Microsoft Federal Developer Summit

Building AI Solutions

SQL in the Era of AI

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11/13/2024

AGENDA

- AI Assistants
  - SQL Copilot
  - SSMS Copilot
  - Natural Language to SQL
- Intelligent Applications
  - AI Connected to SQL
  - TSQL Hybrid search

SQL Server and Azure SQL

Mission critical database for the era of AI

Best for developers

Secured, scaled, available

Everything built-in

DevOps

Build modern AI applications

RAG patterns

Vector and Hybrid search

Model of choice

Assisted by Copilots

Contextual self-assist

NL2SQL

GitHub Copilot

Mission critical database for the era of AI

External

AI Assistants

- Copilots
- NL2SQL
- Auto-complete

Intelligent Applications

- Vector Support
- Integrations with Microsoft AI
- AI ecosystem and OSS

Internal

Autonomous

- It just works
- Auto-tuned
- Success by default

AI Assistants

Microsoft Copilot experiences for SQL

Simplify development, design, operations, and troubleshooting

GitHub Copilot for inline code generation, assistance, and chat

SSMS Copilot – Coming in SSMS 21 – Natural Langiage to SQL

Microsoft Copilot for Azure helps design, operate, optimize, and troubleshoot

Copilot in Azure SQL Database for self-assistance and T-SQL code generation

Our vision for SQL

Simplifying Database Management with AI

Improve efficiency

- Performance
- Security
- Availability
- Disaster Recovery

Design and optimize

- Database schemas
- Correct and performant SQL
- Enable data-driven applications

Simplify

- Manage Databases
- Navigate complexity of SQL
- Maximize use of Azure

Azure SQL Database Copilot portal experiences

Microsoft Copilot in Azure + Azure SQL skills

Assists with several Azure SQL capabilities including database insights, best practices, database management, and troubleshooting common issues.

Natural Language to SQL in Azure SQL Query editor (preview)

Input a natural language question and receive a T-SQL query suggestion.

Copilot principles

Responses are grounded in your Azure SQL Database environment.

Copilot only has access to resources that YOU have access to and can only perform analysis and actions that you have the permissions to perform.

User-provided prompts and responses are NOT used to further train, retrain, or improve Azure OpenAI Service foundation models.

Microsoft Copilot in Azure

AI-Powered Assistant: Copilot for Azure is an AI companion that simplifies how you design, operate, optimize, and troubleshoot apps and infrastructure from cloud to edge.

Open Preview Access announced at BUILD: Rolled out to all customers, with options to enable or disable for specific Azure tenants.

Today's Focus

Enhanced Azure SQL Capabilities: New features for Azure SQL Database to improve the management of SQL-dependent applications.

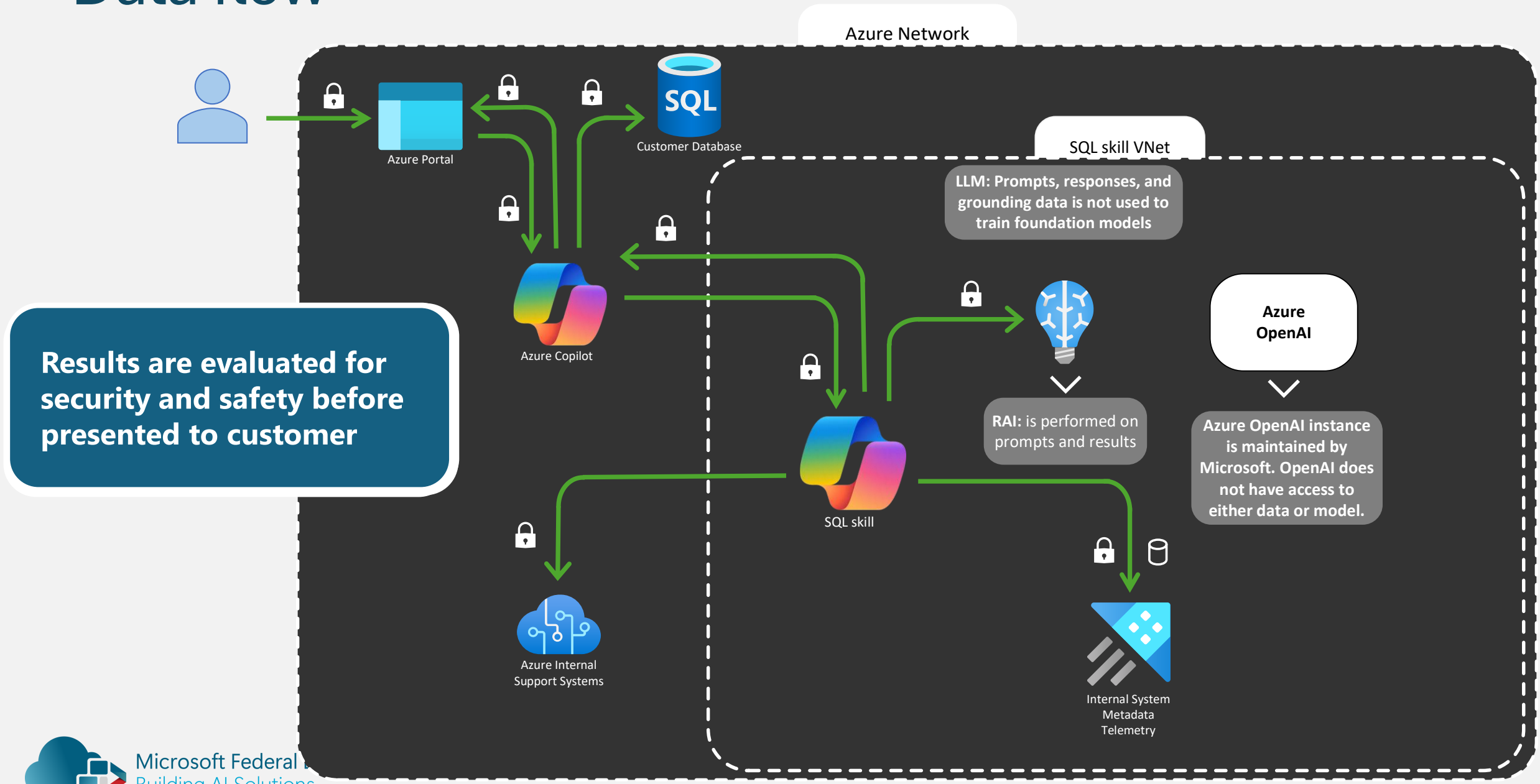
Example prompts

aka.ms/sqlcopilot has 51 skill examples

Topic	Example Prompts
Active User Connections	Who are currently actively connected to the database?
Blocking Session Analysis	Check top blocking sessions.
Database and Table Size	What's the size of this database?
Database Performance Analysis	Why is my database slow?
Deadlock Analysis	Why am I getting deadlock errors? How can I fix it?
Fragmented Index Analysis	Help me find fragmented indexes.
Index Recommendations	Should I add an index on this table?
Missing Index Suggestions	Missing index suggestion for improving query performance?
Point-in-Time Restore Retention	How far back in time can I go for a point-in-time restore?
Query Store - Longest Running Queries	What are the longest running queries in the past day?
Query Store - Queries with Multiple Plans	Queries that have had more than one execution plan.
Related Documentation	What does database compatibility level mean?
Resource Usage Analysis	Is the database hitting resource limits? Which limits?
Wait Statistics Analysis	What do the wait statistics look like for my database?

We have several skills in the roadmap (index tuning, best practices, and much more)

Data flow



Microsoft Federal
Building AI Solutions

Data flow (= all requests are encrypted via HTTPS)

Data Storage (= Indicates the permanent storage of data. Query and Prompt are never included.)

Usage Tips

- **Context matters**. Copilot Azure SQL prompts are most effective when asked within the specific database blade context.
  - Note: Recently we changed the experience to still help with general Q&A outside of a specific database blade.
- **Speed varies based on the task**. Some prompts, like database fragmentation checks, may take longer.
- **No database configuration changes**. For Azure SQL Database questions, Copilot provides information and instructions but won't make configuration changes.
- **Use where you need help**. Copilot doesn’t replace other methods. If you have a preferred efficient way to do something, you should keep doing it…

Microsoft

Demo

“SQL Copilot”

Microsoft Azure (Preview) | Search resources, services, and docs (G+/) | Copilot | MICROSOFT (MICROSOFT.ONMI...

Home >

PropertySearch (josephsack-sqlcopilottesting/PropertySearch)

Azure SQL Database

Search

- Overview
- Activity log
- Tags
- Diagnose and solve problems
- Query editor (preview)
- Resource visualizer
- Settings
- Data management
- Integrations
- Power Platform
- Security
- Intelligent Performance
- Monitoring
- Automation
- Help

Copy | Restore | Export | Set server firewall | Delete | Connect with... | Feedback

Essentials View Cost JSON View

Resource group (move)
josephsack-rg

Server name

Status
Online

Elastic pool
No elastic pool

Location
South Central US

Connection strings
Show database connection strings

Subscription (move)

Pricing tier
Business Critical: Gen5, 4 vCores

Subscription ID

Earliest restore point
2024-05-02 15:14 UTC

Tags (edit)
Add tags

Getting started | Monitoring | Properties | Features | Notifications (1) | Integrations | Tutorials

Database data storage

Review the below metrics and monitor your applications and infrastructure.

Copilot

Preview

Welcome to Microsoft Copilot for Azure. Copilot can help you answer questions, complete tasks, and maximize productivity. However, Copilot has some limits while in public preview.
Learn more

Select one of the suggestions below to get started.

Design
Create a guide for integrating Azure Logic Apps with Azure Functions.

Operate
Which resource groups have non compliant resources? Sort by count of resources that are noncompliant.

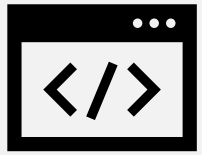
Optimize
Help me identify unused resources.

Troubleshoot
Can you help me get a memory dump from my Azure Web App?

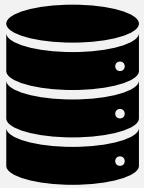
I want to ...

0 / 500

Natural language to SQL (preview)



Azure portal Query editor is a browser-based tool for light querying + exploration



We’re adding a natural language to SQL experience

Generates T-SQL queries based on natural language input

Uses Large Language Models (LLMs) from Azure OpenAI

+ Table schema

+ primary and foreign key constraints

Natural Language to SQL – Usage Tips

- **Schema and relationships help with generation**. NL2SQL uses the following based on user permissions:
  - Table and view schema definition
    - Note: we'll be adding additional context such as NULLability and data types
  - PK\FK relationships
- **Expressive names result in the most effective generation**. NL2SQL relies on meaningful and descriptive table and column names.
- **Roadmap**: We are looking into ways to improve accuracy through additional customer-provided context. For example, ability to share "hints" on naming conventions or example prompt\query pairs.

Microsoft

Demo

NL2SQL

qlcopilottesting/PropertySearch)

[redacted] | Query editor (preview) ☆ ···

Login | New Query | Open query | Feedback | Getting started

[redacted]

Showing limited object explorer here. For full capability please click here to open Azure Data Studio.

- Tables
- Views
- Stored Procedures

Query 1

Run | Cancel query | Save query | Export data as | Show only Editor | Launch inline copilot

```
1
```

Results | Messages

Search to filter items...

Ready

SSMS Copilot

- Coming in SSMS 21.x
- Built on top of your Azure OpenAI model deployment
- Announced Nov 6 2024
- SSMS 21 preview

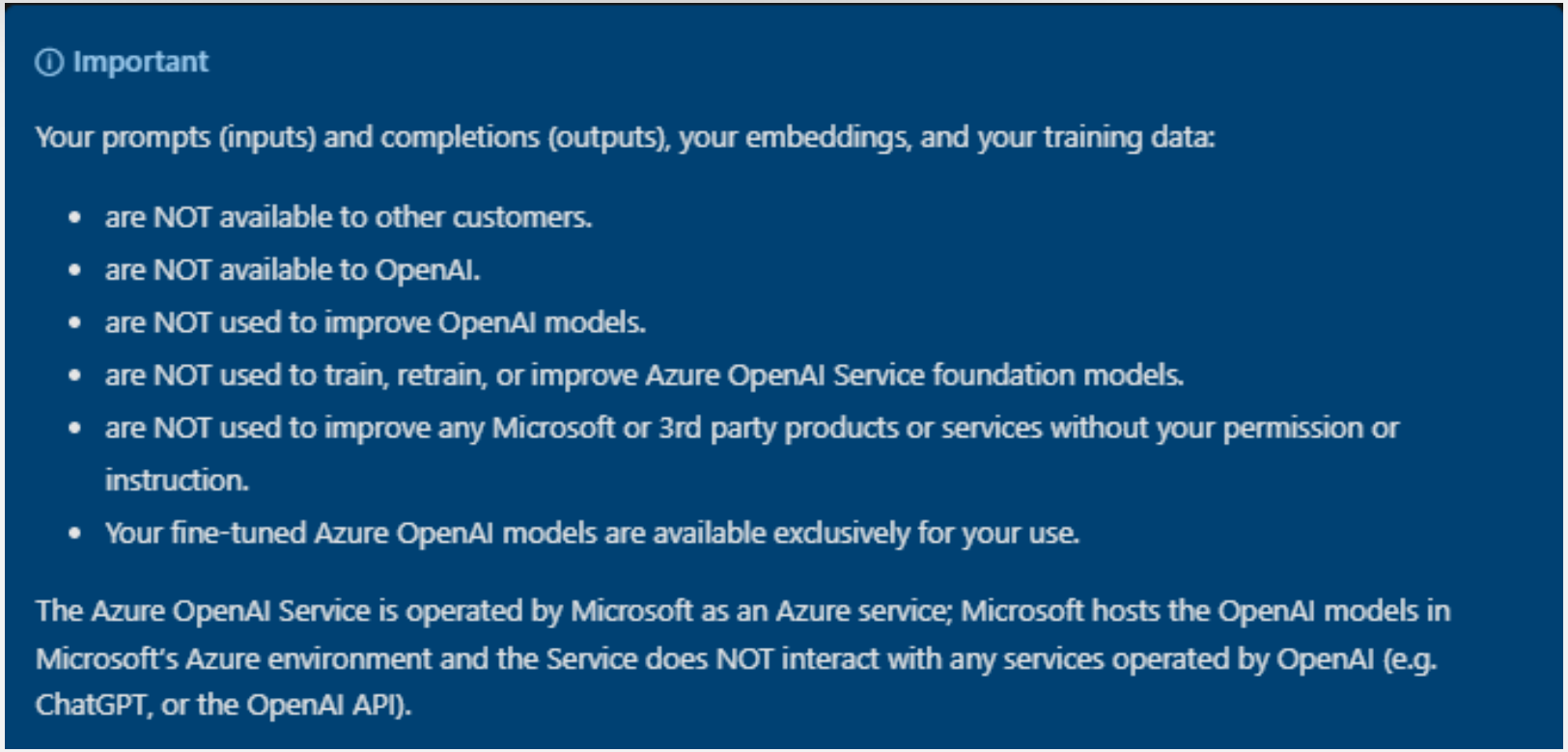
FAQs...

How much will it cost?	• No charge right now, but there will be announcements leading up to Azure Copilot General Availability.
What Azure SQL Database offerings are supported in preview?	• General Purpose, Business Critical, Hyperscale, DTU-based Standard and Premium, Serverless, and Elastic pools.
How do I enable or disable Copilot?	• Manage by following these instructions: aka.ms\sqlcopilot-manage-access
What about Copilots for other SQL offerings?	• We expect opportunities for Copilots across the SQL portfolio. Stay tuned!

Leading Questions

- Privacy
  - No user data is used to train the model
  - Data, privacy, and security for Azure OpenAI Service - Azure AI services | Microsoft Learn
- BYOE – Bring Your Own Endpoint
  - Currently must be Azure OpenAI Endpoint
  - Future is you can bring your own endpoint
- Cost
  - You control the cost
  - Tokens of your OpenAI service
- Permission
  - No Additional permissions needed, uses permission context of current user

Azure OpenAI Security and Privacy



Azure OpenAI <> OpenAI and ChatGPT

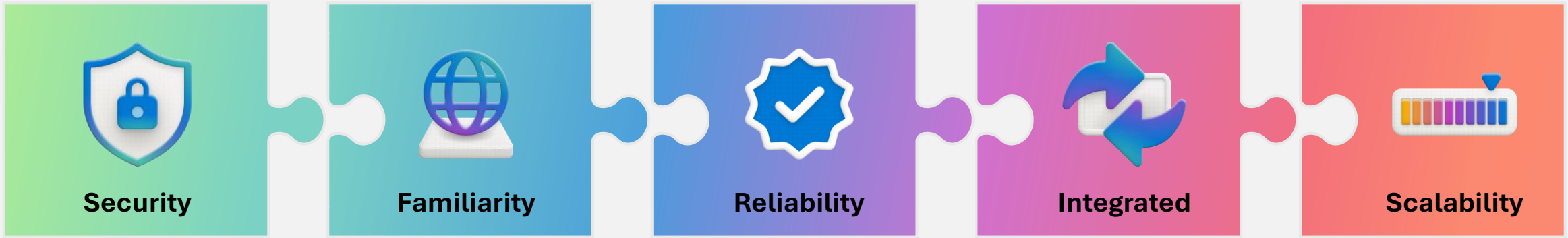
Microsoft

Demo

SSMS Copilot

Intelligent Applications

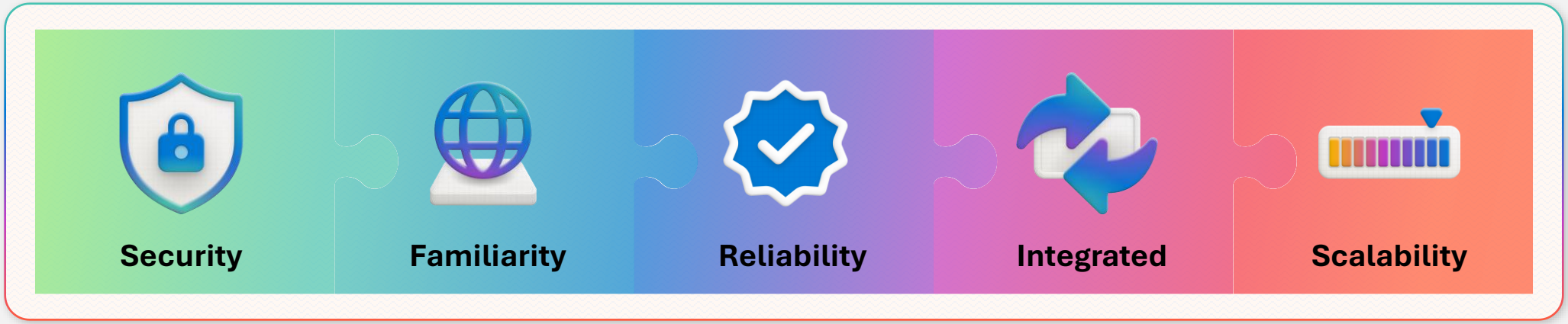
Why SQL for AI apps?

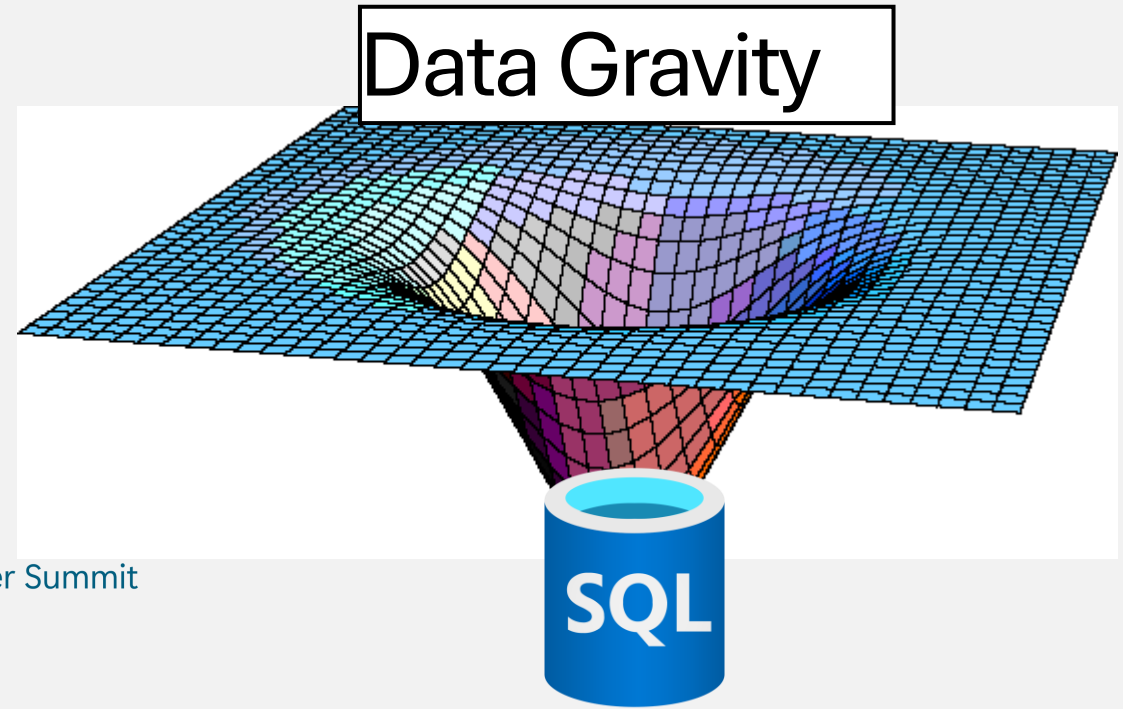


Why SQL for AI apps?

Azure SQL already contains all valuable (present and future) company's data: make sense to move AI to data instead of the other way round!

Why SQL for AI apps?



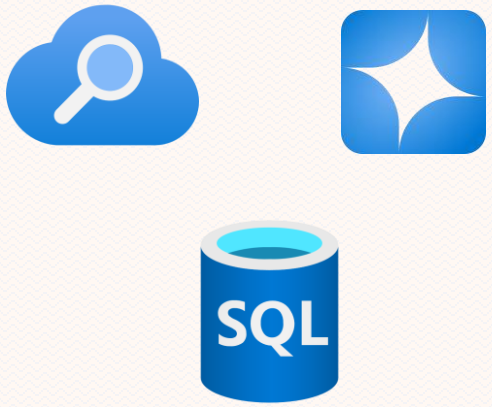


Azure SQL Database and AI Scenarios

Prompt Engineering and Retrieval Augmented Generation (RAG)

Use AI Services

Connected to SQL



Index with Azure AI Search
Vector Search with Azure OpenAI

Use frameworks

Connected to SQL or AI

NL to generate SQL
Orchestrate GenAI apps

Use T-SQL for Hybrid Search

Connected to AI

Store vectors in SQL Invoke
Models using REST API

What about chat history?

Where do you store your text data?

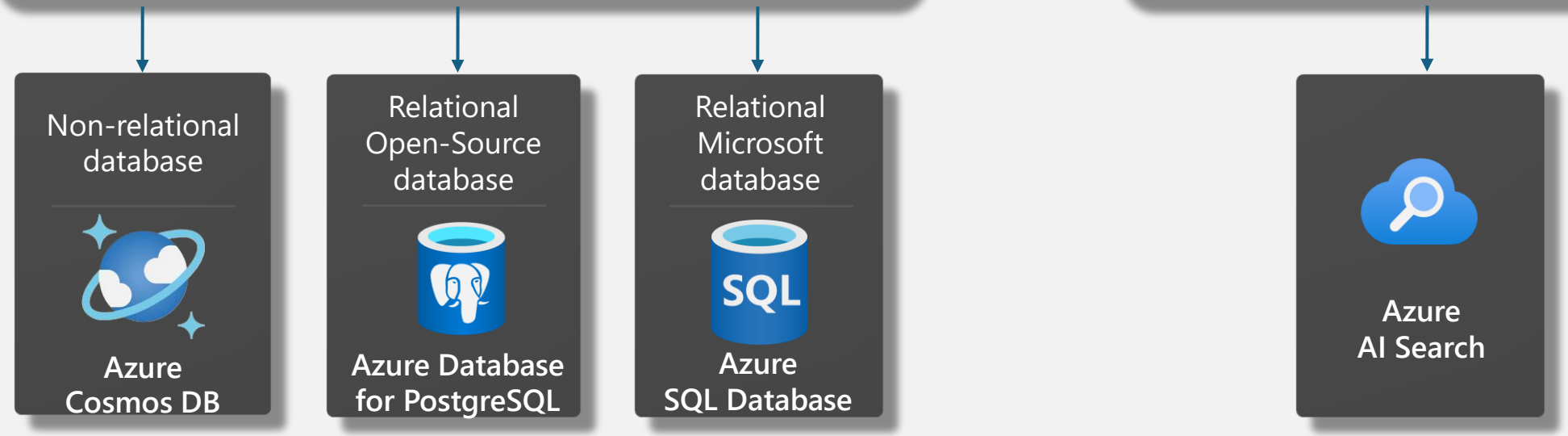
Choosing Vector Indexes between Databases and Azure AI Search

Operational data

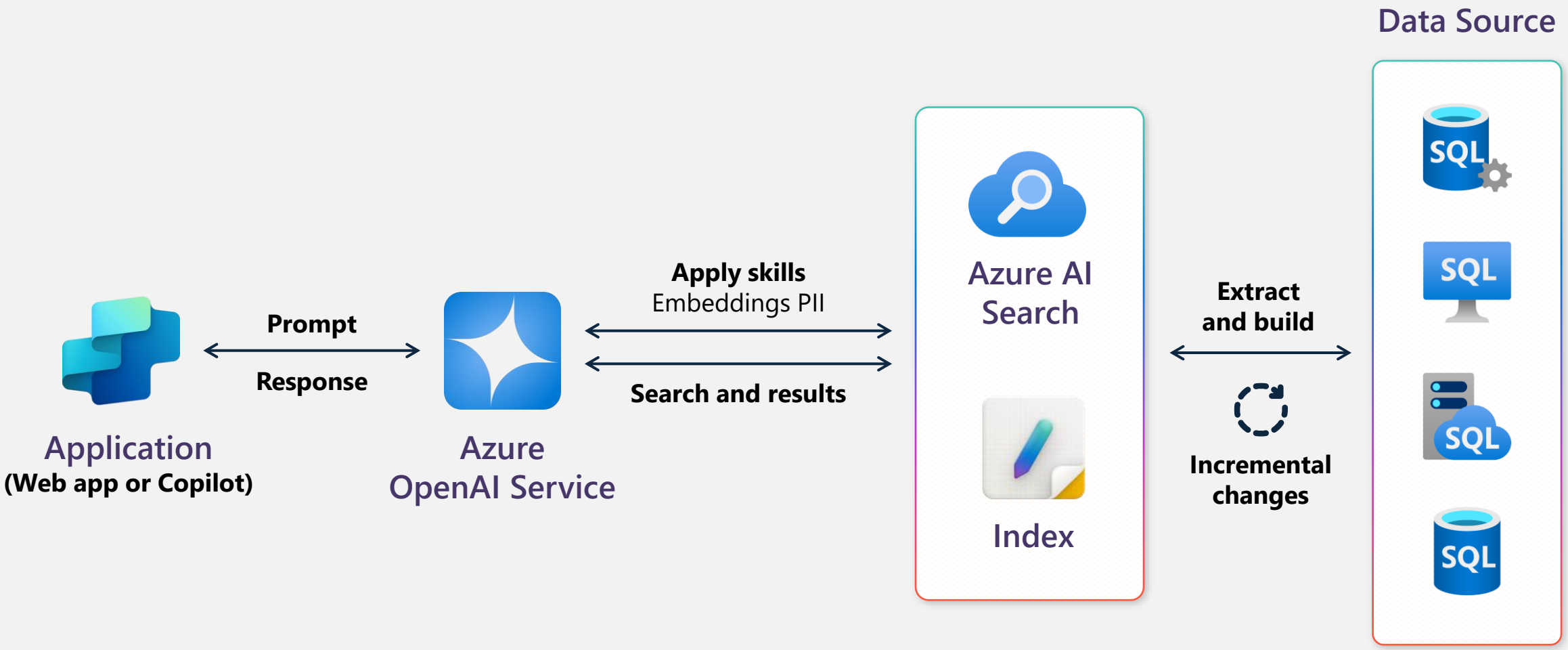
- Operational data in structured or semi-structured format tracking real-time state of the application (product catalog, customer profile, etc.).
- Vector index over operational data created in the same database providing **single source of truth** for operational and vector data.

Non-operational data

- Structured or unstructured data **synchronized from multiple data sources**.
- Vector index created over synchronized data.

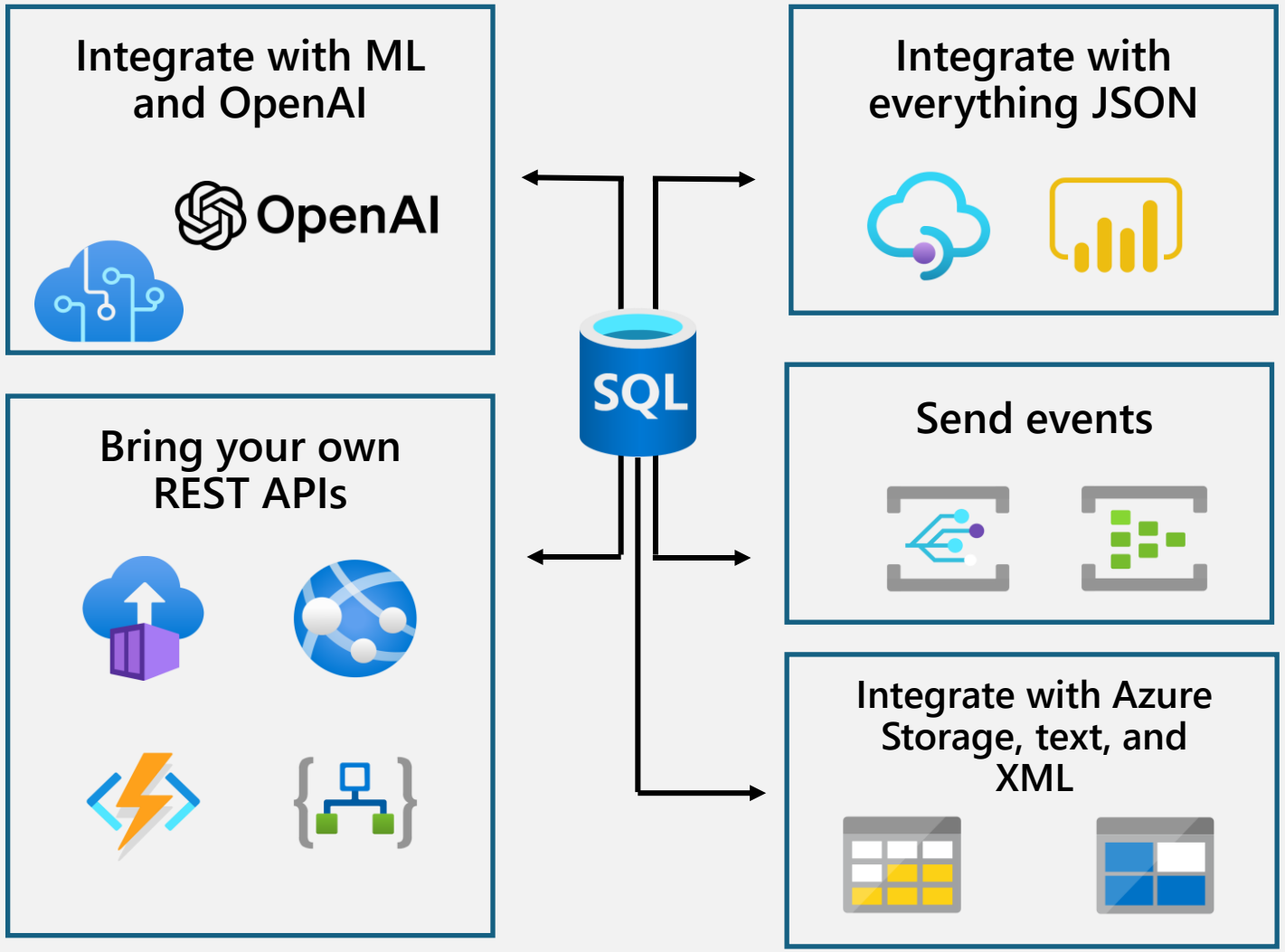


Get smarter with your SQL data



AI powered by your SQL data

Azure SQL Database External REST endpoints



sp_invoke_external_rest_endpoint

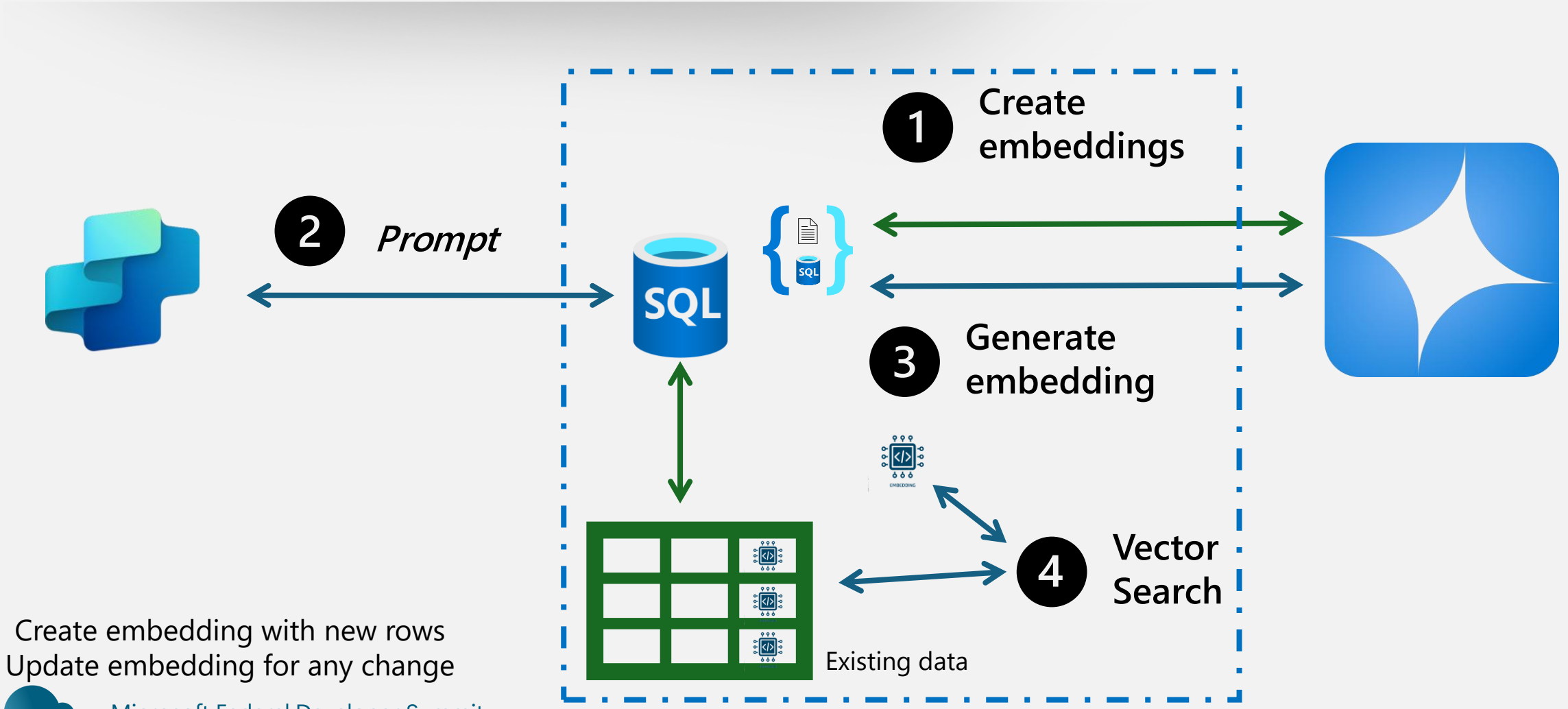
EXECUTE ANY EXTERNAL ENDPOINT

Call REST services from the Azure SQL Database

```
declare @url nvarchar(4000) =
N'https://skynetbeta.openai.azure.com/openai/deployments/chattykathy/chat/completions?api-version=2023-07-01-preview';
declare @headers nvarchar(102) = N'{"api-key":"1001001sos1001001indistress"}'
declare @payload nvarchar(max) = N'{"messages":[[{"role":"system","content":"You are an AI assistant that helps people find information."},
                                {"role":"system","content":"Why is the sky blue?"}]}'
declare @ret int, @response nvarchar(max);
exec @ret = sp_invoke_external_rest_endpoint
    @url = @url,
    @method = 'POST',
    @headers = @headers,
    @payload = @payload,
    @timeout = 230,
    @response = @response output;
select @ret as ReturnCode, @response as Response;
```

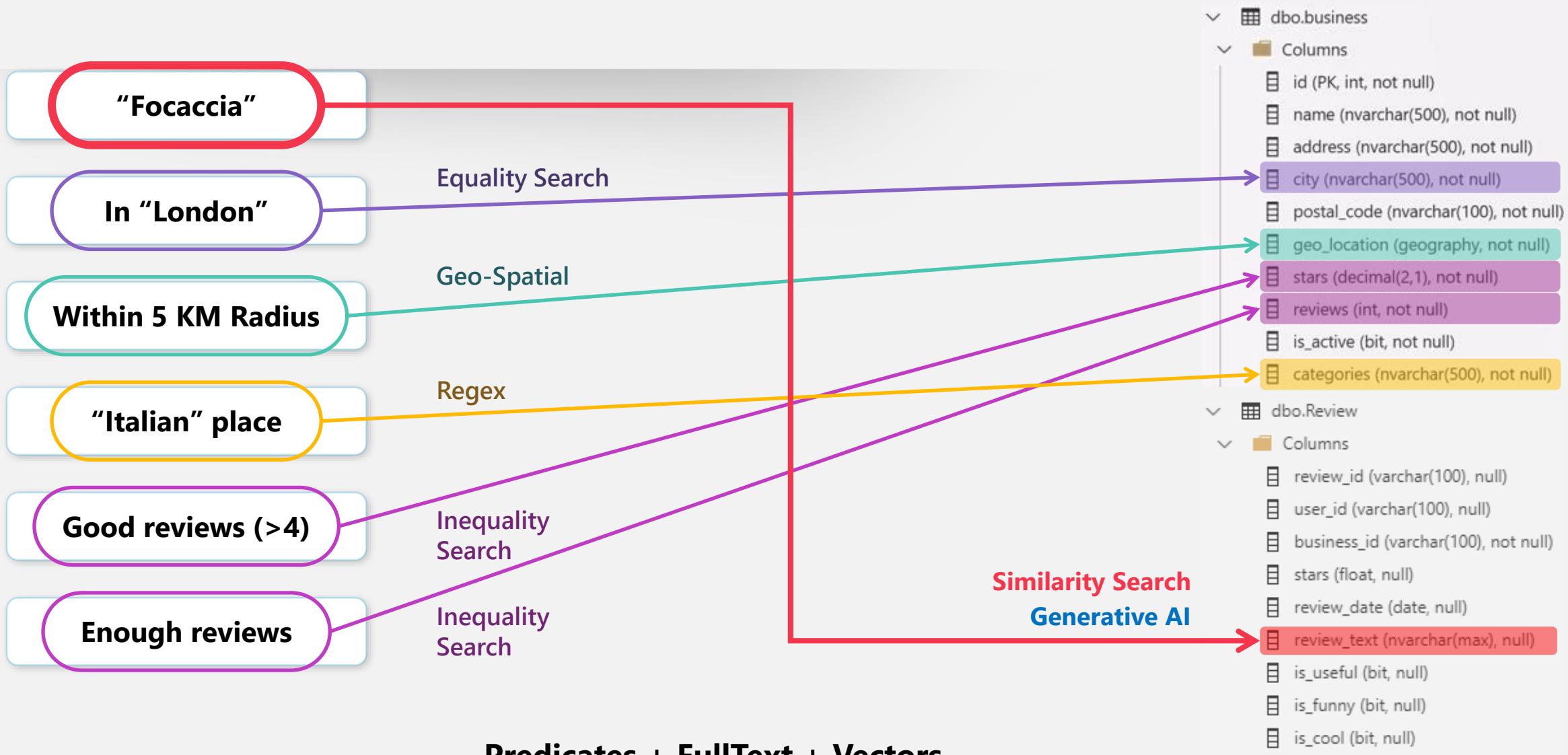
Use T-SQL for Vector and Hybrid Search

Connected to AI



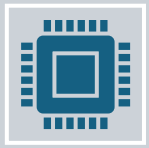
Create embedding with new rows
Update embedding for any change

Finding the Best Focaccia Bread in town



Predicates + FullText + Vectors

Vector Support - Preview



New vector type

VECTOR(<dimensions>)

Efficient binary format, optimized for latest CPU capabilities (SIMD / AVX instruction set)

New vector function to calculate distance between two vectors

VECTOR_DISTANCE

VECTOR_NORMALIZE

VECTOR_NORM

Foundational feature for AI-based solutions

Microsoft

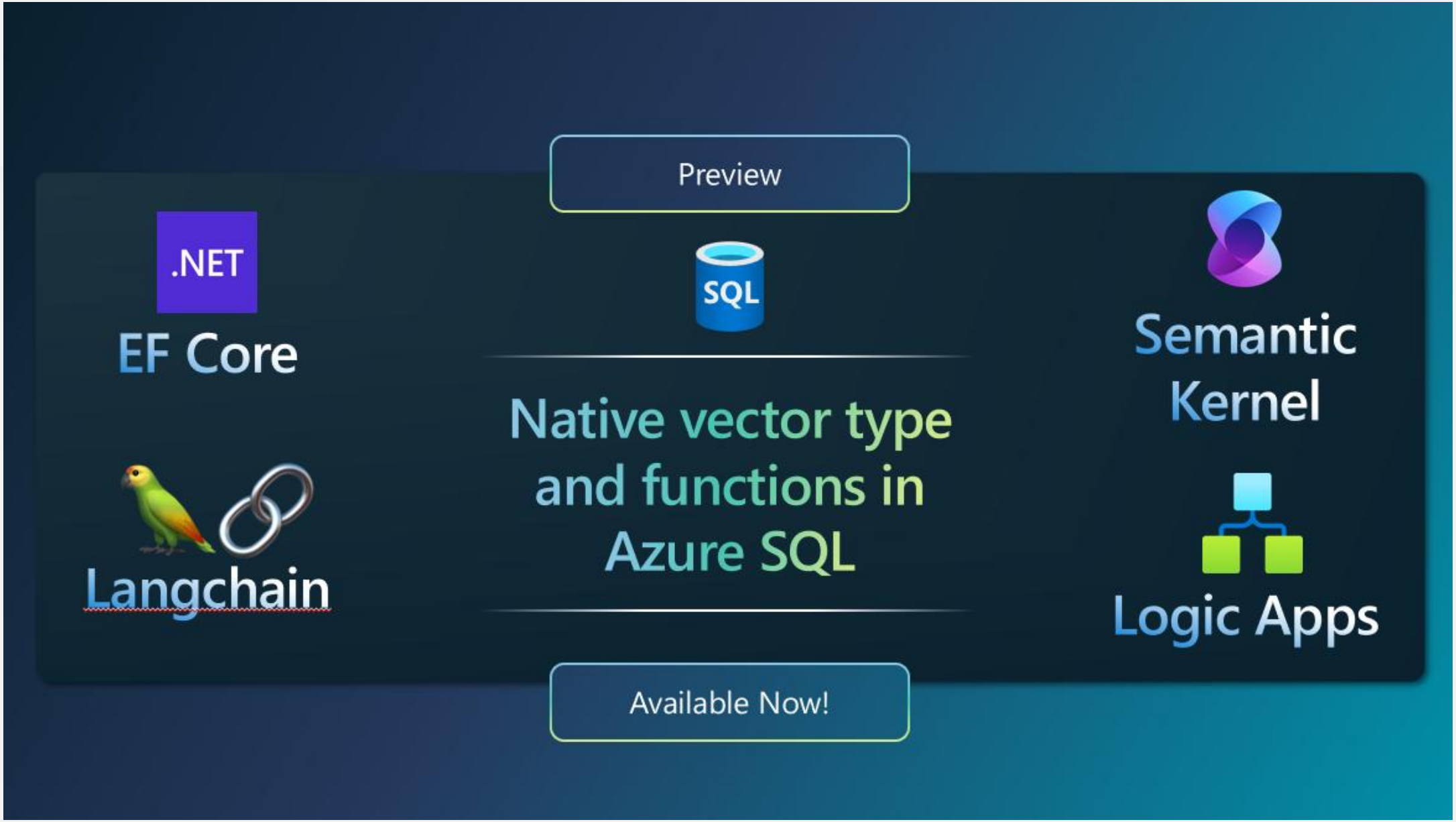
Demo

Hybrid search

Use AI with your SQL data

Microsoft

Retrieval Augmented Generation


Preview
.NET
EF Core
SQL
Semantic Kernel
Native vector type and functions in Azure SQL
Langchain
Logic Apps
Available Now!

Building scalable AI applications

Semantic Search

Store vectors and data together for consistency and Search for most relevant data

RAG Pattern

Retrieve the most semantically relevant data from your database and use it to ground LLMs for specific scenarios.

Structured Queries

Allow LLMs to query structured data and take advantage of rich metadata and query optimization

Key Priority: Intelligent Applications

General Availability | Private Preview | Public Preview | Planned / In-Progress

Standalone +VM

SQL Server

- SQL Server Machine Learning Services with Python and R
- Opensource Language Extensions (R, Python, Java & .NET Core C#)
- sp_execute_external_script
- Native Scoring with PREDICT T-SQL function - SQL machine learning
- Call external REST – Azure Open AI

Azure SQL Managed Instance

- Machine Learning Services with Python and R
- Native Scoring with PREDICT T-SQL function - SQL machine learning
- Call external REST – Azure Open AI
- Vector Support

Azure SQL Database

- Call external REST – Azure Open AI
- Azure Copilot
- Vector Support
- LangChain
- Semantic Kernel
- Integrated Vectorization (Azure AI Search + SQL DB)

The Future of SQL and AI

Enhanced Azure AI Services experiences.

Enhanced vector support

Simpler T-SQL for RAG patterns

Deeper integration with AI frameworks

New and enhanced Copilots experiences

SQL and AI ground to cloud

New SQL Fabric experiences

Resources

- **SQL AI Workshop**
- aka.ms/sqlaiworkshop

- **SQL AI Docs**
- aka.ms/sqlai

- **SQL AI samples**
- aka.ms/sqlaisamples

- **SQL Copilots**
- aka.ms/sqlcopilot

- **Videos** from our team
- aka.ms/dataexposed
- aka.ms/sql_db_essentials

Vector private preview signup
aka.ms/azuresql-vector-eap

Try Azure SQL Database free of charge

Get 100,000 vCore seconds of compute and 32 GB of storage every month!

What's included:

One Azure SQL Database per Azure subscription with 100,000 vCore seconds compute every month

32 GB data storage +
32 GB backup storage

aka.ms/freedboffer

THANK YOU!

Q & A

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Feedback

Do you want us to follow up after the event? Do you have feedback?

https://aka.ms/summit/feedback

Microsoft Federal Developer Summit
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