The latest document is on the GitHub.

If you have any questions or issues, please post an issue on GitHub.

https://github.com/kshoji/Unity-MIDI-Plugin-supports

This document explains how to install the plugin, and to use the plugin's features.

Table of Contents

MIDI Plugin for Mobile and Desktop

This plugin provides MIDI transceiving features to your mobile app(iOS, Android, Universal Windows Platform), desktop app(Windows, OSX, Linux), and WebGL app.
Currently implemented `MIDI 1.0 protocol` only.

Available MIDI interfaces for platforms

The available MIDI interfaces for each platforms are listed below.

Platform	Bluetooth MIDI	USB MIDI	Network MIDI (RTP-MIDI)	Nearby Connections MIDI
iOS	○	○	○	○
Android	○	○	△(experimental)	○
Universal Windows Platform	-	○	△(experimental)	-
Standalone OSX, Unity Editor OSX	○	○	○	○
Standalone Linux, Unity Editor Linux	○	○	△(experimental)	-
Standalone Windows, Unity Editor Windows	-	○	△(experimental)	-
WebGL	○	○	-	-

About limitations

Android

- USB MIDI is supported API Level 12 (Android 3.1) or above.
- Bluetooth MIDI is supported API Level 18 (Android 4.3) or above.
- Build with `Mono backend` causes latency issue, and it supports only `armeabi-v7a` architecture.
  - To fix this problem, change Unity's `Project Settings > Player > Configuration > Scripting Backend` config to `IL2CPP`.
- Nearby Connections MIDI feature requires API Level 28 or above. And with this feature, the app should be compiled with API Level 33 (Android 13.0) or above.

iOS / OSX

- Supported iOS version 11.0 or above.
- Bluetooth MIDI support is Central mode only.

UWP

- Supported UWP platform version 10.0.10240.0 or above.
- Bluetooth MIDI is not supported.
- To use Network MIDI(RTP-MIDI) feature, enable `PrivateNetworkClientServer` at `Project Settings > Player > Capabilities` setting.

Windows

- Bluetooth MIDI is not supported.

WebGL

- Supporting MIDI devices are depend on the running OS/Browser environment.
- WebGL may not access to another server resources with UnityWebRequest, so put resource files(such as SMF) into `StreamingAssets`.
- You *should* modify `index.html` file of `WebGLTemplates` directory like below. This enables to access Unity's runtime from `unityInstance` variable.
  - Or, copy `MIDI/Samples/WebGLTemplates` files to `Assets/WebGLTemplates`, and select `Default-MIDI` or `Minimal-MIDI` template from `Project Settings > Player > Resolution and Presentation > WebGL Template` setting.
  - For more information, see [Unity official document of WebGL Templates](#).

Original:

```
script.onload = () => {
  createUnityInstance(canvas, config, (progress) => {
    progressBarFull.style.width = 100 * progress + "%";
  }).then((unityInstance) => {
```

Modified: add global `unityInstance` variable.

```
var unityInstance = null; // <- HERE
script.onload = () => {
  createUnityInstance(canvas, config, (progress) => {
    progressBarFull.style.width = 100 * progress + "%";
  }).then((unityInst) => { // <- HERE
    unityInstance = unityInst; // <- HERE
```

Network MIDI

- The error correction(RTP MIDI Journaling) protocol is not supported on experimental support specified above.

How to install plugin

1. Import the unitypackage from the Asset Store view.
    - If the package has been updated, some older file versions are installed at `Assets/MIDI/Plugins/Android`. If you find them, please remove all older versions' aar files.
2. Select the app's platform; iOS or Android. and build the sample app.
    - The sample scene is found at Assets/MIDI/Samples directory.

About build PostProcessing

PostProcessing: iOS

- Additional framework will be automatically added while building postprocess.
    - Additional frameworks: `CoreMIDI framework`, `CoreAudioKit.framework`
- `Info.plist` will be automatically adjusted while building postprocess.
    - Additional property: `NSBluetoothAlwaysUsageDescription`

PostProcessing: Android

- `AndroidManifest.xml` will be automatically adjusted while building postprocess.
    - Additional permissions: `android.permission.BLUETOOTH`, `android.permission.BLUETOOTH_ADMIN`, `android.permission.ACCESS_FINE_LOCATION`, `android.permission.BLUETOOTH_SCAN`, `android.permission.BLUETOOTH_CONNECT`, `android.permission.BLUETOOTH_ADVERTISE`.
    - Additional feature: `android.hardware.bluetooth_le`, `android.hardware.usb.host`
- If you want to use the USB MIDI feature on Oculus(Meta) Quest 2, please UNCOMMENT below to detect USB MIDI device connections.

The part of `PostProcessBuild.cs`

```
public class ModifyAndroidManifest : IPostGenerateGradleAndroidProject
{
    public void OnPostGenerateGradleAndroidProject(string basePath)
    {
        :

        // androidManifest.AddUsbIntentFilterForOculusDevices(); // UNCOMMENT
THIS LINE FOR OCULUS QUEST 2
```

How to implement features

Initializing Plugin

1. Call `MidiManager.Instance.InitializeMidi` method on `Awake` method in MonoBehaviour.
   - A GameObject named `MidiManager` will be created in `DontDestroyOnLoad` at the hierarchy view.

   > NOTE: If the EventSystem component already exists in another place, remove gameObject.AddComponent() method calling at MidiManager.Instance.InitializeMidi method.

2. (BLE MIDI only)
   - Call `MidiManager.Instance.StartScanBluetoothMidiDevices` method to scan BLE MIDI devices.
     - This method should be called in the `InitializeMidi` method's callback action.
3. (RTP-MIDI only)
   - Call `MidiManager.Instance.StartRtpMidi` method with session name and udp port number to start RTP-MIDI session accepting.

```
private void Awake()
{
    MidiManager.Instance.RegisterEventHandleObject(gameObject);
    MidiManager.Instance.InitializeMidi(() =>
    {
        MidiManager.Instance.StartScanBluetoothMidiDevices(0);
    });
}
```

Fig.1 Awake method will be like above.

Terminating Plugin

1. Call `MidiManager.Instance.TerminateMidi` method on `OnDestroy` method in `MonoBehaviour`.
   - This method should be called on finishing Scene or finishing to use MIDI functions.
2. (RTP-MIDI only)
   - Call `MidiManager.Instance.StopRtpMidi` method to stop RTP-MIDI session communications.

```
private void OnDestroy()
{
    MidiManager.Instance.TerminateMidi();
}
```

Fig.2 MidiManager termination.

Work with RTP-MIDI (experimental feature for non-iOS platforms)

- Start RTP-MIDI session:
  - Call `MidiManager.Instance.StartRtpMidi` method with session name and udp port number to start RTP-MIDI session accepting.
  - This will start listening to the udp port with the specified port number. The another computer can connect with the app.
- Stop RTP-MIDI session:
  - Call `MidiManager.Instance.StopRtpMidi` method to stop RTP-MIDI session communications.
- Connect another RTP-MIDI running computer:
  - Call `MidiManager.Instance.ConnectToRtpMidiClient` method to start connection with another computer.

```
// Starts to listen UDP 5004 port with session name "RtpMidiSession".
MidiManager.Instance.StartRtpMidi("RtpMidiSession", 5004);
...
// Stop the session
MidiManager.Instance.StartRtpMidi(5004);

// Connect to another machine's RTP-MIDI session
MidiManager.Instance.ConnectToRtpMidiClient("RtpMidiSession", 5004, new
IPEndPoint(IPAddress.Parse("192.168.0.111"), 5004));
```

Fig.3 using RTP-MIDI features

MIDI device attaching/detaching event handling

1. Call `MidiManager.Instance.RegisterEventHandleObject` method to register GameObject to receive event;
2. Implement interface `IMidiDeviceEventHandler` for event receiving.
   - `OnMidiInputDeviceAttached`, `OnMidiOutputDeviceAttached` will be called on a new MIDI device connected.
   - `OnMidiInputDeviceDetached`, `OnMidiOutputDeviceDetached` will be called on a MIDI device disconnected.

```csharp
public void OnMidiInputDeviceAttached(string deviceId)
{
}

public void OnMidiOutputDeviceAttached(string deviceId)
{
    receivedMidiMessages.Add($"MIDI device attached. deviceId: {deviceId}, name:
{MidiManager.Instance.GetDeviceName(deviceId)}");
}

public void OnMidiInputDeviceDetached(string deviceId)
{
}

public void OnMidiOutputDeviceDetached(string deviceId)
{
    receivedMidiMessages.Add($"MIDI device detached. deviceId: {deviceId}, name:
{MidiManager.Instance.GetDeviceName(deviceId)}");
}
```

Fig.4 device attach/detach events handler
All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` file.

Get MIDI device information with the deviceId

- Call `MidiManager.Instance.GetDeviceName(string deviceId)` method to get the device name of the specified device id.
- Call `MidiManager.Instance.GetVendorId(string deviceId)` method to get the vendor id of the specified device id.
  - Some platform or kinds of MIDI connection(BLE MIDI, RTP MIDI) are not supported, so the empty string will be returned with these environments.
- Call `MidiManager.Instance.GetProductId(string deviceId)` method to get the product id of the specified device id.
  - Some platform or kinds of MIDI connection(BLE MIDI, RTP MIDI) are not supported, so the empty string will be returned with these environments.

After the device being disconnected, these method returns empty string.

Availability of GetVendorId / GetProductId method

Platform	Bluetooth MIDI	USB MIDI	Network MIDI (RTP-MIDI)	Nearby Connections MIDI
iOS	○	○	-	-
Android	○	○	-	-
Universal Windows Platform	-	○	-	-
Standalone OSX, Unity Editor OSX	○	○	-	-
Standalone Linux, Unity Editor Linux	-	-	-	-
Standalone Windows, Unity Editor Windows	-	○	-	-
WebGL	-	△ (GetVendorId only)	-	-

VendorId examples

Since the API differs depending on the platform, the obtained VendorId will differ.

Platform	Bluetooth MIDI	USB MIDI	Network MIDI (RTP-MIDI)	Nearby Connections MIDI
iOS	QUICCO SOUND Corp.	Generic	-	-
Android	QUICCO SOUND Corp.	1410	-	-
Universal Windows Platform	-	VID_0582	-	-
Standalone OSX, Unity Editor OSX	QUICCO SOUND Corp.	Generic	-	-
Standalone Linux, Unity Editor Linux	-	-	-	-
Standalone Windows, Unity Editor Windows	-	1	-	-
WebGL	QUICCO SOUND Corp.	Microsoft Corporation	-	-

ProductId examples

Since the API differs depending on the platform, the obtained ProductId will differ.

Platform	Bluetooth MIDI	USB MIDI	Network MIDI (RTP-MIDI)	Nearby Connections MIDI
iOS	mi.1	USB2.0-MIDI	-	-
Android	mi.1	298	-	-
Universal Windows Platform	-	PID_012A	-	-
Standalone OSX, Unity Editor OSX	mi.1	USB2.0-MIDI	-	-
Standalone Linux, Unity Editor Linux	-	-	-	-
Standalone Windows, Unity Editor Windows	-	102	-	-
WebGL	mi.1	UM-ONE	-	-

MIDI Event Receiving

1. Implement event receiving interface written in `IMidiEventHandler.cs` source code, named like `IMidiXXXXXEventHandler`.
   - If you want to receive a Note On event, implement the `IMidiNoteOnEventHandler` interface.
2. Call `MidiManager.Instance.RegisterEventHandleObject` method to register GameObject to receive event;
3. On receiving a MIDI event, the implemented method will be called.

```
public class MidiSampleScene : MonoBehaviour, IMidiAllEventsHandler,
IMidiDeviceEventHandler
{
    private void Awake()
    {
        MidiManager.Instance.RegisterEventHandleObject(gameObject);
        ...
```

Fig.5 example of implementation IMidiAllEventHandler and calling the `RegisterEventHandlerObject` **method in** `Awake`.

```
public void OnMidiNoteOn(string deviceId, int group, int channel, int note, int
velocity)
{
    receivedMidiMessages.Add($"OnMidiNoteOn channel: {channel}, note: {note},
velocity: {velocity}");
}

public void OnMidiNoteOff(string deviceId, int group, int channel, int note, int
velocity)
{
    receivedMidiMessages.Add($"OnMidiNoteOff channel: {channel}, note: {note},
velocity: {velocity}");
}
```

Fig.6 MIDI Note On/ Note Off event receiving handler
All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` **file.**

MIDI Event Sending

1. Call the `MidiManager.Instance.SendMidiXXXXXX` method somewhere. Like this:

```
MidiManager.Instance.SendMidiNoteOn("deviceId", 0/*groupId*/, 0/*channel*/,
60/*note*/, 127/*velocity*/);
```

2. deviceId can be obtained from `MidiManager.Instance.DeviceIdSet` property (type: HashSet<string>).

```
if (GUILayout.Button("NoteOn"))
{
    MidiManager.Instance.SendMidiNoteOn(deviceIds[deviceIdIndex], 0, (int)channel,
(int)noteNumber, (int)velocity);
}
```

Fig.7 Sending MIDI Note On message
All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` **file.**

Creating and start using a Sequencer

```
var isSequencerOpened = false;
var sequencer = new SequencerImpl(() => { isSequencerOpened = true; });
sequencer.Open();
```

Fig.8 Creating SequencerImpl instance and Open it.
All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` **file.**

Read SMF as a Sequence, and play it

```
sequencer.UpdateDeviceConnections();

using var stream = new FileStream(smfPath, FileMode.Open, FileAccess.Read);
sequencer.SetSequence(stream);
sequencer.Start();

...

sequencer.Stop();
```

Fig.9 Read a SMF and play it.

Record a sequence

```
sequencer.UpdateDeviceConnections();

sequencer.SetSequence(new Sequence(Sequence.Ppq, 480));
sequencer.StartRecording();


...


sequencer.Stop();
```

Fig.10 Set a new Sequence to record, and start recording MIDI data

Write the sequence to a SMF file

```
var sequence = sequencer.GetSequence();
if (sequence.GetTickLength() > 0)
{
    using var stream = new FileStream(recordedSmfPath, FileMode.Create,
FileAccess.Write);
    MidiSystem.WriteSequence(sequence, stream);
}
```

Fig.11 Write a SMF from recorded Sequence

Android: Use CompanionDeviceManager to find BLE MIDI devices

You can use CompanionDeviceManager for BLE MIDI device connection on Android.

To enable this feature, add `FEATURE_ANDROID_COMPANION_DEVICE` to the `Scripting Define Symbols` setting.

```
Project Settings > Other Settings > Script Compilation > Scripting Define Symbols
```

Android, iOS, macOS: Using Nearby Connections MIDI

The MIDI transfer using Google's Nearby Connections library.
(At this stage, this is a proprietary implementation, and has no interoperability with other similar libraries.)

Add dependency package

Open the Unity's Package Manager view, push the `+` button on top-left corner, and select `Add package from git URL…` menu.
Then specify the URLs below:
`ssh://git@github.com/kshoji/Nearby-Connections-for-Unity.git`

Specify Scripting Define Symbol

To enable Nearby Connections MIDI feature, add a Scripting Define Symbol to Player settings.
`ENABLE_NEARBY_CONNECTIONS`

Setting for Android

Change Unity's `Project Settings > Player > Identification > Target API Level` to `API Level 33` or higher.

Advertise the nearby devices

To advertise the device to nearby, call the `MidiManager.Instance.StartNearbyAdvertising()` method.
To stop the advertising, call the `MidiManager.Instance.StopNearbyAdvertising()` method.

Discover the advertising devices

To discover the Nearby Connections MIDI devices, call the `MidiManager.Instance.StartNearbyDiscovering()` method.
To stop the discovering, call the `MidiManager.Instance.StopNearbyDiscovering()` method.

Tested devices

- Android: Pixel 7, Oculus Quest2
- iOS: iPod touch 7th gen
- UWP/Standalone Windows/Unity Editor Windows: Surface Go 2
- Standalone OSX/Unity Editor OSX: Mac mini 3,1
- Standalone Linux/Unity Editor Linux: Ubuntu 22.04 on VirtualBox
- MIDI devices:
    - Quicco mi.1 (BLE MIDI)
    - Miselu C.24 (BLE MIDI)
    - TAHORNG Elefue (BLE MIDI)
    - Roland UM-ONE (USB MIDI)
        - NOTE: This device didn't work with iOS.
    - Gakken NSX-39 (USB-MIDI)
    - MacOS Audio MIDI Setup (RTP-MIDI)

Version History

- v1.0 Initial release
- v1.1 Update release
  - Add MIDI sequencer(playing / recording MIDI sequence) feature
  - Add SMF reading / writing feature
  - Add BLE MIDI Peripheral feature on Android
  - Fix USB MIDI receiving issues on Android
  - Fix BLE MIDI sending issues on Android / iOS
  - Fix BLE MIDI receiving issue(NoteOn with velocity = 0) on Android
- v1.2.0 Update release
  - Add experimental RTP-MIDI support for Android, or other platforms.
  - Add USB MIDI support for Universal Windows Platform(UWP).
  - Add Android 12's new Bluetooth permissions support.
  - Fix MIDI tranceiving performance improvement on iOS, Android.
  - Fix EventSystem duplication error when the sample scene appended multiple times.
  - Fix Android BLE MIDI's issue around fixed timestamp.
- v1.2.1 Bugfix release
  - Fix sequencer thread remains after closing
  - Fix Android ProgramChange message failure
  - Fix System exclusive logging issue
  - Fix ThreadInterruptException issue on UWP
  - Fix SMF reading/writing issues around System exclusive
  - Some performance improvements
- v1.3.0 Update release
  - Add platform support for Standalone OSX, Windows, Linux
  - Add platform support for WebGL
  - Add support for Unity Editor OSX, Windows, Linux
  - Changed Sequencer implementation from Thread to Coroutine
  - Fix iOS/OSX device attaching/detaching issue
- v1.3.1 Bugfix release
  - [Issue connecting to Quest 2 via cable](#)
  - [Sample scene stops working.](#)
  - [Byte is obsolete on android](#)
  - [Any way of negotiating MTU?](#)
  - [Can't get it to work on iOS](#)
  - [Have errors with sample scene](#)
  - Android permissions requesting issue
  - Add: Android CompanionDeviceManager support
- v1.3.2 Bugfix release
  - Fixed Android compile error
  - Fixed MIDI event order while playing SMF sequence
- v1.3.3 Bugfix release
  - Fixed WebGL MIDI sending failure
- v1.3.4 Bugfix release

- Fixed: The wrong device name was acquired when a device with the same device ID as the previously connected device but with a different device name.
- iOS: Add 'Done' button to the BLE MIDI searching popover
- Sample scene: BLE MIDI Scan feature is Android/iOS only
- MidiManager singleton pattern refined
- v1.4.0 Update release
  - Add: Nearby Connections MIDI feature for Android, iOS, macOS
  - Add: Bluetooth LE MIDI feature for WebGL
  - Fixed: iOS device attach/detach callback has mismatches
- v1.4.1 Update release
  - Fixed: [The link error at Linux platform](#)
  - Add: Vendor name / device name support for WebGL platform.
  - Add: [Inter App MIDI connections(virtual MIDI) support for iOS/MacOS/Linux/Android](#)
  - Fixed: Memory leak issue on Sample scene.
- v1.4.2 Bugfix release
  - Fixed: WebGL Sample scene fails to initialize
- v1.4.3 Bugfix release
  - Fixed: Android plugin initialization fails when Bluetooth is off
  - Fixed: Fails opening USB MIDI devices on Android 14
  - Fixed: Windows plugin fails updating MIDI devices
  - Fixed: Linux plugin crashes at terminating MidiManager
  - Fixed: Unity Editor stops MIDI feature after stopping the game play
  - Added: Feature to get input/output deviceIds(separated from getting all deviceId set method)
  - Added: Feature to specify device connections to the MIDI sequencer
  - Added: The callback to receive MIDI sequencer playback finished event
  - Added: MIDI sequencer's event timing accuracy improved
  - Added: MIDI sequencer's playback position can be specified with the microseconds time

Contacts

Report issues on GitHub

- GitHub supports repository: https://github.com/kshoji/Unity-MIDI-Plugin-supports
  - Search and report issues: https://github.com/kshoji/Unity-MIDI-Plugin-supports/issues

About plugin author

- Kaoru Shoji : 0x0badc0de@gmail.com
- github: https://github.com/kshoji

Used Open Source Softwares created by me:

- Android Bluetooth MIDI library: https://github.com/kshoji/BLE-MIDI-for-Android
- Android USB MIDI library: https://github.com/kshoji/USB-MIDI-Driver
- Unity MIDI Plugin Android (Inter App MIDI): https://github.com/kshoji/Unity-MIDI-Plugin-Android-Inter-App
- iOS MIDI library: https://github.com/kshoji/Unity-MIDI-Plugin-iOS
- MidiSystem for .NET(sequencer, SMF importer/exporter): https://github.com/kshoji/MidiSystem-for-.NET
- RTP-MIDI for .NET: https://github.com/kshoji/RTP-MIDI-for-.NET
- Unity MIDI Plugin UWP: https://github.com/kshoji/Unity-MIDI-Plugin-UWP
- Unity MIDI Plugin Linux: https://github.com/kshoji/Unity-MIDI-Plugin-Linux
- Unity MIDI Plugin OSX: https://github.com/kshoji/Unity-MIDI-Plugin-OSX

Used example MIDI data by others

Specified as UnityWebRequest's URL source. The SMF binary file is not included. The original website below has no `https` services, so the sample code specifies the another site's URL(https://bitmidi.com/uploads/14947.mid).

- Prelude and Fugue in C minor BWV 847 Music by J.S. Bach
  - The MIDI, audio(MP3, OGG) and video files of Bernd Krueger are licensed under the cc-by-sa Germany License.
  - This means, that you can use and adapt the files, as long as you attribute to the copyright holder
  - Name: Bernd Krueger
  - Source: http://www.piano-midi.de
  - The distribution or public playback of the files is only allowed under identical license conditions.