

Co-funded by the Erasmus+ Programme of the European Union Project No: 610281-EPP-1-2019-1-AL-EPPKA2-CBHE-JP



VR TRAINING



Erasmus+ Programme of the European Union Project No: 610281-EPP-1-2019-1-AL-EPPKA2-CBHE-JP



Contents

Setting up your project: Choosing a Unity Version and XR Plugin	3
Setting up your XR configuration	5
2. Selecting your Unity project	6
3. Discovering and acquiring feature packages	7
4. Importing feature packages	8
5. Reviewing and approving project changes	9
6. Project updated	
Configuring XR Plugin Management for OpenXR	
Setting your build target	
Importing Maps SDK package	
Create a Bing Maps key	
Building our first application with Unity	
Using Visual Studio to debug and deploy	
Enabling Developer Mode	23
HoloLens. Using the Windows Device Portal	23
Connecting over USB	
Deploying a HoloLens app over USB	



Setting up your project: Choosing a Unity Version and XR Plugin

While we currently **recommend installing Unity 2020.3 LTS with the latest Mixed Reality OpenXR plugin** for Mixed Reality development, you can build apps with other Unity configurations as well.

The best way to install and manage Unity is through the **Unity Hub**:

- 1. Install **Unity Hub**.
- 2. Select the **Installs** tab and choose **Add**.
- 3. Select **Unity 2020.3 LTS** and click **Next**.

Unity Hub 2.4.3			- 🗆	×
🚭 unity			\$	YL
Projects	Add Unity Version X	1	ADD	
🗢 Learn	Select a version of Unity Add modules to your install		:	
at Community	Can't find the version you're looking for? Visit our download archive for access to long-term support and patch releases, or join our Open Beta program releases.	0		
≡ Installs	Recommended Release			
	Official Releases			
	 Unity 2021.1.7f1 Unity 2019.4.27f1 (LTS) 			
	Unity 2018.4.35f1 (LTS)			
	CANCEL BACK NEXT			

Check the following components under 'Platforms':

- Universal Windows Platform Build Support
- Windows Build Support (IL2CPP)





If you previously installed Unity without these options, you can add them through 'Add Modules' menu in Unity Hub:

Setting up your XR configuration

Once you have your environment set up:

- <u>Download the latest version of the Mixed Reality Feature Tool</u> from the Microsoft Download Center.
- When the download completes, unzip the file and save it to your desktop.

Follow the below stated steps:

1. Launch the Mixed Reality Feature Tool from the executable file, which displays the start page on first launch:

From the start page, you can:

- <u>Configure</u> tool settings using the **gear icon** button
- Use the **question mark** button to launch the default web browser and display our documentation
- Select **Start** to begin discovering feature packages
- 2. Selecting your Unity project

To ensure that all discovered features are supported on your project's version of Unity, the fist step is to point the Mixed Reality Feature Tool to your project using the **ellipsis** button (to the right of the project path field).

Select project		
The Mixed Reality Feature Tool needs to know th	e location of your Un	ity project.
Project Path: GalaxyExplorer		
Project Unity version: 2020.3.17f1		
NOTE: To be recognized as a Unity project, the selected ProjectSettings folders.	l folder must contain As	sets, Packages and
• ?	Go Back	Discover Features

3. Discovering and acquiring feature packages

Discover features				
• AltspaceVR (0 of 1) Select All		^		
Solution State	Select All			
Mixed Reality Toolkit (2 of 9) Se	lect All Select None			
Mixed Reality Toolkit Examples 2.7.2 × (Details) Version 2.6.2 is cu	urrently installed			
Mixed Reality Toolkit Extensions 2.7.2 × (Details) Version 2.7.2 is 0	currently installed			
Mixed Reality Toolkit Foundation 2.7.2 Y (Details) Version 2.7.2 is	currently installed			
Mixed Reality Toolkit GPU Stats 1.0.3 V (Details)				
Mixed Reality Toolkit Microphone Stream Selector 1.0.0 V (Detail	<u>ls)</u>			
Mixed Reality Toolkit Plane Finding 1.0.0 V (Details)				
Mixed Reality Toolkit Standard Assets 2.7.2 × (Details) Version 2.7.2 is currently installed				
Mixed Reality Toolkit Test Utilities 2.7.2 × (Details)				
Mixed Reality Toolkit Tools 2.7.2 × (Details) Version 2.6.2 is currently installed				
		~		
Last updated 7/7/2021 3:43:32 PM				
? C	Go Back	Get Features		

When the Mixed Reality Feature Tool recognizes previously imported feature(s), it displays a notification message by each.

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23	Microsoft	Mixed	Reality	Feature	Tool
_	When oboth	MINCU	recurry	reature	1001

			^
Discover features			
• AltspaceVR (0 of 1) Select All			
Select All Select All			
• Mixed Reality Toolkit (2 of 9) Select All Select None			
Platform Support (1 of 3) Select All Select None			
Mixed Reality OpenXR Plugin 1.0.0 × (Details) Version 1.0.0 is currently installed			
Mixed Reality Scene Understanding 0.6.0 × (Details)			
Mixed Reality WinRT Projections 0.5.2009 × (Details)			
Spatial Audio (0 of 1) Select All			
World Locking Tools (0 of 4) Select All			
• Other features (0 of 3) Select All			
Last updated 7/7/2021 3:43:32 PM			
C ? Go Back	Get Fea	tures	

Once you've made your choices, select **Get features** to fetch all the required packages from the catalog.

4. Importing feature packages

Following acquisition, the complete set of packages is presented, along with a list of required dependencies. If you need to change any feature or package selections, this is the time:

Microsoft Mixed Reality Feature	e Tool				-		>
Import Fea	tures						
The Mixed Reality Feature Tool features.	has identified the p	backag	es that are required to	import yo	our cho	osen	
Features		Rec	uired depende	ncies			
Mixed Reality Toolkit Extension	us 2.7.2 <u>(Details)</u>	\checkmark	Mixed Reality Toolkit Stan	dard Assets	2.7.2	<u>(Details)</u>	
Mixed Reality Toolkit Foundati	on 2.7.2 <u>(Details)</u>						
?	Go back		Validate	Ir	mport		

We highly recommend using the **Validate** button to ensure the Unity project can successfully import the selected features. After validation, you'll see a pop-up dialog with a success message or a list of identified issues.

Select **Import** to continue.

5. Reviewing and approving project changes

The final step is reviewing and approving the proposed changes to the manifest and project files:

- The proposed changes to the manifest are displayed on the left
- The files to be added to the project are listed to the right
- The **Compare** button allows for side-by-side viewing of the current manifest and the proposed changes

Review and Appro	DVC	into the project
{ "dependencies": { "com.microsoft.mixedreality.openxr": "file:MixedRea "com.microsoft.mrtk.core": "file:D:/git-int/v3_handS "com.microsoft.mrtk.input": "file:D:/git-int/v3_hand! "com.microsoft.mrtk.performance": "file:D:/git-int/v "com.microsoft.mrtk.simulation": "file:D:/git-int/v3_l "com.microsoft.mrtk.standardassets": "file:D:/git-int/v3_l "com.microsoft.spatialaudio.spatializer.unity": "file:N "com.unity.ide.visualstudio": "2.0.11", "com.unity.inputsystem": "1.1.0-pre.6", "com.unity.test-framework": "1.2.2", "com.unity.test-framework": "3.0.6"	com.microsoft.mixedreality.toolkit. com.microsoft.mixedreality.toolkit. com.microsoft.mixedreality.toolkit.	extensions-2.7.2.tgz foundation-2.7.2.tgz standardassets-2.7.2.tgz
Compare ?	Go Back	Approve

6. Project updated

When the proposed changes are approved, your target Unity project is updated to reference the selected Mixed Reality features.

The Unity project's **Packages** folder now has a **MixedReality** subfolder with the feature package file(s) and the manifest will contain the appropriate reference(s).

Return to Unity, wait for the new selected features to load, and start building!

Configuring XR Plugin Management for OpenXR

To set OpenXR as the the runtime in Unity:

- 1. In the Unity Editor, navigate to **Edit > Project Settings**
- 2. In the list of Settings, select **XR Plugin Management** (should already be installed if you installed the Mixed Reality OpenXR plugin using MRFT)
- 3. Check the **Initialize XR on Startup** box
- 4. If targeting Desktop VR, stay on the PC Standalone tab (the monitor) and check the **OpenXR** and **Windows Mixed Reality feature set** boxes

 If targeting HoloLens 2, switch to the Universal Windows Platform tab (the Windows logo) and select the **OpenXR** and **Microsoft HoloLens feature** set boxes

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Project Settings					: 🗆 ×	
Adaptive Performance	XR Plug-in Manager	nent				
Graphics	P			.	9	
Input Manager	Initialize VP on Startun					
Input System Package						
MIXed Reality ToolKit Build Settings	Plug-in Providers ?					
Package Manager	OpenXR (9) A					
Physics	 Microsoft HoloLens featu 	reset 🙆				
Physics 2D	Holographic Remoting rer	note ann feature set Ø				
Player						
Preset Manager						
Quality Scene Template						
Script Execution Order						
 Services 	Information about configuration,	tracking and migration can be f				
Ads						
Analytics						
Cloud Build						
Collaborate	Collaborate					
In-App Purchasing						
Tags and Layers						
TextMesh Pro						

If you see a yellow warning icon next to **OpenXR Plugin**, click the icon and select **Fix All** before continuing. The Unity Editor may need to restart itself for the changes to take effect.

Setting your build target

Since we are targeting HoloLens 2, you need to switch to the Universal Windows Platform:

- 1. Select File > Build Settings...
- 2. Select **Universal Windows Platform** in the Platform list and select **Switch Platform**
- 3. Set Architecture to ARM64
- 4. Set **Target device** to **HoloLens**
- 5. Set Build Type to D3D Project
- 6. Set **Target SDK Version** to **Latest installed**

					dd Open Scene
Platform					
PC, Mac & Linux Standalone 🗧	Universal Windows F				
Universal Windows Platform					
103 103		D3D Project			
Android		Latest installed			
HTML	Minimum Platform Version	10.0.10240.0			
🕤 WebGL	Visual Studio Version	Latest installed			
	Build and Run on	USB Device			
tvos tvos					
REA PS4	Copy References				
1 3 4 1 0 1	Development Build				
PJS PS5					
-					
🐼 Xbox One					
Discuss Contribution					
Player Settings				Switch Platform	

7. Click Switch Platform

Importing Maps SDK package

The SDK can also be added to an existing Unity project. This requires modifying Unity's package manifest to include a reference to the SDK package.

```
1. Locate the Unity project's folder.
   In the Packages directory, open manifest.json.
   Append the scopedRegistries section to the beginning of the manifest and
   modify dependencies as follows:
   {
    "scopedRegistries": [
     {
      "name": "Maps SDK for Unity",
      "url": "https://unity.virtualearth.net/npm/registry/",
      "scopes": [
       "com.microsoft.maps"
      1
     }
    ],
    "dependencies": {
     "com.microsoft.maps.unity": "0.11.1",
```

<Existing dependencies: Do not remove>

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🕅 File Edit View Git Project Debug Test Analyze Tools Extensions Window Help Search (Ctri+C), 🔑 Solution1	<u>ss</u> – a ;
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manifestjon a X	
Schema: https://json.schemastore.org/foxx-manifest.json	
2 🖨 "scopedRegistries": [
3 自: : {	
4 "name": "Maps SDK for Unity",	
5 📮 scopes": [
6 "com.microsoft.maps"	
8 "url": " <u>https://unity.virtualeartn.net/npm/registry/</u> "	
10 E. (
11 name : Microsoft Mixed Reality ;	
12 Cl., Stopes . [
14 "commicrosoft spatial audio"	
16 "url": "https://nkgs.dev.azure.com/ainmr/MixedReality-Unity-Packages/ packaging/Unity-packages/nnm/registry/"	
18 1)	
19 🗄 "dependencies": {	
20 "com.microsoft.maps.unity": "0.11.0",	
21 "com.microsoft.mixedreality.toolkit.examples": "2.6.2",	
22 "com.microsoft.mixedreality.toolkit.foundation": "file:MixedReality/com.microsoft.mixedreality.toolkit.foundation-2.7.2.tgz",	
23 "com.microsoft.mixedreality.toolkit.tools": "2.6.2",	
24 "com.unity.2d.sprite": "1.0.0",	
25 "com.unity.2d.tilemap": "1.0.0",	
26 "com.unity.ide.rider": "2.0.7",	
27 🗧 ' "com.unity.ide.visualstudio": "2.0.9",	

2. Open the Unity editor for the corresponding project. A dialog should appear showing the progress of importing the new package.

Create a Bing Maps key

A Bing Maps developer key is required to enable the mapping functionality of the SDK.

1. Sign-in to the <u>Bing Maps Dev Center</u>.

• For new accounts, follow the instructions at <u>Creating a Bing Maps Account</u>.

2. Select **My keys** under **My Account** and select the option to create a new key.

Click here to create a new key. Click here to download complete list of keys. View Specific Key: Enter key to search Q Application name Key details Enable Preview for All Keys O 2DMapExamlpe Key: Show key Update Application Uri: Created date: 08/03/2021 Enable Report Created date: 08/03/2021 Enable Security Expiration date: None Key Status: Enabled Security Enabled: No CityTourExample Key: Show key Update Application Uri: Created date: 08/03/2021 Enable Security Expiration date: None Key: Show key Update Application Uri: Created date: 08/03/2021 Enable Security Expiration date: None Key: Show key Update Application Uri: Created date: 08/03/2021 Enable Security Expiration date: None Key: Show key Update Copy key Update Key: Show key Upda	My keys		
Click here to download complete list of keys. View Specific Key: Enter key to search Application name Key details ZDMapExamlpe Key: Show key Application Uri: Copy key ZDMapExamlpe Key: Show key Application Uri: Copy key Key type: Basic / Dev/Test Usage Report Created date: 08/03/2021 Enable Preview I Enable Preview Enable Preview Key Status: Enabled Security Security Enabled: No Update CityTourExample Key: Show key Update Application Uri: Copy key Update Key status: Enabled Security Enable Preview MapServiceExample Key: Show key Update MapServiceExample Key: Show key Update Application Uri: Copy key Key	Click here to create a new	<i>w</i> key.	
View Specific Key: Enter key to search Q Application name Key details Enable Preview for All Keys Image: Copy key in the second	Click here to download c	omplete list of keys.	
View Specific Key: Enter key to search Q Application name Key details Enable Preview for All Keys Image: Copy key 2DMapExamilpe Key: Show key Update Application Uri: Copy key Key yeb: Basic / Dev/Test Usage Report Created date: 08/03/2021 Enable Security Expiration date: None Enable Preview Key strus: Enabled Security Enabled Security Enabled: No Update CitlyTourExample Key: Show key Lipdate Update Application Uri: Copy key Key strus: Enabled Security Basic / Dev/Test Update CitlyTourExample Key: Show key MapServiceExample Key: Show key MapServiceExample Key: Show key			
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Expiration date: None Enable Preview Key Status: Enabled Security Enabled MapServiceExample Key: Show key Application Urt: Copy key		Created date: 08/03/2021	Enable Security
Key Status: Enabled Security Enabled: No MapServiceExample Key: Show key Application Urt: Update Copy key		Expiration date: None	Enable Preview
Security Enabled: No Update MapServiceExample Key: Show key Application Urt: Update		Key Status: Enabled	
MapServiceExample Key: Show key Update Application Urt: Copy key		Security Enabled: No	
Application Uri: Copy key	MapServiceExample	Key: Show key	Update
		Application Url:	Copy key

- 3. Provide the following required information to create a key:
 - **Application name**: The name of the application.
 - **Key type**: *Basic* or *Enterprise*.
 - Application type: Select Other Public Mobile App.

Bing maps Dev Center		
My account	Announcements	Contacts & Info
My keys		
Create key		
Application name *		
Enter application name		
Application URL		
Enter application URL		
Key type [*]		What's This
Basic		~
Application type *		
Dev/Test		~
Create Cancel		

4. Click the **Create** button. The new key displays in the list of available keys. This key will be used later when setting up the Unity project.

Building our first application with Unity

Open your configured project and follow the steps:

- 1. Select Mixed Reality > Toolkit > Add to Scene and Configure.
- 2. Create a new Empty Object in your scene and rename it to Map.

ARMap - MapScene - PC, Mac & Linux Standalone - Unity 2020.3.

File Edit Assets GameObject Component Mixed Reality Window H

3. Scale the Map in X to 4 and Z to 4.

- 4. Click the Map and on the right side in the Inspector you will have the option: **Add a Component**
- 5. Click on **Add a Component**

	Account 💌	Layers	▼ Layo	ut
Insp	pector			а
\bigcirc	🖌 Map			Stati
٦	Tag Untagged	T	Layer Det	fault
▼ 人	Transform			0 it
Posit	tion	ХО	Y O	ZO
Rota	tion	X 0	Y 0	ZO
Scale	е	X 1	Y 1	Z 1
	A	dd Compo	nent	

6. Search for **Map Renderer** and add it.

5. Copy the key from Bing Maps Portal and paste it to the **Developer key** placeholder.

6. Give the **Latitude** and **Longitude** coordinates of a city available in 3D.

De	veloper Key	*****	******	******	*****
Sh	ow Map Data in Ec	~			
	Localization Autodetect Region	~			
	Region Override				
	Autodetect Langua	~			
	Language	Englis	h		
	Language Change	ed (Sys	temLang	Juage)	
	List is Empty				
				+	
\$	🗸 Map Renderei	[.] (Scrip	t)	0	: :
	Location				
	Latitude	37.79	58		
	Longitude	-122.3	3938		
	Zoom Level			17	.7
	Zoom Level Rang	1		20	
	Map Layout				
	Map Shape	Ble	ock	Cylinc	ler
	Local Map Dimens	sion			
	X 1		Y 1		

- 7. Specify **Zoom Level** to 17.5
- 8. Position the Map so it can be seen by the camera.

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# Scene	😎 Game			Inspector	
Shaded	▼ 2D	🥊 🖤 😎 🔻 📈 🐺 🔻 🗰 🕈 Gizmos	▼ 🗣 All		
			V a	🔻 🔳 🗹 Camera	0
			V	Clear Flags	Skybox
				Background	
			* 1 12	Culling Mask	Everything
				Projection	Perspective
7				FOV Axis	Vertical
				Field of View	
				Physical Camera	
				Clipping Planes	Near 0.1
and the second					Far 1000
				Viewport Rect	
			Main Camera	X 0	YO
				W 1	H 1
				Depth	-1
			A CONTRACT	Rendering Path	Use Graphics Settings
				Target Texture	None (Render Texture)
				Occlusion Culling	~
			🏅 🛷 🚖 💋 24	HDR	Use Graphics Settings
				MSAA	Use Graphics Settings
				Allow Dynamic Resc	A
	_				

9. Press Play

10. Next Build your project by going to File > Build Settings and click Build

11. Create a folder ARMapBuild and Select Folder

sktop > ARMap > ARMap > G Name Date modified Туре Siz ARMapBuild 11/27/2021 3:29 PM File folder Assets 11/27/2021 2:59 PM File folder 📜 Library 11/27/2021 3:28 PM File folder 📜 Logs 11/27/2021 3:07 PM File folder Packages File folder 11/27/2021 3:06 PM ProjectSettings 11/27/2021 3:28 PM File folder Temp 11/27/2021 3:28 PM File folder UserSettings 11/27/2021 2:55 PM File folder

We wait for build to finish

		_			
		Com	piling shader variants (busy for 06:20)		
ndalone	Universal Windows F	latform			
		Mixe	d Reality Toolkit/Standard - Main: 3563 of 4608 fp	Cancel	
Platform 🔫	Target Device	HoloLens			
	Architecture	x64			
	Build Type	D3D Project			
	Target SDK Version	Latest installed			
	Minimum Platform Version	10.0.10240.0			
	Visual Studio Version	Latest installed			
	Build and Run on	USB Device			
	Build configuration	Release			
	Copy References				
	Copy PDB files				
	Development Build				

Once the build finishes, we have the following build folder:

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) Name	Date modified	Type Size
📒 ARMap	11/27/2021 3:39 PM	File folder
📒 II2CppOutputProject	11/27/2021 3:39 PM	File folder
🕢 ARMap.sln	11/27/2021 3:39 PM	Visual Studio Solu
🞝 UnityCommon.props	11/27/2021 3:39 PM	Project Property File

Using Visual Studio to debug and deploy

Visual Studio is your go-to tool for debugging and deployment.

Enabling Developer Mode

Start by enabling **Developer Mode** on your device, so Visual Studio can connect to it.

HoloLens. Using the Windows Device Portal

The Windows Device Portal for HoloLens lets you configure and manage your device remotely over Wi-Fi or USB. The Device Portal is a web server on your HoloLens that you can connect to from a web browser on your PC. The Device Portal includes many tools that will help you manage your HoloLens and debug and optimize your apps.

This documentation is specifically about the Windows Device Portal for HoloLens.

- 1. Power on your HoloLens and put on the device.
- 2. Use the <u>Start gesture</u> for HoloLens2 or <u>Bloom</u> on HoloLens (1st Gen) to launch the main menu.
- 3. Gaze at the **Settings** tile and do an <u>air-tap</u> gesture on HoloLens (1st Gen). You can also select it on HoloLens 2 by <u>touching it or using a Hand ray</u>.
- 4. Select the **Update** menu item.
- 5. Select the **For developers** menu item.
- 6. Enable **Developer Mode**.
- 7. <u>Scroll down</u> and enable **Device Portal**.
- 8. If you're setting up Windows Device Portal so you can deploy apps to this HoloLens over USB or Wi-Fi, select **Pair** to <u>generate a pairing PIN</u>. Leave the Settings app at the PIN popup until you enter the PIN into Visual Studio during your first deployment.

Co-funded by the Erasmus+ Programme of the European Union **Project No: 610**

of the European Union Project No: 610281-EPP-1-2019-1-AL-EPPKA2-CBHE-JP

Connecting over USB

- 1. If your HoloLens 2 is running Windows Holographic version 21H1 or higher, go to 'For developers' in the Settings app and make sure that 'Device discovery' is toggled ON.
- 2. Connect your HoloLens 2 to your PC with a USB-C cable.
- 3. Find your UsbNcm IP. There are a few ways to do this:
- In the Settings app on the device (This method only works for HoloLenses running Windows Holographic version 21H1 or higher, with 'Device discovery' toggled ON.)
 - 1. Go into the Settings app on the device.
 - 2. Go to "Update & Security" > "For developers." This is the same place you enabled Device Portal.
 - 3. At the bottom of the page, copy your **Ethernet** IP address. This is your UsbNcm IP.

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← Settings		Ö	×
Ω Home	For developers		
Find a setting P	Unpair all		
Windows Update Troubleshoot Reset & recovery Certificates E For development	Device Portal Tum on remote diagnostics over USB and local area network connect using: Connect using: Etement Input/PDL Shid Ph2.15		
 For developers P₆ Windows Insider Program Clive feedback 	Wi-Fr https://192.168.00.168 localhost https://iocalhost		

- In Device Portal
 - 1. On your device, open Device Portal using your HoloLens' WiFi address. If you don't know your HoloLens' WiFi address, you can use the voice command "What's my IP address?"
 - 2. Go to System > Networking
 - On the far-right side of the page in the "IP Configuration" panel, locate the section that starts with "Description: UsbNcm Function."
 - 4. Your UsbNcm IP is the "IPv4 address" line. You can copy the address or just click on the address it is a hyperlink which will reopen Device Portal using the UsbNcm IP.
- In a command prompt
 - In any command prompt, navigate to the bin<SDK version>\x86 folder where your Windows 10 SDK is installed, such as C:\Program Files (x86)\Windows Kits\10\bin\10.0.19041.0\x86.
 - 2. Type "winappdeploycmd devices" and press Enter.
 - In the output, look for the entry where the Model/Name column is your HoloLens device name, such as HOLOLENS-xxxxxx. The UsbNcm IP is at the start of this line and will be an Automatic Private IP address in the form of 169.254.x.x. Copy this address.
- 4. If you copied your UsbNcm IP, from a web browser on your PC go to https:// followed by your UsbNcm IP.

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Deploying a HoloLens app over USB

1. Open the build in Visual Studio.

2. Go to Project > Properties > Debugging and set the IPv4 address that you have in HoloLens

Configuration Properties	Debugger to launch:					
Debugaina	Remote Machine		×			
VC++ Directories						
▷ C/C++	Launch Application	Yes				
▷ Linker	Allow Local Network Loopback	Yes				
▷ Manifest Tool	Debugger Type	Native Only				
> XML Document Generator	Machine Name	192.168.1.59				
▷ Browse Information	Authentication Type	Universal (Unencrypted Protocol)				
▷ Build Events	Deploy Visual C++ Debug Runti	m Yes				
 Custom Build Step Code Analysis 	Amp Default Accelerator	WARP software accelerator				
	Package Layout Path					
	Advanced Remote Deployment TyCopy To Device					
	Package Registration Path					
	Remove Non-Layout Files from I	D(No				
	Command Line Arguments					

- 3. Next Select your apps compilation options
 - Choose either **Release** or **Master**
- 4. Select your build configuration based on your device

5. Select **Remote Machine** in the deployment target drop-down menu

- 6. Build, deploy, and debug your app based on your needs
 - Select **Debug > Start debugging** to deploy your app and start debugging
 - Select **Build > Deploy** to build and deploy without debugging