

# Speechly Client Library for Unity and C#

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## Overview

[Speechly](#) is an API for building voice features and voice chat moderation into games, XR, applications and web sites. Speechly Client Library for Unity and C# streams audio for analysis and provides real-time speech-to-text transcription and information extracted from the speech via the library's C# API.

Speech recognition runs by default in Speechly cloud (online). On-device (offline) capabilities are available via separate libSpeechly add-on that runs machine learning models on the device itself using Core ML and TensorFlow Lite.

## Package contents

- [speechly-dotnet/](#) contains the C# SpeechlyClient without Unity dependencies
- [speechly-unity/Assets/com.speechly.speechly-unity/](#) folder contains the C# SpeechlyClient plus Unity-specifics like [Speechly.prefab](#) and [MicToSpeechly.cs](#) script and Unity sample projects:
  - [speechly-unity/Assets/com.speechly.speechly-unity/Examples/MicToSpeechly/](#)
  - [speechly-unity/Assets/com.speechly.speechly-unity/Examples/HandsFreeListening/](#)
  - [speechly-unity/Assets/com.speechly.speechly-unity/Examples/HandsFreeListeningVR/](#)
  - [speechly-unity/Assets/com.speechly.speechly-unity/Examples/HandsFreeListeningVR/](#)
  - [speechly-unity/Assets/com.speechly.speechly-unity/Examples/PointAndTalk/](#)

## Unity

### Installation

- Download [speechly-client.unitypackage](#)
- Select Assets > Import Package > Custom Package... and select the downloaded file.
- Import [Speechly/](#) folder from the package to your Unity project
- Drop [MicToSpeechly](#) prefab to your scene hierarchy
- Select it and enter a valid token in the [App Id](#) field

Refer to <https://docs.unity3d.com/Manual/upm-ui-install.html> for instructions on using Unity packages.

### Requirements

- Unity 2018.1 or later (tested with 2019.4.36f1 and 2021.2.12f1)
- TextMeshPro (examples only)
- XR Plug-in Management (VR example only)

### Supported languages

- English
- Finnish
- Additional language support is discussed [here](#).

### Workflows

## Hands-free voice input via Unity microphone

- Add the **Speechly.prefab** to your scene and select it.
- In the inspector, enter a valid **App id** acquired from [Speechly dashboard](#)
- Check **VAD controls listening** and **debug print**.
- Run the app, speak and see the console for the basic transcription results.

## Controlling listening with SpeechlyClient.Start() and Stop()

- Add the **Speechly.prefab** to your scene and select it.
- In the inspector, enter a valid **App id** acquired from [Speechly dashboard](#)
- Check **debug print** to see basic transcription results in the console.
- Create the following script to listen only when mouse/finger is pressed. Ensure that **VAD controls listening** is unchecked as we're controlling listening manually.
- Run the app, press and hold anywhere on the screen and see the console for the basic transcription results.

```
void Update()
{
    SpeechlyClient speechlyClient = MicToSpeechly.Instance.SpeechlyClient;

    if (Input.GetMouseButton(0))
    {
        if (!speechlyClient.IsActive)
        {
            _ = speechlyClient.Start();
        }
    }
    else
    {
        if (speechlyClient.IsActive)
        {
            _ = speechlyClient.Stop();
        }
    }
}
```

**Speechly.prefab** is by default set with **Don't destroy on load** so it's available in every scene. It creates a **SpeechlyClient** singleton which you can access with **MicToSpeechly.Instance.SpeechlyClient**.

## Accessing speech recognition results via Segment API

- Use either hands-free listening or manual listening as described above.
- To handle the speech-to-text results, attach a callback for **OnSegmentChange**. The following example displays the speech transcription in a TMP text field.

```
void Start()
{
    SpeechlyClient speechlyClient = MicToSpeechly.Instance.SpeechlyClient;
    speechlyClient.OnSegmentChange += (segment) =>
    {
        Debug.Log(segment.ToString());
        TranscriptText.text = segment.ToString(
            (intent) => "",
            (words, entityType) => $"<color=#15e8b5>{words}<color=#ffffff>",
            ".");
    };
}
```

## Using other audio sources

You can send audio from other audio sources by calling `SpeechlyClient.Start()`, sending any number of packets containing samples as float32 array (mono 16kHz by default) using `SpeechlyClient.ProcessAudio()`. Finally, call `SpeechlyClient.Stop()`.

## Reference

- [SpeechlyClient API documentation \(DocFX generated\)](#)

## Samples

### MicToSpeechly

Import `com.speechly.speechly-unity/Examples/MicToSpeechly/` and `Speechly/` folders from `speechly-client.unitypackage` to run a Unity sample scene that streams data from microphone to Speechly using `MicToSpeechly.cs` script running on a GameObject. App-specific logic is in `UseSpeechly.cs` which registers a callback and shows speech-to-text results in the UI.

### PointAndTalk

Import `com.speechly.speechly-unity/Examples/PointAndTalk/` and `Speechly/` folders from `speechly-client.unitypackage` to run a Unity sample scene that showcases a point-and-talk interface: target an object and hold the mouse button to issue speech commands like "make it big and red" or "delete". Again, app-specific logic is in `UseSpeechly.cs` which registers a callback to respond to detected intents and keywords (entities).

## Other Examples

- `AudioFileToSpeechly` streams a pre-recorded audio file for speech recognition.
- `HandsFreeListening` demonstrates hands-free voice input.
- `HandsFreeListeningVR` demonstrates hands-free voice input on a VR headset. Tested on Meta Quest 2.

## On-device support

Speechly Client for Unity is on-device speech recognition ready. Enabling on-device support requires add-on files (libSpeechly, speech recognition model) from Speechly.

### Install libSpeechly for each target platform

- OS X (Intel): Replace the zero-length placeholder file `libSpeechlyDecoder.dylib` in `Assets/com.speechly.speechly-unity/SpeechlyOnDevice/libSpeechly/OS_X/libSpeechlyDecoder.dylib`
- Android (arm64): Replace the zero-length placeholder file `libSpeechlyDecoder.so` in `Assets/com.speechly.speechly-unity/SpeechlyOnDevice/libSpeechly/Android/libSpeechlyDecoder.so`
- Other platforms: Follow the installation instruction provided with the files.

### Installing the speech recognition model

- Add the `my-custom-model.bundle` file into `speechly-unity/Assets/StreamingAssets/SpeechlyOnDevice/Models/`
- Select the `Speechly.prefab` and enter the model's filename (e.g. `my-custom-model.bundle`) as the value for Model Bundle property.

## Target player details

### OS X

To enable microphone input on OS X, set `Player Settings > Settings for PC, Mac & Linux Standalone > Other Settings > Microphone Usage Description`, to for example, "Voice input is automatically processed by Speechly.com".

### Android

### Testing on an Android Device

To diagnose problems with device builds, you can do the following:

- First try running `MicToSpeechlyScene.unity` in the editor without errors.
- Change to Android player, set `MicToSpeechlyScene.unity` as the main scene and do a **build and run** to deploy and start the build to on a device.
- On the terminal start following Unity-related log lines:

```
adb logcat -s Unity:D
```

- Use the app on device. Ensure it's listening (e.g. keep **Hold to talk** button pressed) and say "ONE, TWO, THREE". Then release the button.
- You should see "ONE, TWO, THREE" displayed in the top-left corner of the screen. If not, see the terminal for errors.

## Android troubleshooting

- **Exception: Could not open microphone** and green VU meter won't move. Cause: There's no implementation in place to wait for permission prompt to complete so mic permission is not given on the first run and `Microphone.Start()` fails. Fix: Implement platform specific permission check, or, restart app after granting the permission.
- **WebException: Error: NameResolutionFailure** and transcript won't change when button held and app is spoken to. Cause: Production builds restrict access to internet. Fix: With Android target active, go Player settings and find "Internet Access" and change it to "required".
- IL2CPP build fails with **NullReferenceException** at `System.Runtime.Serialization.Json.JsonFormatWriterInterpreter.TryWritePrimitive`. Cause: `System.Runtime.Serialization.dll` uses reflection to access some methods. Fix: To prevent Unity managed code linker from stripping away these methods add the file `link.xml` with the following content:

```
<linker>
  <assembly fullname="System.Runtime.Serialization" preserve="all"/>
</linker>
```

## C# / dotnet

### Requirements

- A C# development environment with .NET Standard 2.0 API:
  - Microsoft .NET Core 3 or later (tested with .NET 6.0.200)

### CLI usage with `dotnet`

SpeechlyClient features can be run with prerecorded audio on the command line in `speechly-dotnet/` folder:

- `dotnet run test` processes an example file, sends to Speechly cloud SLU and prints the received results in console.
- `dotnet run vad` processes an example file, sends the utterances audio to files in `temp/` folder as 16 bit raw and creates an utterance timestamp `.tsv` (tab-separated values) for each audio file processed.
- `dotnet run vad myaudiofiles/*.raw` processes a set of files with VAD.

## Developing and contributing

We are happy to receive community contributions! For small fixes, feel free to file a pull request. For bigger changes or new features start by filing an issue.

- `./link-speechly-sources.sh` shell script will create hard links from `speechly-dotnet/Speechly/` to `speechly-unity/Assets/com.speechly.speechly-unity/` so shared .NET code remains in sync. Please run the script after checking out the repo and before

making any changes. If you can't use the script please ensure that the files are identical manually before opening a PR.

- `./build-docs.sh` generates public API documentation using DocFX from triple-slash `///` comments with C# XML documentation tags.