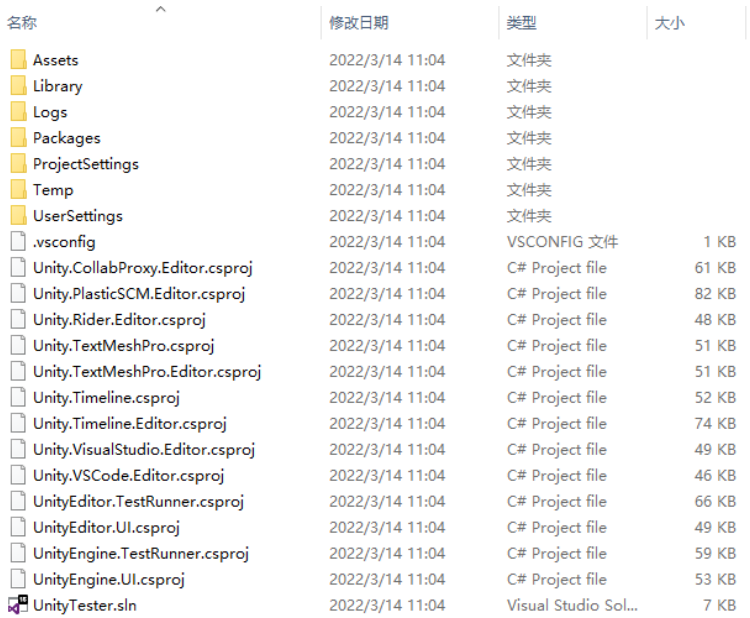
Unity资源管理系统

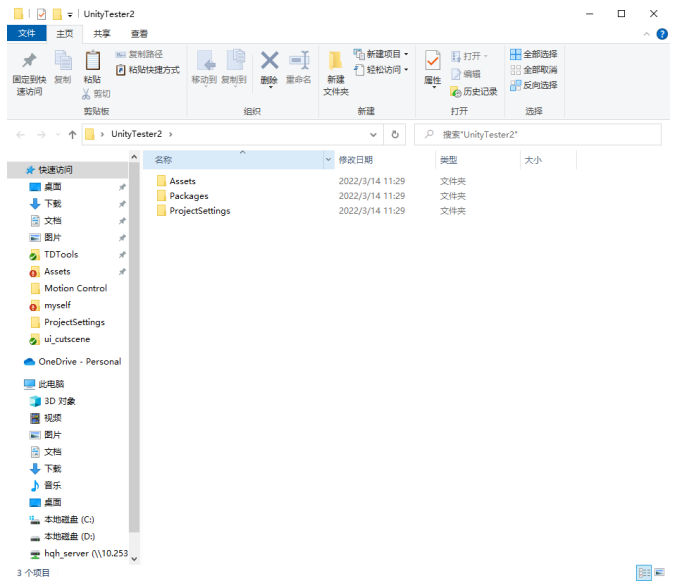
Unity中的文件夹

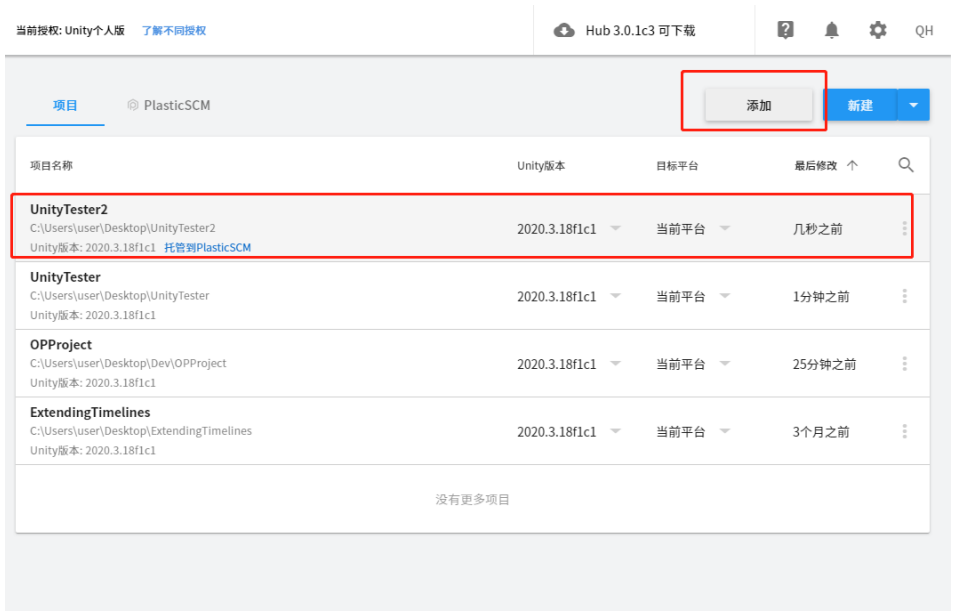
- 当我们创建一个空项目时，Unity会自动为我们创建几个文件夹
  - Assets：资源文件夹，所有原始资源都必须放在此文件夹中才能参与编译，包括场景、代码、配置、库、动画、脚本等等
  - Library：Unity编译后产生的文件，用于cache（增量编译）
  - Logs：日志
  - Packages：记录已安装的package信息
  - ProjectSettings：Unity中的各项设定（可修改）
  - Temp：临时文件
  - UserSettings：用户设定，如页面布局

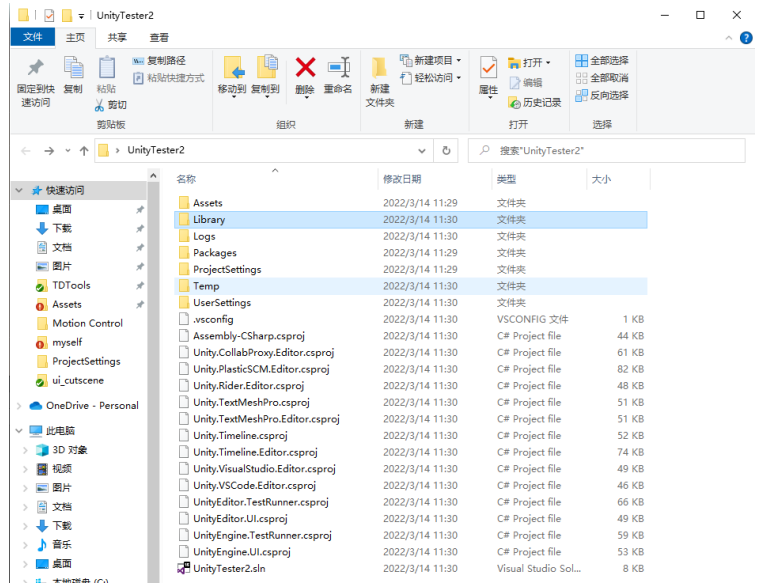


可删除的文件夹

- 如果需要进行项目迁移，可以将除了Assets、Packages和ProjectSettings之外的文件夹删除，下次Unity就会根据这三个文件夹的信息自动编译生成其他文件夹







AssetBundle

- AssetBundle是一类资源的集合，对Assets进行有序地归档
  - 它是针对平台的
  - 它不包含代码（但是可以包含序列化文件）
  - 它支持在运行时加载
  - 它表达了Assets之间的依赖
- 将AssetBundle与代码分隔是为了更加高效地索引、使用Assets，提高运行时加载资源的效率

  （你是否发现了BundleRes这个文件夹下不包含代码文件？）
- 然而，使用AssetBundle需要对资源打包进行合理规划
  - 为此，Unity推出了Addressable Assets System，但似乎没有维护了……

Asset/Object

- 简单来说，Asset就是存储在Assets文件夹中的文件，它仅仅指资源本身，包含Texture、Model、Audio Clip、Materials、Fbx等等
  - Native：像Material这种Asset直接存储了Unity调用所需的数据，使用时无需处理
  - Non-nativte：像Fbx这种Asset在使用时首先需要被Unity处理成可以运行的格式

- Object则是针对Unity运行时而言，在运行时，Unity会把Asset**实例化**为Object，从而使用，比如mesh、sprite、AudioClip等等
- ScriptableObject和MonoBehaviour是最重要的两类Object

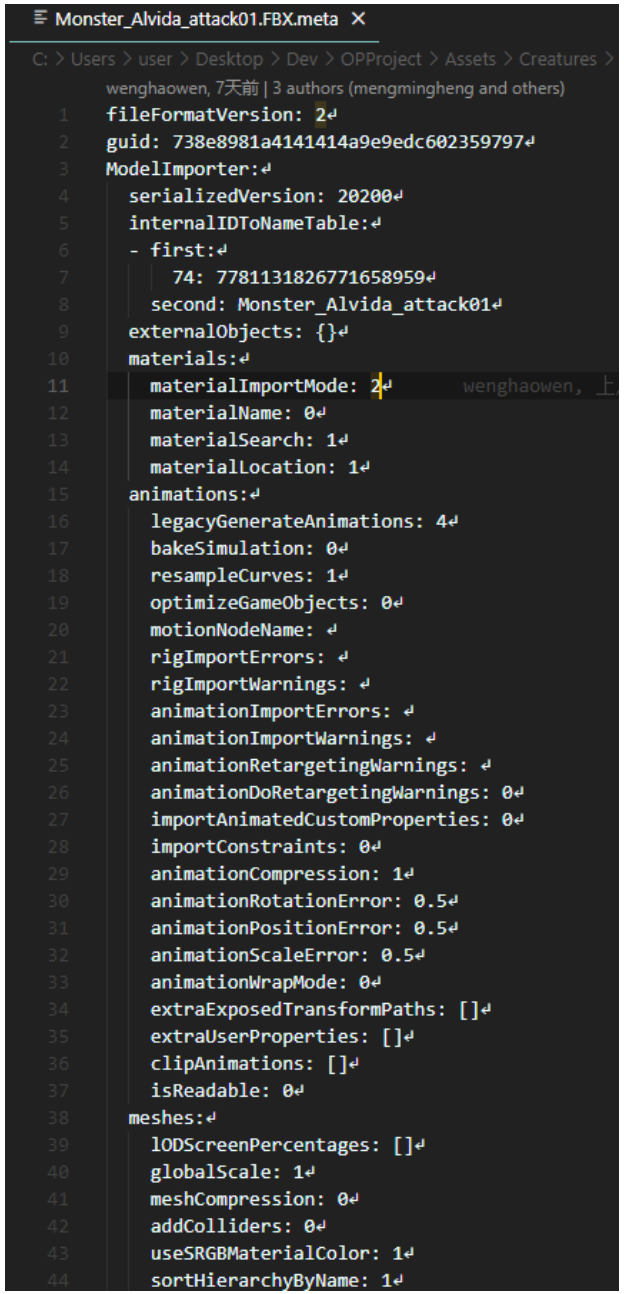
- Asset与Object是一对多的关系，一般来说，一个Asset文件（比如prefab）包含多个Object

Inter-Object references

- Object之间有相互引用的关系，可以在同一个Asset内，也可能通过另外的Asset导入
- 引用通过两个ID实现：File GUID和Local ID
  - File GUID与**Asset**绑定，保存在.meta文件中
  - Local ID标识了**Object**在Asset中的引用，一般保存在Asset文件中

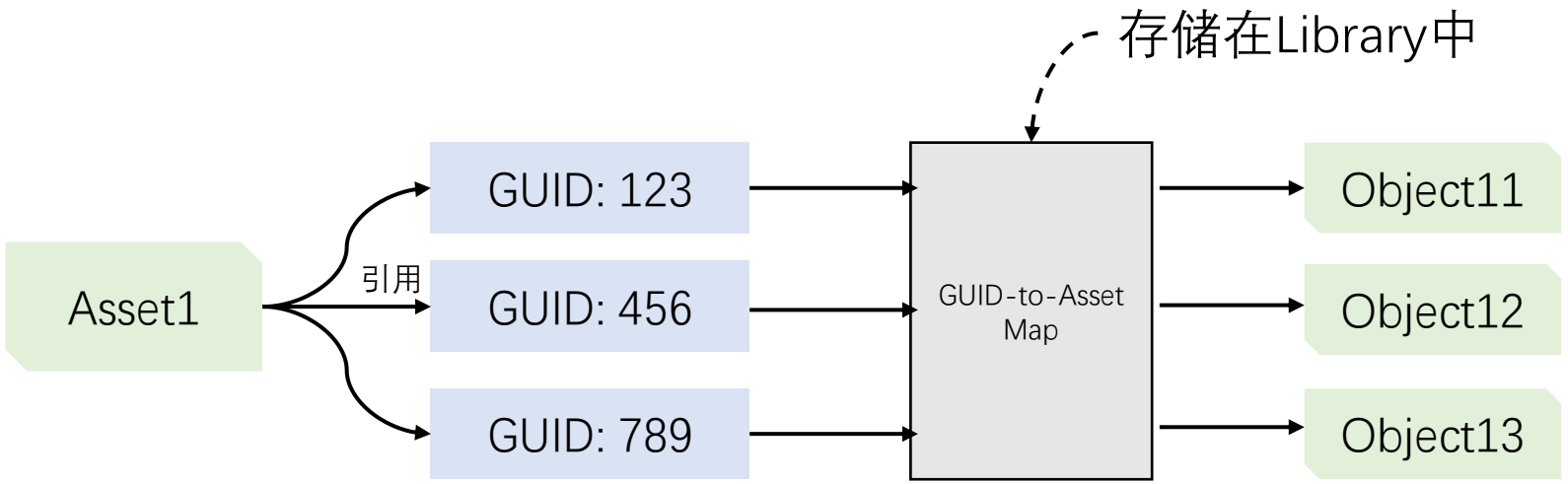
- 每个.meta文件实际上保存了两个关键信息：
  - GUID，标识了每个独特的Asset
  - ImportSettings信息，即每个包含的Object导入时的设置是怎样的

- .meta文件的注意点：
  - 第一次导入自动生成
  - 在Project窗口对Asset的修改Unity会自动修改对应的.meta文件（移动、删除等）
  - 在其他文件系统（如Windows/Mac文件夹目录）中修改Asset不会自动修改.meta，需要手动调整



Why File GUIDs and Local IDs

- 为了提供灵活、且跨平台的资源管理系统
  - File GUID是具体资源的抽象位置，只要与资源绑定，那么资源在文件夹中的位置就不再重要；当GUID与对应资源的绑定丢失时，所有对该资源的引用也会丢失
  - Local ID为Asset中包含的每个Object做出了区分，对同一个Asset包含的多个Object，它们共享同一个GUID
  - Unity维护了一个GUID到资源的Map，当有引用关系时，会首先通过GUID检索到对应的Asset文件，再通过Local ID找到具体的Object

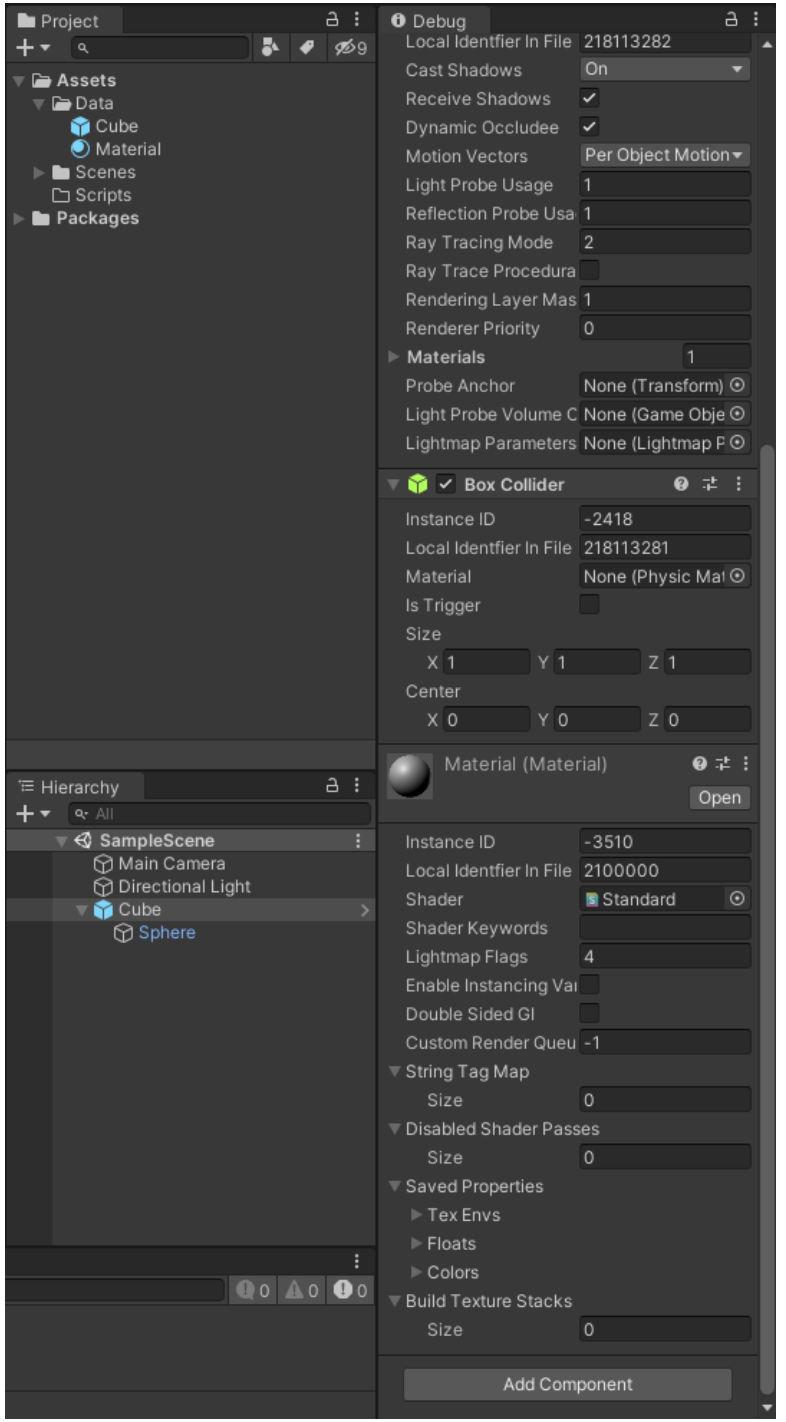


Instance ID

- 运行时，每次都检索GUID和Local ID会产生效率问题
- 将GUID和Local ID转化为一个单独的Instance ID并把对应的Object增加到cache中
  - 是一个递增的整数
  - 维护了与GUID和Local ID的关系
  - 维护了对应的Object

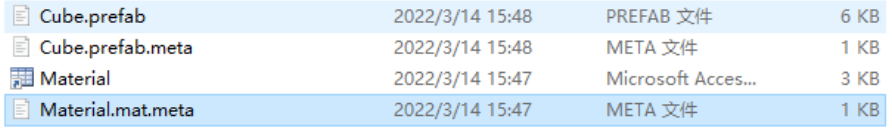
Example

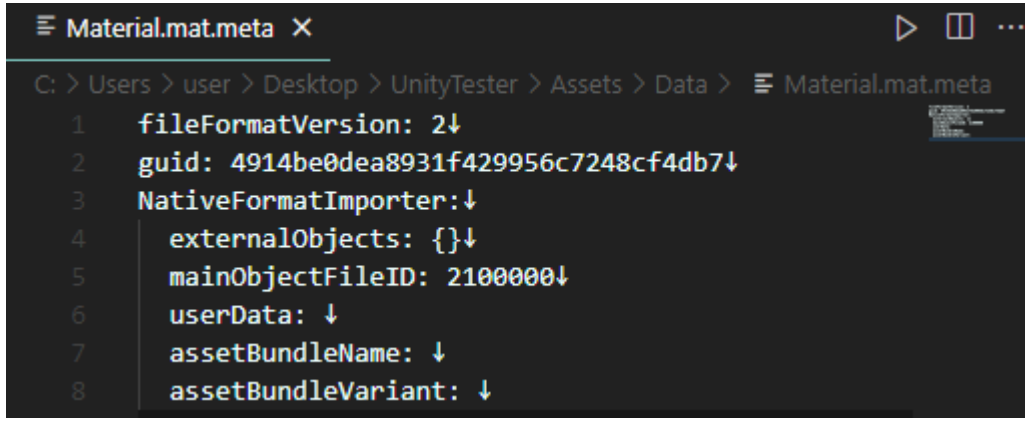
- 在Scene中创建了一个Cube，并将一个Sphere作为它的child，再新建一个material挂在Cube上，最后把Cube创建为prefab

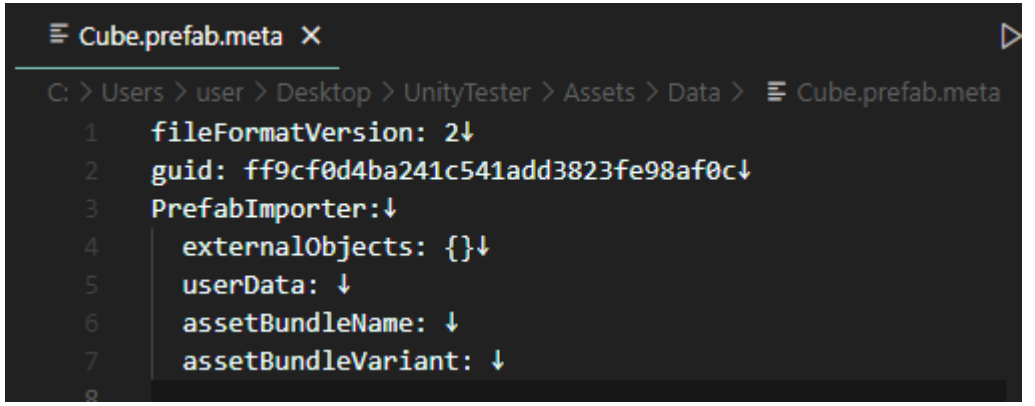


Example

- 首先打开Material.meta文件查看
- 有GUID和ImportSettings信息
  - 可以通过AssetDatabase.GUIDToAssetPath和AssetDatabase.AssetPathToGUID对GUID和资源相互转换
  - mainObjectFileID则是它的Local ID：2100000
- 再打开Cube.prefab.mata文件查看，同样包含了自身的GUID







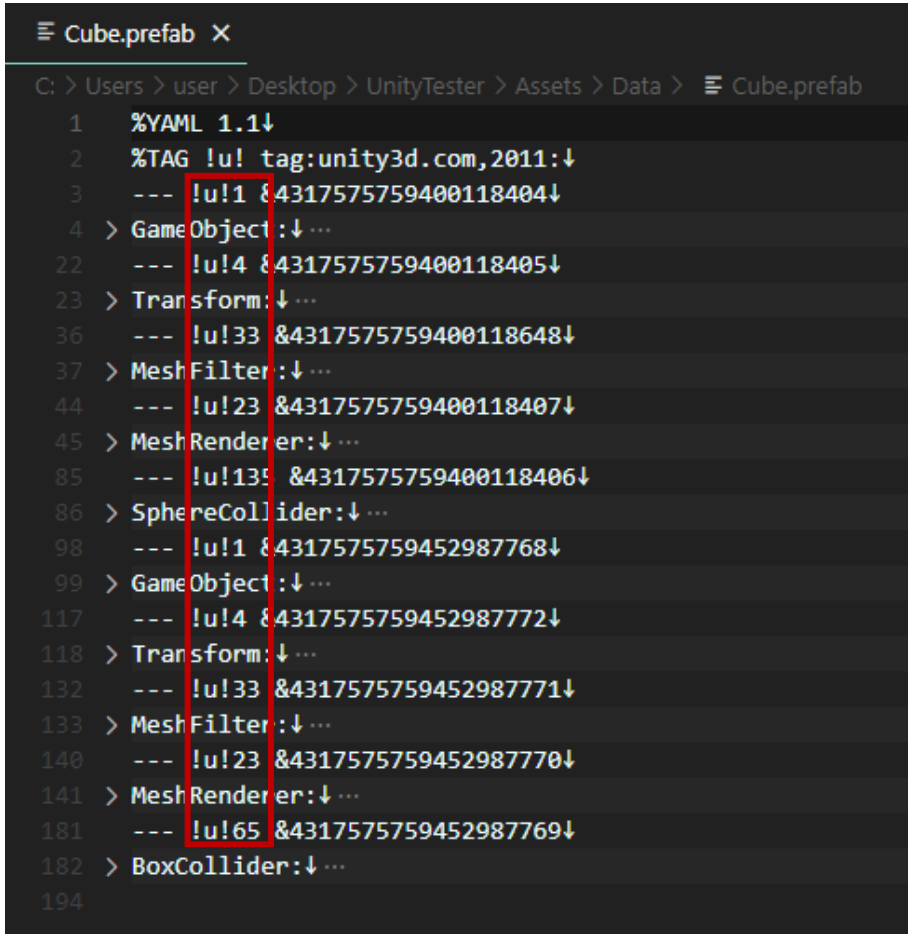
Example

- 现在打开Cube.prefab，有如下组成部分：
  - GameObject
  - Transform
  - MeshFilter
  - MeshRenderer
  - SphereCollider

  子物体Sphere相关
  - GameObject
  - Transform
  - MeshFilter
  - MeshRenderer
  - BoxCollider

  自身Cube相关

Class ID



Example

Sphere GameObject本身的LID

```
--- !u!1 &4317575759400118404
GameObject:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  serializedVersion: 6
  m_Component:
  - component: {fileID: 4317575759400118405}
  - component: {fileID: 4317575759400118648}
  - component: {fileID: 4317575759400118407}
  - component: {fileID: 4317575759400118406}
  m_Layer: 0
  m_Name: Sphere
  m_TagString: Untagged
  m_Icon: {fileID: 0}
  m_NavMeshLayer: 0
  m_StaticEditorFlags: 0
  m_IsActive: 1
--- !u!4 &4317575759400118405
Transform:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  m_GameObject: {fileID: 4317575759400118404}
  m_LocalRotation: {x: -0, y: -0, z: -0, w: 1}
  m_LocalPosition: {x: 0, y: 0, z: 0}
  m_LocalScale: {x: 1, y: 1, z: 1}
  m_Children: []
  m_Father: {fileID: 4317575759452987772}
  m_RootOrder: 0
  m_LocalEulerAnglesHint: {x: 0, y: 0, z: 0}
```

MeshFilter的LID

```
--- !u!33 &4317575759400118648
MeshFilter:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  m_GameObject: {fileID: 4317575759400118404}
  m_Mesh: {fileID: 10207, guid: 0000000000000000e0000000000000, type: 0}
```

Sphere有这些Component

Sphere Transform的LID

Transform所属的GameObject的LID，也就是Sphere的LID

父级Transform的LID

MeshRenderer的LID

```
--- !u!23 &4317575759400118407
MeshRenderer:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  m_GameObject: {fileID: 4317575759400118404}
  m_Enabled: 1
  m_CastShadows: 1
  m_ReceiveShadows: 1
  m_DynamicOccludee: 1
  m_MotionVectors: 1
  m_LightProbeUsage: 1
  m_ReflectionProbeUsage: 1
  m_RayTracingMode: 2
  m_RayTraceProcedural: 0
  m_RenderingLayerMask: 1
  m_RendererPriority: 0
  m_Materials:
  - {fileID: 10303, guid: 0000000000000000f000000000000000, type: 0}
  m_StaticBatchInfo:
    firstSubMesh: 0
    subMeshCount: 0
  m_StaticBatchRoot: {fileID: 0}
  m_ProbeAnchor: {fileID: 0}
  m_LightProbeVolumeOverride: {fileID: 0}
  m_ScaleInLightmap: 1
  m_ReceiveGI: 1
  m_PreserveUVs: 0
  m_IgnoreNormalsForChartDetection: 0
  m_ImportantGI: 0
  m_StitchLightmapSeams: 1
  m_SelectedEditorRenderState: 3
  m_MinimumChartSize: 4
  m_AutoUVMaxDistance: 0.5
  m_AutoUVMaxAngle: 89
  m_LightmapParameters: {fileID: 0}
  m_SortingLayerID: 0
  m_SortingLayer: 0
  m_SortingOrder: 0
  m_AdditionalVertexStreams: {fileID: 0}
```

SphereCollider的LID

```
--- !u!135 &4317575759400118406
SphereCollider:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  m_GameObject: {fileID: 4317575759400118404}
  m_Material: {fileID: 0}
  m_IsTrigger: 0
  m_Enabled: 1
  serializedVersion: 2
  m_Radius: 0.5
  m_Center: {x: 0, y: 0, z: 0}
```

Example

Cube GameObject本身的LID

```
--- !u!1 &4317575759452987768↓
GameObject:↓
  m_ObjectHideFlags: 0↓
  m_CorrespondingSourceObject: {fileID: 0}↓
  m_PrefabInstance: {fileID: 0}↓
  m_PrefabAsset: {fileID: 0}↓
  serializedVersion: 6↓
  m_Component:↓
  - component: {fileID: 4317575759452987772}↓
  - component: {fileID: 4317575759452987771}↓
  - component: {fileID: 4317575759452987770}↓
  - component: {fileID: 4317575759452987769}↓
  m_Layer: 0↓
  m_Name: Cube↓
  m_TagString: Untagged↓
  m_Icon: {fileID: 0}↓
  m_NavMeshLayer: 0↓
  m_StaticEditorFlags: 0↓
  m_IsActive: 1↓
--- !u!4 &4317575759452987772↓
Transform:↓
  m_ObjectHideFlags: 0↓
  m_CorrespondingSourceObject: {fileID: 0}↓
  m_PrefabInstance: {fileID: 0}↓
  m_PrefabAsset: {fileID: 0}↓
  m_GameObject: {fileID: 4317575759452987768}↓
  m_LocalRotation: {x: 0, y: 0, z: 0, w: 1}↓
  m_LocalPosition: {x: 0, y: 0, z: 0}↓
  m_LocalScale: {x: 1, y: 1, z: 1}↓
  m_Children:↓
  - {fileID: 4317575759400118405}↓
  m_Father: {fileID: 0}↓
  m_RootOrder: 0↓
  m_LocalEulerAnglesHint: {x: 0, y: 0, z: 0}↓
```

有这些Component

Cube Transform的LID

子级Transform的LID

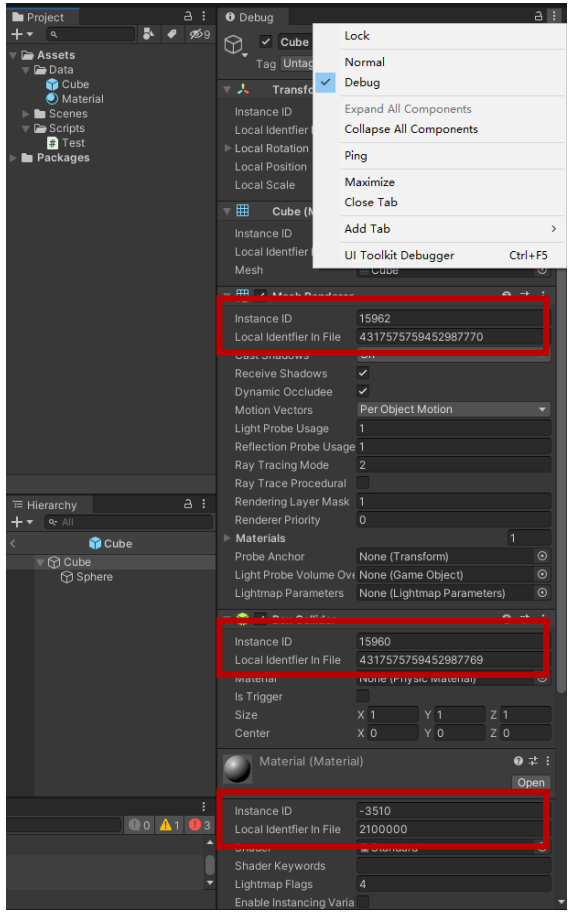
Mesh Renderer的LID

```
--- !u!23 &4317575759452987770↓
MeshRenderer:↓
  m_ObjectHideFlags: 0↓
  m_CorrespondingSourceObject: {fileID: 0}↓
  m_PrefabInstance: {fileID: 0}↓
  m_PrefabAsset: {fileID: 0}↓
  m_GameObject: {fileID: 4317575759452987768}↓
  m_Enabled: 1↓
  m_CastShadows: 1↓
  m_ReceiveShadows: 1↓
  m_DynamicOccludee: 1↓
  m_MotionVectors: 1↓
  m_LightProbeUsage: 1↓
  m_ReflectionProbeUsage: 1↓
  m_RayTracingMode: 2↓
  m_RayTraceProcedural: 0↓
  m_RenderingLayerMask: 1↓
  m_RendererPriority: 0↓
  m_Materials:↓
  - {fileID: 2100000, guid: 4914be0dea8931f429956c7248cf4db7, type: 2}↓
  m_StaticBatchInfo:↓
    firstSubMesh: 0↓
    subMeshCount: 0↓
  m_StaticBatchRoot: {fileID: 0}↓
  m_ProbeAnchor: {fileID: 0}↓
  m_LightProbeVolumeOverride: {fileID: 0}↓
  m_ScaleInLightmap: 1↓
  m_ReceiveGI: 1↓
  m_PreserveUVs: 0↓
  m_IgnoreNormalsForChartDetection: 0↓
  m_ImportantGI: 0↓
  m_StitchLightmapSeams: 1↓
  m_SelectedEditorRenderState: 3↓
  m_MinimumChartSize: 4↓
  m_AutoUVMaxDistance: 0.5↓
  m_AutoUVMaxAngle: 89↓
  m_LightmapParameters: {fileID: 0}↓
  m_SortingLayerID: 0↓
  m_SortingLayer: 0↓
  m_SortingOrder: 0↓
  m_AdditionalVertexStreams: {fileID: 0}↓
```

引用Material的LID和GUID

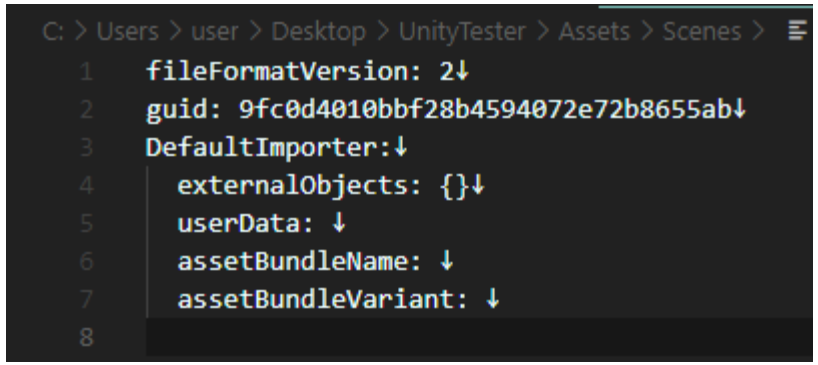
Example

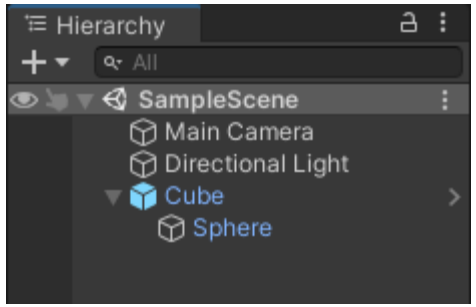
- 每个Component的Local ID都能通过Inspector面板的Debug模式看到

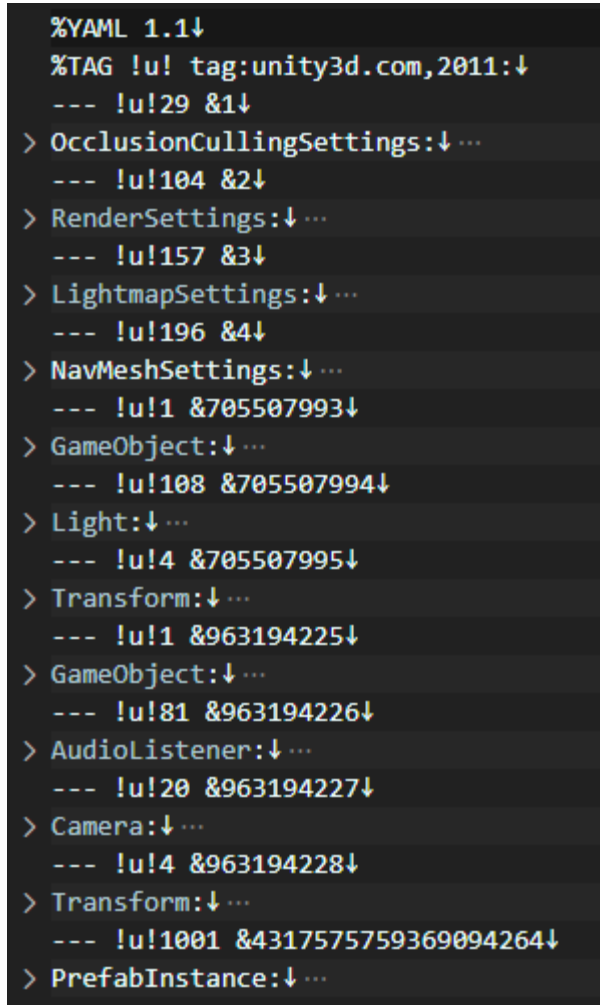


Example

- 下面再打开SampleScene.unity.meta文件查看
- 还是包含了该场景的GUID
- 当打开SampleScene.unity时，会发现有很多部分
  - Local ID为1、2、3、4的部分是场景的内置Setting

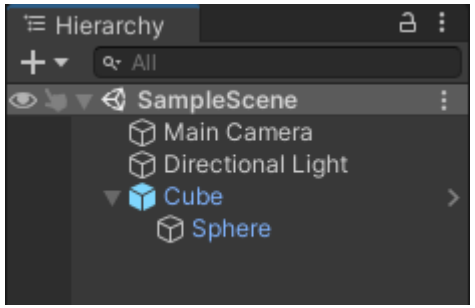




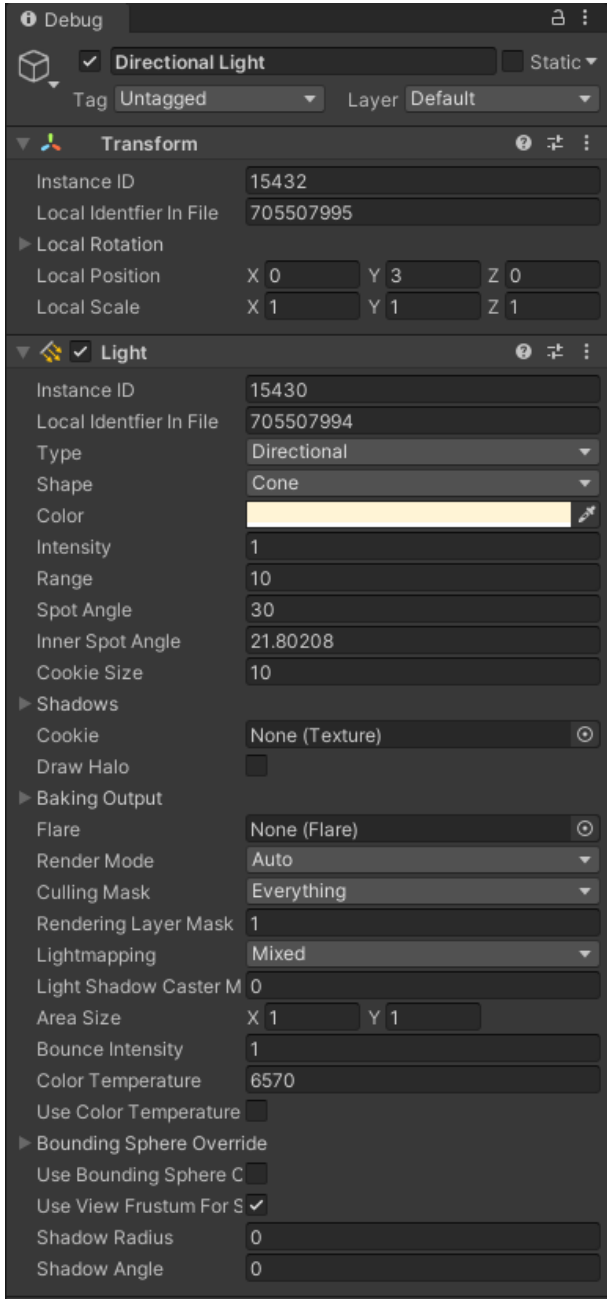


Example

- 连续的三个Local ID都是Directional Light及其内部组件

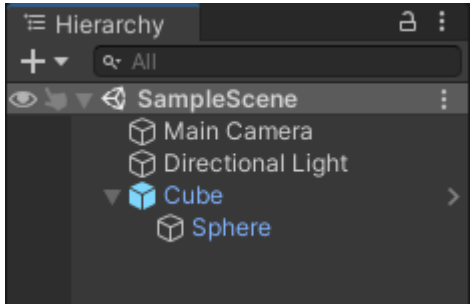



```
--- !u!1 &7705507993
GameObject:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  serializedVersion: 6
  m_Component:
  - component: {fileID: 705507995}
  - component: {fileID: 705507994}
  m_Layer: 0
  m_Name: Directional Light
  m_TagString: Untagged
  m_Icon: {fileID: 0}
  m_NavMeshLayer: 0
  m_StaticEditorFlags: 0
  m_IsActive: 1
--- !u!108 &705507994
Light:
--- !u!4 &705507995
Transform:
```

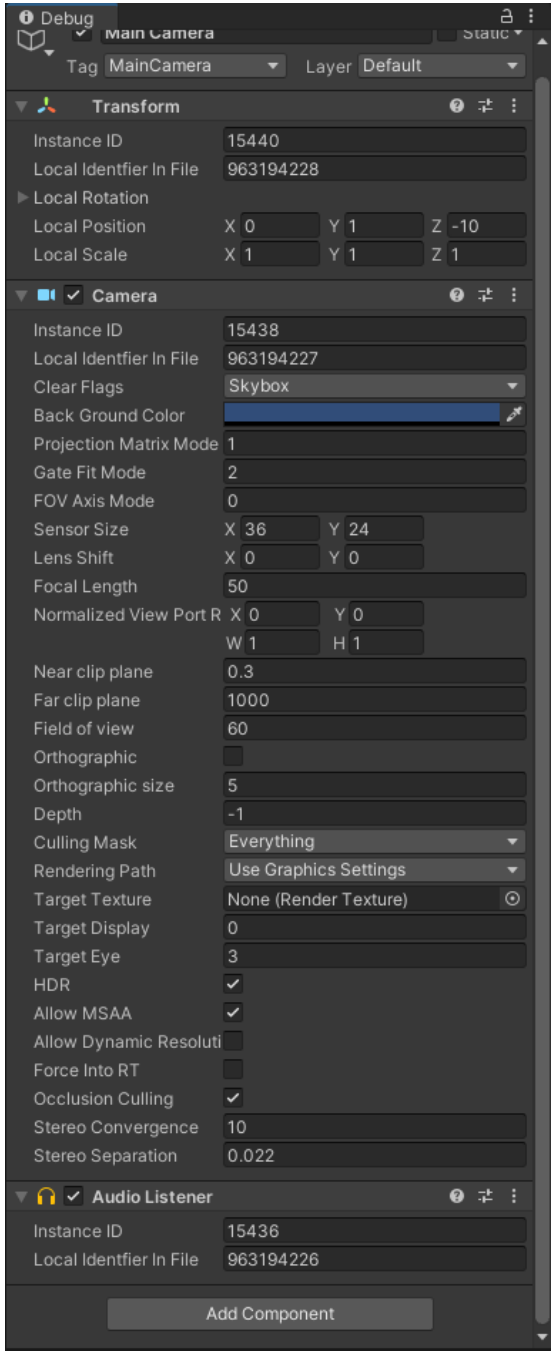


Example

- 接下来的4个Local ID是Camera及其内部组件



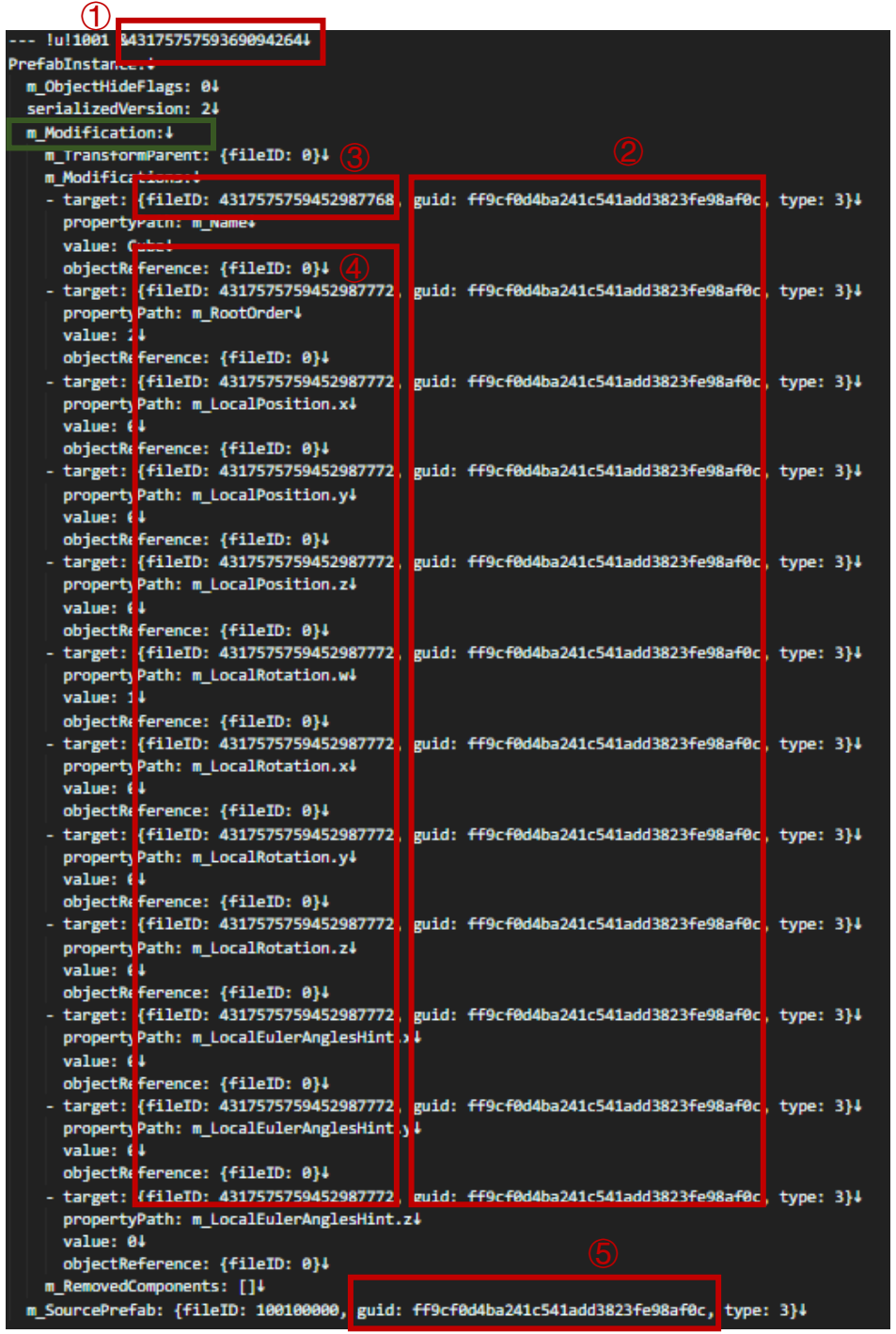

```
--- !u!1 &963194225↓
GameObject:↓
  m_ObjectHideFlags: 0↓
  m_CorrespondingSourceObject: {fileID: 0}↓
  m_PrefabInstance: {fileID: 0}↓
  m_PrefabAsset: {fileID: 0}↓
  serializedVersion: 6↓
  m_Component:↓
  - component: {fileID: 963194228}↓
  - component: {fileID: 963194227}↓
  - component: {fileID: 963194226}↓
  m_Layer: 0↓
  m_Name: Main Camera↓
  m_TagString: MainCamera↓
  m_Icon: {fileID: 0}↓
  m_NavMeshLayer: 0↓
  m_StaticEditorFlags: 0↓
  m_IsActive: 1↓
--- !u!81 &963194226↓
AudioListener:↓···
--- !u!20 &963194227↓
Camera:↓···
--- !u!4 &963194228↓
Transform:↓···
```

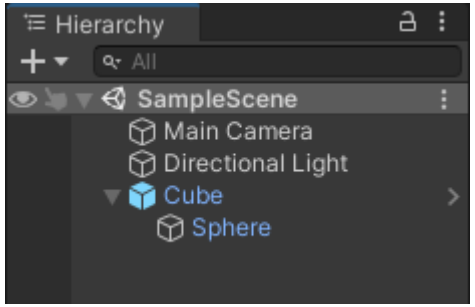


Example

- 最后的PrefabInstance与我们创建的Cube prefab有关，是这个Asset在场景中的实例化信息
  - ①：在该场景中prefab的实例化LID
  - ②：Cube.prefab的GUID
  - ③：Cube.prefab中Cube GameObject的LID
  - ④：Cube.prefab中Cube Transform的LID
  - ⑤：Cube.prefab的GUID

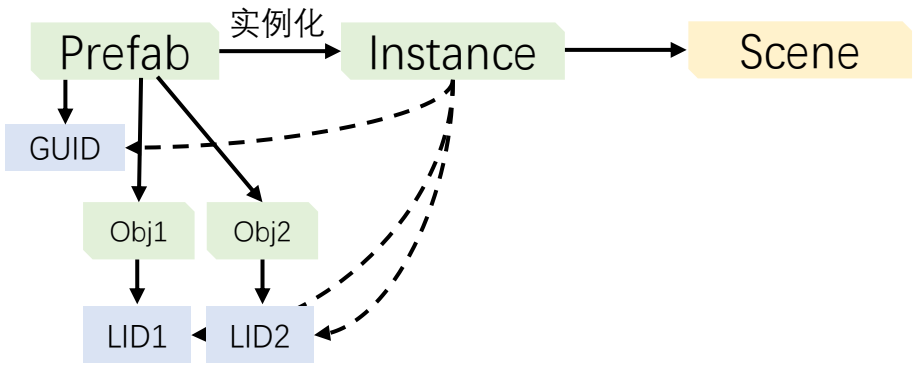
实例化时对原prefab的所有修改都会呈现在下面

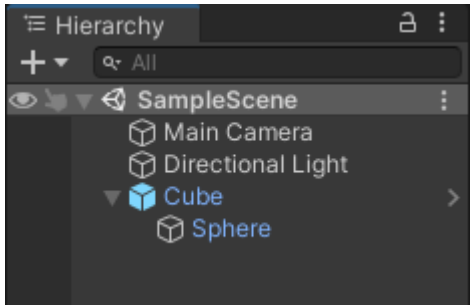




Example

- 最后的PrefabInstance与我们创建的Cube prefab有关，是这个Asset在场景中的实例化信息
  - ①：在该场景中prefab的实例化LID
  - ②：Cube.prefab的GUID
  - ③：Cube.prefab中Cube GameObject的LID
  - ④：Cube.prefab中Cube Transform的LID
  - ⑤：Cube.prefab的GUID





实例化时对原prefab的所有修改都会呈现在下面

①

```
--- !u!1001 &4317575759369094264
PrefabInstance:
  m_ObjectHideFlags: 0
  serialVersionUnity: 2
  m_Modification:
    m_TransformParent: {fileID: 0}
    m_Modifications:
    - target: {fileID: 4317575759452987768, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_Name
      value: Cube
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_RootOrder
      value: 2
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalPosition.x
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalPosition.y
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalPosition.z
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalRotation.w
      value: 1
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalRotation.x
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalRotation.y
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalRotation.z
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalEulerAnglesHint.x
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalEulerAnglesHint.y
      value: 0
      objectReference: {fileID: 0}
    - target: {fileID: 4317575759452987772, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
      propertyPath: m_LocalEulerAnglesHint.z
      value: 0
      objectReference: {fileID: 0}
    m_RemovedComponents: []
  m_SourcePrefab: {fileID: 100100000, guid: ff9cf0d4ba241c541add3823fe98af0c, type: 3}
```

②

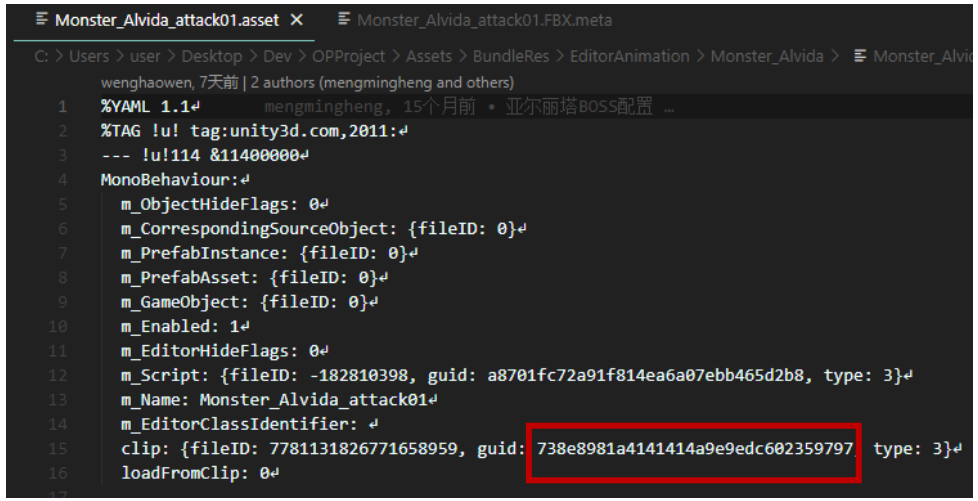
③

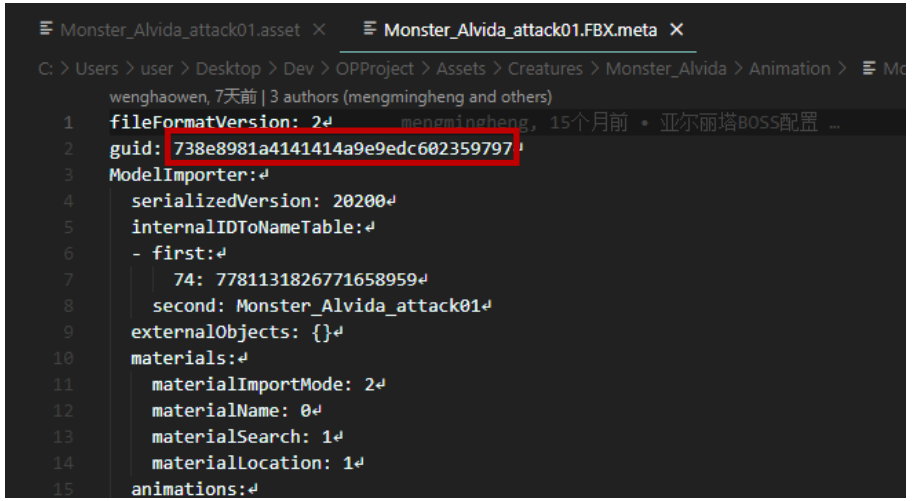
④

⑤

一个实际例子

- 需求：找到.anim文件对应的.fbx文件
- 已有.anim文件，通过调用API获取.asset文件，再通过.asset中存储的fbx文件对应的GUID获取fbx文件






```
if (AssetDatabase.TryGetGUIDAndLocalFileIdentifier(t_clip, out string t_guid, out long t_localid))
{
    string fbxName = AssetDatabase.GUIDToAssetPath(t_guid).Split('/').Last();
    return fbxName;
}
else return "";
```

参考文献

- https://zhuanlan.zhihu.com/p/96709802
- https://blog.uwa4d.com/archives/USparkle_inf_UnityEngine.html
- https://docs.unity3d.com/Manual/AssetMetadata.html
- https://learn.unity.com/tutorial/assets-resources-and-assetbundles#
- https://docs.unity3d.com/Packages/com.unity.addressables@0.3/manual/AddressableAssetsGettingStarted.html