p

Leverages a broad skillset to cause failures

# AI-specific red teaming hardens the effectiveness of security protections

Expands the definition and scope for AI

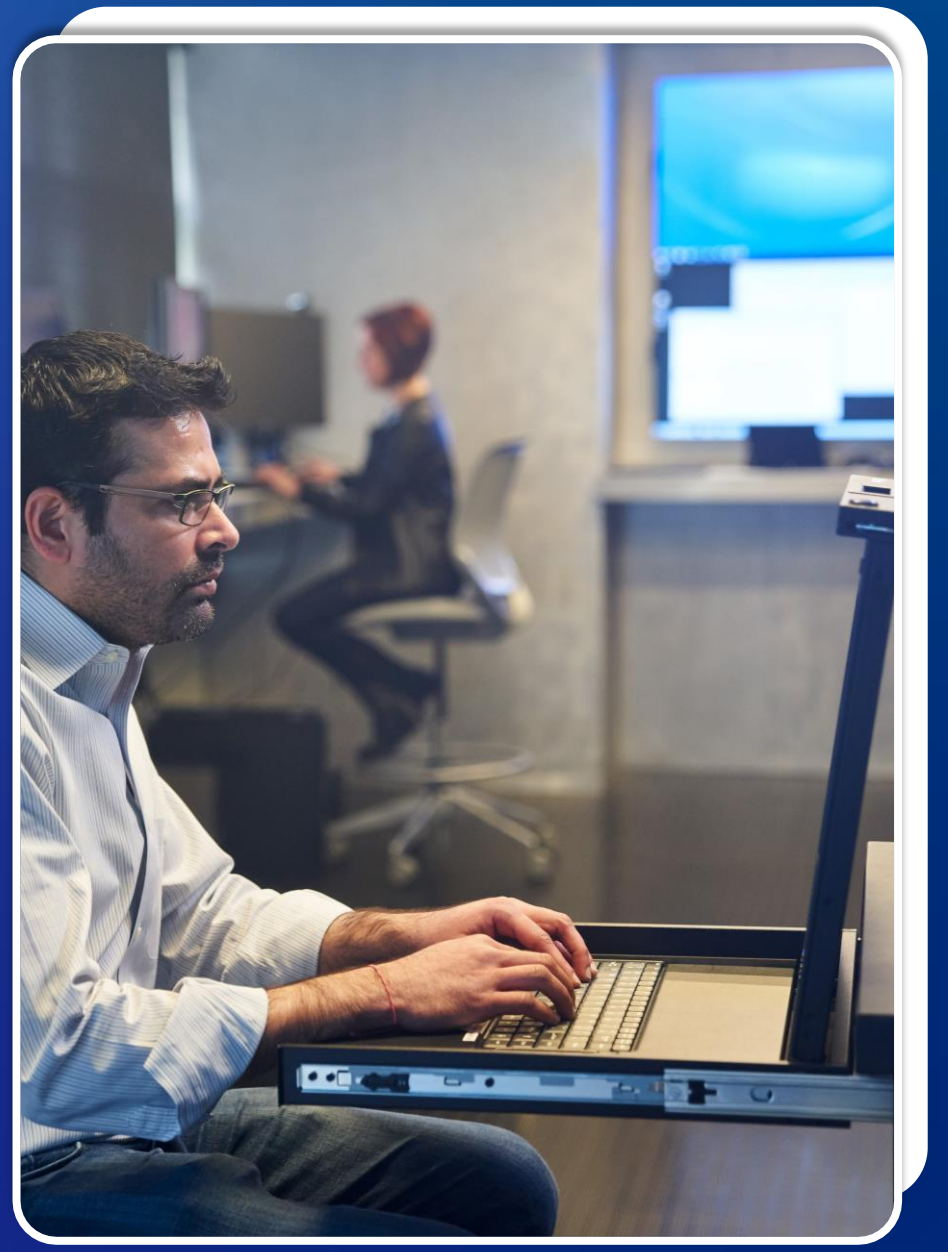
Focuses on failures from both malicious and benign personas

Recognizes that AI systems are constantly evolving

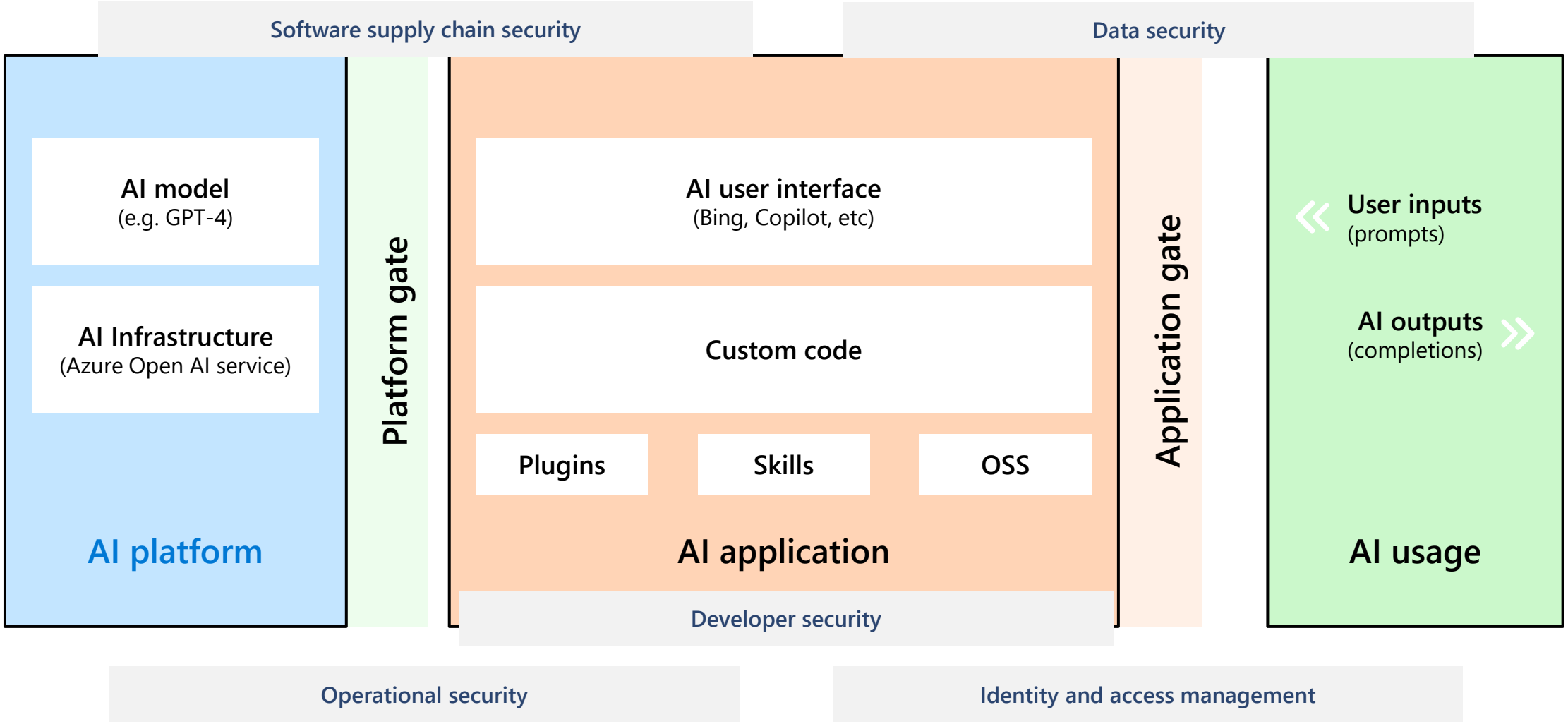
Learn More

https://www.microsoft.com/en-us/security/blog/2023/08/07/microsoft-ai-red-team-building-future-of-safer-ai/

# Security controls for developers building AI-enabled applications



# Security controls within AI systems



# Threat Modelling Scenarios

MSRC AI Bug Bar | OWASP Top 10 for ML | Generative AI Specific
MITRE ATLAS | OWASP Top 10 for LLM | Common Cyber Threats

## AI Usage

- Social Engineering
  - Phishing: Hyperlinks
  - Phishing: Documents
  - Poisoned Content
- AI Generated Malware
- Insider Risk (GenAI)
- Insider Risk (Customer)
- 9 Overreliance
- Data Loss Prevention
- Vulnerable Applications
- Compromised Endpoint
- Compromised Identity

## AI Application

### Command Injection 1

- Textual prompt from untrusted source
- Instructions that cause model to deviate from intended behavior

### Input Extraction

- Specially crafted input that causes the model to reveal (part of) another users' input to the attacker
- Extract or reconstruct other users' inputs to the model

### Prompt Extraction

- Specially crafted prompt to cause the model to output (part of) its system prompt
- Extract or reconstruct the system prompt provided to the model

### 9 Output Integrity Attack 2

- Modify or manipulate the output of AI model to change behavior or cause harm.
- Tampering with the outputs to provide different results to the user

- Code Design / Implementation 6 7 8
- AI Supply Chain (inc. SSCS) 5

## AI Platform

### Input Perturbation 1

- Modifying valid inputs to cause the model to produce incorrect outputs
- May cause misclassification of the input by the model

SAI
- Adversarial suffixes 6
- Meta Prompt Extraction
- Guardrail Escape (30 chat limit) 6

RAI
- AI Hallucination
- Model Bias

- Distributed Denial of Service (DDoS) 4
- Insider Risk (Service Provider) 10
- Hosting Platform Architecture 6

### Model/Data Poisoning 2 3 7 8 3

- Model tampering through architecture, training code/data, or hyperparameters

### Membership Inference 4

- Infer whether specific data records or groups of records were part of the models training data

### Attribute Inference

- Infer sensitive attributes of one or more records that were part of the training data

### Training Data Reconstruction

- Reconstruct individual data records from the training dataset

### Property Inference

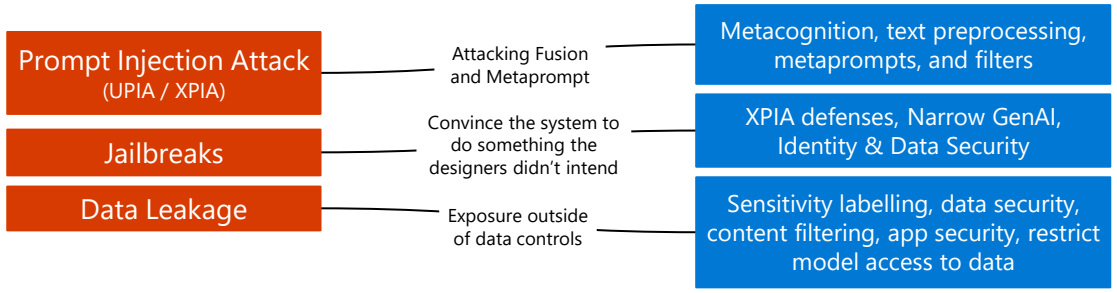
- Infer sensitive properties about the training dataset

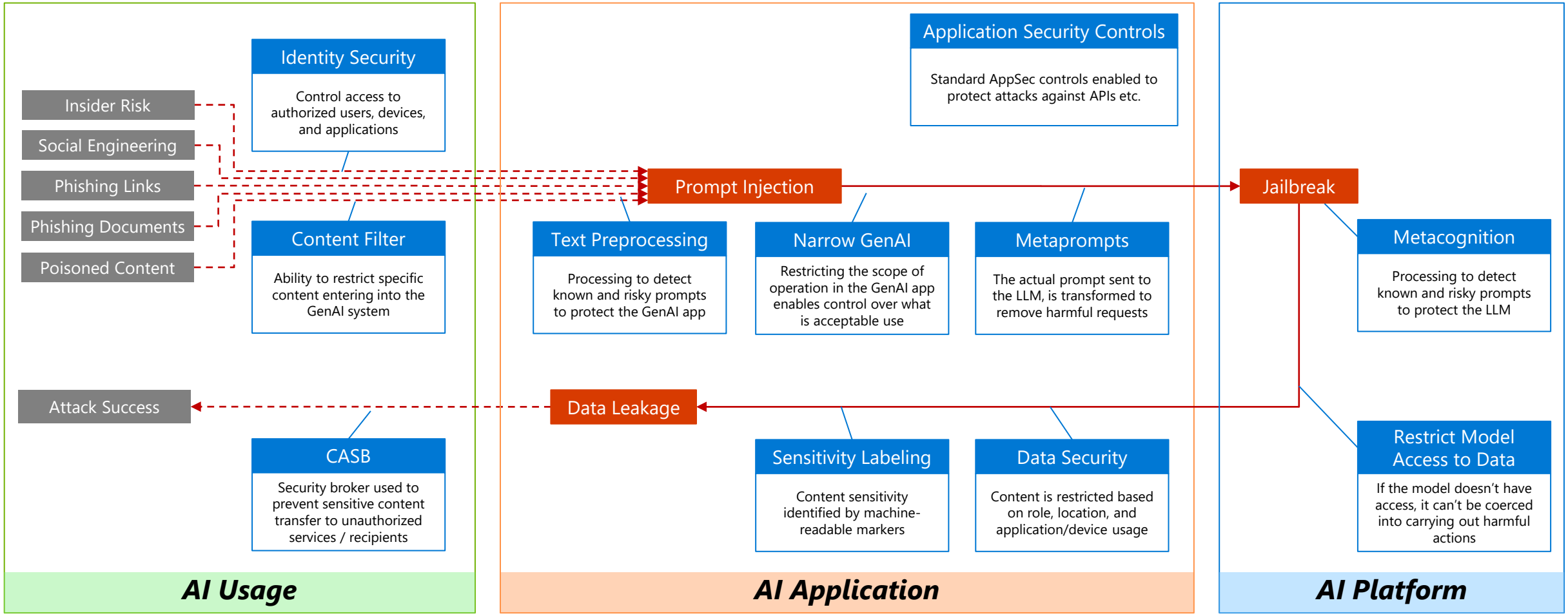
### Model Stealing 5 10

- Infer/extract the architecture or weights of the trained model

# Threat Mapping Template

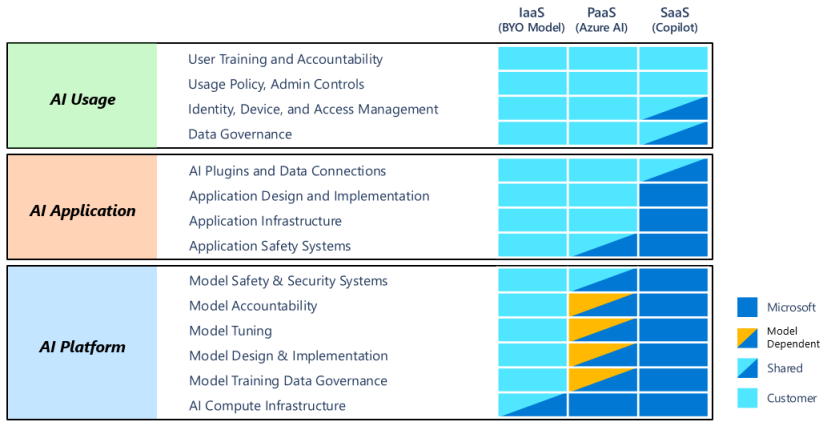
## This framework provides a repeatable method of articulating both the vulnerabilities (red) and the mitigations (blue)



# End-to-End Secure AI

## SaaS (Copilot)




| | |
|---|---|
| User Training | Customer needs to update their internal training to help users become productive with AI |
| Accountability | The user needs to remain accountable for the input and use of the output with AI |
| AI Acceptable Use Policy | Developing an AI Acceptable Use Policy is important for the identification of bad behavior |
| Administrative Controls | Configuration must be secure by default, with clear guidance to administrators for changes |
| Identity & Access Management | Built-in capabilities ensure customers can enable high-security controls |
| Data Governance | Copilot solutions honor the data governance of the existing solution they are created for |

***AI Usage***

| | |
|---|---|
| AI Plugins | Extending functionality via plugins must be carefully considered to protect integrity |
| Data Connectors | Internal and external data connectors must be carefully considered to protect data |
| Application Design & Implementation | Copilot solutions are developed following strict SDL governance with a deployment safety review board and AI Red Team |
| Application Infrastructure | Copilot solutions are made highly available, secure, and monitored from code to cloud |
| Application Safety Systems | Copilot specific safety systems are used to add additional layers of defense for AI |

***AI Application***

| | |
|---|---|
| Model Safety & Security Systems | The copilot inherits the safety and security systems built to protect the LLM |
| Model Accountability | Microsoft offers the pre-trained LLM capabilities as a private hosting |
| Model Tuning | For copilot solutions, models are not tuned, instead we use semantics and grounding |
| Model Design & Implementation | Microsoft builds, implements, and support the entire copilot stack end to end |
| Model Training Data Governance | Copilot runs on pre-trained LLM. Microsoft does not access the model or training data. |
| AI Compute Infrastructure | Azure has the largest … (GPUs?) |

***AI Platform***

# Wrap up

# Security for AI is an ever-evolving process

## Develop

Continually evolving secure by design and by default requirements

## Test

Continual assessment and AI-specific red teaming

## Monitor/Respond

Analyze 65T+ threat signals, respond to incidents

## Evolve

Learn, share, collaborate

# Further reading

- [Microsoft Security Copilot documentation | Microsoft Learn]
- [AI shared responsibility model – Microsoft Azure | Microsoft Learn]
- [Best practices for AI security risk management | Microsoft Security Blog]
- [Microsoft Cybersecurity Reference Architectures (MCRA) – Security documentation | Microsoft Learn]

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