GitHub Copilot - Part 2

By RaKeTe-Technology

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Agenda

1. Quick Recap
2. Technology Stack
3. Key Components & Copilot Pricing
4. Commercial Aspects
5. Considerations & Limitations
6. Responsibilities
7. Policy
8. Privacy, Data Protection & Security
9. Comparison / Alternatives
10. Next Steps
11. Q&A

AI helps across the entire software development lifecycle

1. Code faster with code suggestions
2. Migrate code
3. Faster bug finding and fixing
4. Generate unit test cases
5. Sys admin scripting
6. Code to doc, doc to code

Build

Test

Deploy

GitHub Copilot lets developers focus on what matters most

More time on

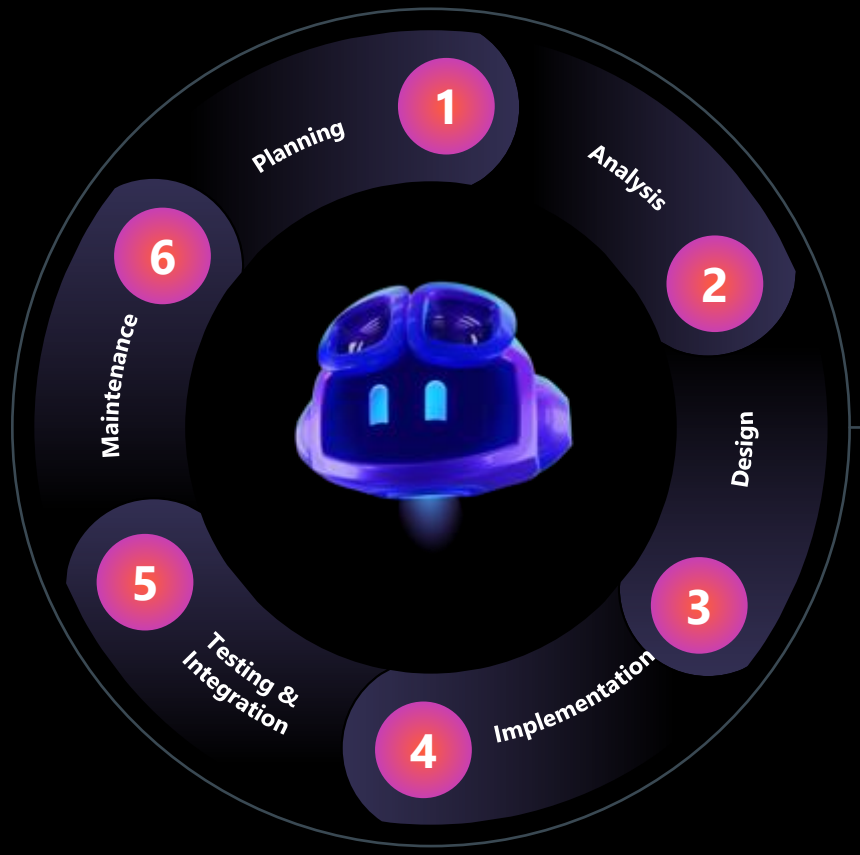
- Designing
- Brainstorming
- Collaborating
- Iterating
- Planning

Less time on

- Writing tests, repetitive code, and boilerplate
- Debugging
- Searching documentation
- Finding vulnerabilities
- Deciphering existing code
- Correcting syntax
- Summarizing changes and comments
- Learning GitHub commands

GitHub Copilot

Leading the AI Revolution in Developer Experience



AI Assistant for entire SDLC

Personalized

Tailored to your organization

AI-native

Accelerates workflows

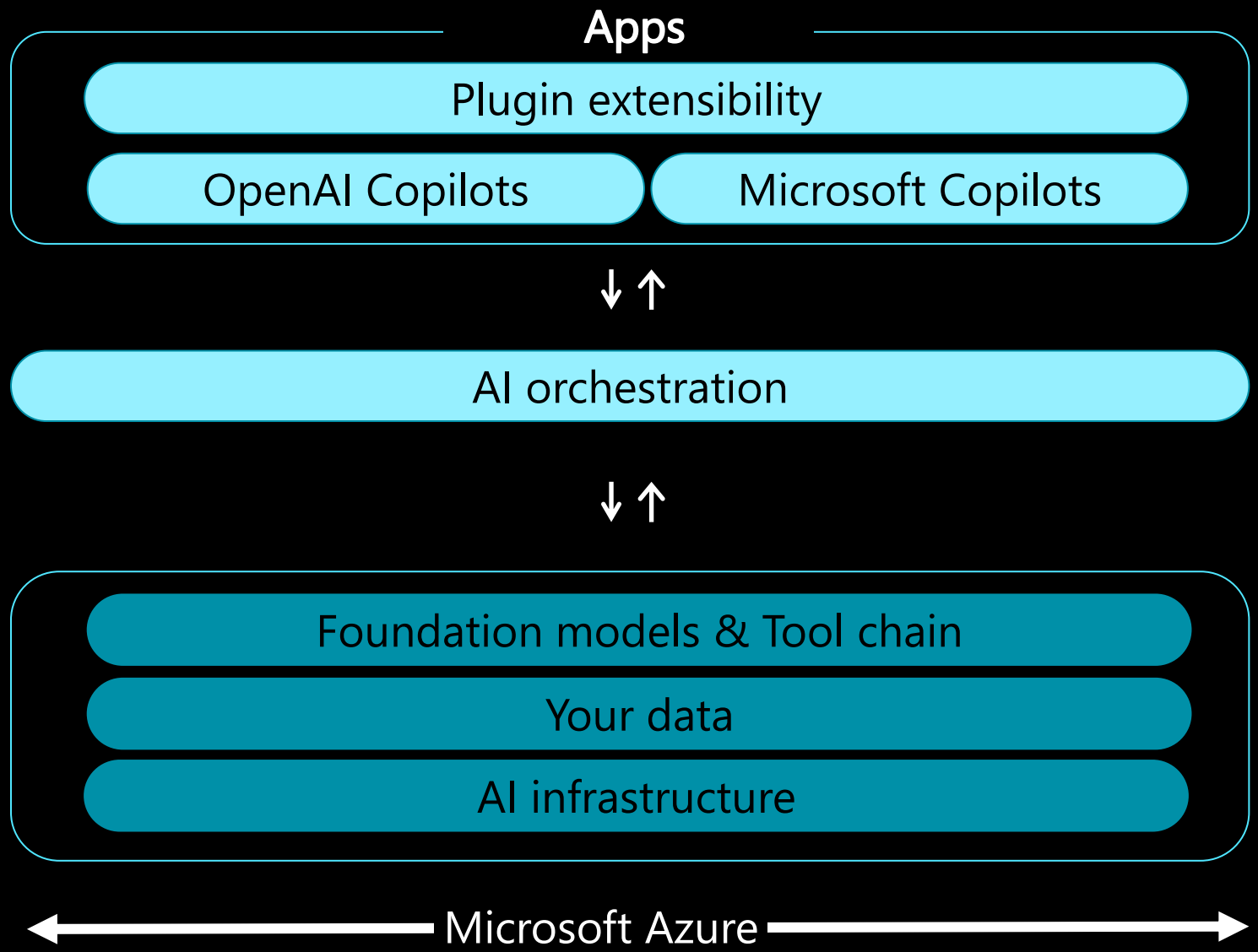
Ubiquitous

Across every tool

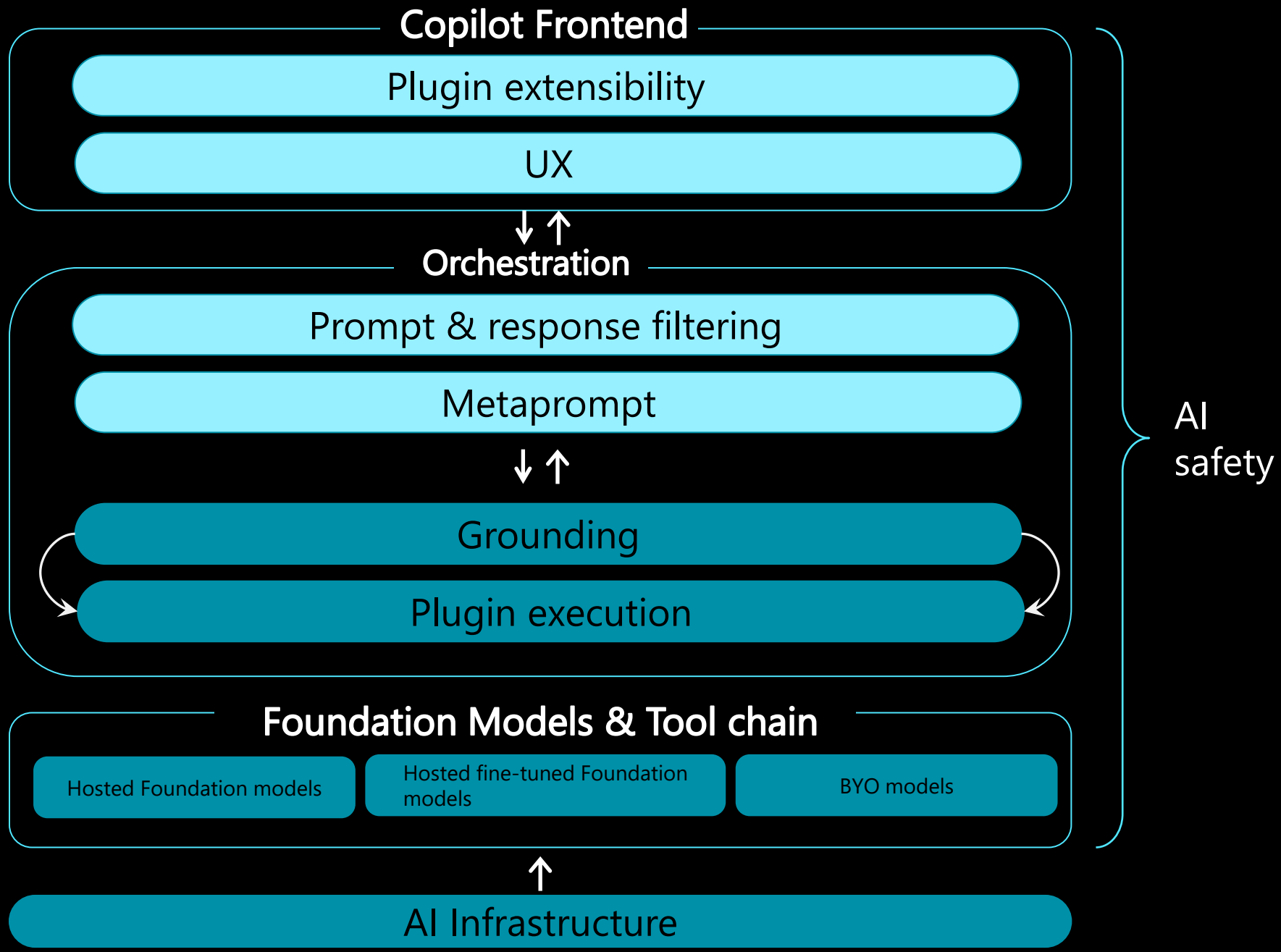
Enterprise-grade

Scalable, secure and enterprise-ready

Copilot stack



Copilot stack

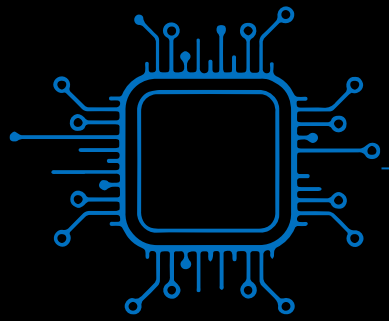


Quick Recap

OpenAI + GitHub

Don't fly solo.

OpenAI Codex Model



Public code and text on the internet

Codex

GitHub

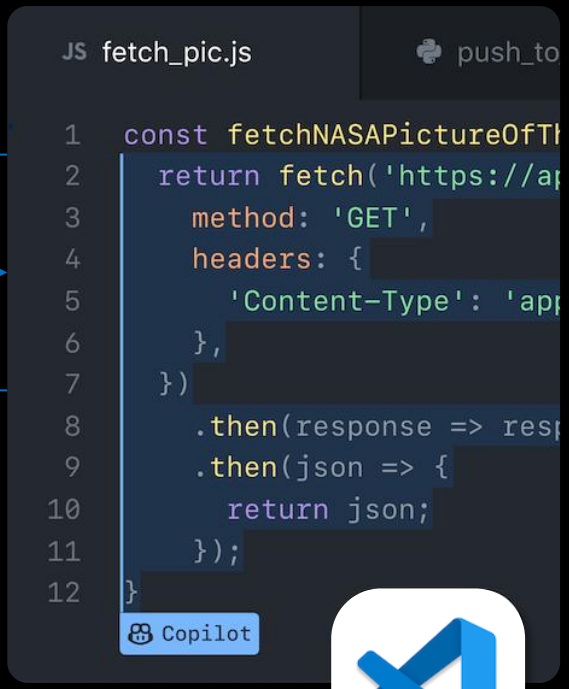
GitHub Copilot Service

Provide editor context

Provide suggestions

Improve suggestions

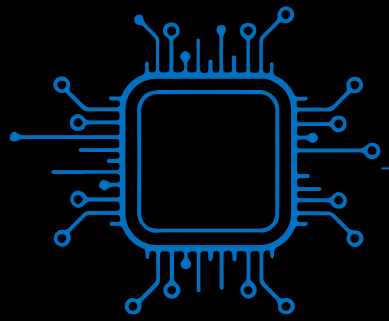
Private code



OpenAI + GitHub + [Enterprise]

Don't fly solo.

OpenAI Codex Model



Private code and Context from GitHub Enterprise Repos

GitHub

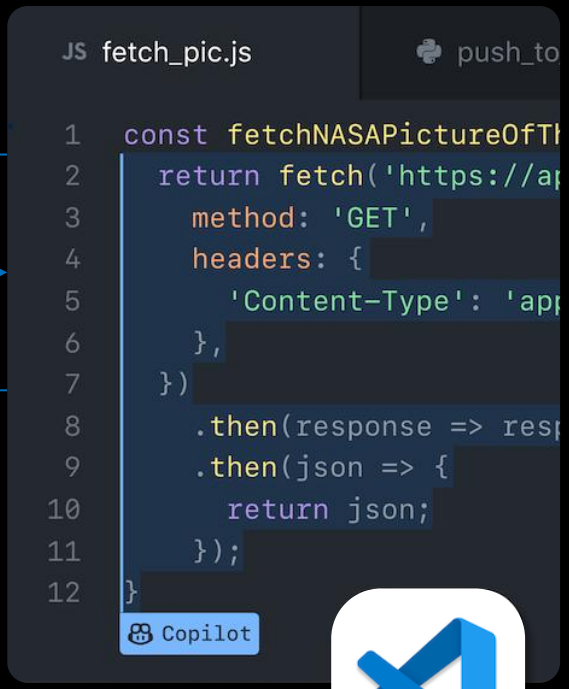
GitHub Copilot Service

Provide editor context

Provide suggestions

Improve suggestions

Private code



GitHub Chat Execution Modes =

Mode	Tasks	Purpose
Ask	• Ask questions • get explanations, suggestions related to code, repositories , • programming concepts.	For learning or resolving specific queries without directly modifying your code.
Edit	• Providing suggestions • performs actions to edit • refactor code	Improving or modifying the code directly based current input, aka optimizing functions or fixing bugs.
Agent	Assistant for more complex tasks, such as automating workflows, running commands, or integrating tools.	Beyond editing or answering questions. Involves executing multistep processes Using external integrations: @Azure

Copilot Licenses per User per Month

Individuals

Organizations

Free
$0 USD

- 50 agent mode or chat requests per month
- 2,000 completions per month
- Access to Claude 3.5 Sonnet, GPT-4o, and more

Pro
$10 USD

Everything in Free +

- Unlimited agent mode and chats with GPT-4o
- Unlimited code completions
- Access to code review, Claude 3.7 Sonnet, o1, and more
- 6x more premium requests to use latest models than Free, with the option to buy more

Pro+
$39

- Everything in Pro +
- Access to all models, including GPT-4.5
- 30x more premium requests to use latest models than Free, with the option to buy more

Business
$19 USD

Everything in Pro +

- User management and usage metrics
- IP indemnity and data privacy

Enterprise
$39

- Everything in Business +
- Everything in Pro+

Functionality by Copilot Service

Copilot Licenses	Free	Pro	Pro+	Business	Enterprise
Pricing	$ 0	$10 USD per month $100 USD per year	$39 USD per user per month	$19 USD per user per month	$39 USD per user per month
Types of GitHub accounts	Personal	Personal	Personal	Organization or enterprise accounts	Enterprise accounts on GitHub Enterprise Cloud
Chat in-line, IDE, CLI	√	√	√	√	√
Premium requests, Agent Mode	≤ 50 / month	≤ 300 / month	≤ 1500 / month	≤ 300 / month	≤ 1000 / month
Chat skills in IDE	X	√	√	√	√
Copilot pull request summaries	X	√	√	√	√
Increased Model rate limit	X	X	√	√	√
Exclude specific files	X	X	√	√	√
Organization-wide policy management	X	X	√	√	√
Audit logs	X	X	√	√	√
Coding guidelines, custom instruction	X	X	X	X	√
Copilot knowledgebase	X	X	X	X	√
Best Model available	GTP-4.1, o3-mini	Free+: Claude 3.7, Gemini 2.5 Pro, o1, o4-mini	Pro+: GTP-4.5, o3	Pro+ minus: GTP -4.5, o3	Same as Copilot Pro+

Copilot Billing

Copilot is billed via

- Credit card
- PayPal

Copilot for Organizations

- Via linked Azure Subscription, monthly billing by users

Copilot Cost

Copilot Cost depend on

- Model in charge for the task
- Amount of context to be processed
- Complexity of operation
  - Deep reasoning task takes more tokens as a completion task
  - Larger models cost more than mini models os self-hosted models

Model suggestions

- **Balance** between cost and performance
  - GPT-4.1
  - Claude 3.7 Sonnet
- **Fast**, low-cost support for basic tasks
  - o4-mini
  - Claude 3.5 Sonnet
- **Deep reasoning** or complex coding challenges
  - o3, GPT-4.5,
  - Claude 3.7 Sonnet
- **Multimodal** inputs and real-time performance
  - Gemini 2.0 Flash
  - GPT-4o

New GitHub Advanced Security capabilities

Help customers reduce security debt

GitHub Copilot Autofix

Security Campaigns

Copilot Autofix for Code Scanning Partner Tools

GitHub Platform

A single integrated enterprise-ready platform

Industry-best collaborative tools for developers

Security at every step of the workflow

Powered by AI

GitHub Enterprise Cloud

Multi-tenant, enterprise SaaS deployment option for GitHub, running on Microsoft Azure

- Self-provision from Azure Portal
- Enterprise Managed Users (EMU) configuration option
- Powered by Azure for advanced security, business continuity, and disaster recovery features
- GitHub Enterprise Cloud with data residency available in the US and EU**

**More regions coming soon

What is GitHub Enterprise? - Different account plans from Free to Enterprise, with GitHub Enterprise representing the most complete feature set*

GitHub

Personal accounts

- **GitHub Free**: Unlimited number of public and private repositories and free use of organizations. Limited feature set for private repositories. No GitHub support
- **GitHub Pro**: Extends GitHub Free to full feature set for private repositories. GitHub support via email

Organization accounts

- **GitHub Free for organizations:** Extends GitHub Free to unlimited collaborators on unlimited public repos with full feature set, or private repos with limited feature set. No GitHub support
- **GitHub Team:** Extends feature set of GitHub Free for organizations. GitHub support via email

Enterprise accounts

- **GitHub Enterprise Cloud:** Cloud-hosted deployment, part of GitHub.com
- **GitHub Enterprise Server:** Self-hosted deployment

Both extend GitHub Team to additional security/compliance & deployment controls, SAML single sign-on & identity provider support. Option to centrally manage policy and billing for multiple GitHub.com organizations with an enterprise account. GitHub Enterprise support

* See https://docs.github.com/en/get-started/learning-about-github/githubs-plans for up-to-date accounnt plan details.

GitHub Enterprise licensing - Distinction between unit-based licensing (seats/committers), metered licensing (GitHub Copilot) and metered consumption such as GitHub Actions

GitHub Enterprise billing model

Unit licensing

- Applies to the following services:
  - **GitHub Enterprise** (per seat)
  - **GitHub Advanced Security** (per active committer in last 90 days)
- Discounts with central GitHub Enterprise environment (only)
- Seat-based licenses, quarterly billing

Metered licensing

- Applies to the following services:
  -**GitHub Copilot***
- **Assigned/Unassigned flexibly** by GitHub org owners („in-app“)
- Azure subscription-based, monthly billing **on Enterprise Account-level****

Metered consumption

- Applies to the following services:
  -**GitHub Actions**
  -Codespaces
  -Packages
  -Storage for Actions and Packages
  -Git LFS (Large File Storage)
- Azure subscription-based, monthly billing **on Enterprise Account-level****

* Currently centrally sponsored for testing purposes only. In-company charging to start in 2024.
** Support for Azure subscriptions on GitHub org-level on GitHub since mid 2024.

Pricing

- **GitHub Offerings at** Microsoft Product Terms **and** GitHub's plans - GitHub Docs
- **For GitHub Codepilot for Business an Agreement must be in place:**
  - **Enterprise Agreement** Enterprise Agreement | Microsoft Volume Licensing
  - **Microsoft Customer Agreement** Licensing Documents (microsoft.com)
- GitHub Copilot Business, $19 USD per user per month.
- GitHub Copilot Enterprise, $39 USD per user per month.
- A connected Azure subscription by your organization or enterprise account will enable metered billing via Azure
- About billing for GitHub Copilot - GitHub Docs
- Watch out: Upgrading from Business to Enterprise may upgrade all seats!
- GitHub Advanced Security licenses About billing for GitHub Advanced Security - GitHub Docs

Limitations

Quality of Generated Code

While Copilot is impressive, it doesn't always produce code that adheres to best practices. For instance, in JavaScript, it might generate var and == instead of const and ===, which can lead to subtle bugs and shadowing[1].

Biased Language and Libraries

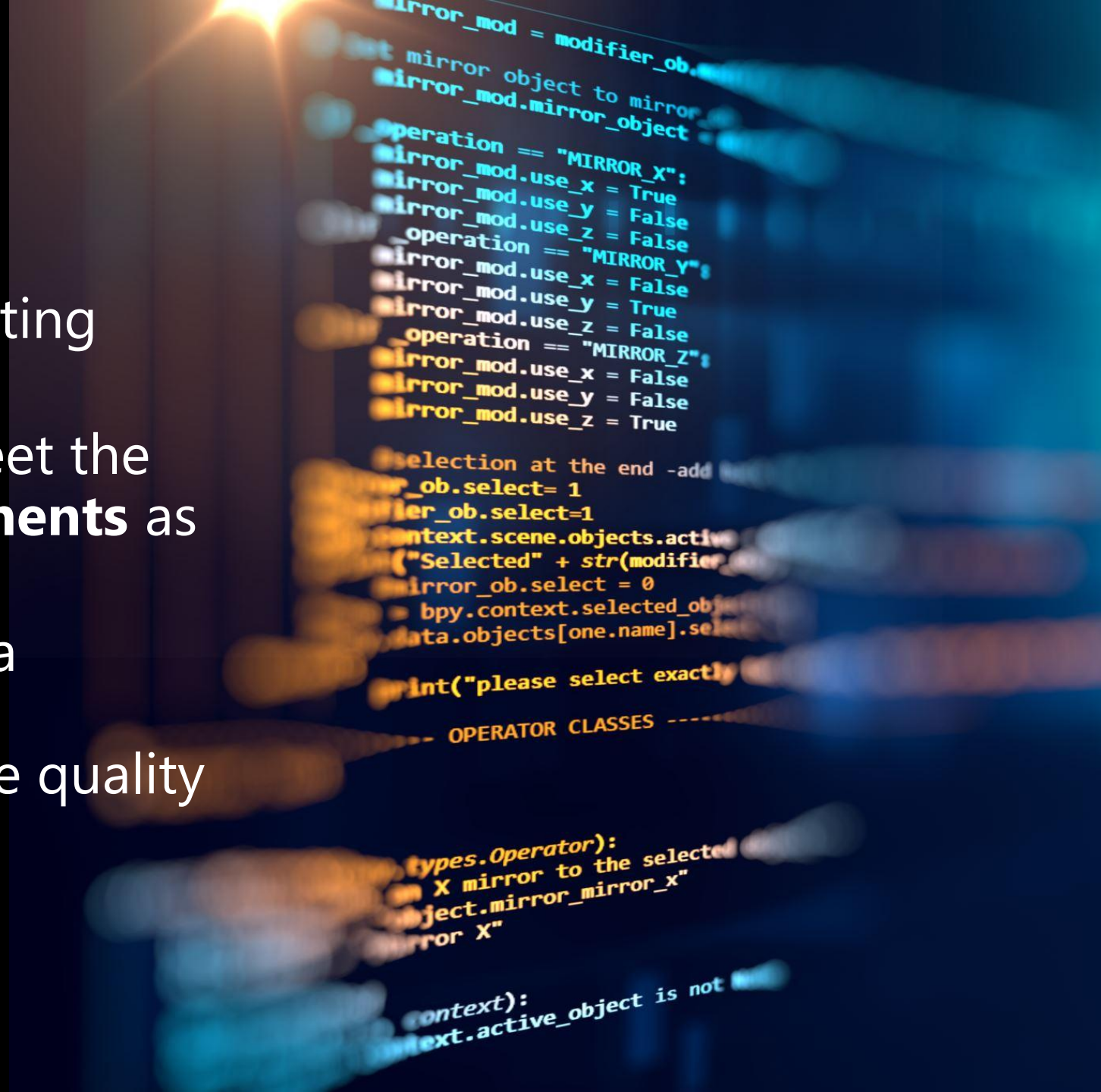
Copilot tends to favor certain libraries or frameworks. For example, in Python, it heavily leans toward using SQLAlchemy, which may not align with your preferred stack[2].

Single Context

You can only provide one piece of context when asking Copilot a question. This limitation can impact its ability to generate accurate code when dealing with complex scenarios[2].

Responsibilities

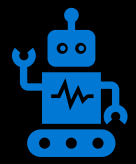
- Developers are taking full **responsibility** for implementing suggestions.
- The proposed code must meet the same strict **quality requirements** as **self-written** code.
- **Understanding** the code is a fundamental prerequisite to ensuring the highest possible quality and safety



Policy Framework - I

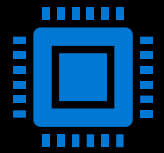
Purpose

Ensure importance of maintaining data security and code integrity when using AI tools



Scope

All developers using generative AI tools, should be aware of their responsibilities and the boundaries of the policy.



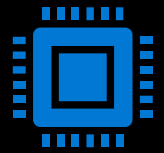
Responsible use

Developers are accountable for the code generated with AI and must adhere to existing coding standards and practices.

Intellectual property (IP)

Compliance with intellectual property laws and internal policies

Policy Framework - II



Output validation

Developers must ensure code adheres to the company’s standards, doesn't introduce security risks, and aligns with project requirements, just like manually written code.

Monitoring

Developers should track the quality of the code produced and impact on productivity by addressing issues or limitations.

Documentation

Should cover the user, purpose, and manner of usage, to aid in tracking effectiveness and ensuring compliance with the policy.

Training

Understanding the tool's capabilities, limitations, and the principles of in the policy, ensuring competent and responsible usage.

Policy Framework - III

- Policy review
  - Regular reviews and updates to the policy are necessary to adapt to evolving technologies and coding practices.
  - It's also important to communicate this to the employees.
- Governance and policy set the groundwork for fostering adoption of AI tooling!

Source: Empower developers with AI policy and governance - GitHub Resources

Handle Connections Gracefully

Here: Python + SQL Server

- **Close Connections**: Only establish connections when necessary and close them promptly after use. Leverage connection pooling for efficiency.
- **Exception Handling**: Implement proper exception handling to gracefully handle connection errors.
- **Example (Python)**:
- ```
  import pyodbc
  def execute_sql(query):
      try:
          conn = pyodbc.connect("your_connection_string_here")
          cursor = conn.cursor()
          cursor.execute(query)
          result = cursor.fetchall()
          return result
      except pyodbc.Error as e:
          print(f"Error executing query: {e}")
      finally:
          conn.close()
  # Example usage
  query = "SELECT * FROM Sales.Orders WHERE OrderDate >= '2024-04-03'"
  results = execute_sql(query)
  ```
  ```

Privacy, Data Protection, Security and IP Protection

A. GitHub Copilot sends an encrypted prompt from Customer to GitHub to provide suggestions. Except as detailed below, Prompts are transmitted only to generate these suggestions in real-time, are deleted once the suggestions are generated, and are not used for any other purpose. Prompts are encrypted during transit and are not stored at rest without your permission.

B. Your Prompts are retained by GitHub in the following circumstances:

   A. CLI and Other Tools. If you use GitHub Copilot tools that operate outside of your code editor, such as Copilot for the Command Line Interface, GitHub Copilot retains your Prompts to those tools to provide the service.

   B. Private Language Models. If you have requested a customized private language model, GitHub Copilot retains your Prompts to fine-tune your private model.

   C. Customization. If you have customized GitHub Copilot to use alternative data handling, such as enabling interaction with third party extensions, GitHub Copilot will retain your Prompts based on that customization.

C. More Information. More detailed information on how data is processed by GitHub Copilot is in the GitHub Privacy Statement available at https://gh.io/privacy

Privacy: Data being collected

- Prompts
  - Bundle of contextual information Copilot sends when working on a file, Copilot pane is opened.
  - Prompts are retained unless you have disabled code **snippet collection** in settings.
- Suggestions
  - Lines of proposed text returned to Copilot after a Prompt is processed.
  - Suggestions are retained unless code snippet collection is disable in settings.

Source: About GitHub Copilot Individual - GitHub Enterprise Cloud Docs

IP Protection

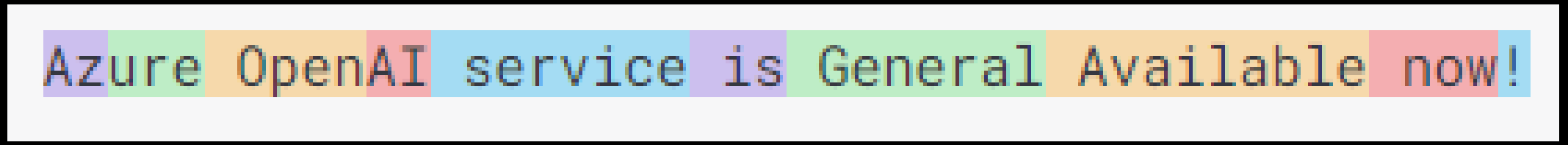
- **Defense of Third-Party Claims**

Notwithstanding any other provision in Customer's volume licensing agreement, Microsoft’s obligation to defend Customer's use of GitHub Copilot under the Copilot Copyright Commitment will not apply if Customer has not set the **Duplicate Detection** filtering feature available in GitHub Copilot to its “**Block**” setting. You can learn how to enable the Duplicate Detection filter at https://gh.io/cfb-dd

What is a token?

Sentence:
- Azure OpenAI service is General Available now!

Tokens:
- [AZ]-[ure] [Open]-[AI] [service] [is] [General] [Available] [now][!]



1 token is approximately 4 characters or 0.75 words.

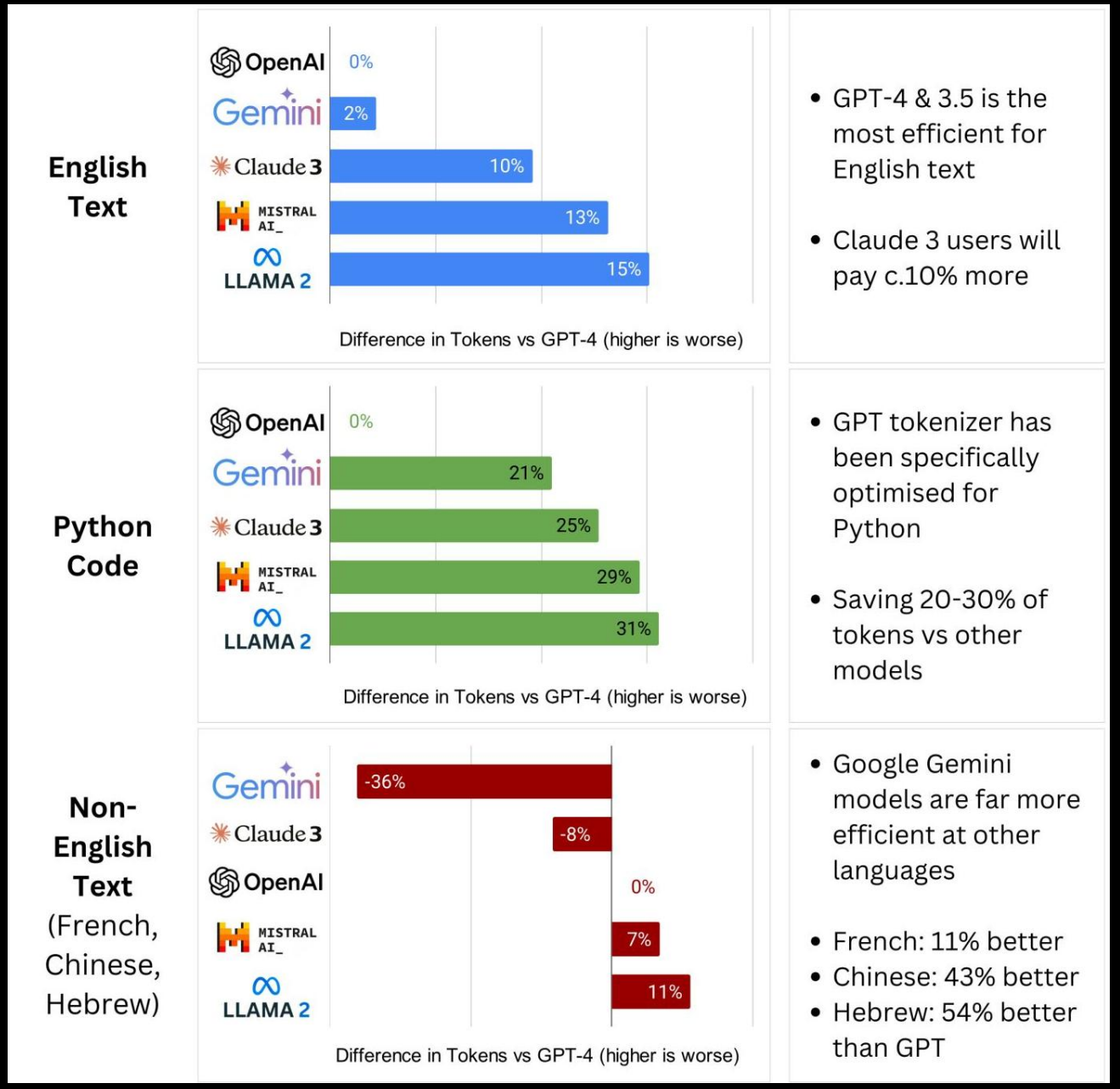
Do you know:
The collected works of Shakespeare are about 900,000 words or 1.2M tokens.
How many tokens are generated by each Tokenizer?
The Tokenizer Playground - a Hugging Face Space by Xenova

Pricing

Comparison of price per token across common LLM-Models

Tokens cost money and their efficiency varies widely across models

OpenAI is leading on English and Python, but Gemini in non-English content



Source: https://www.linkedin.com/in/peter-gostev/

Benchmarking

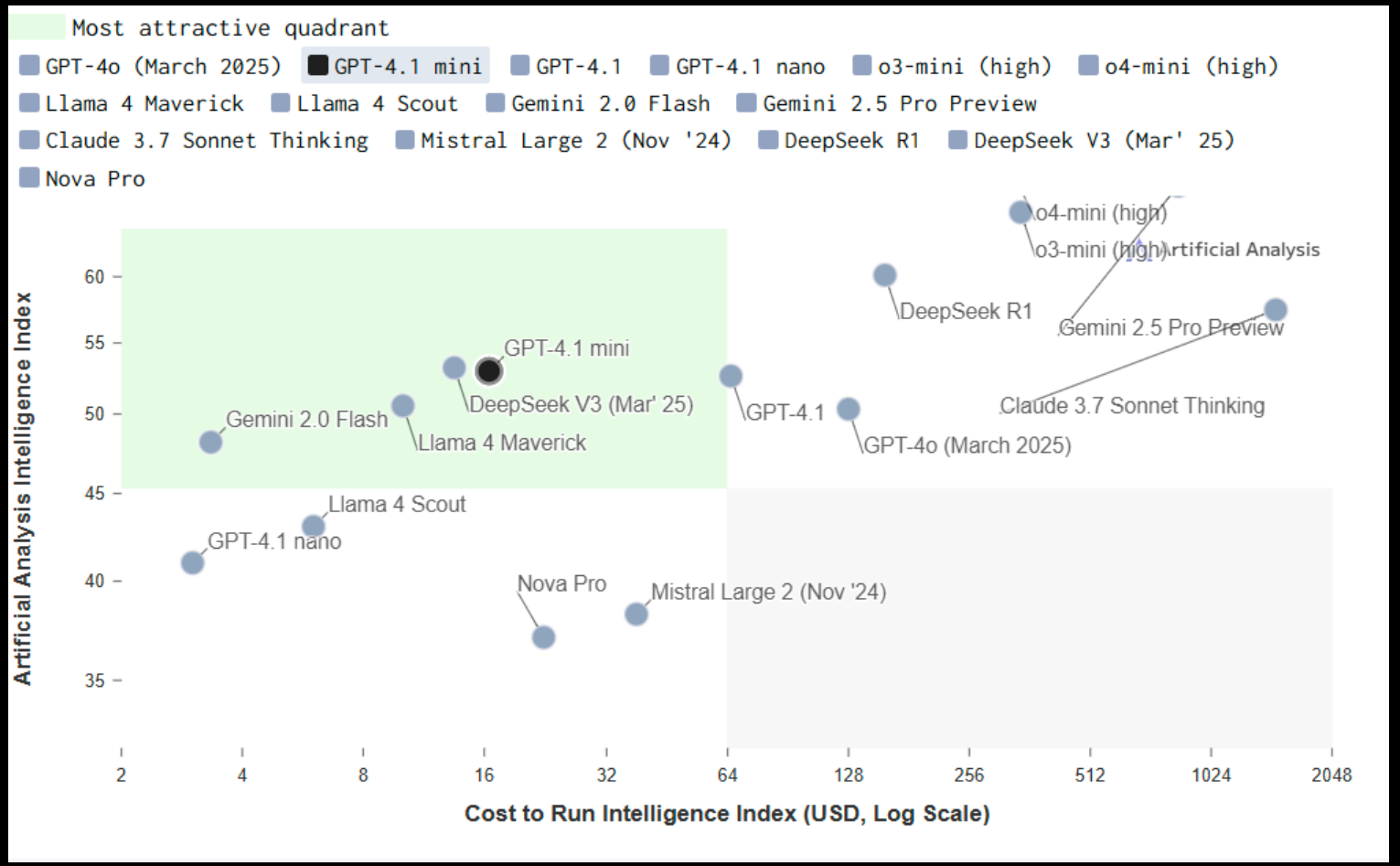
GPT-41-mini is the new star LLM-Model for Developers at 80% lower cost than previous models and outperforms GPT-4 hugely

[AI Model & API Providers Analysis | Artificial Analysis]

Source: https://www.linkedin.com/in/peter-gostev/

Intelligence vs. Cost to Run AI Intelligence Index

GPT-41-mini is the new star LLM-Model for Developers at 80% lower cost than previous models and outperforms GPT-4o hugely



Cost to Run Artificial Analysis Intelligence Index: The cost to run the evaluations in the Artificial Analysis Intelligence Index, calculated using the model's input and output token pricing and the number of tokens used across evaluations (excluding repeats).
Artificial Analysis Intelligence Index: Combination metric covering multiple dimensions of intelligence - the simplest way to compare how smart models are. Version 2 was released in Feb '25 and includes: MMLU-Pro, GPQA Diamond, Humanity's Last Exam, LiveCodeBench, SciCode, AIME, MATH-500. See Intelligence Index methodology for further details, including a breakdown of each evaluation and how we run them.

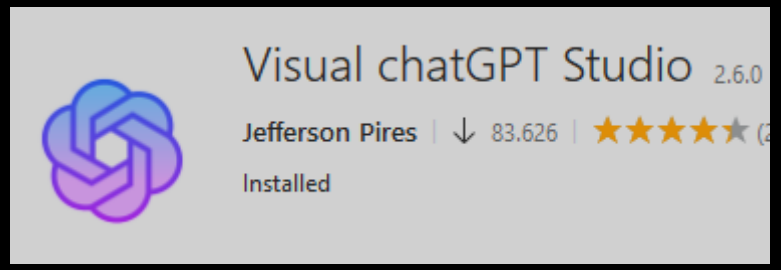
Source: [Artificialanalysis.a Gpt-4-1-mini Intelligence-vs-Cost]

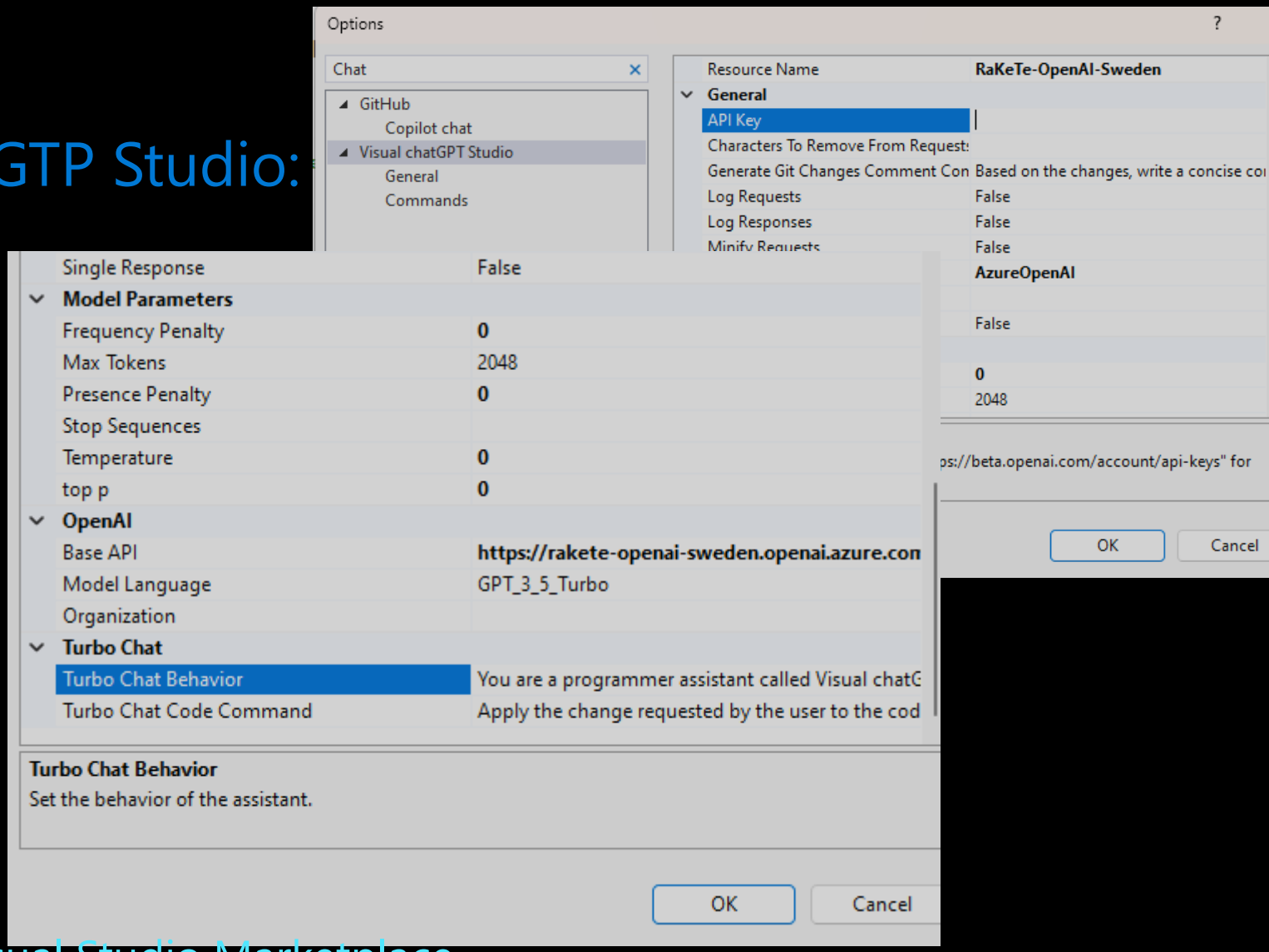
Visual Studio 2022 Alternatives to GitHub Copilot

Tool	Coding Power	Pricing	Notes
Visual ChatGPT Studio	High	Free, Donations welcome VS ChatGPT GitHub repo	Multiple model support plus agents, SQL Server extension, Hosted models via Azure Foundry / Huggingface
Visual Studio AI Buddy	Medium-High	Free Integration with DeepSeek R1 VS Marketplace	Self-host/on-prem Ollama runtime or Azure Foundry; Privacy ?
GitHub Copilot Completions	High	Works with VS 2022 version 17.8-17.9 only VS Marketplace	Deprecated, VS 2022 >= 17.10 versions have GitHub Copilot natively integrated
Azure OpenAI Service	High-Super power	Azure OpenAI Model Services	Multiple model services required for above tools

How to configure Visual ChatGPT Studio

- Within Visual Studio 2022:
- Configure Visual chatGTP Studio:
- Under Tools -> Options
- Search for “Chat”:



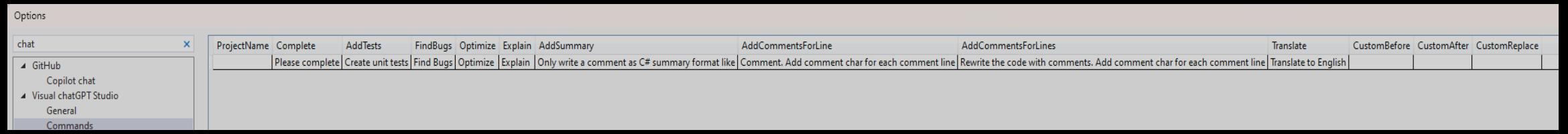


- General:
-

Marketplace: Visual chatGPT Studio - Visual Studio Marketplace
GitHub: jeffdapaz/VisualChatGPTStudio: Add chatGPT functionalities directly on Visual Studio (github.com

How to configure Visual ChatGPT

- Commands:
- Allow to change the behavior via natural language prompts:
-



Commercial/SaaS Alternatives to GitHub Copilot

Tool	Coding Power	Privacy / GDPR	Notes
Amazon CodeWhisperer	High	AWS GDPR-compliant; no training on customer code Code Whisper Data protection, AWS data protection	Deep AWS IDE integrations, good for AWS stack.
Tabnine	Medium-High	SOC 2, ISO 9001, full GDPR DPA; zero data retention Tabnine GDPR, Code Privacy	Self-host/on-prem or SaaS; strongest privacy guarantees.
Google Gemini Code Assist	High	Uses Google Cloud (GDPR via Google Cloud DPA)	Free tier: 180k completions; detailed privacy stance less visible.
Replit Ghostwriter	Medium	GDPR DPA available; DPA last updated Feb 2025 Replit DPA, Replit Privacy	Built into Replit IDE; some users report slow DPA response times.

Enterprise Ready Alternatives to GitHub Copilot

Tool	Coding Power	Privacy / GDPR	Notes
Sourcegraph Cody Enterprise	High	SOC 2 Type II, GDPR, CCPA; zero retention; EU-region host Sourcegraph	Deep code-search + chat; on-prem or cloud with geographic controls.
Windsurf	Medium-High	SOC 2 Type II; zero-retention mode; hybrid on-prem option Windsurf	MSA caveat re: EU personal “offerings” but DPA exists; caution.
Cursor	High	Privacy Mode (no remote storage); SOC 2; local only option CURSOR	Full IDE replacement; strong enterprise security posture.

Open-Source / Self hosted Alternatives to GitHub Copilot

Tool	Coding Power	Privacy / GDPR	Notes
Meta Code Llama	Medium-High (67% HE, 65% MBPP) arXivIT Pro	Fully self-hosted → 100% GDPR control	7B/13B/70B models; infilling; instruction-tuned variants.
StarCoder (BigCode)	Medium	Self-hosted → full GDPR control	15B parameters; permissive license; good for local setups.
GPTutor / Clara Copilot	Medium (OpenAI backend)	Depends on your ChatGPT plan (GDPR via OpenAI DPA)	VS Code extension; prompt-customizable; less “out-of-box” polish.

Composite Ranking of GitHub Copilot Alternatives

Rank	Tool	Why
1	**Tabnine**	Very good power, enterprise-grade privacy, flexible on-prem TabnineTabnine.
2	**Sourcegraph Cody Enterprise**	Top power + ironclad GDPR & hosting controls Sourcegraph, Cody is Enterprise Ready.
3	**Amazon CodeWhisperer**	High power, AWS GDPR, strong enterprise tools CodeWhisper Data protection, AWS EU GDPR.
4	**Meta Code Llama (self-host)**	Near-SOTA open performance + absolute privacy arXivIT Pro.
5	**Codeium**	Solid power, zero-retention, hybrid on-prem Windsurf Security
6	**Cursor**	Excellent suggestions, strong privacy mode Cursor Security
7	**Google Gemini**	Very capable, but privacy stance less transparent.
8	**Replit Ghostwriter**	Easy to try, GDPR DPA, but mixed reviews on responsiveness Replit DPA, Replit Privacy.
9	**AskCodi**	Great privacy promise, moderate power Bito Blog.
10	**GPTutor / Clara**	Fully open but backend-dependent, good learning tool.

Key Takeaways for EU-Developers

- **Top Privacy Picks:**
  - **Tabnine Enterprise** (zero retention, full GDPR DPA)
  - **Sourcegraph Cody Enterprise** (SOC 2, on-prem/EU hosting)
  - **Amazon CodeWhisperer** (AWS GDPR, no code training)
  - **Self-hosted Code Llama** (complete data control)
- **Best "Power" Choices:**
  - **Amazon CodeWhisperer**, **Sourcegraph Cody**, **Tabnine**, **Cursor**, **Google Gemini**
- **Open-Source Option:**
  - **Meta Code Llama** or **StarCoder** if you can run locally for absolute compliance.
- Your ideal pick depends on how you weight raw model performance versus absolute data sovereignty. If GDPR/data-residency is **paramount**, go with **Tabnine**, **Cody Enterprise**, or a **self-hosted** open-source LLM. If you want **bleeding-edge suggestions** and can trust a cloud provider's GDPR program, **CodeWhisperer** or **Gemini Code Assist** are excellent.

Next Steps

- Decide where to purchase your services
  - OpenAI or Azure OpenAI or others
- **Get started**
- Learning
  - Emphasizing continuous learning and upskilling in a fast-changing environment is key to able to push boundaries
  - Ensure AI-Act Article 4: AI Literacy is fulfilled aka train your employees on benefits and risks associated with AI
- Discovering
  - Encourage experimenting to uncover what really works and strive for meaningful impact
- Deploying
  - Applying models to real-life and create value.
    Monitor and finetune, learn and repeat the process.

Resources

- Learn more about Visual Studio Copilot
- Getting started with GitHub Copilot - GitHub Enterprise Cloud Docs
- Essentials of GitHub Copilot - GitHub Resources
- Microsoft Learn AI Skills Challenge
- Welcome | Learn how to interact with OpenAI models (microsoft.github.io)


Thank you!