Microsoft Azure

AI-102 Designing and Implementing an Azure AI Solution – Exam Prep

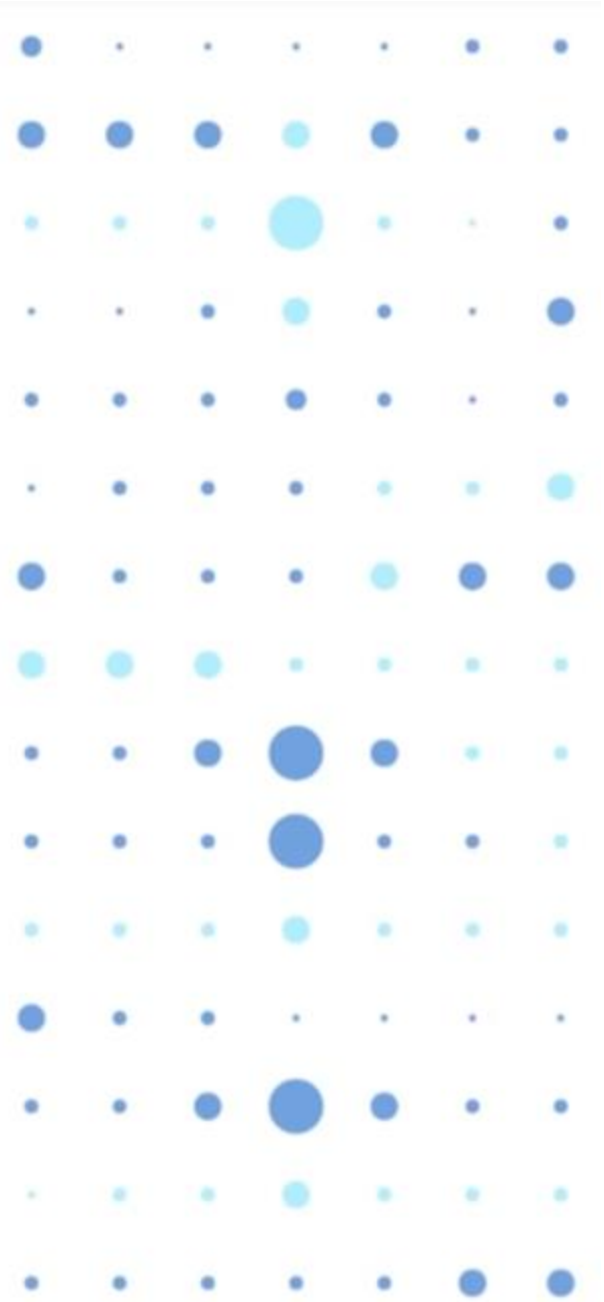
Objective

After taking the course you will be able to

- Identify what will be covered on exam
- Determine which concepts to prioritize for further study
- Explain different potential exam question formats
- Locate available learning resource and utilize

Exam Scoring

- **Each Exam has cut score**
  - Score ranges from 0-1000
  - Passing score is 700(scaled score not 70%)
- **Tips and Tricks**
  - No points deducted for wrong answers
  - Some questions can not be revisited
  - Answer every question



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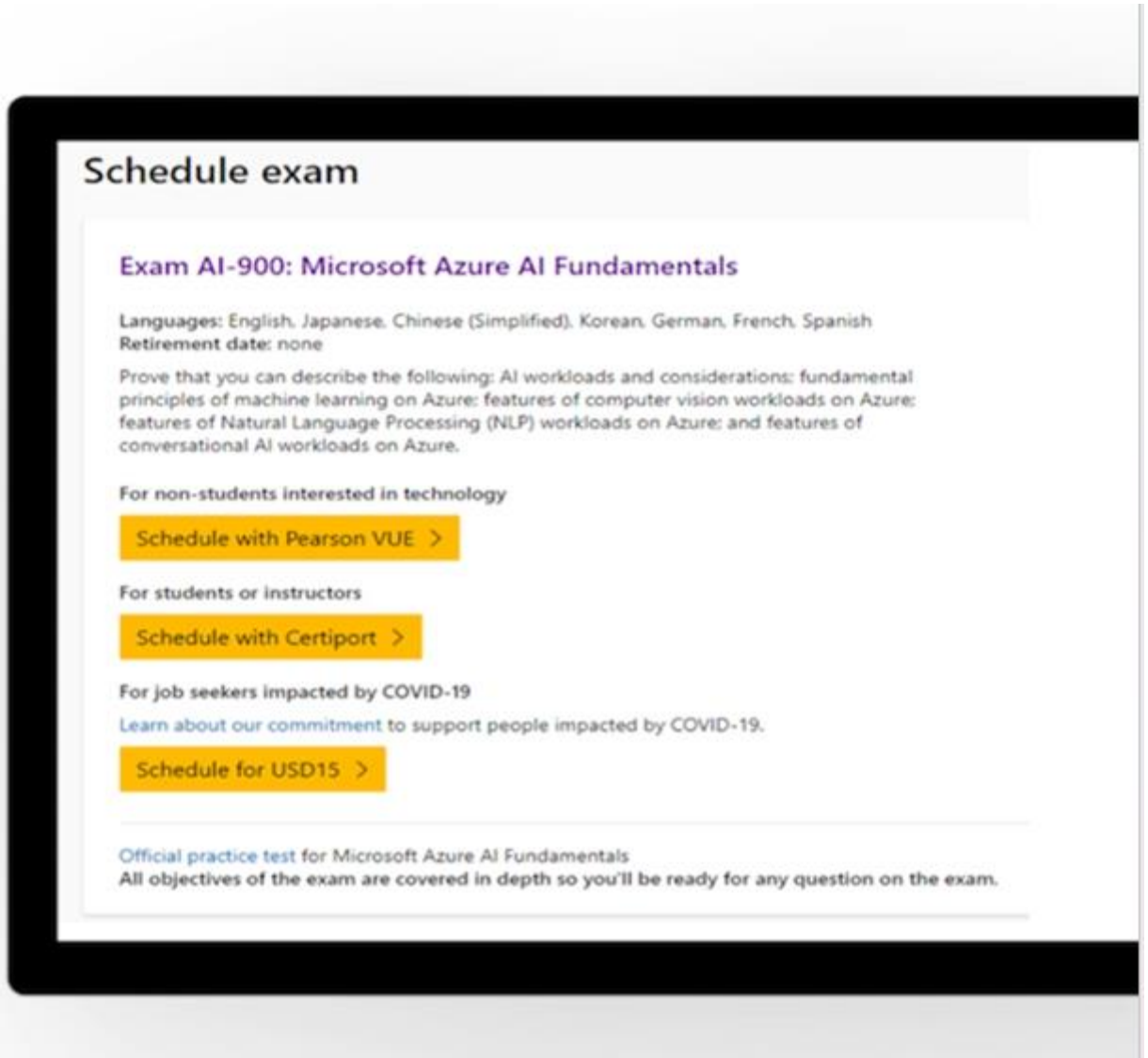
Online Role-based training resources:

Microsoft Learn

https://learn.microsoft.com/en-us/certifications/exams/ai-102

How to Register for the exam

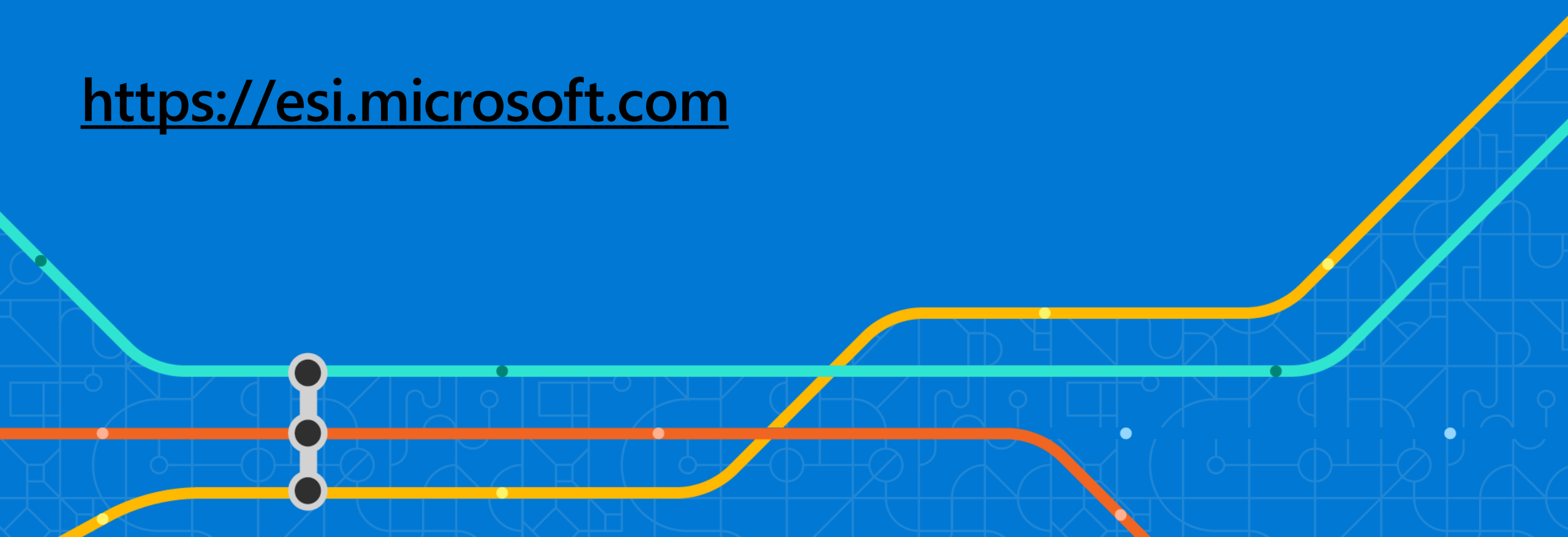


Microsoft

Enterprise Skills Initiative

Learner Experience Portal

https://esi.microsoft.com



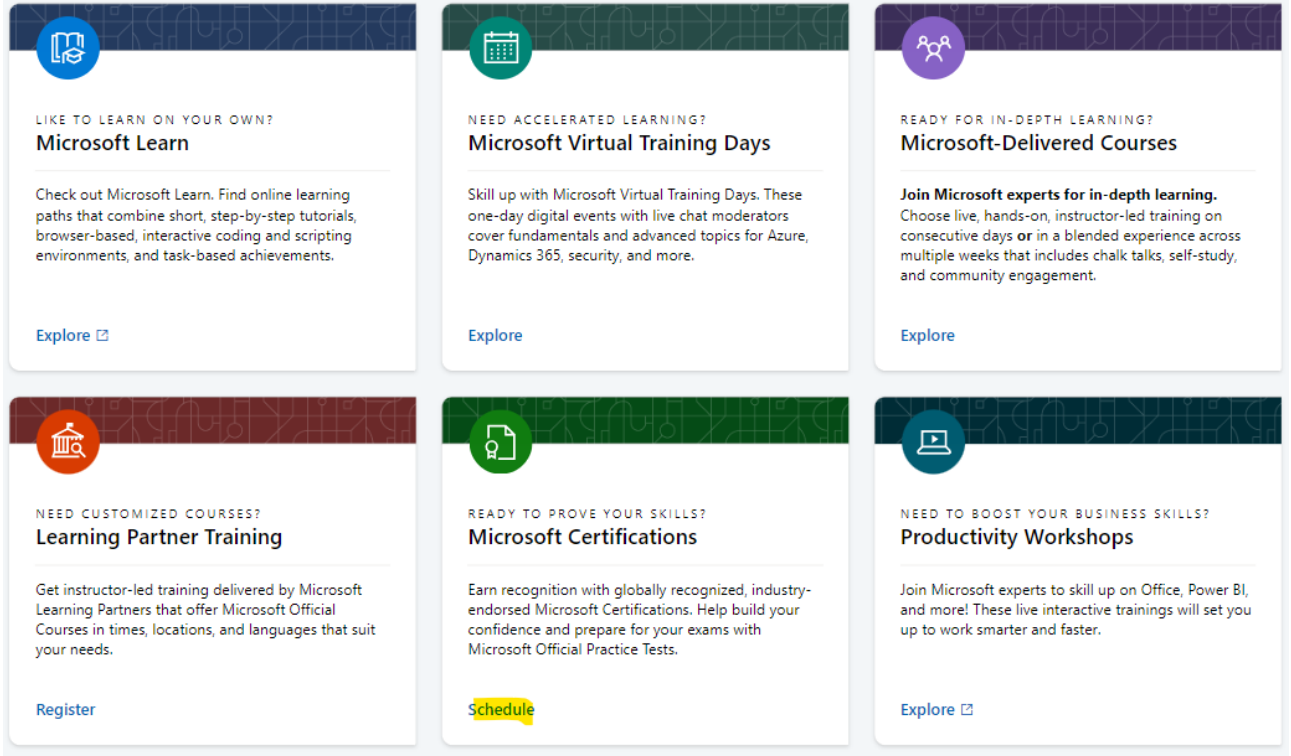
Learner Experience Portal (LxP) at a glance

The LxP is a one-stop shop for Learners

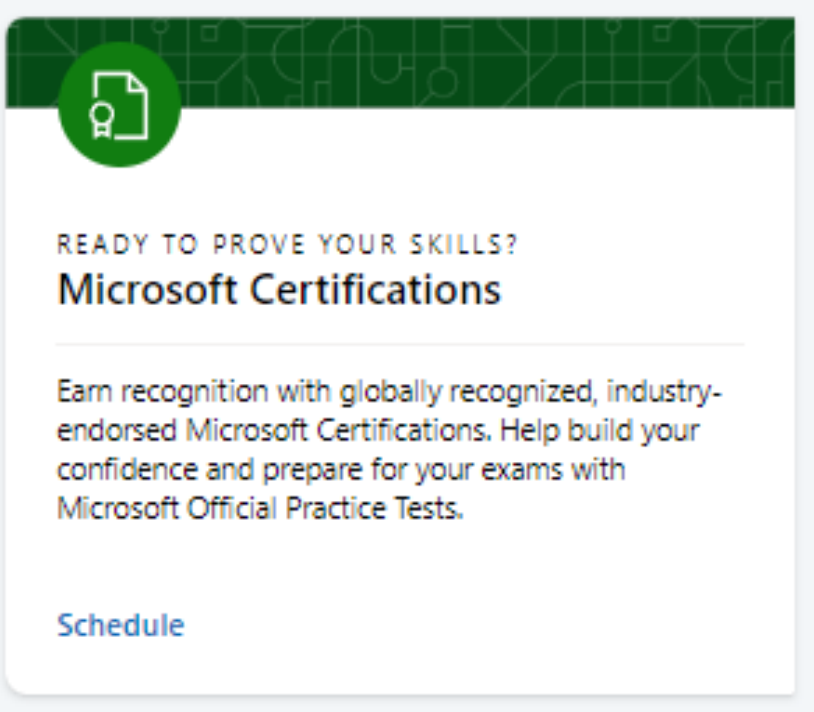
Enable Learners to view and register for 100% free certifications without the need for a voucher or code via the “Microsoft Certifications” tile

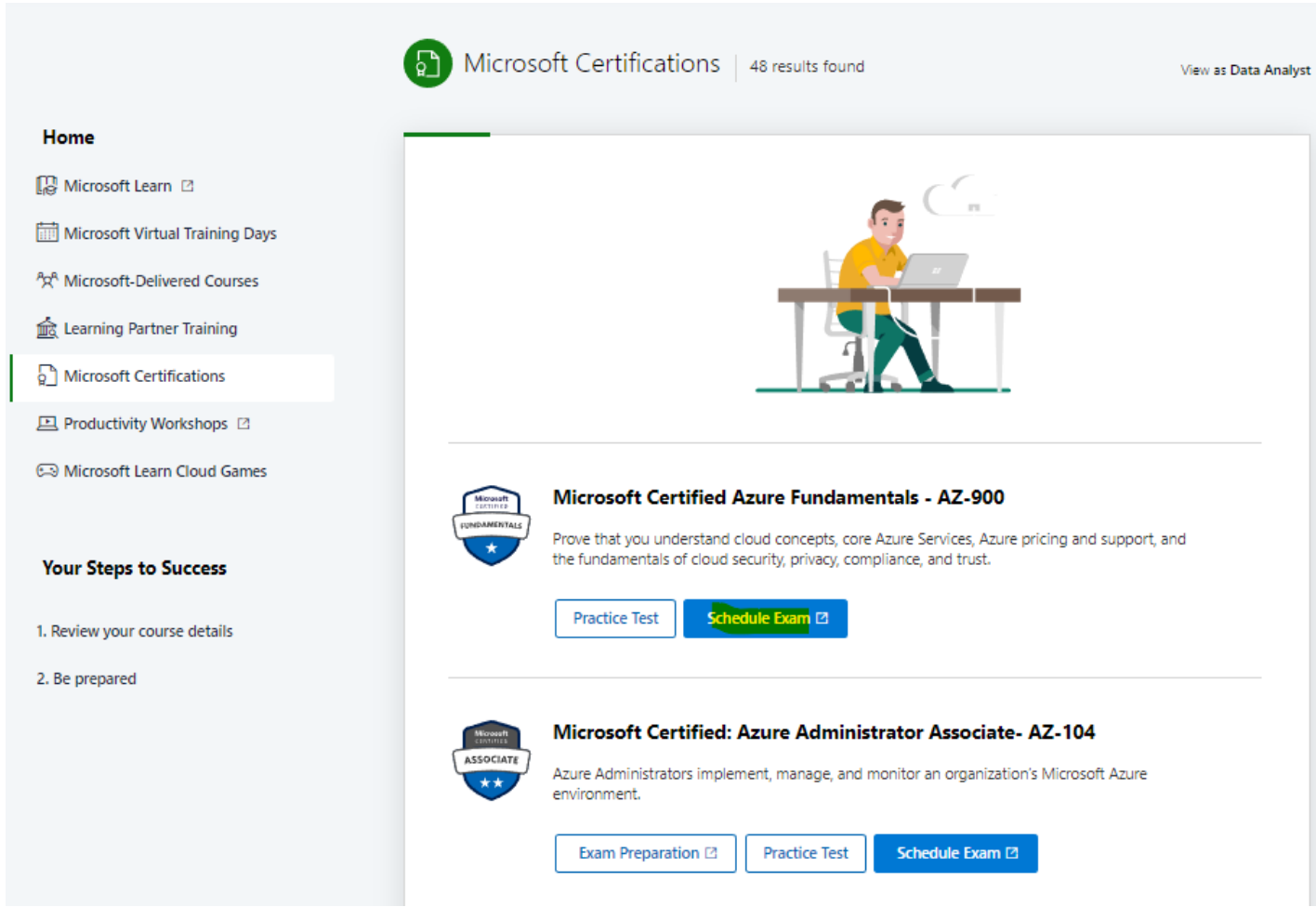
Access registration for deliveries, Learning Partner discounted class seats, and launch self-paced training directly from the portal

Access self-paced learning via Microsoft Learn



LxP – Microsoft Certifications Tile





- Enable Learners to view and register for 100% free exam certifications with no need for vouchers or codes
- Provides Learners the ability to take a practice exam at no charge.

Microsoft Azure

Exam Related Information

a. LxP (Learning Experience Portal) Introduction: https://aka.ms/LxPWalkthroughVideo

b. Schedule your Azure Exam for FREE: https://aka.ms/LxPExamDiscountVideo

c. Azure Learning Journey Documentation: https://aka.ms/ESIAzureTrainingJourney

Skills Measured

- Plan and manage an Azure AI solution (15–20%)
- Implement decision support solutions (10–15%)
- Implement computer vision solutions (15–20%)
- Implement natural language processing solutions (30–35%)
- Implement knowledge mining and document intelligence solutions (10–15%)
- Implement generative AI solutions (10–15%)

Microsoft

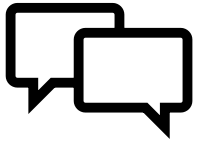
Introduction to AI and AI on Azure

What is Artificial Intelligence?

Software that exhibits human-like capabilities, such as:

Visual Perception

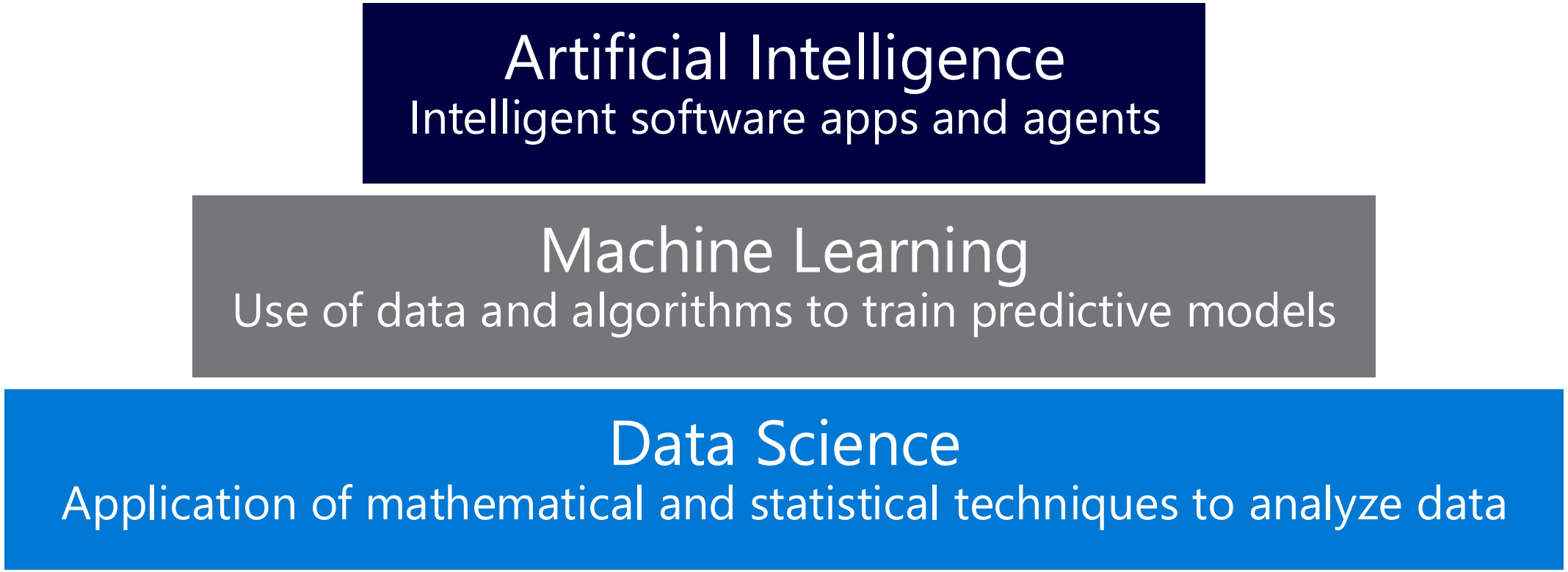
Text Analysis



Conversation

Decision Making

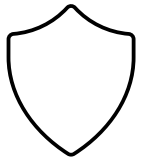
Data Science, Machine Learning, and AI



Considerations for Responsible AI

Fairness

Reliability & Safety



Privacy & Security

Inclusiveness

Transparency

Accountability

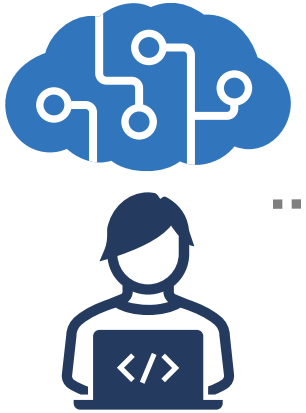
https://www.microsoft.com/ai/responsible-ai

Azure AI Services

Prepackaged AI services you can integrate into solutions

Capabilities include:

Language	Speech	Vision	Generative
• Text analysis • Question answering • Language understanding • Translation	• Speech recognition • Speech synthesis • Speech Translation • Speaker Recognition	• Image and video analysis • Image classification • Object detection • Optical character recognition	• Generate text completions • Image generation



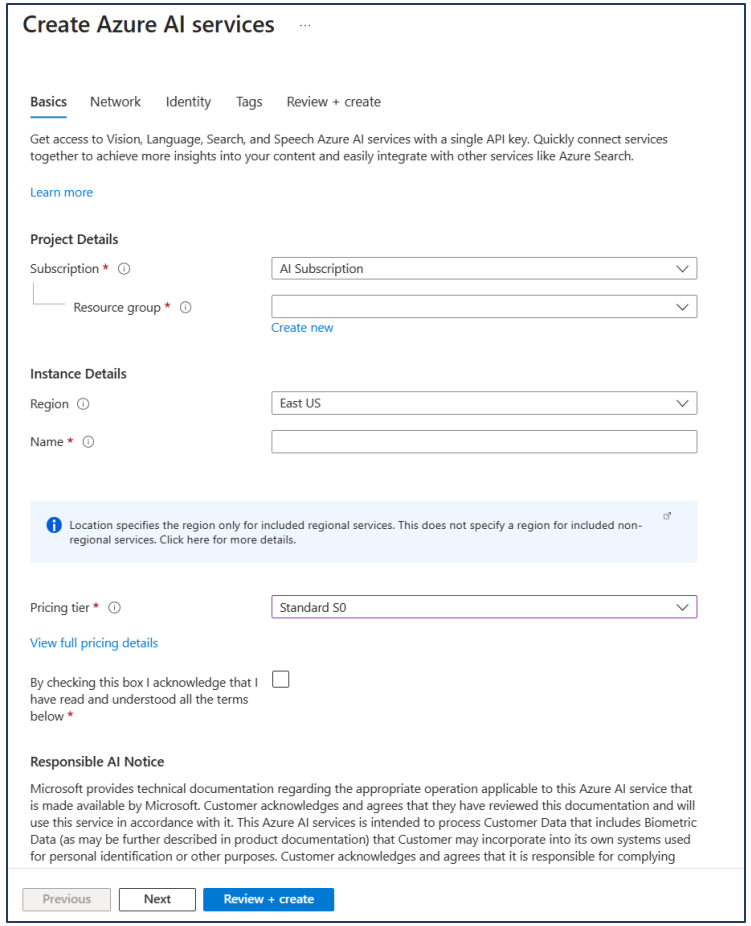
Azure AI Services

- Azure AI Document Intelligence
- Azure AI Language
- Azure AI Vision
- Azure OpenAI
- Azure AI Search

Provisioning Azure AI Services resources

Create a resource in your Azure subscription

- You will create either a *single-service* resource or a *multi-service* resource:
- Multi-service resource (Azure AI Services):
  - Access multiple Azure AI Services with a single key and endpoint.
  - Consolidates billing from the services you use.
- Single-service resource (for example, Language):
  - Access a single Azure AI service with a unique key and endpoint for each service created.
  - Use the free tier to try out the service.



Endpoints, Keys, and Locations

Information required to connect

Endpoint:

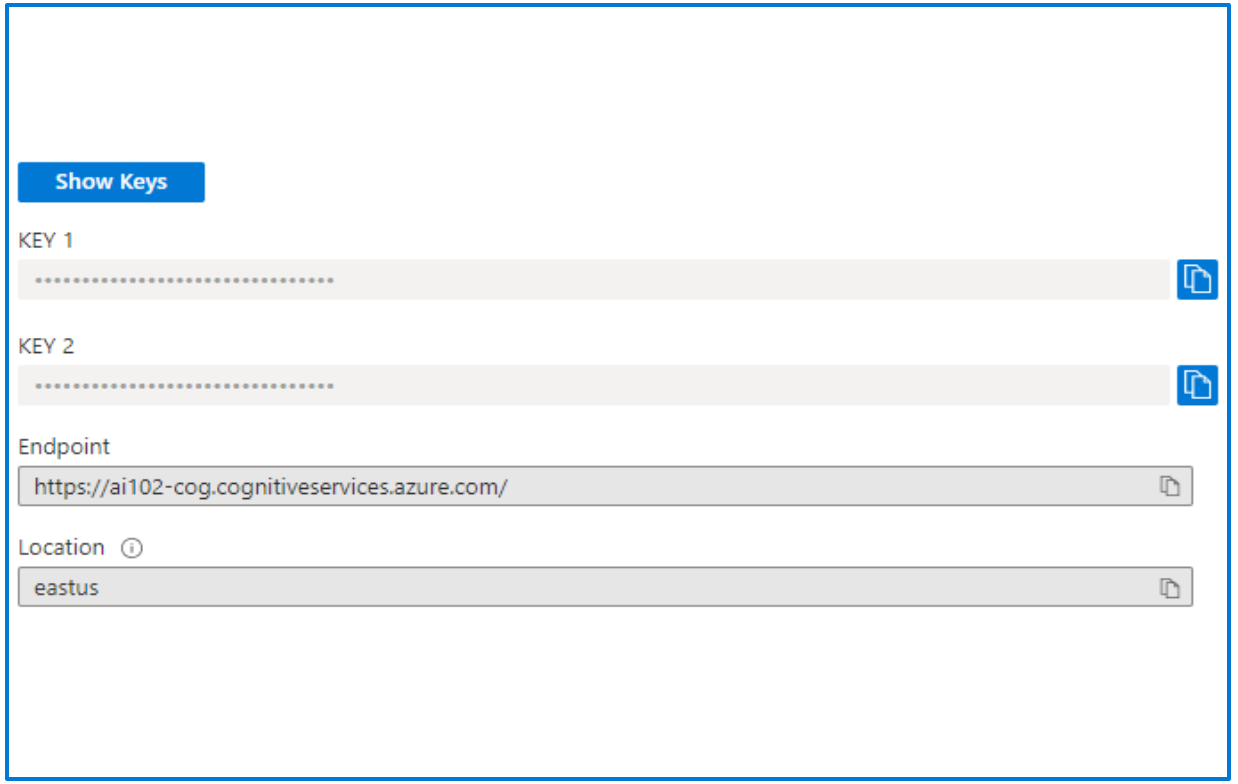
- URL at which service can be consumed
- Required by *most* SDK clients

Keys:

- Use *either* key to authenticate

Location:

- Azure data center in which resource is provisioned
- Required by *some* SDK clients

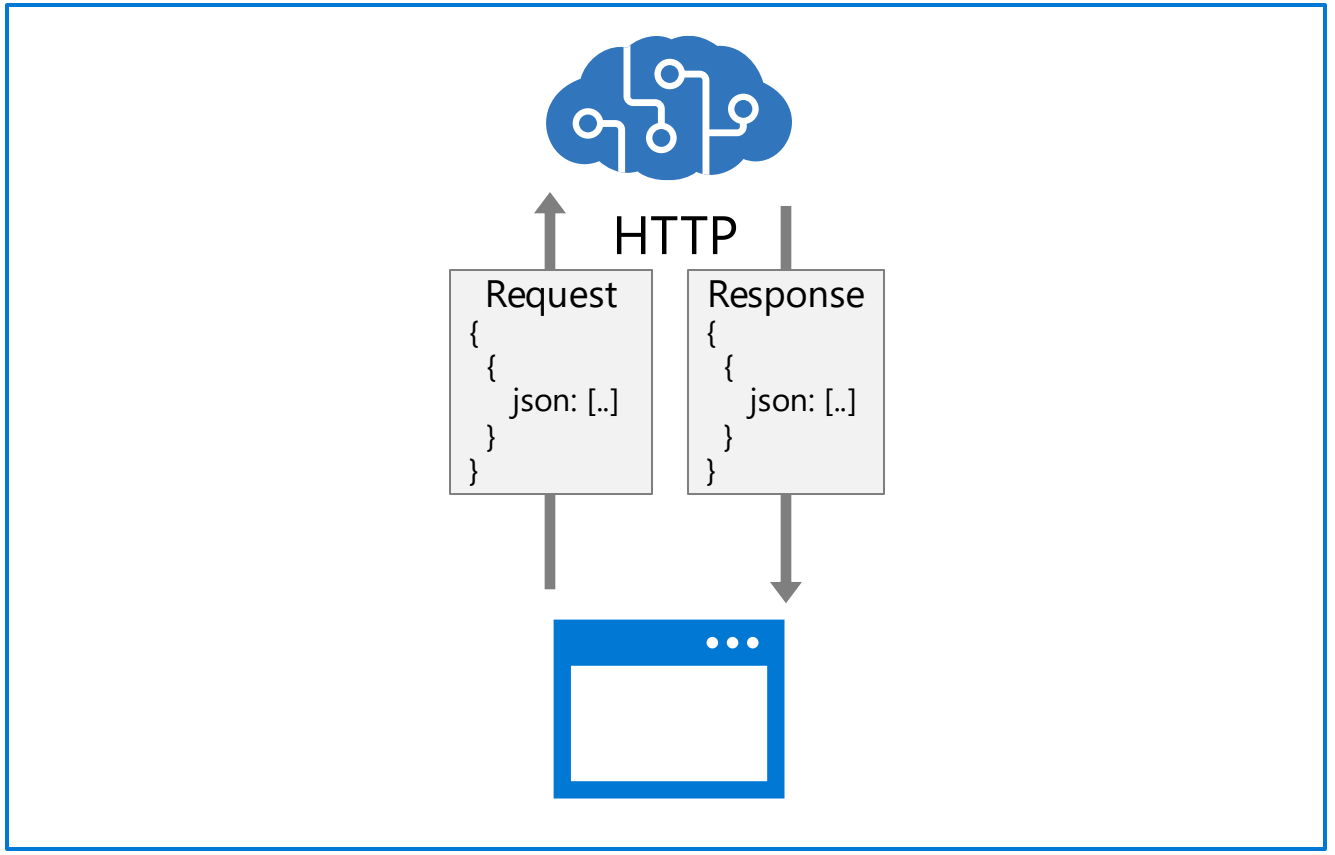


Azure AI Services REST APIs

Clients submit HTTP requests to the resource endpoint

- Key specified in request header
- Input data in JSON format
- Specific schema varies by service and method

Service returns JSON response

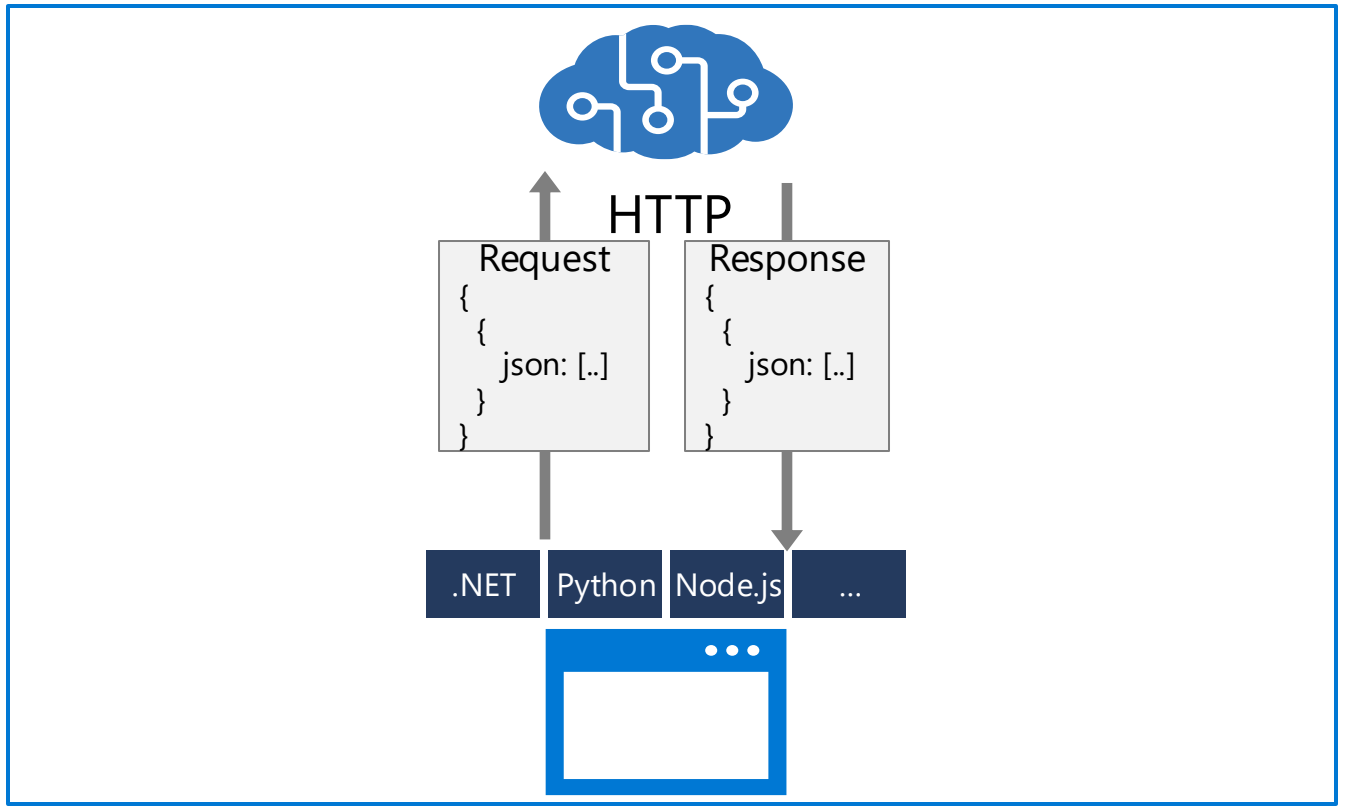


Azure AI Services SDKs

Runtime library abstracts REST interface

Multiple SDKs for each service:

- .NET
- Python
- Node.js
- Java
- Others…



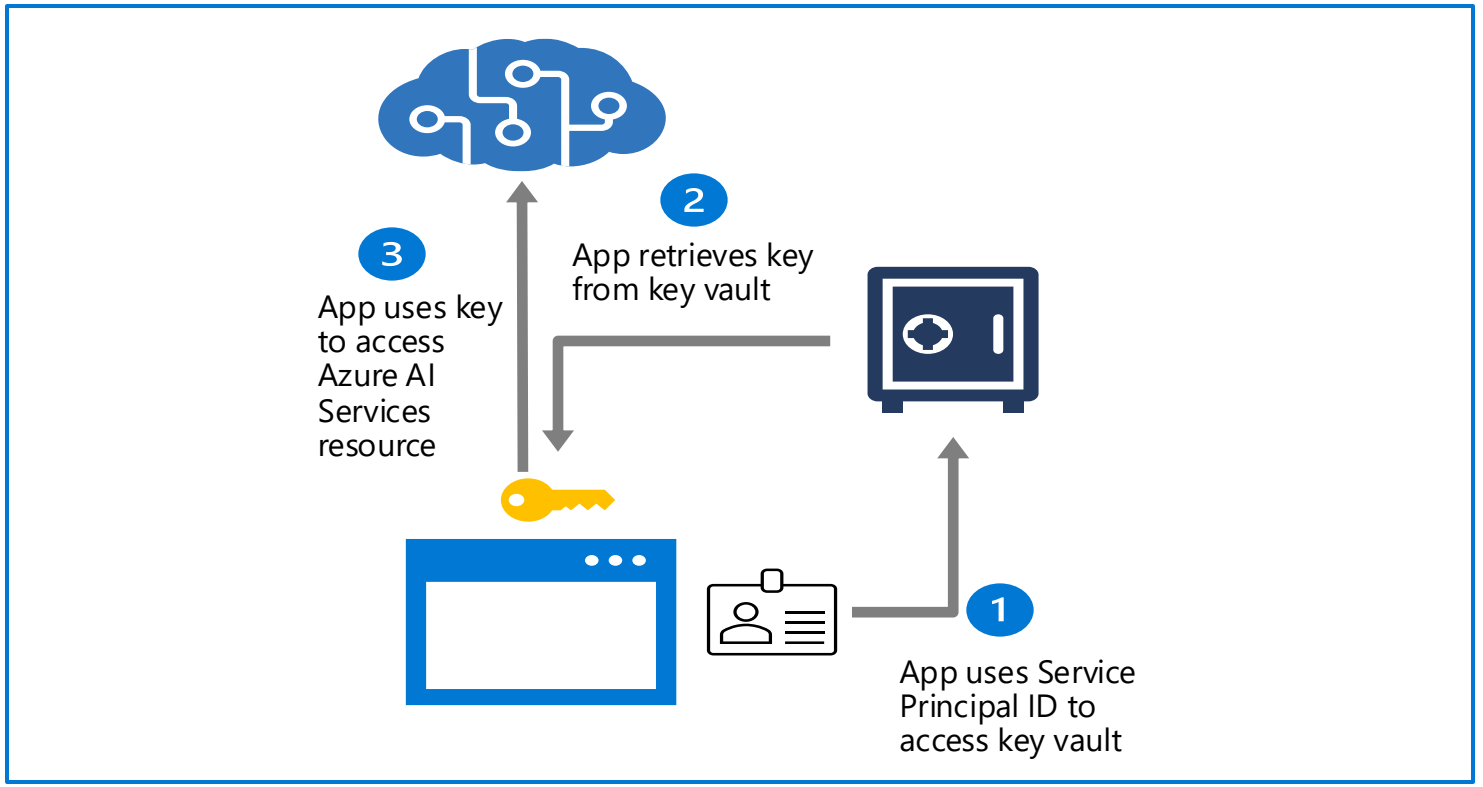
Considerations for Azure AI Services security

Regenerate keys regularly to protect access

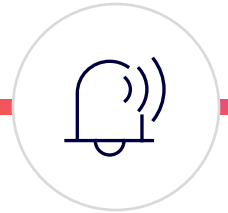
- To avoid service interruption, switch apps to use key 2 before regenerating key 1; and vice-versa

Consider protecting keys by storing them in Azure Key Vault

- Apps can use a Service Principal as a managed identity to retrieve keys from Key Vault

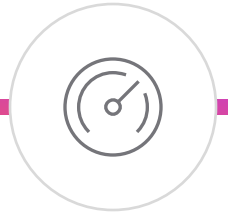


Monitoring Azure AI Services Activity



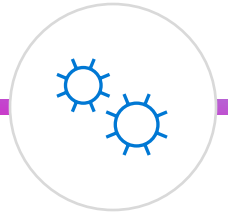
Alerts

- Alerts will ensure that the correct team knows when a problem arises.
- Every alert or notification available in Azure Monitor is the product of a



Metrics

- Metrics are numerical values
- The metrics are collected at regular intervals and are useful for alerting.
- Metrics are stored in a time-



Diagnostic settings

- Configure diagnostic settings is to provide detailed information for diagnostics and auditing.
- Diagnostic Destinations:
  - Log Analytics Workspace

Logs

- Logs contain time-stamped information about changes made to resources.
- The log data is organized into record
- The logs can include numeric

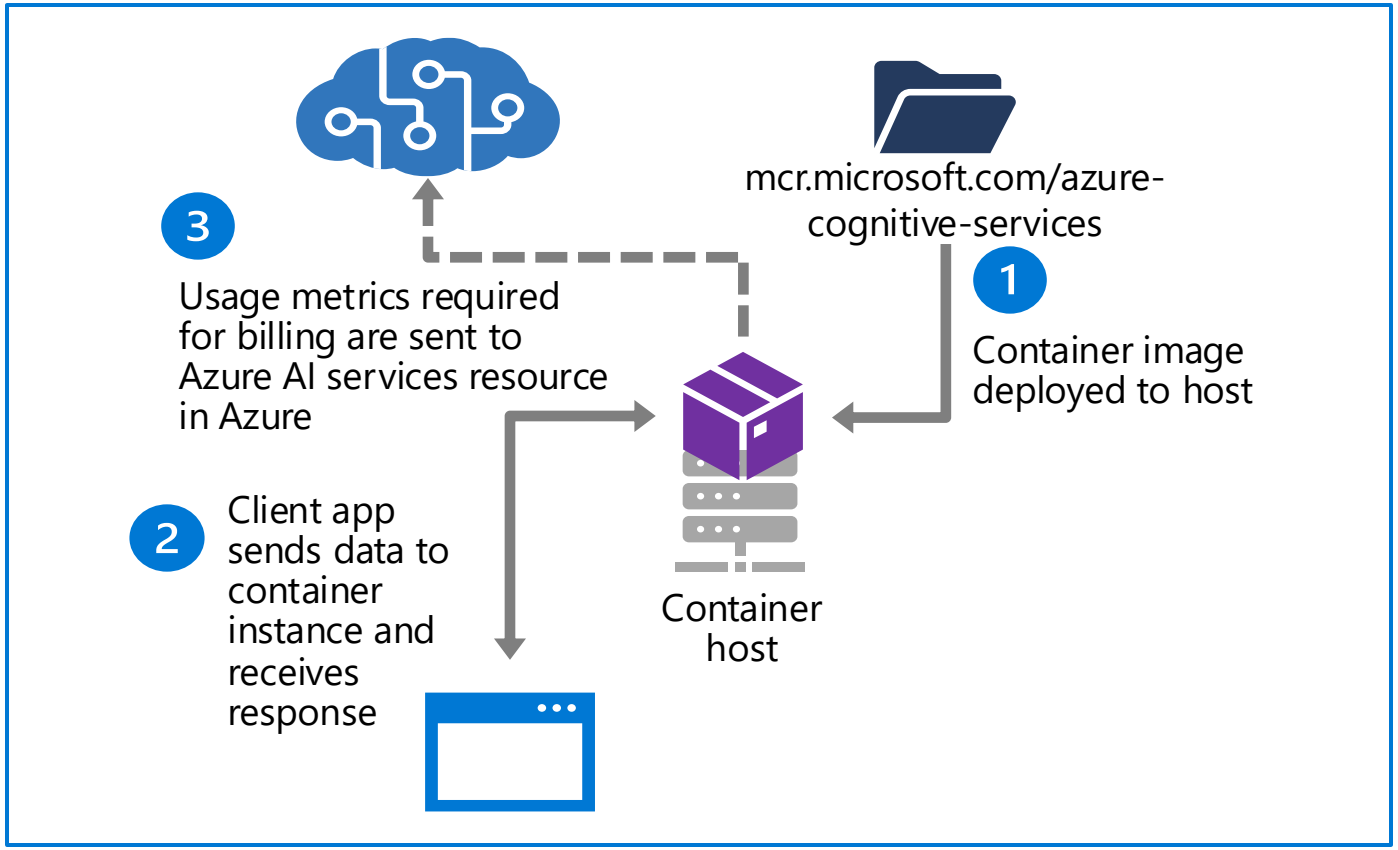
Azure AI Services and Containers

Container images are available for commonly used Azure AI services APIs

- Deploy containers to:
- Local Docker hosts
- Azure Container Instances
- Azure Kubernetes Services clusters
- others…

Enables more control over data sent to public Azure AI service endpoint

- An Azure AI services resource is still required, and the container must communicate with it to send billing data



Knowledge check

1 How are client applications typically granted access to an Azure AI services endpoint?

- ☑ The application must specify a valid subscription key for the Azure resource.
- ☐ The user of the application must enter a user name and password associated with the Azure subscription.
- ☐ Access to Azure AI services is granted to anonymous users by default.

2 You want to keep track of how often the subscription keys for your Azure AI services resource are retrieved. What should you do?

- ☐ Regenerate the keys for your Azure AI services resource.
- ☑ Create an alert for your Azure AI services resource.
- ☐ Store the keys in Azure Key Vault.

3 You plan to use an Azure AI services container in a local Docker host. Which of the following is true?

- ☐ Client applications must pass a subscription key to the Azure resource endpoint before using the container.
- ☐ All data passed from the client application to the container is forwarded to the Azure resource endpoint.
- ☑ The container must be able to connect to the Azure resource endpoint to send usage data for billing.

Microsoft

Develop computer vision solutions with Azure AI Vision

Azure AI Vision – Image Analysis

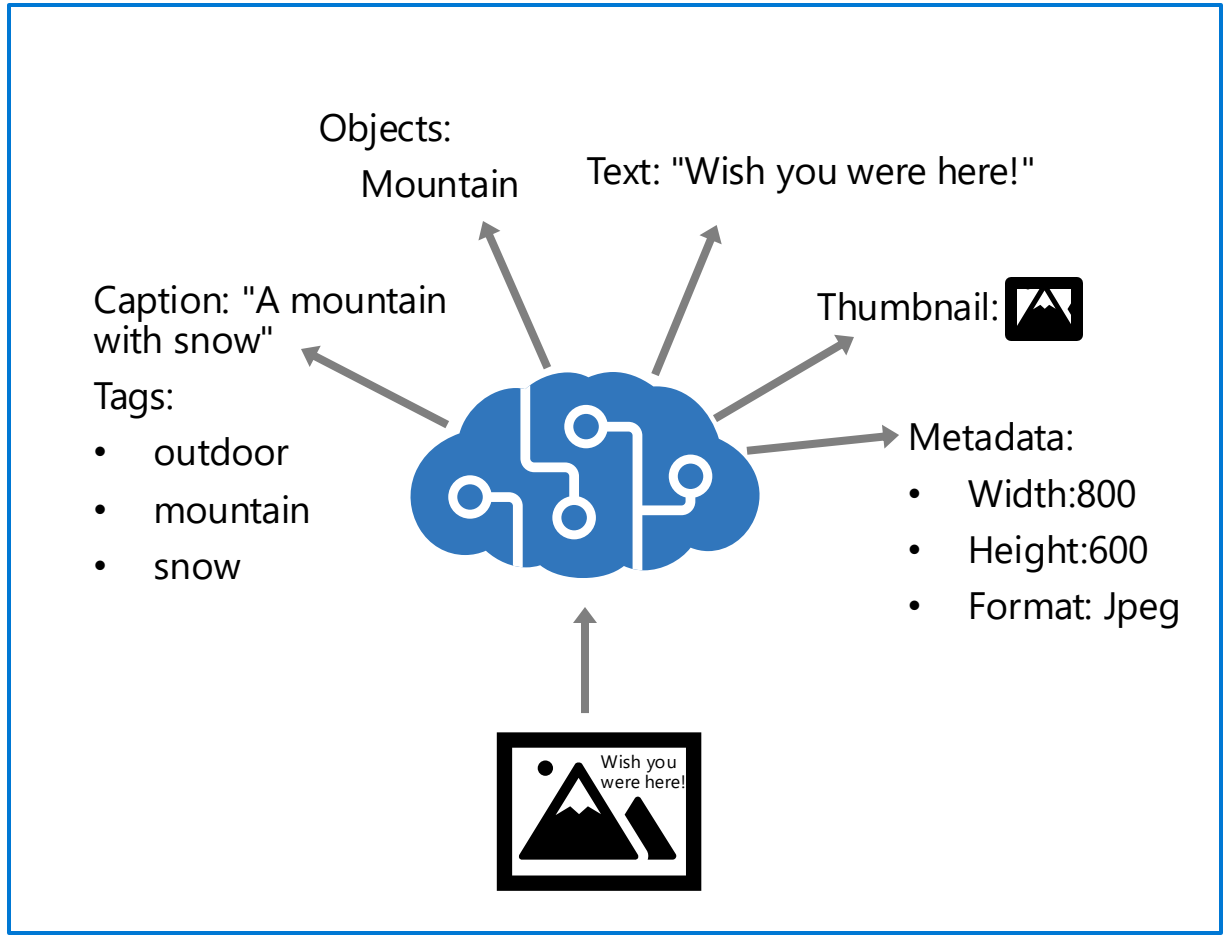
Image analysis:

- Caption and tag generation
- Object detection
- People detection
- Optical character recognition
- Smart crop thumbnails
- Background removal
- Multi-modal embeddings
- Product recognition

Can be used as:

- Standalone **Azure AI Vision** resource
- Multi-service **Azure AI Services** resource

* Some new features are limited to specific regions



Azure AI Vision - OCR

Use **Image analysis** with READ feature

Vision OCR vs Document Intelligence:

- OCR: General, non-document images with smaller amounts of text. Synchronous API.
- Document Intelligence: Ideal for larger text heavy documents. Asynchronous API.

Results in JSON (REST) or object (SDK) of similar structure


```
[{
    "lines": [{
        "text": "You must be the change you",
        "boundingPolygon": [
          {
            "x": 251,
            "y": 265
          },
          {
            "x": 673,
            "y": 260
          },
          {
            "x": 674,
            "y": 308
          },
          {
            "x": 252,
            "y": 318
          }
        ],
        "words": [
          {
            "text": "You",
            "boundingPolygon": ...
            "confidence": 0.996
          },
          {
            "text": "must",
            "boundingPolygon": ...
            ...
```

Options for Face Detection, Analysis, and Recognition

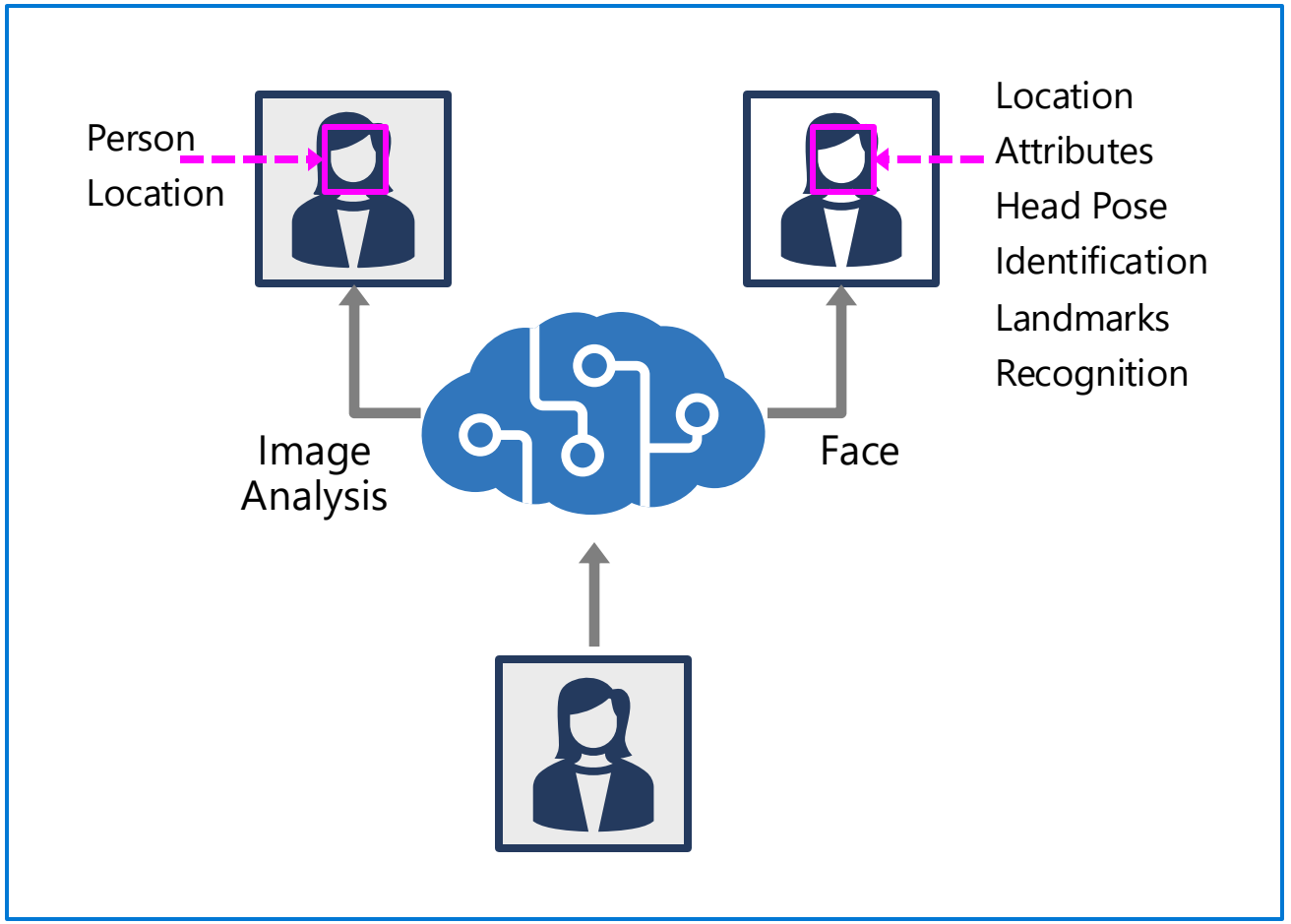
Image Analysis

- People detection
- Only location provided

Face Service

- Face detection
- Comprehensive facial feature analysis
- Face comparison and identification*
- Facial recognition*

** Require Limited Access approval*



Two types of custom vision models

Azure AI Custom Vision (previous service)

- **Portal: customvision.ai**
- **Base model:**
  - Convolutional neural network (CNN)
- **Tasks:**
  - Image classification
  - Object detection
- **Labeling:**
  - Customvision.ai
- **Minimum training data needed:**
  - 15 images per category
- **Training data storage**
  - Uploaded to Custom Vision service

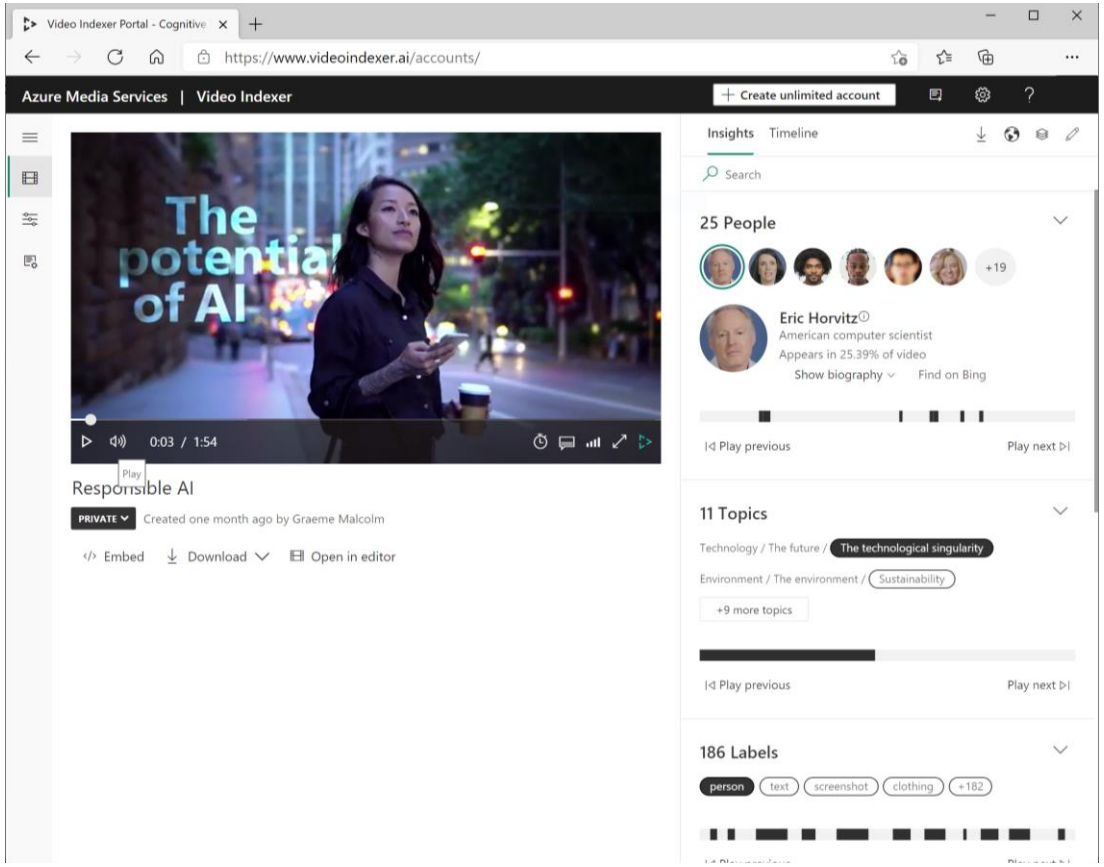
Custom AI Vision models (new Florence model)

- **Portal: Vision Studio**
- **Base model:**
  - Transformer (multi modal)
- **Tasks:**
  - Image classification
  - Object detection
  - Product recognition
- **Labeling:**
  - AML Studio or COCO file
- **Minimum training data needed:**
  - 2-5 images per category
- **Training data storage**

Video Indexer

Video analysis:

- Facial recognition (limited access)
- Optical character recognition
- Speech transcription
- Topics
- Sentiment
- Labels
- Content moderation
- Scene segmentation



Knowledge check

1 You want to use the Azure AI Vision Analyze Image function to generate an appropriate caption for an image. Which visual feature should you specify?

- ☐ Tags
- ☑ Caption
- ☐ Text

2 What is the effect of the *Smart Cropping* option when using Azure AI Vision to generate a thumbnail?

- ☐ The aspect ratio of the original image is maintained.
- ☐ The thumbnail is skewed to fit the specified proportions.
- ☑ The region of interest is centered in the thumbnail.

3 You want Video Analyzer to recognize colleagues in videos recorded from conference calls. What should you do?

- ☑ Create a custom model containing a *Person* for each colleague, with example images of their faces.
- ☐ Edit the conference call videos to include a caption of each person's name on their first appearance.
- ☐ Embed the Video Analyzer widgets in a custom web site that employees access using their own user credentials.

Knowledge check

4 Which of the following facial attributes can the Azure AI Vision service predict?

- ☐ Location
- ☐ Type of eye-classes
- ☐ Occlusion

5 You need to create a facial recognition solution that can identify named employees. Which service should you use?

- ☐ Vision
- ☐ Personalizer
- ☑ Face

6 You need to detect if a specific dangerous item is in your company's inspection photos. What should you do?

- ☐ Create an image classification custom model.
- ☐ Use the Object feature in Image Analysis.
- ☑ Train a custom model to detect that item.

Microsoft

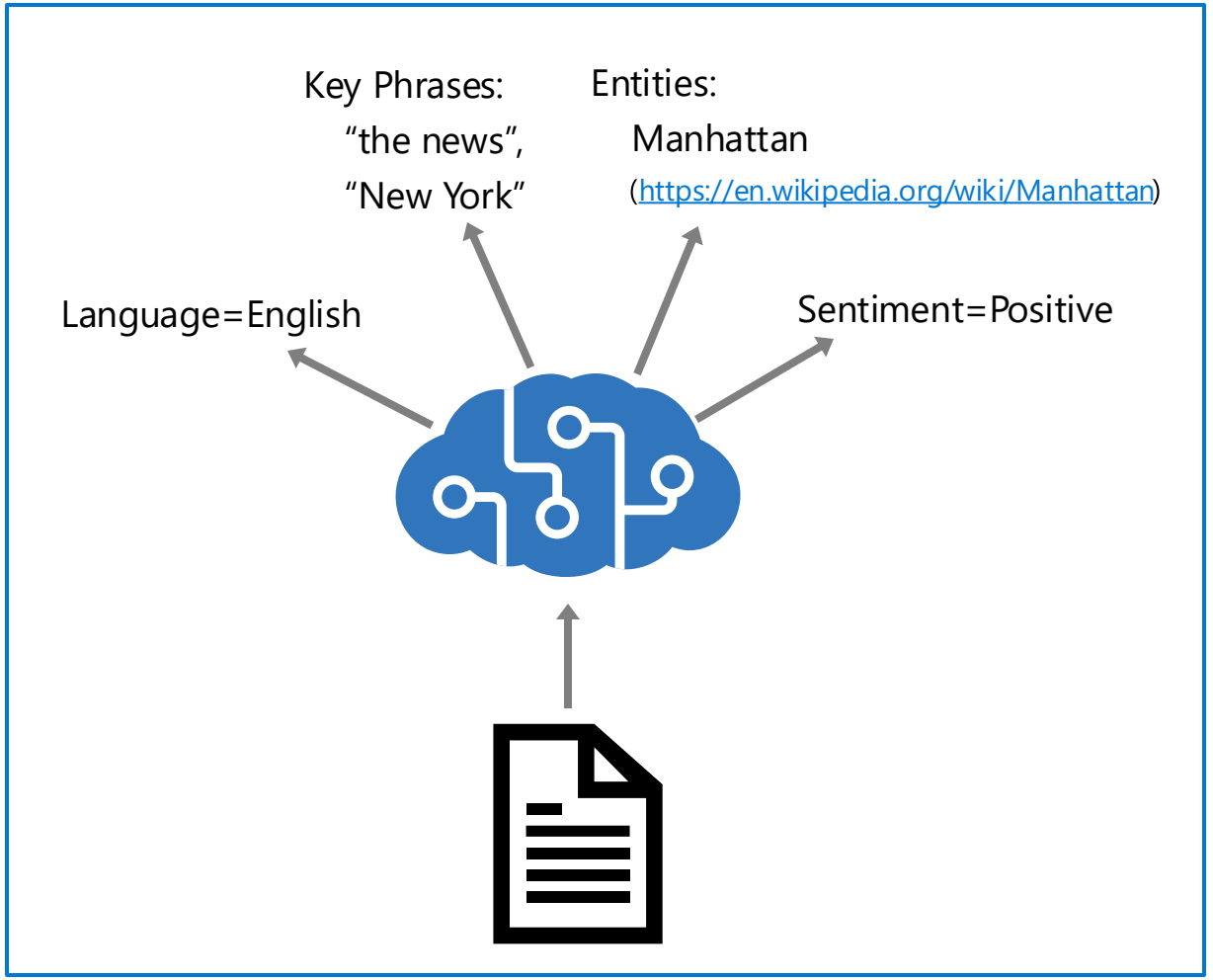
Develop natural language processing solutions

The Azure AI Language Service

Preconfigured features:

- **Language detection**
- **Key phrase extraction**
- **Sentiment analysis**
- **Named entity recognition**
- **Entity linking**
- **Summarization**
- **PII detection**

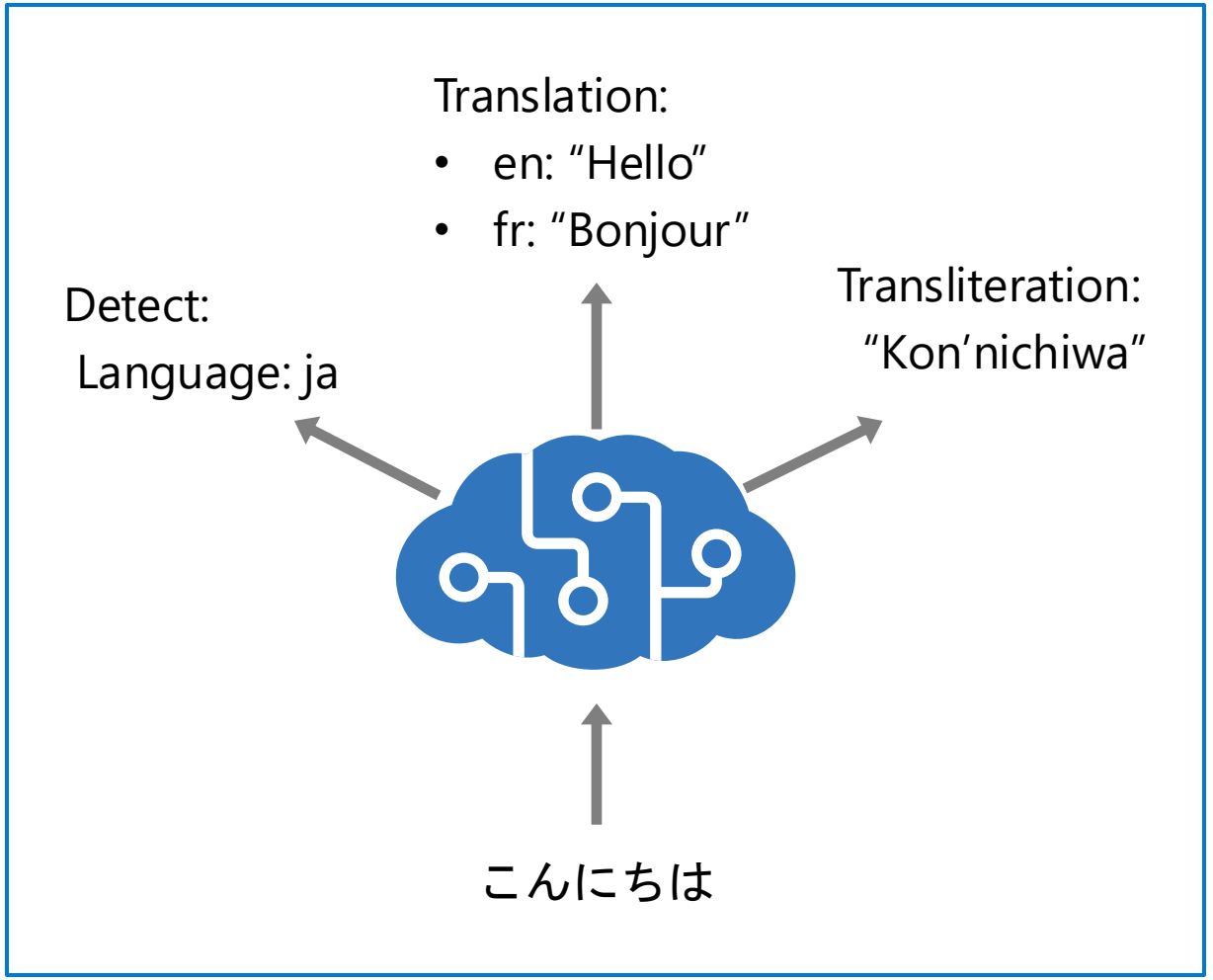
Customizable features are covered in another section



The Translator Service

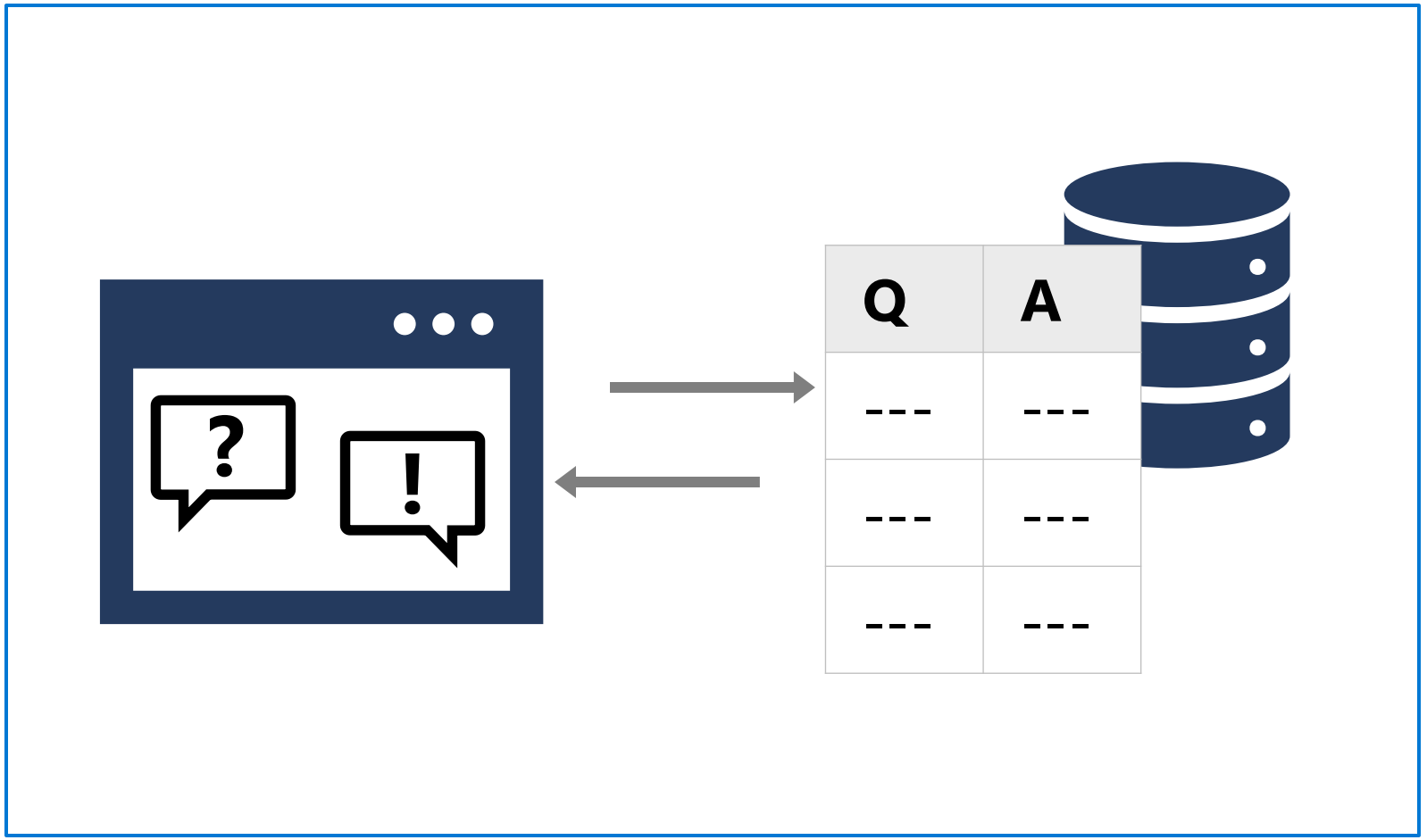
Multilingual text translation REST API

- **Language *detection***
- **One-to-many *translation***
- **Script *transliteration***



Introduction to Question Answering

- Knowledge base of question and answer pairs with natural language understanding
- Published as a REST endpoint for applications to consume
- Available through language specific SDKs



Intents and utterances

To train a language understanding model:

- Specify *utterances* that represent expected natural language input
- Map utterances to *intents* that assign semantic meaning

Utterance	Intent
What time is it?	GetTime
Tell me the time.	
What is the weather forecast?	GetWeather
Do I need an umbrella?	
Turn the light on.	TurnOnDevice
Switch on the fan.	
Hello	None

Entities

Define *entities* to add specific context to intents

Utterance	Intent	Entities
What is the time?	GetTime	
What time is it in London?	GetTime	Location (London)
What's the weather forecast for Paris?	GetWeather	Location (Paris)
Will I need an umbrella tonight?	GetWeather	Time (tonight)
What's the forecast for Seattle tomorrow?	GetWeather	Location (Seattle), Time (tomorrow)
Turn the light on.	TurnOnDevice	Device (light)
Switch on the fan.	TurnOnDevice	Device (fan)

Entity types:

Learned	List	Prebuilt
Machine learned through training	Term in a defined list	Common types like numbers and date/times

Custom Text Classification

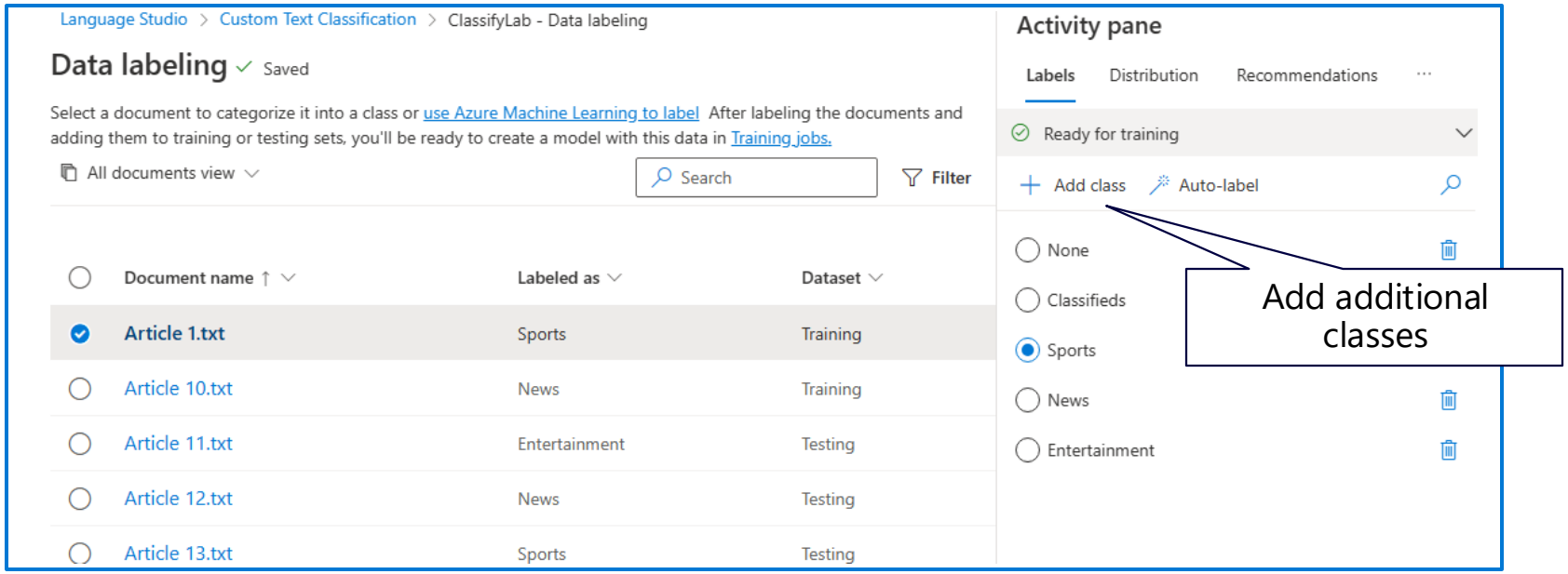
Assign custom labels to documents

1. **Connect to documents in Azure**
2. **Define class labels to assign to your documents**
3. **Label documents**
4. **Train your model**

Call your model through the Language API

- **Specify project and deployment name**

Can be single label or multi label projects



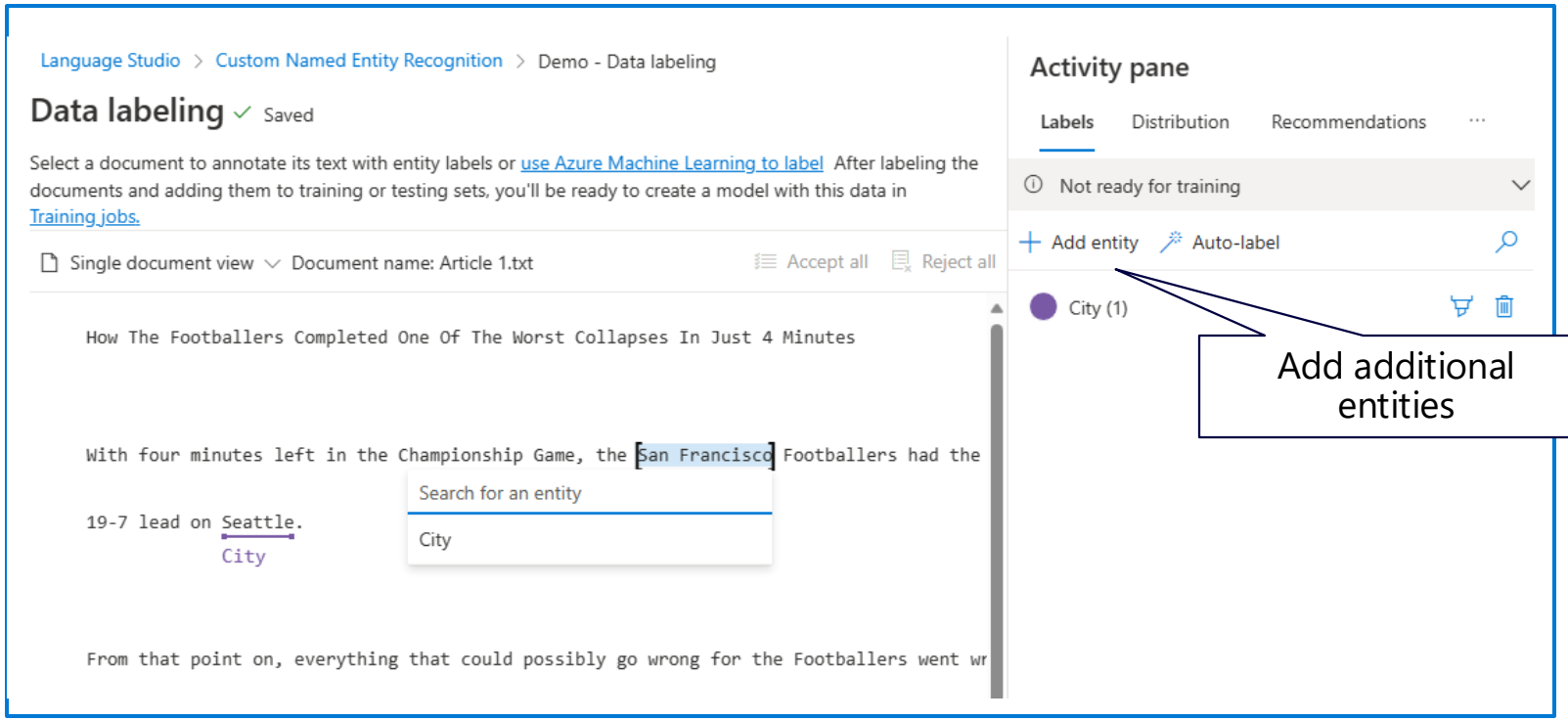
Custom Named Entity Recognition

Assign custom labels to entities in your documents

1. **Connect to documents in Azure**
2. **Define entity labels to assign to your documents**
3. **Label documents completely and consistently**
4. **Train your model**

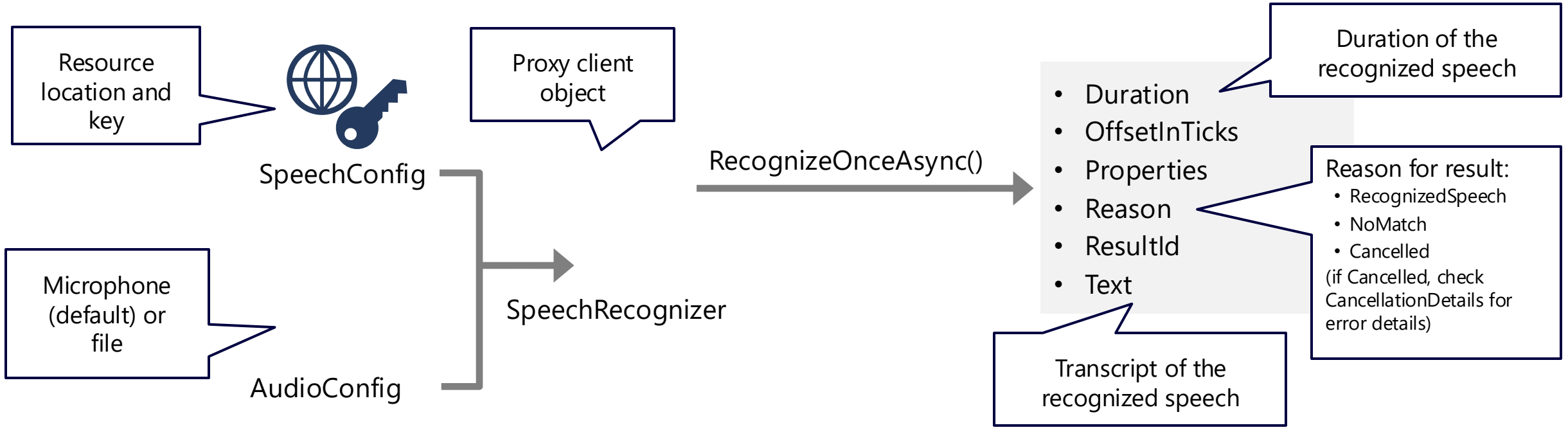
Call your model through the Language API

- **Specify project and deployment name**



Speech recognition, translation and synthesis

Speech-to-Text

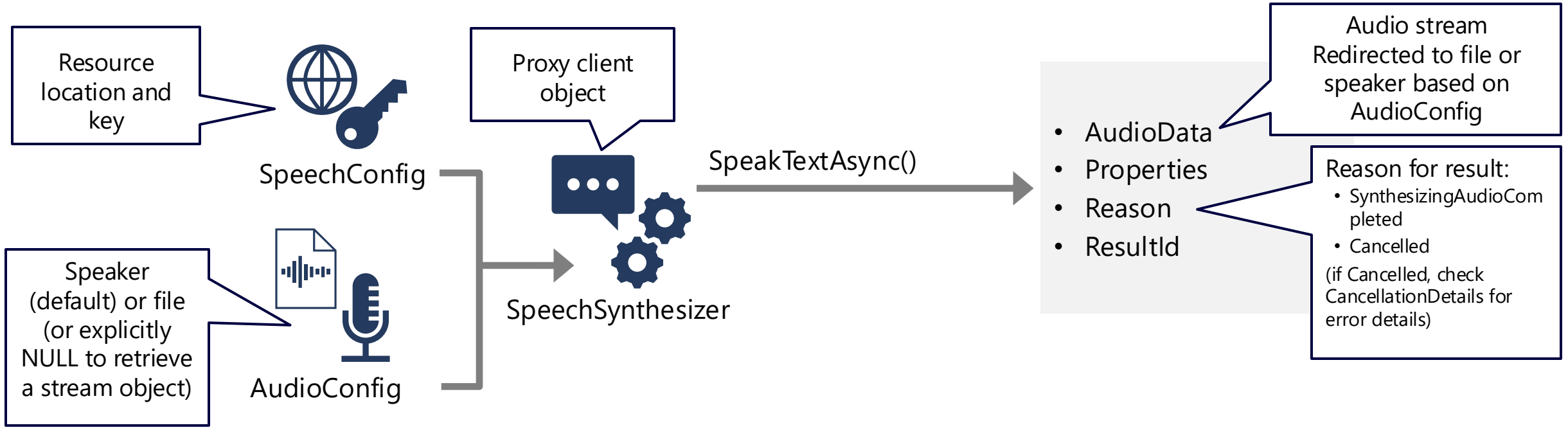


Two REST APIs:

- **Speech-to-text API – Used by Azure AI Speech SDK – preferred for most scenarios**
- **Speech-to-text Short Audio API – Useful for short (up to 60s) of audio**

Azure AI Speech SDK (.NET, Python, JavaScript, etc.)

Text-to-Speech

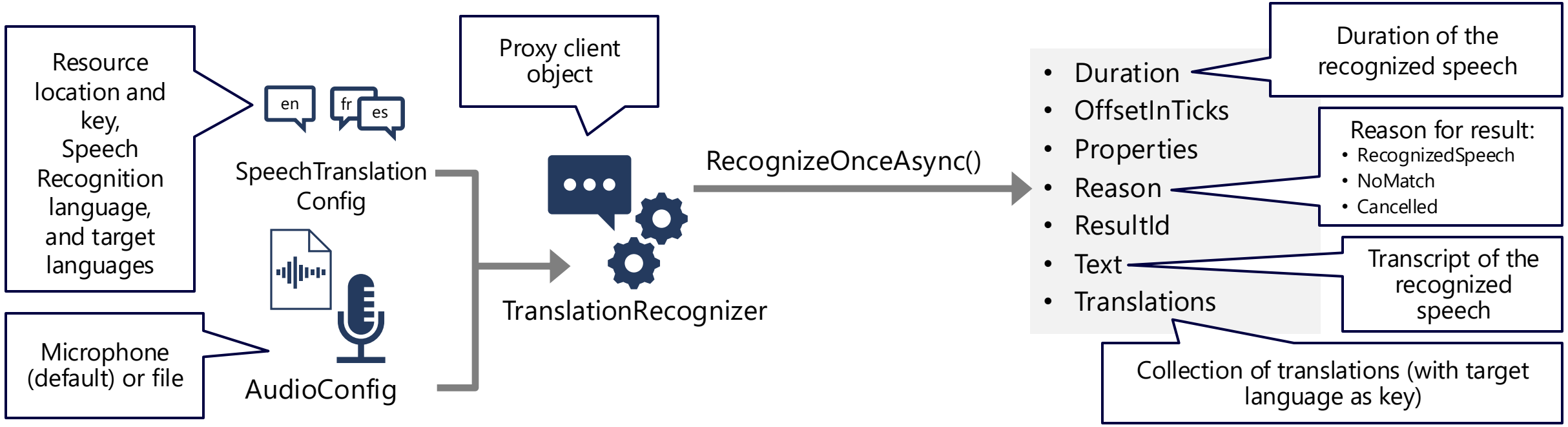


Two REST APIs:

- **Text-to-speech API – Suitable for most scenarios**
- **Batch synthesis API – Convert large volumes of text to audio files**

Azure AI Speech SDK (.NET, Python, JavaScript, etc.)

Translating Speech to Text



Translation builds on speech recognition:

1. **Recognize and transcribe spoken input in speech recognition language**
2. **Return translations for one or more target languages**

Knowledge check

1 Which object should you use to specify that the speech input to be transcribed to text is in an audio file?

- ☐ SpeechConfig
- ☑ AudioConfig
- ☐ SpeechRecognizer

2 You have analyzed text that contains the word “Paris”. How might you determine of this word refers to the French city or the character in Homer’s *The Iliad*?

- ☐ Use the Azure AI Language service to extract key phrases.
- ☐ Use the Azure AI Language service to analyze sentiment.
- ☑ Use the Azure AI Language service to extract linked entities.

3 When translating speech, in which cases can you can use the Synthesizing event to synthesize the translations and speech?

- ☑ topIntent
- ☐ kind
- ☐ query

Knowledge check

4 Your app must interpret a command to book a flight to a specified city, such as "Book a flight to Paris." How should you model the city element of the command?

- ☐ As an intent.
- ☐ As an utterance.
- ☑ As an entity.

5 Your language model needs to detect an email when present in an utterance. What is the simplest way to extract that email?

- ☐ Use Regular Expression entities.
- ☑ Use Prebuilt entity components
- ☐ Use Learned entity components.

6 How should you create an application that monitors the comments on your company's web site and flags any indication that customers are unhappy?

- ☑ Use the Azure AI Translator service to detect profanities in comments.
- ☐ Use the Azure AI Language service to perform sentiment analysis of the comments.
- ☐ Use the Azure AI Language service to extract named entities from the comments

Microsoft

Develop solutions with Azure AI Document Intelligence

The Document Intelligence Service

Data extraction from forms and documents:

- Document analysis from general documents

  Read: OCR for printed and written text

  Layout: Extract text and structure

  General document: Extract text, structure, and key-value pairs

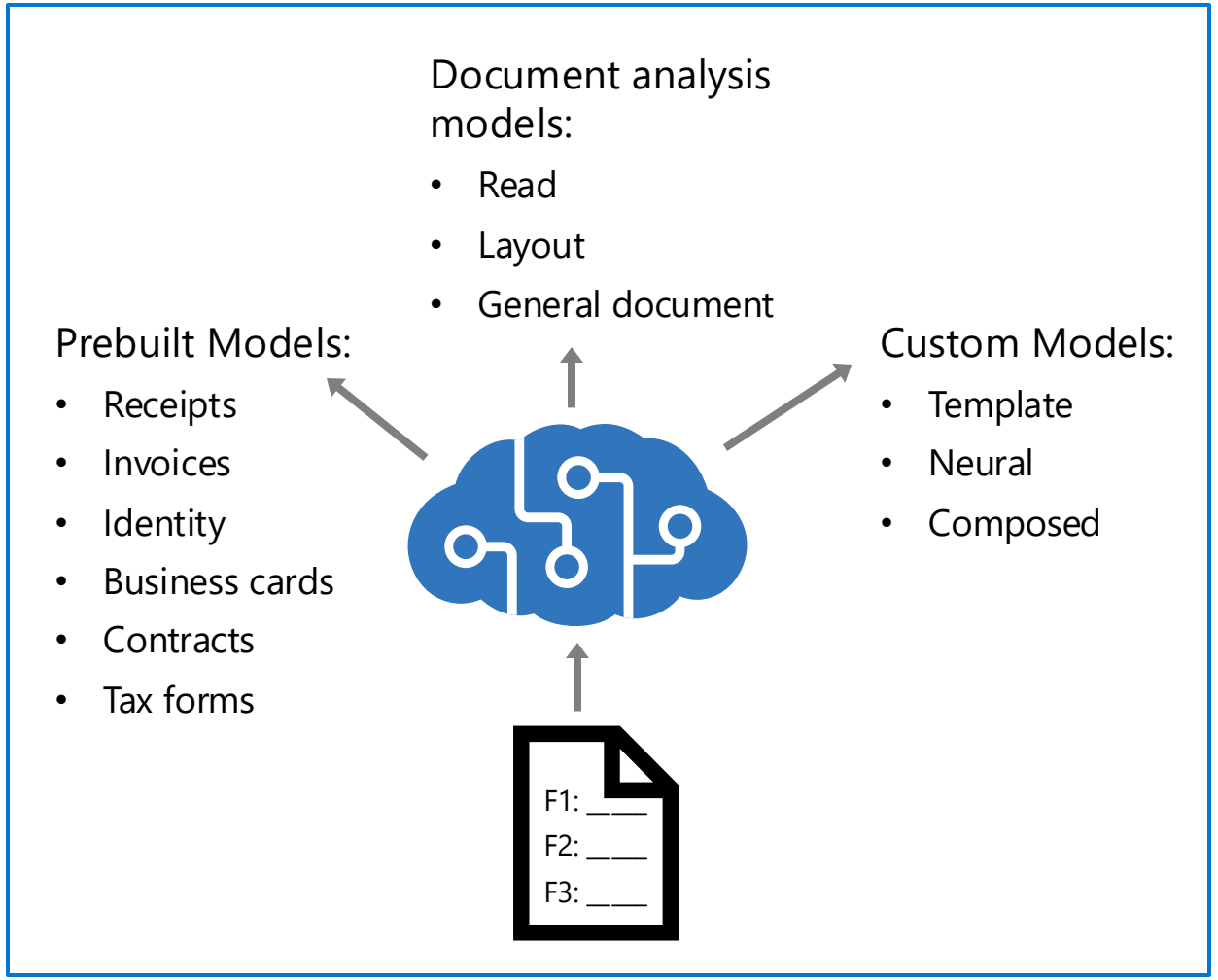
- Prebuilt models for common form types
- Train custom models for your own forms

  Custom template: Extract data from static layouts

  Custom neural: Extract data from mixed-type documents

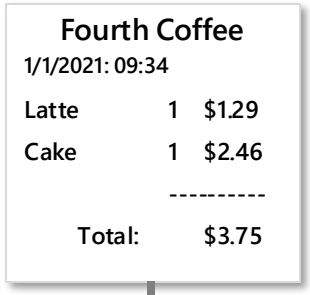
  Custom composed: Collection of multiple models assigned to a single model

Provision as single-service **Document Intelligence** resource or multi-service **Azure AI Services** resource



Prebuilt models

Receipt

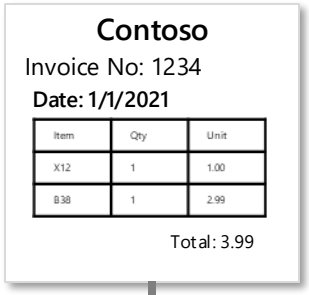


Analyze Receipt

Get Analyze Receipt Result

```
{
  "MerchantName": "Fourth Coffee",
  "TransactionDate": 2021-01-01,
  "TransactionTime": 09:34,
  "Items" [
    ...],
  "Total": 3.75
}
```

Invoice

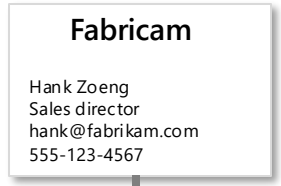


Analyze Invoice

Get Analyze Invoice Result

```
{
  "VendorName": "Contoso",
  "InvoiceNumber": 1234,
  "InvoiceDate": 2021-01-01
  "Tables" [
    ...],
  "TotalInvoiceAmount": 3.99
}
```

Business Card



Analyze Business Card

Get Analyze Business Card Result

```
{
  "ContactNames": [
    {
      "FirstName": "Hank",
      "LastName": "Zoeng"
    }],
    ...
}
```

Knowledge check

1 You have scanned a letter into PDF format and need to extract the text it contains. What should you do?

- ☐ Use the Image Analysis feature in Azure AI Vision.
- ☑ Use the Read model in the Document Intelligence service.
- ☐ Use a custom model in the Document Intelligence service.

2 You need to build an application that submits expense claims, extracting the merchant, date, and amount from scanned receipts. What's the best way to do this?

- ☐ Use the general document model.
- ☐ Use the prebuilt Contract model.
- ☑ Use the prebuilt Receipt model.

3 You need to extract only data from specific fields in cargo manifest forms using Document Intelligence. What should you do?

- ☐ Use a prebuilt model.
- ☐ Build a custom composed model from several custom models.
- ☑ Train custom template model with labeled documents.

Microsoft

Creating a Knowledge Mining Solution

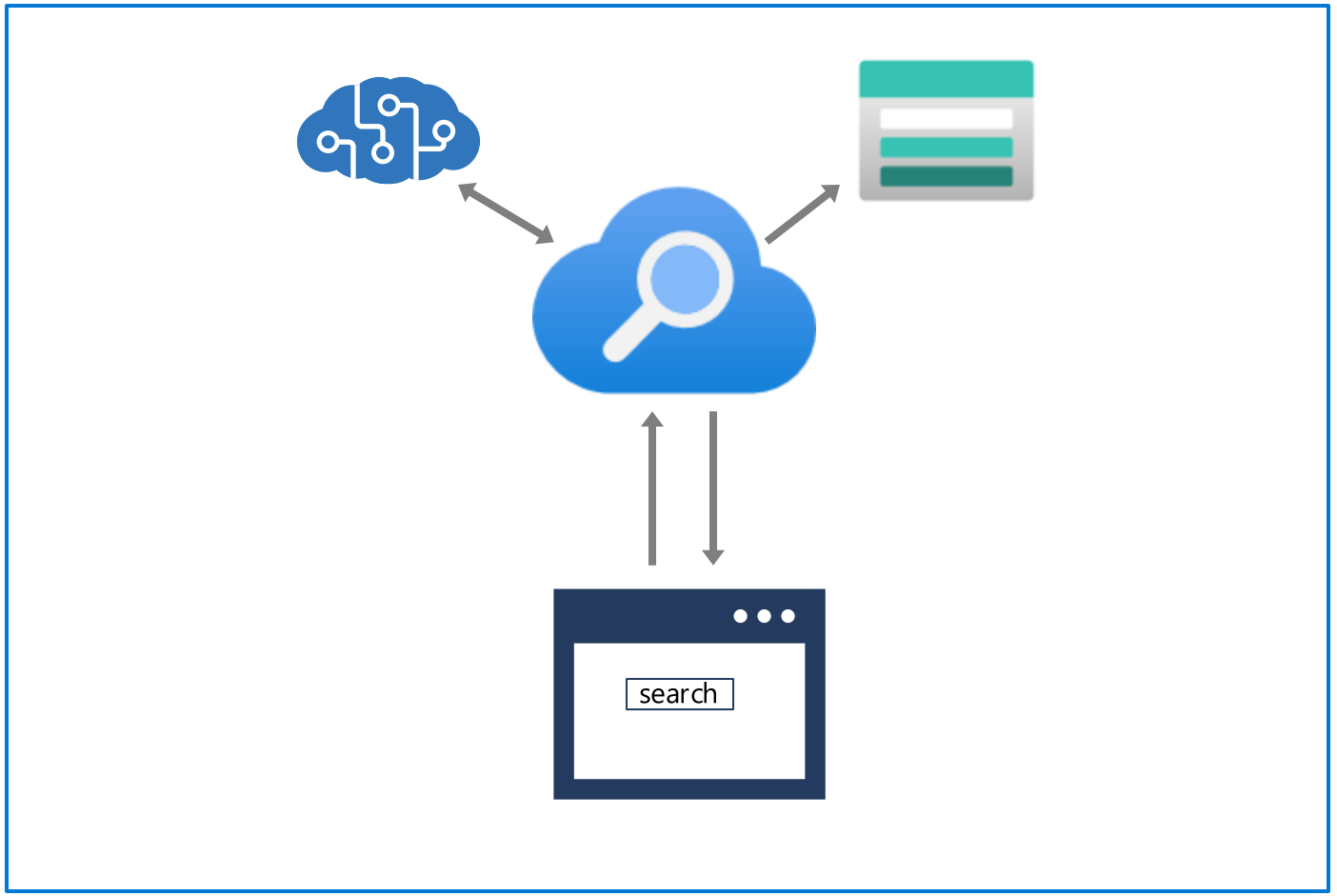
Azure AI Search

AI-Powered Knowledge Mining

- Index documents and data from a range of sources
- Use skills to enrich index data
- Store extracted insights in a knowledge store for analysis and integration

Azure Resources:

- **Azure AI Search** for core indexing and querying
- **Azure AI Services** for index enrichment
- **Storage account** for knowledge store persistence



Core Components of a AI Search Solution

Data Source

The data store to be searched:

- Blob storage container
- SQL Database
- Cosmos DB

You can also push JSON documents directly into an index

Skillset

Defines an enrichment pipeline of AI skills to enhance data during indexing:

- Built-in AI skills
- Custom skills

Indexer

Maps data source fields and skillset outputs to index fields

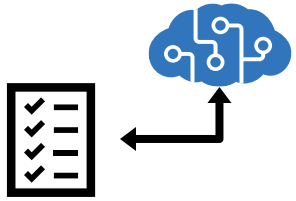
- Running the indexer builds the index

Index

Searchable collection of JSON documents containing extracted and enriched fields

How an Enrichment Pipeline Works

Document cracking and field extraction



Enrichment pipeline

Indexing

Index fields

Skill 1: Language Detection

- Input: document/content
- Output: document/language

Skill 2: OCR

- Input: document/normalized_images/*
- Output: document/normalized_images/*/text

Skill 3: Merge

- Input: document/content
- Input: document/normalized_images/*/text
- Output: document/merged_content

```
{

metadata_storage_name,
  metadata_author,
  content,
  normalized_images:
    […],
  …
}
```

```
{
  metadata_storage_name,
  metadata_author,
  content,
  normalized_images:
    […],
  language,
}
```

```
{
  metadata_storage_name,
  metadata_author,
  content,
  normalized_images:
    [
      {text},
    ],
  language
}
```

```
{
  metadata_storage_name,
  metadata_author,
  content,
  normalized_images:
    [
      {text}
    ],
  language,
  merged_content
}
```

Explicit field mappings

Implicit output field mappings

```
{
  file_name,
  metadata_author,
  language,
  document_text
}
```

Introduction to Custom Skills

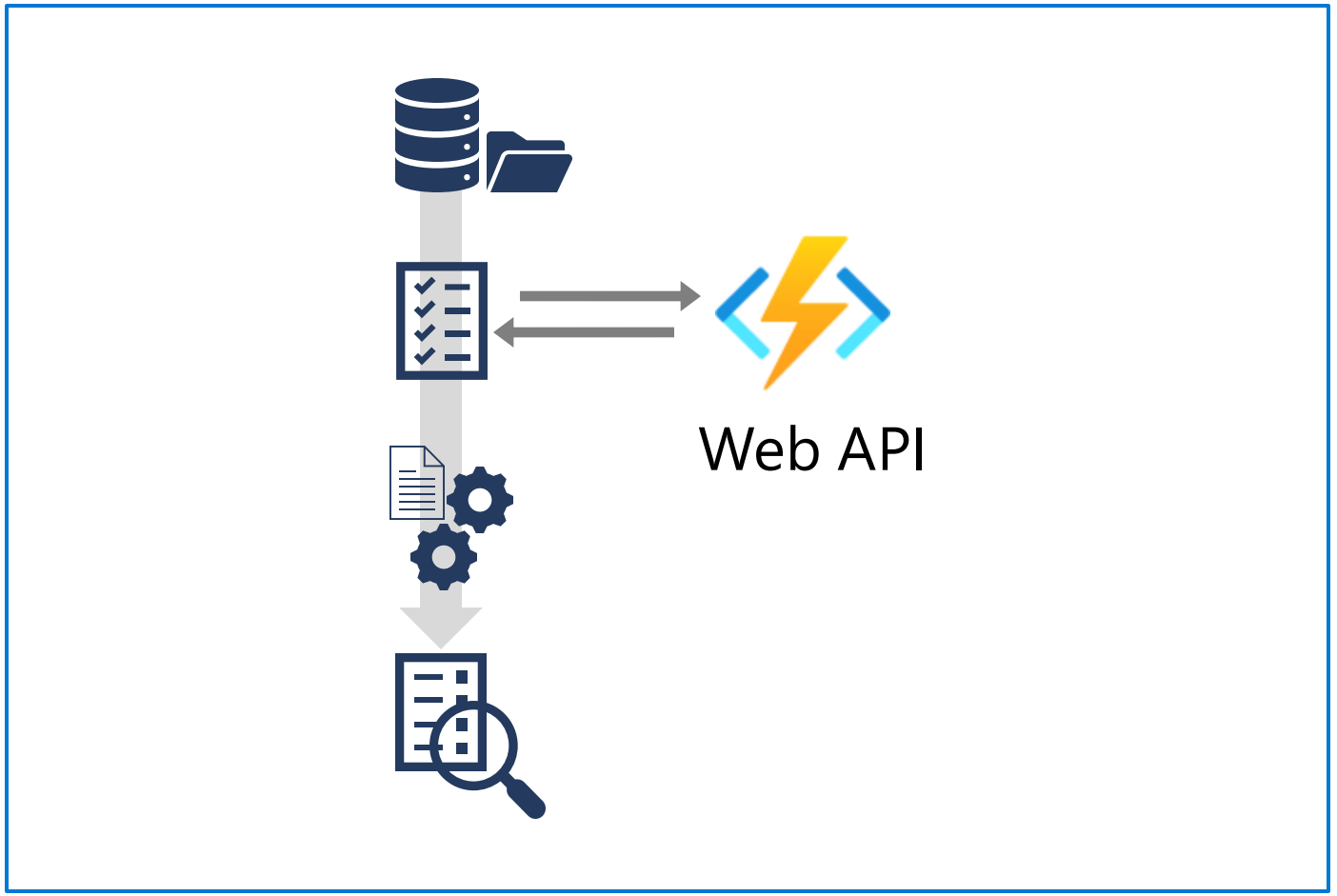
When built-in skills don't provide what you need...

Create a custom skill, for example:

- Integrate Document Intelligence
- Consume an Azure Machine Learning model
- Any other custom logic

Custom skills are implemented as Web APIs

- Commonly Azure Functions



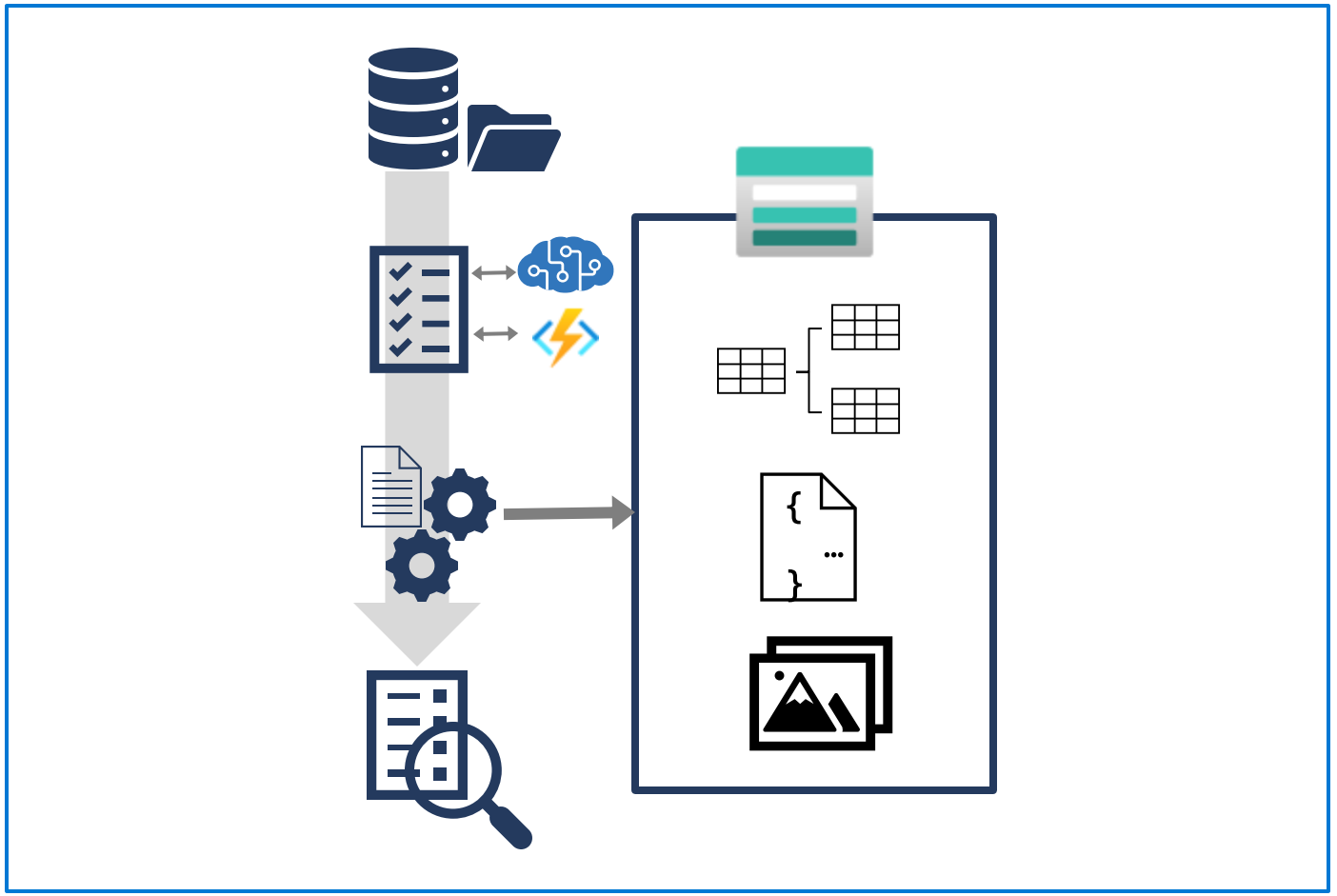
What is a Knowledge Store?

Persisted insights extracted by indexing process

Stored as *projections in Azure Storage*

- **Tables:** Relational tables with keys for joining
- **Objects:** JSON structures of document fields
- **Files:** Extracted images saved in JPG format

Used for analysis or integration into data processing workflows



Knowledge check

1 You want to enrich an index by extracting any geographical locations mentioned in the source data. Which built-in skill should you use?

- ☑ Entity Recognition
- ☐ Key Phrase Extraction
- ☐ Language Detection

2 You have implemented a custom skill as an Azure function. How can you include the custom skill in your indexing process?

- ☐ Add a Merge skill to the skillset to combine output from built-in skills with your custom skill.
- ☑ Add a WebApiSkill to a skillset, referencing the Azure function's URI
- ☐ Add a Shaper skill to the skillset to create a collection of records with unique IDs generated by your custom

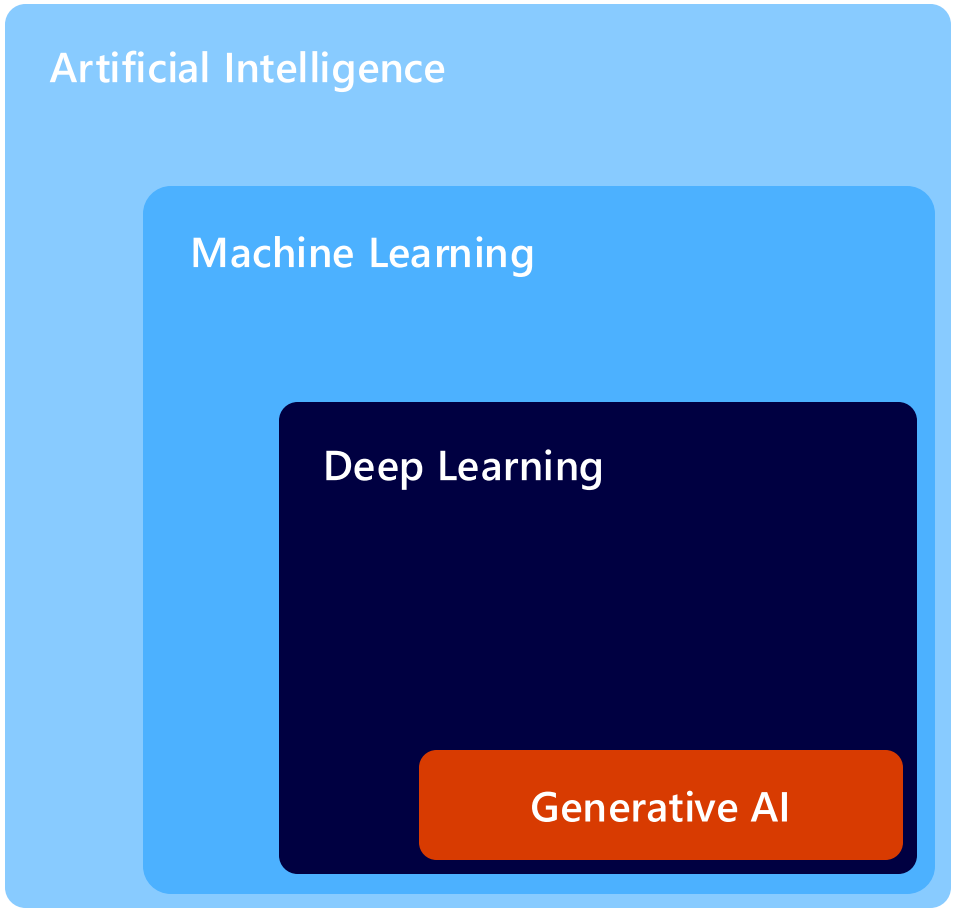
3 You want to create a knowledge store that contains JSON representations of the extracted data. What kind of projection should you define?

- ☐ File
- ☐ Object
- ☑ Table

Microsoft

Develop Generative AI Solutions with Azure OpenAI Service

What is generative AI?



1950s

Artificial Intelligence
the field of computer science that seeks to create intelligent machines that can replicate or exceed human intelligence

1990s

Machine Learning
subset of AI that enables machines to learn from existing data and improve upon that data to make decisions or predictions

2010s

Deep Learning
a machine learning technique in which layers of neural networks are used to process data and make decisions

2020s

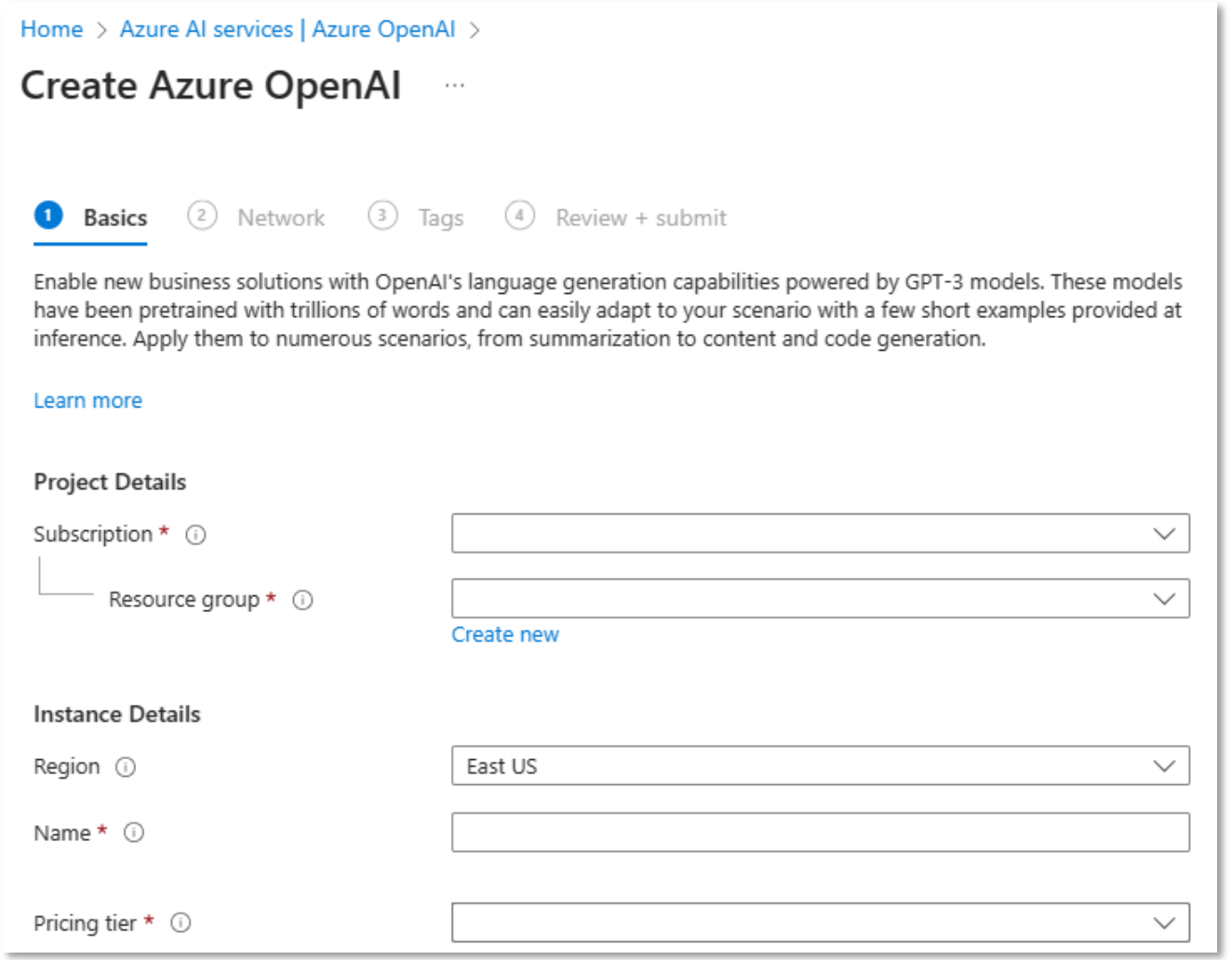
Generative AI
Create new written, visual, and auditory content given prompts or existing data.

Provision an Azure OpenAI resource in Azure

Deploy a model in Azure OpenAI Studio to use it

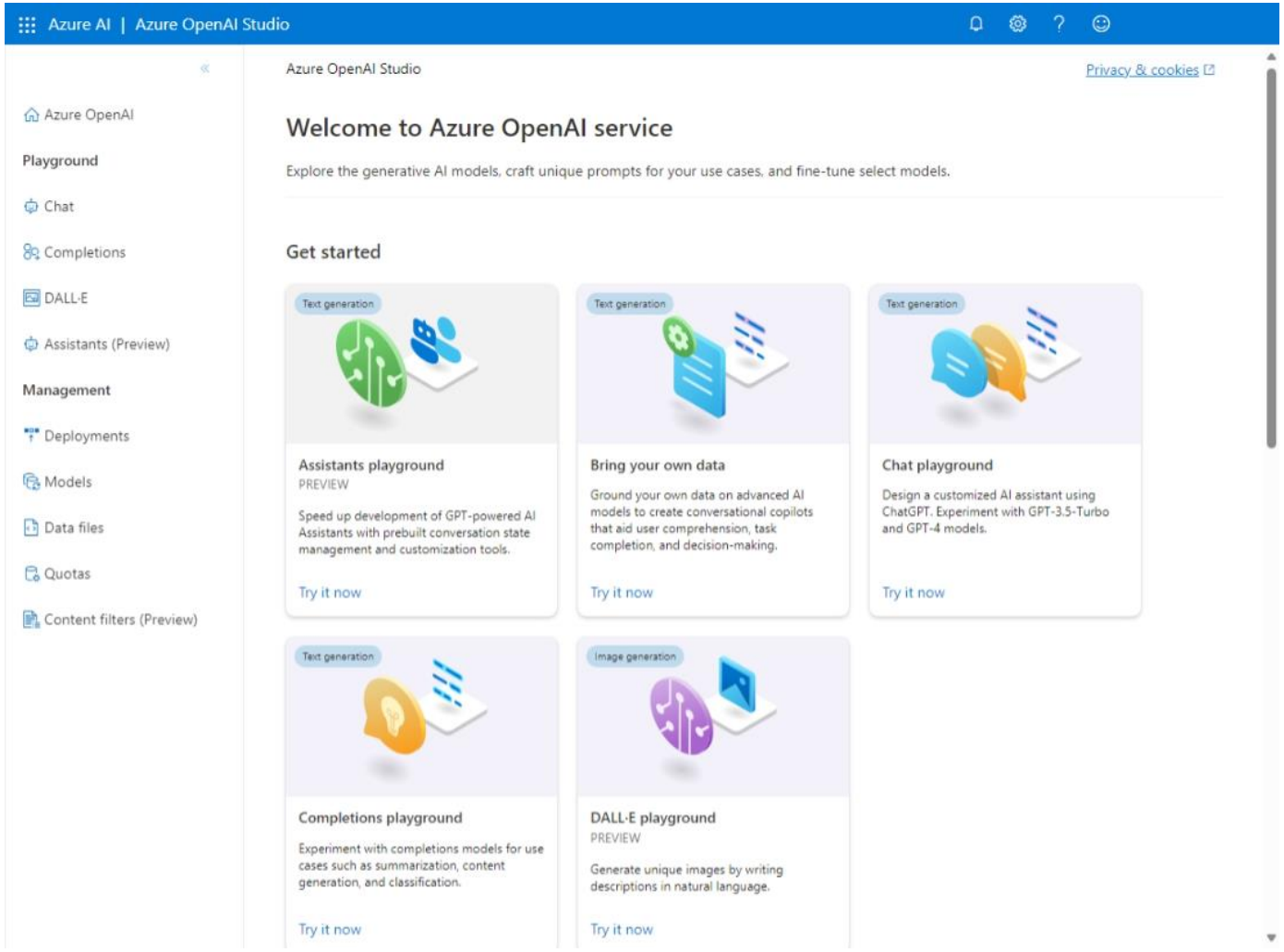
1. Apply for access to the Azure OpenAI service: https://aka.ms/oaiapply
2. Create an Azure OpenAI resource in the Azure portal

```
az cognitiveservices account create \
-n MyOpenAIResource \
-g MyResourceGroup \
-l eastus \
--kind OpenAI \
--sku s0 \
--subscription subscriptionID
```

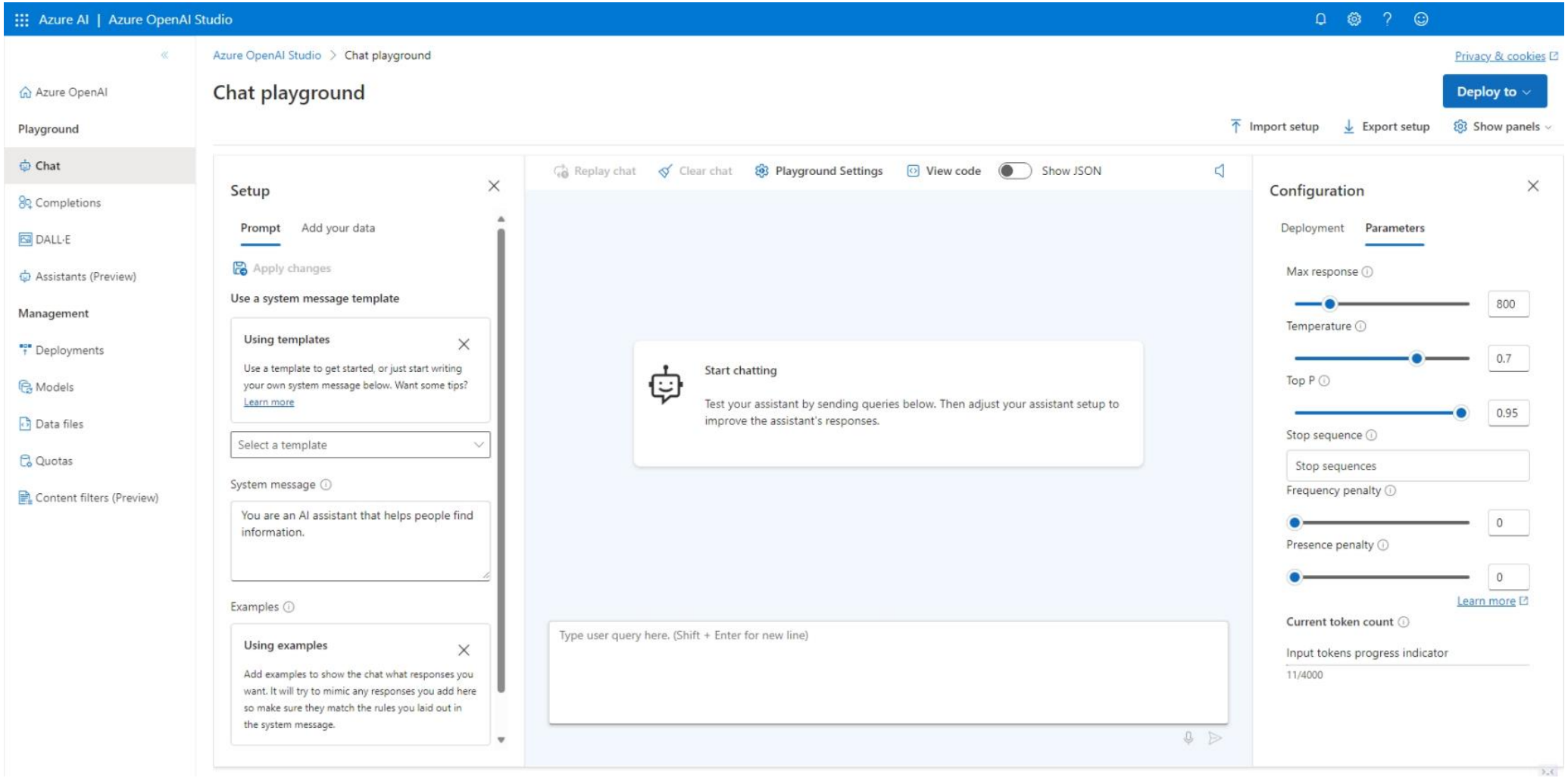


Azure OpenAI Studio

- Web portal for working with Azure OpenAI models: https://oai.azure.com/
- View and deploy base models
- Connect your own data source
- Manage fine tuning and data files for custom models
- Test models in visual playgrounds:
  - **Chat** (GPT-3.5-Turbo and later models)
  - **Completions** (GPT-3 and earlier models)
  - **DALL-E** (Image generations)
  - **Assistants** (Custom and Copilot-like experiences)



Testing models in Azure OpenAI Studio playground



Integrating Azure OpenAI into your app

Applications submit prompts to deployed models. Responses are completions.
Three REST API endpoints:

- Completion - model takes an input prompt, and generates one or more predicted completions
- Embeddings - model takes input and returns a vector representation of that input
- ChatCompletion - model takes input in the form of a chat conversation (where roles are specified with the message they send), and the next chat completion is generated

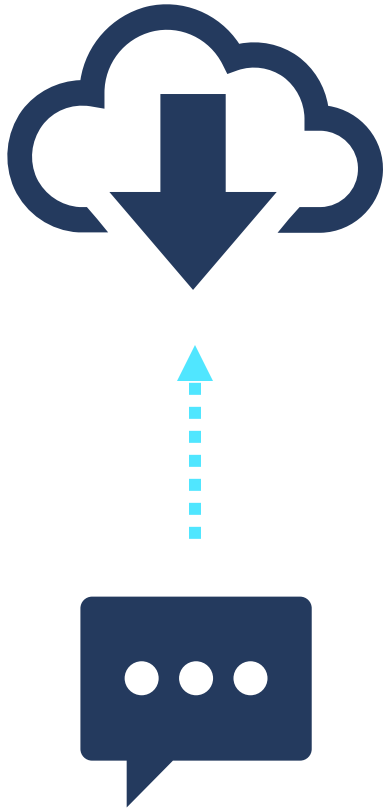
Use **Completion** and **Embeddings** with GPT-3 based models
Use **ChatCompletion** with GPT-35-Turbo and later models

ChatCompletion will be the endpoint we focus on for this course

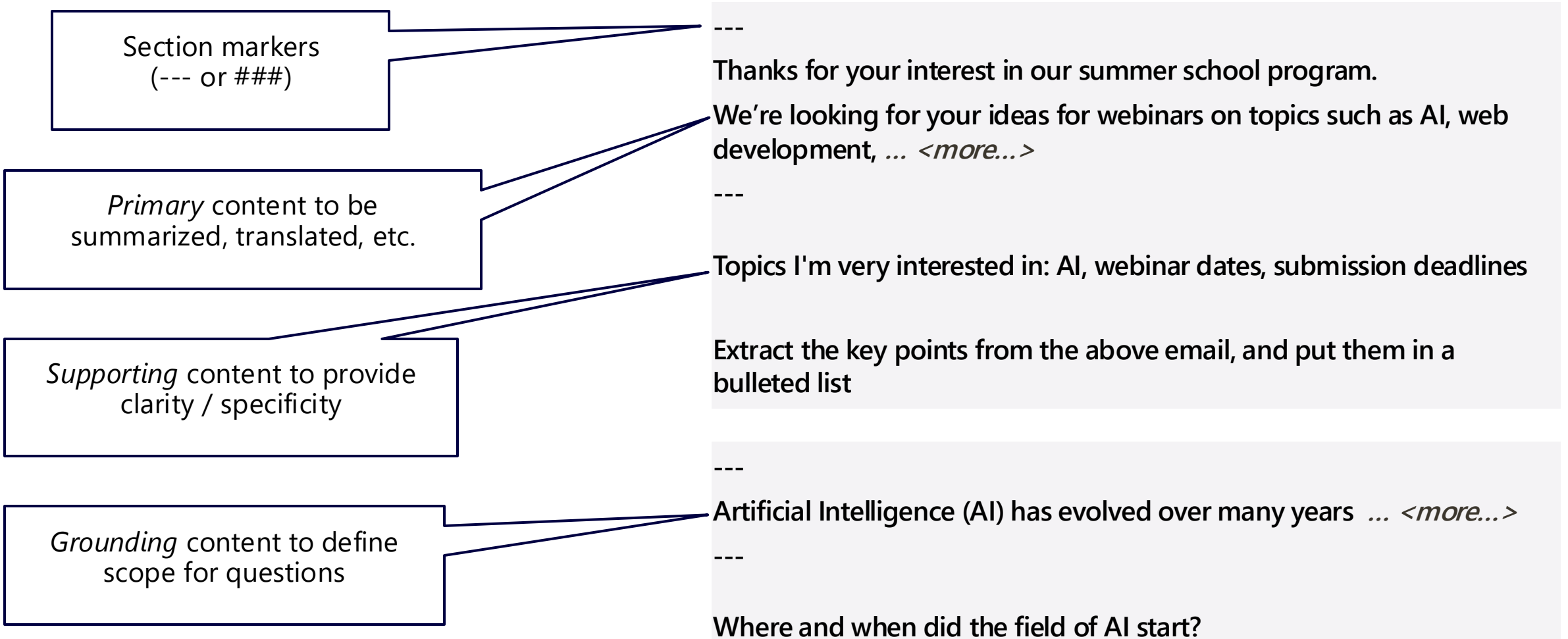
What is Prompt Engineering?

Constructing prompts to:

- Maximize relevancy and accuracy of completions
- Specify formatting and style of completions
- Provide conversational context
- Mitigate bias and improve fairness



Primary, *supporting*, and *grounding* content



How Azure OpenAI can use your data

Set up your data source

- Use an existing data source, such as an Azure search resource
- Use the Azure OpenAI studio to create that data source, if you don't already have one
- When creating the data source, you can use data already in your account such as blob storage

Configure the studio or your app to connect to that data source

- In the studio, set up the connection by pointing it to the data source
- In your app, specify the data source in the prompt parameters
- Both configurations allow the search resource to augment the prompt

Use the Azure OpenAI model, which now uses your data for grounding

- Chat with the AI models like normal
- If the data source has relevant information about the prompt, it will use that data
- You can specify if the AI model is limited to just your data source

Knowledge check

1 What is the purpose of providing conversation history to an AI model?

- ☐ Providing conversation history to an AI model is irrelevant and has no effect on the AI's performance.
- ☐ To limit the number of input tokens used by the model
- ☑ To enable the model to continue responding in a similar way and allow the user to reference previous content in subsequent queries

2 Which parameter could you adjust to change the randomness or creativeness of completions?

- ☑ Temperature
- ☐ Frequency penalty
- ☐ Stop sequence

3 You plan to implement a multi-turn conversation with Azure OpenAI. Which endpoint should you use?

- ☐ Completions
- ☑ Chat
- ☐ Embeddings