3.8 - Translate speech with the Azure AI Speech service

Overview

Translation of speech builds on speech recognition by recognizing and transcribing spoken input in a specified language, and returning translations of the transcription in one or more other languages.

Learning objectives

In this module, you will learn how to:

- Provision Azure resources for speech translation.
- Generate text translation from speech.
- Synthesize spoken translations.

Introduction

Translation of speech builds on speech recognition by recognizing and transcribing spoken input in a specified language, and returning translations of the transcription in one or more other languages.

In this module, you'll learn how to:

- Provision Azure resources for speech translation.
- Generate text translation from speech.
- Synthesize spoken translations.

The units in the module include important conceptual information about Azure AI Speech and how to use its API through one of the supported software development kits (SDKs), after which you're able to try Azure AI Speech for yourself in a hands-on exercise. To complete the hands-on exercise, you'll need a Microsoft Azure subscription. If you don't already have one, you can sign up for a free trial at https://azure.com/free

Provision an Azure resource for speech translation

The Azure AI Speech service provides robust, machine learning and artificial intelligence-based speech translation services, enabling developers to add end-to-end, real-time, speech translations to their applications or services. You can use either a dedicated Azure AI Speech resource or a multi-service Azure AI Services resource.

Before you can use the service, you need to create an Azure AI Speech resource in your Azure subscription.

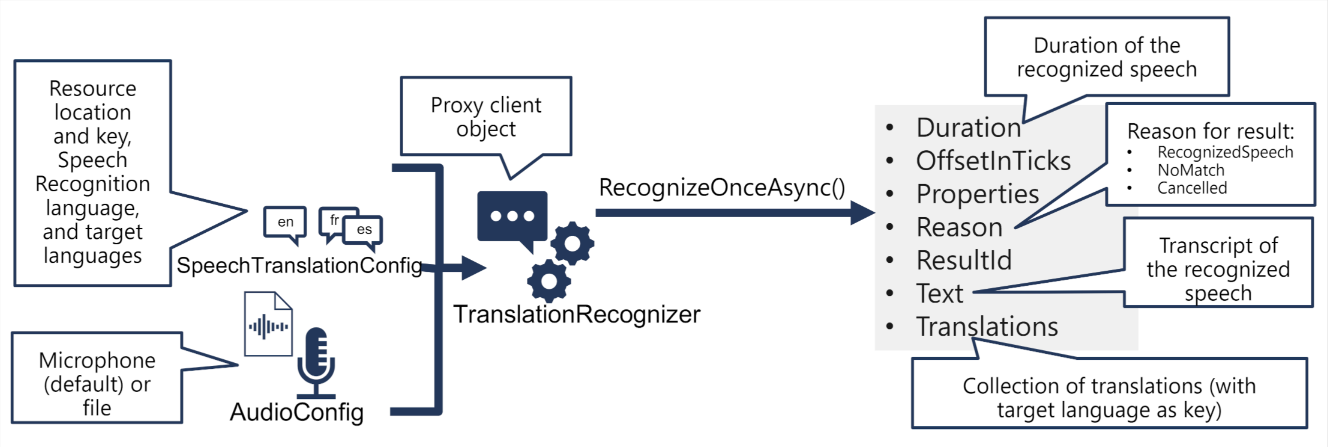
After creating your Azure resource, you'll need the following information to use it from a **client application** through one of the supported SDKs:

- The **location** in which the resource is deployed (for example, `eastus`)
- One of the **keys** assigned to your resource.

You can view of these values on the **Keys and Endpoint** page for your resource in the Azure portal.

Translate speech to text

The pattern for speech translation using the Azure AI Speech SDK is similar to speech recognition, with the **addition of information about the source and target languages** for translation:


Resource location and key, Speech Recognition language, and target languages
en
fr
es
SpeechTranslationConfig
Microphone (default) or file
AudioConfig
Proxy client object
TranslationRecognizer
RecognizeOnceAsync()
Duration of the recognized speech
Duration
OffsetInTicks
Properties
Reason
ResultId
Text
Translations
Reason for result:
RecognizedSpeech
NoMatch
Cancelled
Transcript of the recognized speech
Collection of translations (with target language as key)

1. Use a **SpeechTranslationConfig** object to encapsulate the information required to connect to your Azure AI Speech resource. Specifically, its **location** and **key**.

2. The **SpeechTranslationConfig** object is also used to specify the speech recognition language (the language in which the input speech is spoken) and the target languages into which it should be translated.
3. Optionally, use an **AudioConfig** to define the input source for the audio to be transcribed. By default, this is the **default system microphone, but you can also specify an audio file.**
4. Use the **SpeechTranslationConfig**, and **AudioConfig** to create a **TranslationRecognizer** object. This object is a **proxy client** for the Azure AI Speech translation API.
5. Use the methods of the **TranslationRecognizer** object to call the underlying API functions. For example, the **RecognizeOnceAsync**() method uses the Azure AI Speech service to asynchronously translate a single spoken utterance.
6. Process the response from Azure AI Speech. In the case of the **RecognizeOnceAsync**() method, the result is a **SpeechRecognitionResult** object that includes the following properties:
   - Duration
   - OffsetInTicks
   - Properties
   - Reason
   - ResultId
   - Text
   - Translations

If the operation was successful, the **Reason** property has the enumerated value **RecognizedSpeech**, the **Text** property contains the transcription in the original language.

You can also access a **Translations** property which contains a dictionary of the translations (using the two-character ISO language code, such as "en" for English, as a key).

Synthesize translations

The **TranslationRecognizer** returns translated transcriptions of spoken input - essentially translating audible speech to text.

You can also synthesize the translation as speech to create speech-to-speech translation solutions. There are two ways you can accomplish this.

Event-based synthesis

When you want to perform **1:1 translation (translating from one source language into a single target language)**, you can use event-based synthesis to **capture the translation as an audio stream**. To do this, you need to:

Specify the desired voice for the translated speech in the **TranslationConfig**. Create an event handler for the **TranslationRecognizer** object's **Synthesizing** event. In the event handler, use the **GetAudio**() method of the **Result** parameter to **retrieve** the byte stream of translated audio.

The specific code used to implement an event handler varies depending on the programming language you're using. See the C# and Python examples in the Speech SDK documentation.

Manual synthesis

Manual synthesis is an alternative approach to event-based synthesis that doesn't require you to implement an event handler. You can use manual synthesis to generate audio translations for one or more target languages.

Manual synthesis of translations is essentially just the combination of two separate operations in which you:

1. Use a **TranslationRecognizer** to translate spoken input into text transcriptions in one or more target languages.
2. Iterate through the **Translations** dictionary in the result of the translation operation, using a **SpeechSynthesizer** to synthesize an audio stream for each language.

Exercise - Translate speech

Azure AI Speech includes a speech translation API that you can use to translate spoken language. For example, suppose you want to develop a translator application that people can use when traveling in places where they don't speak the local language. They would be able to say phrases such as "Where is the station?" or "I need to find a pharmacy" in their own language, and have it translate them to the local language.

> **NOTE** This exercise requires that you are using a computer with speakers/headphones. For the best experience, a microphone is also required. Some hosted virtual environments may be able to capture audio from your local microphone, but if this doesn't work (or you don't have a microphone at all), you can use a provided audio file for speech input. Follow the instructions carefully, as you'll need to choose different options depending on whether you are using a microphone or the audio file.

Provision an *Azure AI Speech* resource

If you don't already have one in your subscription, you'll need to provision an **Azure AI Speech** resource.

1. Open the Azure portal at `https://portal.azure.com`, and sign in using the Microsoft account associated with your Azure subscription.
2. In the search field at the top, search for **Azure AI services** and press **Enter**, then select **Create** under **Speech service** in the results.
3. Create a resource with the following settings:
    - **Subscription**: *Your Azure subscription*
    - **Resource group**: *Choose or create a resource group*
    - **Region**: *Choose any available region*
    - **Name**: *Enter a unique name*
    - **Pricing tier**: Select **F0** (*free*), or **S** (*standard*) if F is not available.
    - **Responsible AI Notice**: Agree.
4. Select **Review + create**, the select **Create** to provision the resource.
5. Wait for deployment to complete, and then go to the deployed resource.
6. View the **Keys and Endpoint** page. You will need the information on this page later in the exercise.

Prepare to develop an app in Visual Studio Code

You'll develop your speech app using Visual Studio Code. The code files for your app have been provided in a GitHub repo.

> **Tip**: If you have already cloned the **mslearn-ai-language** repo, open it in Visual Studio code. Otherwise, follow these steps to clone it to your development environment.

1. Start Visual Studio Code.
2. Open the palette (SHIFT+CTRL+P) and run a **Git: Clone** command to clone the `https://github.com/MicrosoftLearning/mslearn-ai-language` repository to a local folder (it doesn't matter which folder).
3. When the repository has been cloned, open the folder in Visual Studio Code.

   > **Note**: If Visual Studio Code shows you a pop-up message to prompt you to trust the code you are opening, click on **Yes, I trust the authors** option in the pop-up.

4. Wait while additional files are installed to support the C# code projects in the repo.

   > **Note**: If you are prompted to add required assets to build and debug, select **Not Now**.

Configure your application

Applications for both C# and Python have been provided. Both apps feature the same functionality. First, you'll complete some key parts of the application to enable it to use your Azure AI Speech resource.

1. In Visual Studio Code, in the **Explorer** pane, browse to the **Labfiles/08-speech-translation** folder and expand the **CSharp** or **Python** folder depending on your language preference and the **translator** folder it contains. Each folder contains the language-specific code files for an app into which you're you're going to integrate Azure AI Speech functionality.
2. Right-click the **translator** folder containing your code files and open an integrated terminal. Then install the Azure AI Speech SDK package by running the appropriate command for your language preference:

   C#

   ```
   dotnet add package Microsoft.CognitiveServices.Speech --version 1.30.0
   ```

   Python

   ```
   pip install azure-cognitiveservices-speech==1.30.0
   ```

3. In the **Explorer** pane, in the **translator** folder, open the configuration file for your preferred language
   - **C#**: appsettings.json
   - **Python**: .env
4. Update the configuration values to include the **region** and a **key** from the Azure AI Speech resource you created (available on the **Keys and Endpoint** page for your Azure AI Speech resource in the Azure portal).

   > **NOTE**: Be sure to add the *region* for your resource, **not the endpoint!**

5. Save the configuration file.

Add code to use the Speech SDK

1. Note that the **translator** folder contains a code file for the client application:

    - **C#**: Program.cs
    - **Python**: translator.py (View here: translator.py)

    Open the code file and at the top, under the existing namespace references, find the comment **Import namespaces**. Then, under this comment, add the following language-specific code to import the namespaces you will need to use the Azure AI Speech SDK:

    C#: Program.cs

    ```
    // Import namespaces using Microsoft.CognitiveServices.Speech; using
    Microsoft.CognitiveServices.Speech.Audio; using
    Microsoft.CognitiveServices.Speech.Translation;
    ```

    Python: translator.py (View here: translator.py)

    ```
    # Import namespaces import azure.cognitiveservices.speech as speech_sdk
    ```

2. In the **Main** function, note that code to load the Azure AI Speech service key and region from the configuration file has already been provided. You must use these variables to create a **SpeechTranslationConfig** for your Azure AI Speech resource, which you will use to translate spoken input. Add the following code under the comment **Configure translation**:

    C#: Program.cs

    ```
    // Configure translation translationConfig =
    SpeechTranslationConfig.FromSubscription(aiSvcKey, aiSvcRegion);
    translationConfig.SpeechRecognitionLanguage = "en-US";
    translationConfig.AddTargetLanguage("fr"); translationConfig.AddTargetLanguage("es");
    translationConfig.AddTargetLanguage("hi"); Console.WriteLine("Ready to translate from "
    + translationConfig.SpeechRecognitionLanguage);
    ```

    Python: translator.py (View here: translator.py)

    ```
    # Configure translation translation_config =
    speech_sdk.translation.SpeechTranslationConfig(ai_key, ai_region)
    translation_config.speech_recognition_language = 'en-US'
    translation_config.add_target_language('fr')
    translation_config.add_target_language('es')
    translation_config.add_target_language('hi') print('Ready to translate
    from',translation_config.speech_recognition_language)
    ```

3. You will use the **SpeechTranslationConfig** to translate speech into text, but you will also use a **SpeechConfig** to synthesize translations into speech. Add the following code under the comment **Configure speech**:

    C#: Program.cs

    ```
    // Configure speech speechConfig = SpeechConfig.FromSubscription(aiSvcKey,
    aiSvcRegion);
    ```

    Python: translator.py (View here: translator.py)

    ```
    # Configure speech speech_config = speech_sdk.SpeechConfig(ai_key, ai_region)
    ```

4. Save your changes and return to the integrated terminal for the **translator** folder, and enter the following command to run the program:

C#

```
dotnet run
```

Python

```
python translator.py
```

5. If you are using C#, you can ignore any warnings about using the **await** operator in asynchronous methods - we'll fix that later. The code should display a message that it is ready to translate from en-US and prompt you for a target language. Press ENTER to end the program.

Implement speech translation

Now that you have a **SpeechTranslationConfig** for the Azure AI Speech service, you can use the Azure AI Speech translation API to recognize and translate speech.

> **IMPORTANT**: This section includes instructions for two alternative procedures. Follow the first procedure if you have a working microphone. Follow the second procedure if you want to simulate spoken input by using an audio file.

If you have a working microphone

1. In the **Main** function for your program, note that the code uses the **Translate** function to translate spoken input.
2. In the **Translate** function, under the comment **Translate speech**, add the following code to create a **TranslationRecognizer** client that can be used to recognize and translate speech using the default system microphone for input.

   C#: Program.cs

   ```
   // Translate speech using AudioConfig audioConfig =
   AudioConfig.FromDefaultMicrophoneInput(); using TranslationRecognizer translator = new
   TranslationRecognizer(translationConfig, audioConfig); Console.WriteLine("Speak
   now..."); TranslationRecognitionResult result = await translator.RecognizeOnceAsync();
   Console.WriteLine($"Translating '{result.Text}'"); translation =
   result.Translations[targetLanguage]; Console.OutputEncoding = Encoding.UTF8;
   Console.WriteLine(translation);
   ```

   Python: translator.py (View here: translator.py)

   ```
   # Translate speech audio_config = speech_sdk.AudioConfig(use_default_microphone=True)
   translator = speech_sdk.translation.TranslationRecognizer(translation_config,
   audio_config = audio_config) print("Speak now...") result =
   translator.recognize_once_async().get() print('Translating "{}"'.format(result.text))
   translation = result.translations[targetLanguage] print(translation)
   ```

   > **NOTE** The code in your application translates the input to all three languages in a single call. Only the translation for the specific language is displayed, but you could retrieve any of the translations by specifying the target language code in the **translations** collection of the result.

3. Now skip ahead to the **Run the program** section below.

Alternatively, use audio input from a file

1. In the terminal window, enter the following command to install a library that you can use to play the audio file:

   C#: Program.cs
   ```
   dotnet add package System.Windows.Extensions --version 4.6.0
   ```

   Python: translator.py (View here: [translator.py]())
   ```
   pip install playsound==1.3.0
   ```
2. In the code file for your program, under the existing namespace imports, add the following code to import the library you just installed:

   C#: Program.cs
   ```
   using System.Media;
   ```

   Python: translator.py
   ```
   from playsound import playsound
   ```
3. In the **Main** function for your program, note that the code uses the **Translate** function to translate spoken input. Then in the **Translate** function, under the comment **Translate speech**, add the following code to create a **TranslationRecognizer** client that can be used to recognize and translate speech from a file.

   C#: Program.cs
   ```
   // Translate speech string audioFile = "station.wav"; SoundPlayer wavPlayer = new SoundPlayer(audioFile); wavPlayer.Play(); using AudioConfig audioConfig = AudioConfig.FromWavFileInput(audioFile); using TranslationRecognizer translator = new TranslationRecognizer(translationConfig, audioConfig); Console.WriteLine("Getting speech from file..."); TranslationRecognitionResult result = await translator.RecognizeOnceAsync(); Console.WriteLine($"Translating '{result.Text}'"); translation = result.Translations[targetLanguage]; Console.OutputEncoding = Encoding.UTF8; Console.WriteLine(translation);
   ```

   Python: translator.py (View here: [translator.py]())
   ```
   # Translate speech audioFile = 'station.wav' playsound(audioFile) audio_config = speech_sdk.AudioConfig(filename=audioFile) translator = speech_sdk.translation.TranslationRecognizer(translation_config, audio_config = audio_config) print("Getting speech from file...") result = translator.recognize_once_async().get() print('Translating "{}"'.format(result.text)) translation = result.translations[targetLanguage] print(translation)
   ```

Run the program

1. Save your changes and return to the integrated terminal for the **translator** folder, and enter the following command to run the program:

   C#

   ```
   dotnet run
   ```

   Python

```
python translator.py
```

2. When prompted, enter a valid language code (*fr*, *es*, or *hi*), and then, if using a microphone, speak clearly and say "where is the station?" or some other phrase you might use when traveling abroad. The program should transcribe your spoken input and translate it to the language you specified (French, Spanish, or Hindi). Repeat this process, trying each language supported by the application. When you're finished, press ENTER to end the program.

   The TranslationRecognizer gives you around **5 seconds to speak**. If it detects **no spoken input, it produces a "No match"** result. The translation to Hindi may not always be displayed correctly in the Console window due to character encoding issues.

> **NOTE**: The code in your application translates the input to all three languages in a single call. Only the translation for the specific language is displayed, but you could retrieve any of the translations by specifying the target language code in the **translations** collection of the result.

Synthesize the translation to speech

So far, your application translates spoken input to text; which might be sufficient if you need to ask someone for help while traveling. However, it would be better to have the **translation spoken aloud in a suitable voice.**

1. In the **Translate** function, under the comment **Synthesize translation**, add the following code to use a **SpeechSynthesizer** client to synthesize the translation as speech through the default speaker:

   C#: Program.cs

   ```
   // Synthesize translation var voices = new Dictionary<string, string> { ["fr"] = "fr-FR-
   HenriNeural", ["es"] = "es-ES-ElviraNeural", ["hi"] = "hi-IN-MadhurNeural" };
   speechConfig.SpeechSynthesisVoiceName = voices[targetLanguage]; using SpeechSynthesizer
   speechSynthesizer = new SpeechSynthesizer(speechConfig); SpeechSynthesisResult speak =
   await speechSynthesizer.SpeakTextAsync(translation); if (speak.Reason !=
   ResultReason.SynthesizingAudioCompleted) { Console.WriteLine(speak.Reason); }
   ```

   Python: translator.py (View here: translator.py)

   ```
   # Synthesize translation voices = { "fr": "fr-FR-HenriNeural", "es": "es-ES-
   ElviraNeural", "hi": "hi-IN-MadhurNeural" } speech_config.speech_synthesis_voice_name =
   voices.get(targetLanguage) speech_synthesizer =
   speech_sdk.SpeechSynthesizer(speech_config) speak =
   speech_synthesizer.speak_text_async(translation).get() if speak.reason !=
   speech_sdk.ResultReason.SynthesizingAudioCompleted: print(speak.reason)
   ```

2. Save your changes and return to the integrated terminal for the **translator** folder, and enter the following command to run the program:

   C#

   ```
   dotnet run
   ```

   Python

```
python translator.py
```

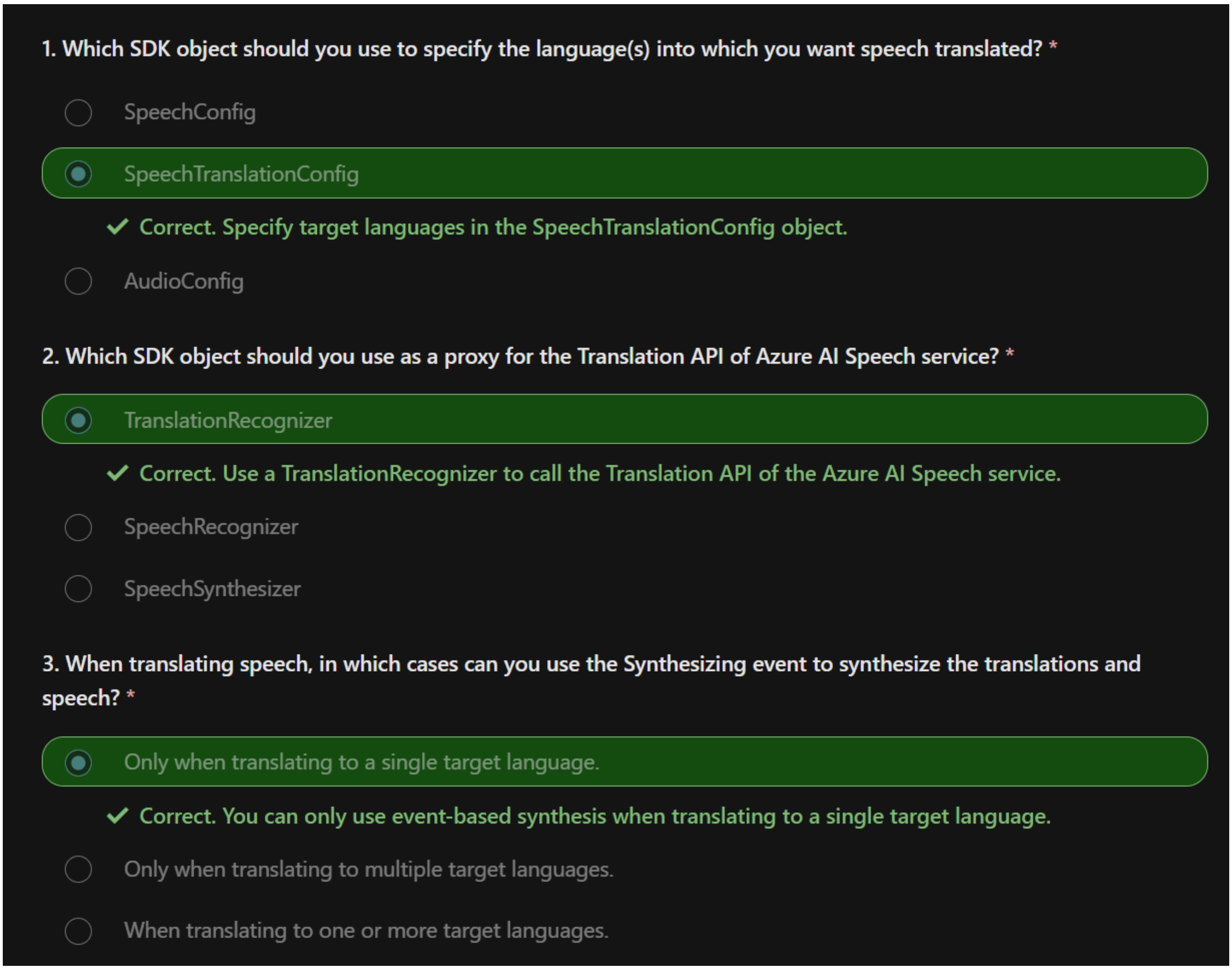
3. When prompted, enter a valid language code (*fr*, *es*, or *hi*), and then speak clearly into the microphone and say a phrase you might use when traveling abroad. The program should transcribe your spoken input and respond with a spoken translation. Repeat this process, trying each language supported by the application. When you're finished, press **ENTER** to end the program.

> **NOTE** *In this example, you've used a* ***SpeechTranslationConfig*** *to translate speech to text, and then used a* ***SpeechConfig*** *to synthesize the translation as speech. You can in fact use the* ***SpeechTranslationConfig*** *to* ***synthesize*** *the translation* ***directly, but this only works when translating to a single language, and results in an audio stream that is typically saved as a file rather than sent directly to a speaker.***

More information

For more information about using the Azure AI Speech translation API, see the [Speech translation documentation](#).

Knowledge Check



1. Which SDK object should you use to specify the language(s) into which you want speech translated? *

○ SpeechConfig

● SpeechTranslationConfig

✓ Correct. Specify target languages in the SpeechTranslationConfig object.

○ AudioConfig

2. Which SDK object should you use as a proxy for the Translation API of Azure AI Speech service? *

● TranslationRecognizer

✓ Correct. Use a TranslationRecognizer to call the Translation API of the Azure AI Speech service.

○ SpeechRecognizer

○ SpeechSynthesizer

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

● Only when translating to a single target language.

✓ Correct. You can only use event-based synthesis when translating to a single target language.

○ Only when translating to multiple target languages.

○ When translating to one or more target languages.

Summary

Now that you've completed this module, you learned how to:

- Provision Azure resources for speech translation.
- Generate text translation from speech.
- Synthesize spoken translations.

For more information about speech translation, refer to the Azure AI Speech documentation.

✍️ Compiled by Kenneth Leung (2025)