



Topic of speech

UE4全平台热更新方案

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Title UE4开发者、技术博主

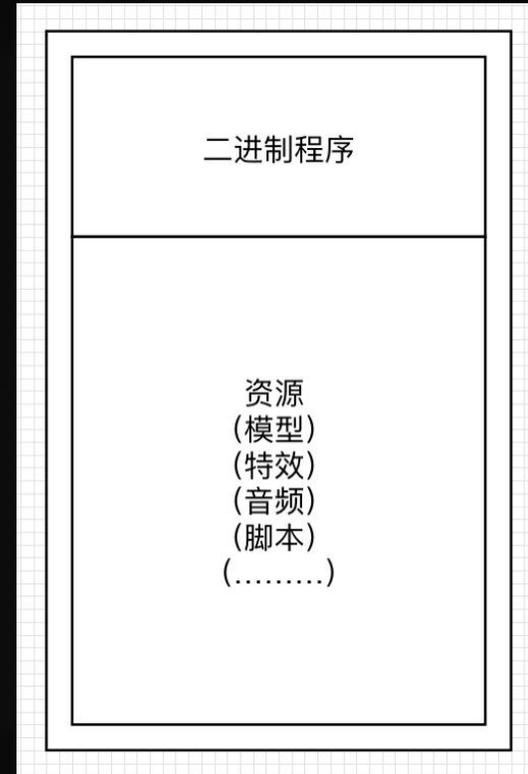
Part One

热更新简介



游戏包体：

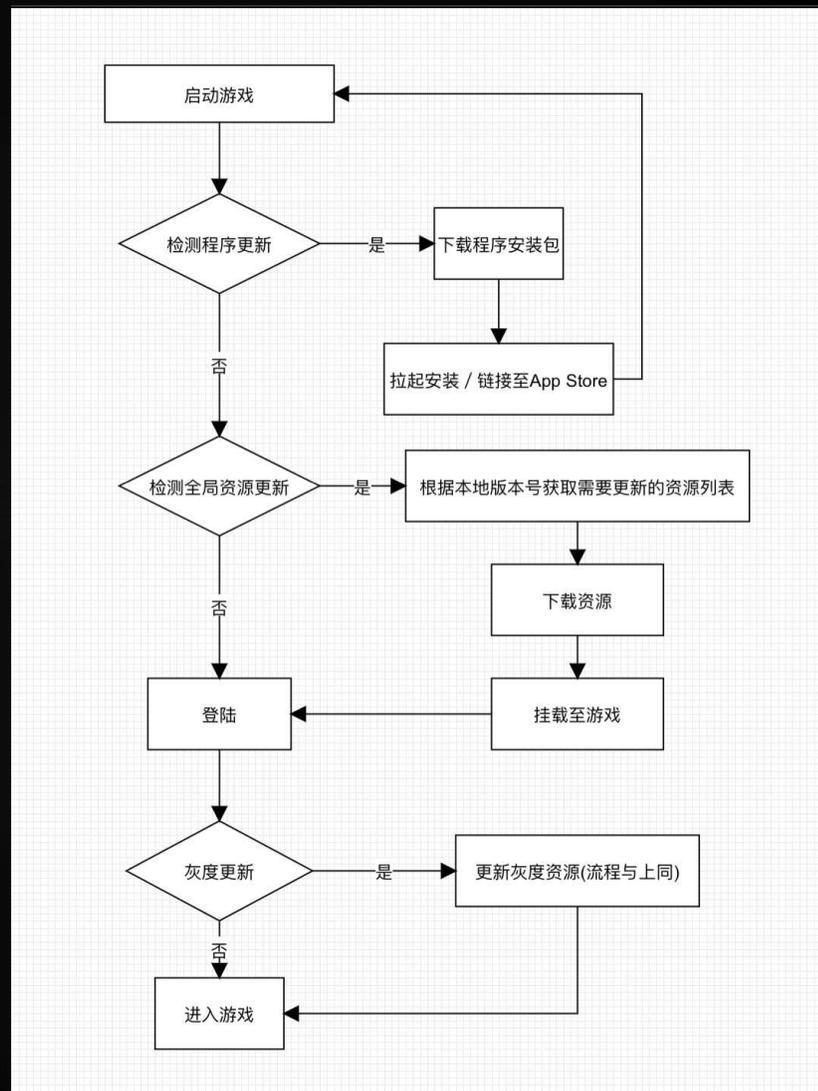
- 程序
- 美术资源
- 脚本、数据文件等



游戏更新流程

热更新解决了哪些问题?

- 不需要玩家重新安装应用
- 快速迭代游戏内容





UE4中各平台包中的内容

```
Windows.txt X
1 D:\WindowsNoEditor>tree /a /f
2 | Blank425.exe
3 |
4 +---Engine
5 | +---Binaries
6 | | \---ThirdParty
7 |
8 \---Blank425
9 | +---Binaries
10 | | \---Win64
11 | | | Blank425.exe
12 | |
13 | \---Content
14 | | \---Paks
15 | | | Blank425-WindowsNoEditor.pak

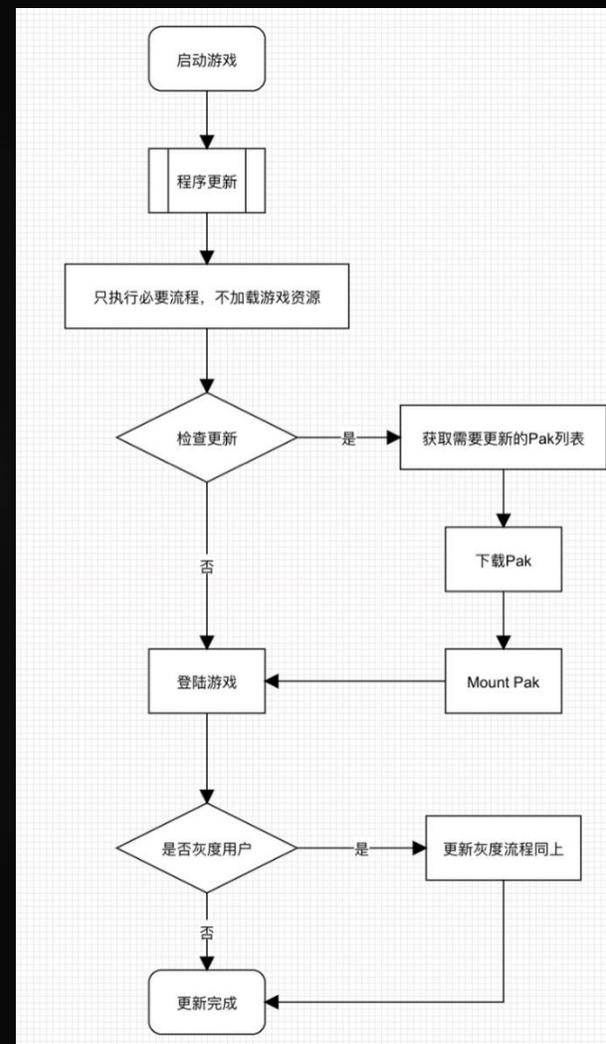
Android_ASTC.txt X
1 D:\Android_ASTC>tree /a /f
2 | AndroidManifest.xml
3 |
4 +---assets
5 | | ...
6 | | main.obb.png
7 | | ...
8 | |
9 | | \---beaconcomp
10 | | | comp_list
11 | | | libBeacon.so.arm64-v8a
12 | | | libBeacon.so.armeabi
13 | +---lib
14 | | \---armeabi-v7a
15 | | | ...
16 | | | libUE4.so
17 | | | ...
18 | +---original
19 | | | AndroidManifest.xml
20 | | |
21 | | | \---META-INF
22 | | | | ...
23 | +---res
24 | | +---anim
25 | | | ...
26 | |
27 | \---unknown
28 | | ...

iOS.txt X
1 D:\iOS>tree /a /f
2 | ...
3 | Blank425
4 | Info.plist
5 | LaunchScreenIOS.png
6 | ...
7 | ue4commandline.txt
8 |
9 +---cookeddata
10 | \---blank425
11 | | \---content
12 | | | +---movies
13 | | | | ...
14 | | | |
15 | | | \---paks
16 | | | | blank425-ios.pak
17 | |
18 | +---Engine
19 | | \---Content
20 | | | \---SlateDebug
21 | | | | \---Fonts
22 | | | | | LastResort.ttf
23 | |
24 | +---LaunchScreen.storyboardc
25 | | | ...
26 | |
27 | +---MidasIAPSDK.bundle
28 | | | ...
29 | |
30 | +---MSDKAppSetting.bundle
31 | | | ...
32 | |
33 | +---MSDKWebViewResource.bundle
34 | | | ...
35 | |
36 | \---CodeSignature
37 | | CodeResources
38 |
```

UE4热更新的流程

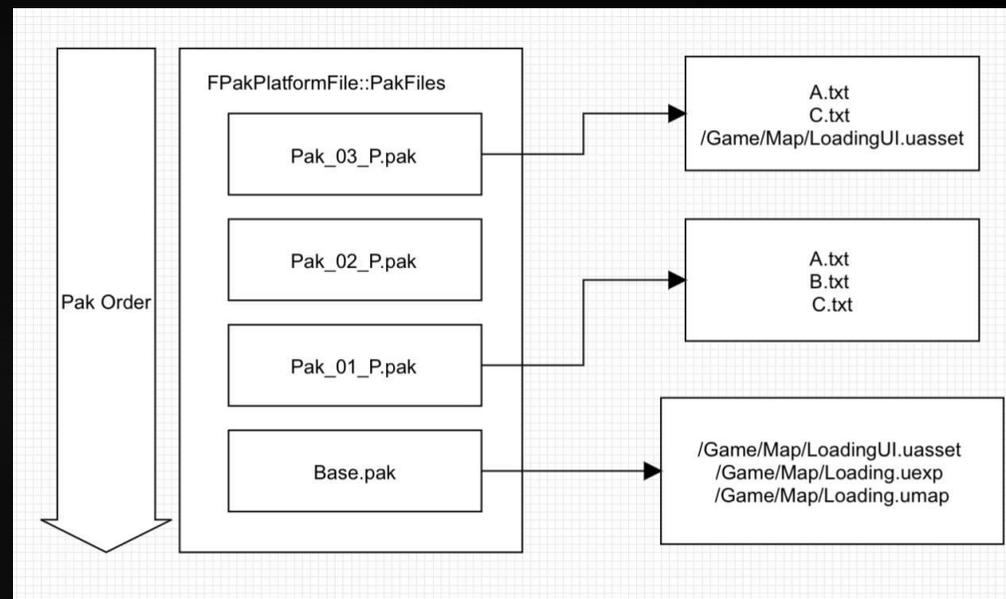
UE中热更新的是基于Pak的更新

- 资源在Pak中
- 自己控制挂载时机
- Pak可以设定优先级



UE热更新的核心点:

- UFS读取文件具有优先级(PakOrder)
- 默认读取Order最大的Pak中的文件



Part Two

UE4热更新：资源管理

哪些内容可以被热更新

打包热更的资源

管理热更新的版本

使用热更的资源

Pak中包含哪些内容

- Cooked uasset
- Slate资源
- Internationalization
- .uproject / .uplugin
- Config
- AssetRegistry.bin
- ushaderbytecode
- shadercache
- 添加的Non-Asset文件

Engine\Config\BaseGame.ini

```
1 +EarlyDownloaderPakFileFiles=...\Content\Internationalization\...\*.icu
2 +EarlyDownloaderPakFileFiles=...\Content\Internationalization\...\*.brk
3 +EarlyDownloaderPakFileFiles=...\Content\Internationalization\...\*.res
4 +EarlyDownloaderPakFileFiles=...\Content\Internationalization\...\*.nrm
5 +EarlyDownloaderPakFileFiles=...\Content\Internationalization\...\*.cfu
6 +EarlyDownloaderPakFileFiles=...\Content\Localization\...\*.*
7 +EarlyDownloaderPakFileFiles=...\Content\Localization\*.*
8 +EarlyDownloaderPakFileFiles=...\Content\Certificates\...\*.*
9 +EarlyDownloaderPakFileFiles=...\Content\Certificates\*.*
10 ; have special cased game localization so that it's not required for early pak file
11 +EarlyDownloaderPakFileFiles=-...\Content\Localization\Game\...\*.*
12 +EarlyDownloaderPakFileFiles=-...\Content\Localization\Game\*.*
13 +EarlyDownloaderPakFileFiles=...\Config\...\*.ini
14 +EarlyDownloaderPakFileFiles=...\Config\*.*.ini
15 +EarlyDownloaderPakFileFiles=...\Engine\GlobalShaderCache*.bin
16 +EarlyDownloaderPakFileFiles=...\Content\ShaderArchive-Global*.ushaderbytecode
17 +EarlyDownloaderPakFileFiles=...\Content\Slate\*.*
18 +EarlyDownloaderPakFileFiles=...\Content\Slate\...\*.*
19 +EarlyDownloaderPakFileFiles=...\*.upluginmanifest
20 +EarlyDownloaderPakFileFiles=...\*.uproject
21 +EarlyDownloaderPakFileFiles=...\global_sf*.metalmap
```

热更新需要重点关注的内容

- uasset
- Internationalization
- AssetRegistry
- Shaderbytecode
- Shadercache
- 外部文件 (lua等)



Part Two

UE4热更新：资源管理

哪些内容可以被热更新

打包热更的资源

管理热更新的版本

使用热更的资源

Pak打包流程:

- 收集要打包的资源以及外部文件
- cook uasset
- 存储打包的Response文件
- 使用UnrealPak执行打包

ResponseFile格式: 文件的绝对路径+Mount之后的路径+打包参数

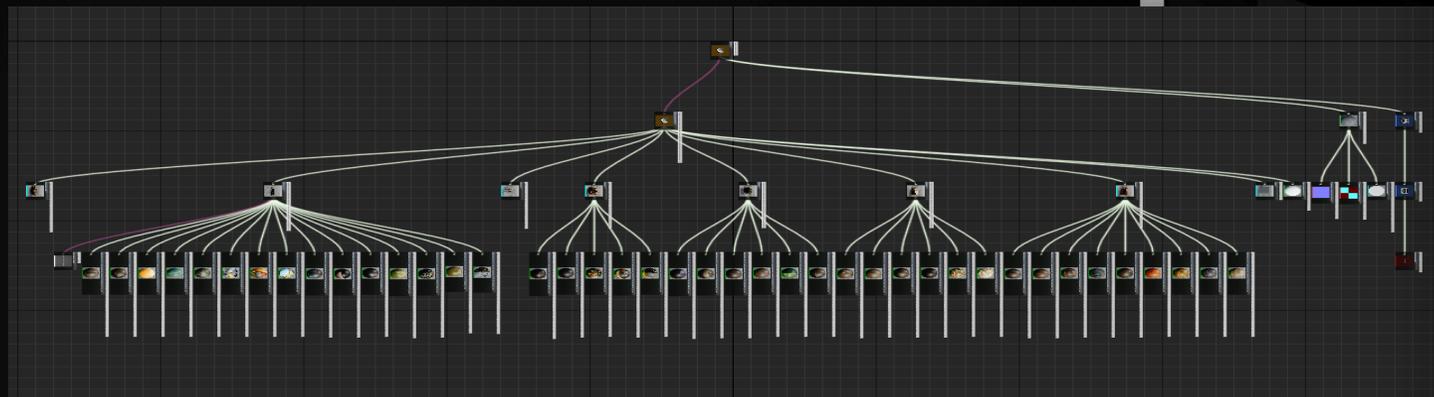
```
1 "D:\Blank425\Blank425.uproject" "../../../../../Blank425/Blank425.uproject"  
2 "D:\Blank425\Plugins\HotPatcher\HotPatcher.uplugin" "../../../../../Blank425/Plugins/HotPatcher/HotPatcher.uplugin"  
3 "C:\UE425\Engine\Plugins\2D\Paper2D\Paper2D.uplugin" "../../../../../Engine/Plugins/2D/Paper2D/Paper2D.uplugin"  
4 "C:\UE425\Engine\Plugins\AI\AISupport\AISupport.uplugin" "../../../../../Engine/Plugins/AI/AISupport/AISupport.uplugin"
```

UnrealPak的打包命令:

`UnrealPak.exe SAVE_PAK.pak -create=RESPONSE_FILE.txt -compress`

手动打包的繁琐问题：

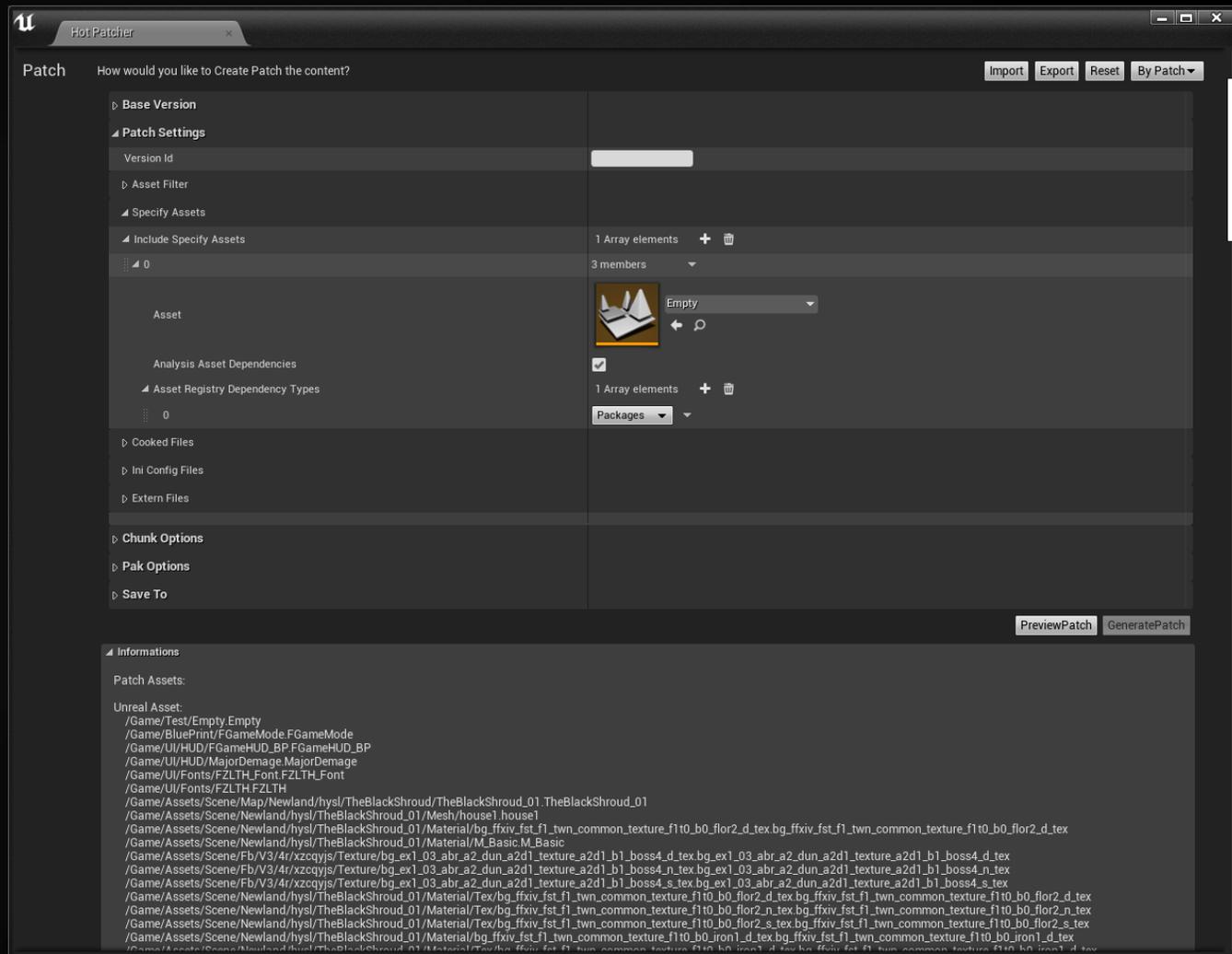
1. 需要分析uasset资源的依赖
2. 对uasset资源进行Cook
3. 添加需要打包的Non-Asset文件
4. 编辑ResponseFile文件
5. 执行UnrealPak命令
6. 每个平台都要执行一遍上述流程



自动化Pak打包工具 HotPatcher

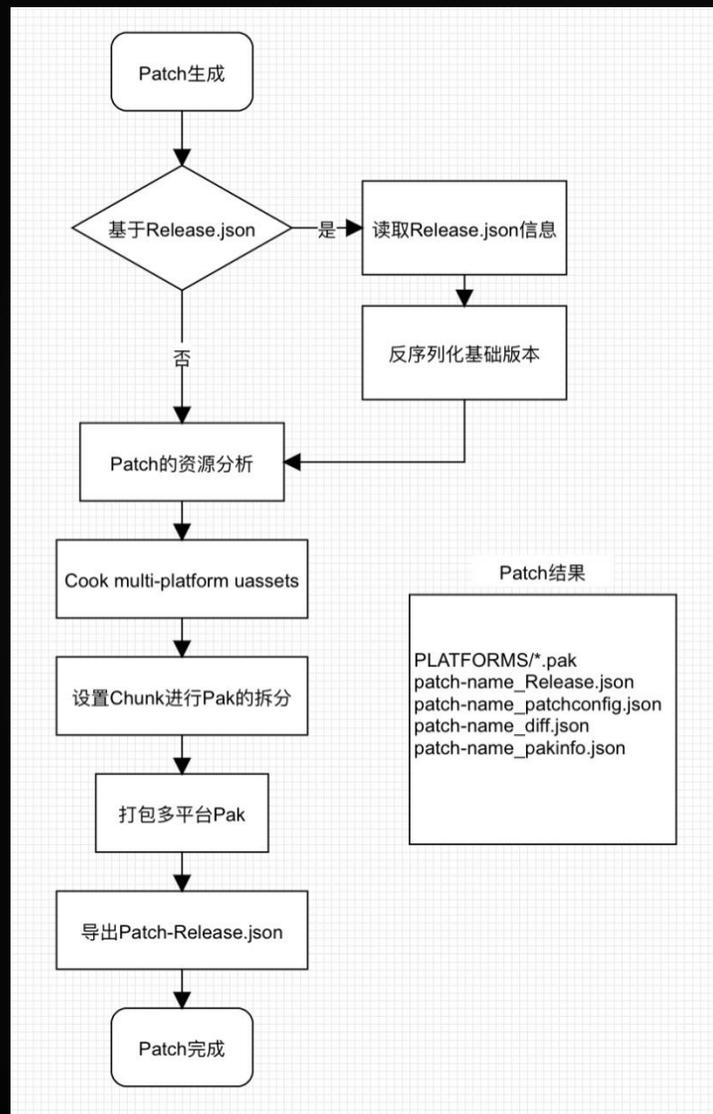
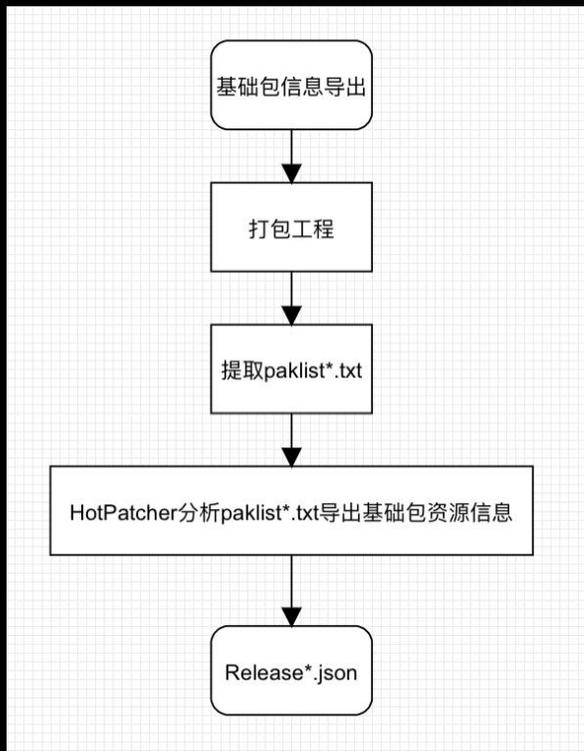
优势:

- 开源: <https://github.com/hxhb/HotPatcher>
- MIT License
- 持续迭代更新
- 灵活的配置化选项
- 支持自动化打包, 可以与ci集成



HotPatcher核心功能模块

- Cook: 方便对uasset进行多平台的Cook, 并且支持Commandlet
- Release: 对基础包资源信息的记录、导出
- Patch: 版本比对、生成Patch信息、打包Pak



```

D:\Blank425\Package>tree /a /f
+---BaseVersion
|   BaseVersion_Release.json
|   BaseVersion_ReleaseConfig.json
|
+---Patch1.1
|   BaseVersion_Patch1.1_Diff.json
|   Patch1.1_PakFilesInfo.json
|   Patch1.1_PatchConfig.json
|   Patch1.1_Release.json
|
+---Android_ASTC
|   Patch1.1_Android_ASTC_001_P.pak
|   Patch1.1_Android_ASTC_001_P_PakCommands.txt
|
+---IOS
|   Patch1.1_IOS_001_P.pak
|   Patch1.1_IOS_001_P_PakCommands.txt
|
+---WindowsNoEditor
|   Patch1.1_WindowsNoEditor_001_P.pak
|   Patch1.1_WindowsNoEditor_001_P_PakCommands.txt
    
```

HotPatcher功能简介

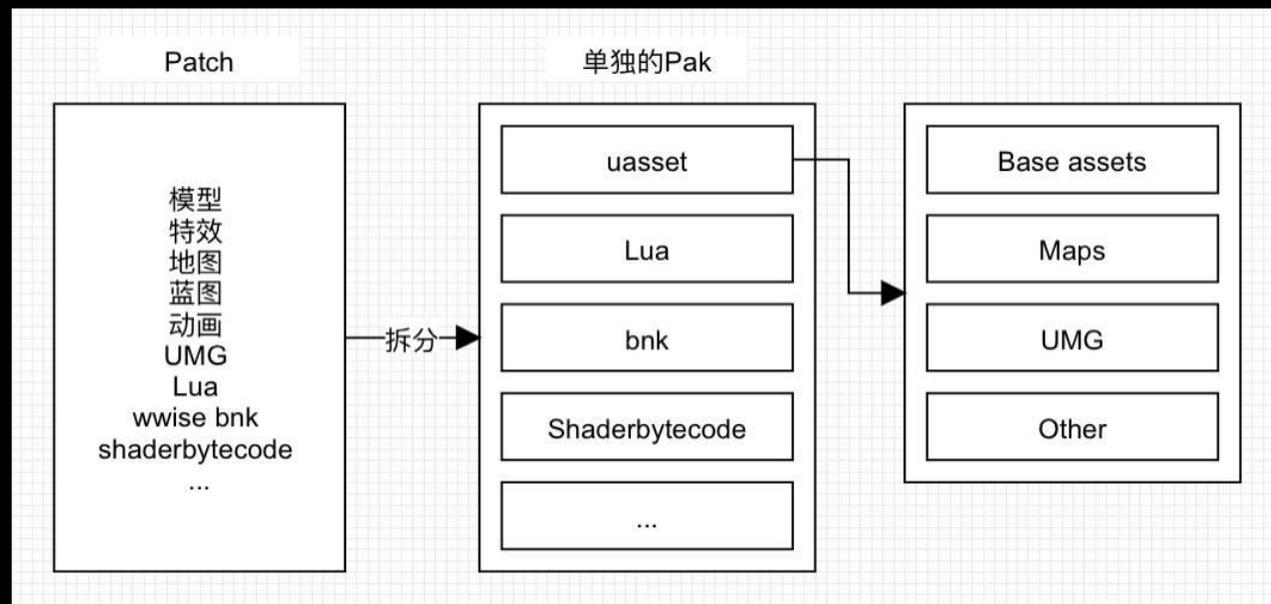
1. 支持uasset的资源选择包含
2. 支持uasset的资源依赖分析
3. 支持从Paklist导入基础包信息（支持多平台）
4. 支持版本信息比对，打出差异包
5. 支持添加Non-Asset文件
6. 支持版本间Non-Asset的Diff
7. 支持自定义UnrealPak参数
8. 支持同时Cook多个平台
9. 支持添加ini/Shaderbytecode/AssetRegistry
10. 支持同时打出多个平台的Patch
12. 支持Patch的迭代打包
12. 支持Chunk，可以把一个Patch拆分为多个Pak
13. 支持多线程打包
14. 支持导出资源的引用信息
15. 支持配置的导入/导出
16. 支持Commandlet进行Cook/Patch/Release
17. 支持给指定平台添加额外的Non-Asset文件
18. 支持ContentBrowser中Cook单个资源
19.

HotPatch资料

- 项目地址: <https://github.com/hxhb/HotPatcher>
- 视频介绍: [UE4热更新: HotPatcher插件使用教程](#)
- 文档和更新记录: [UE4 资源热更打包工具 HotPatcher](#)

Pak的几种打包粒度：

1. 整个Patch为单个Pak
2. 根据地图为Patch打包
3. 根据资源分类Patch打包



思考：基础包更新后，先前热更的Pak如何处理？

Part Two

UE4热更新：资源管理

哪些内容可以被热更新

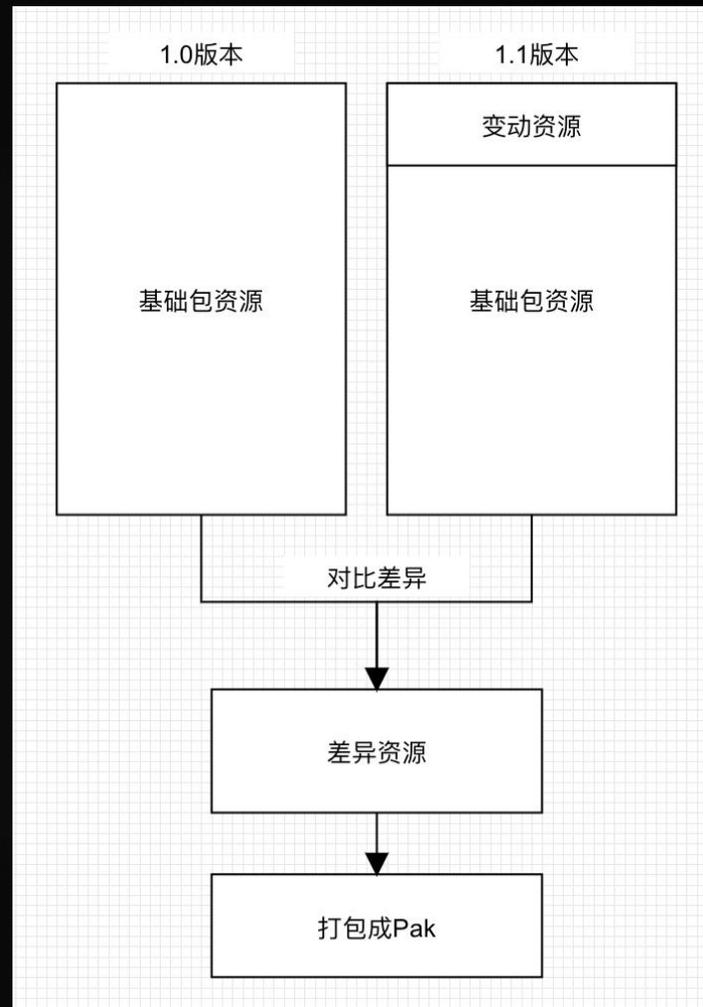
打包热更的资源

管理热更新的版本

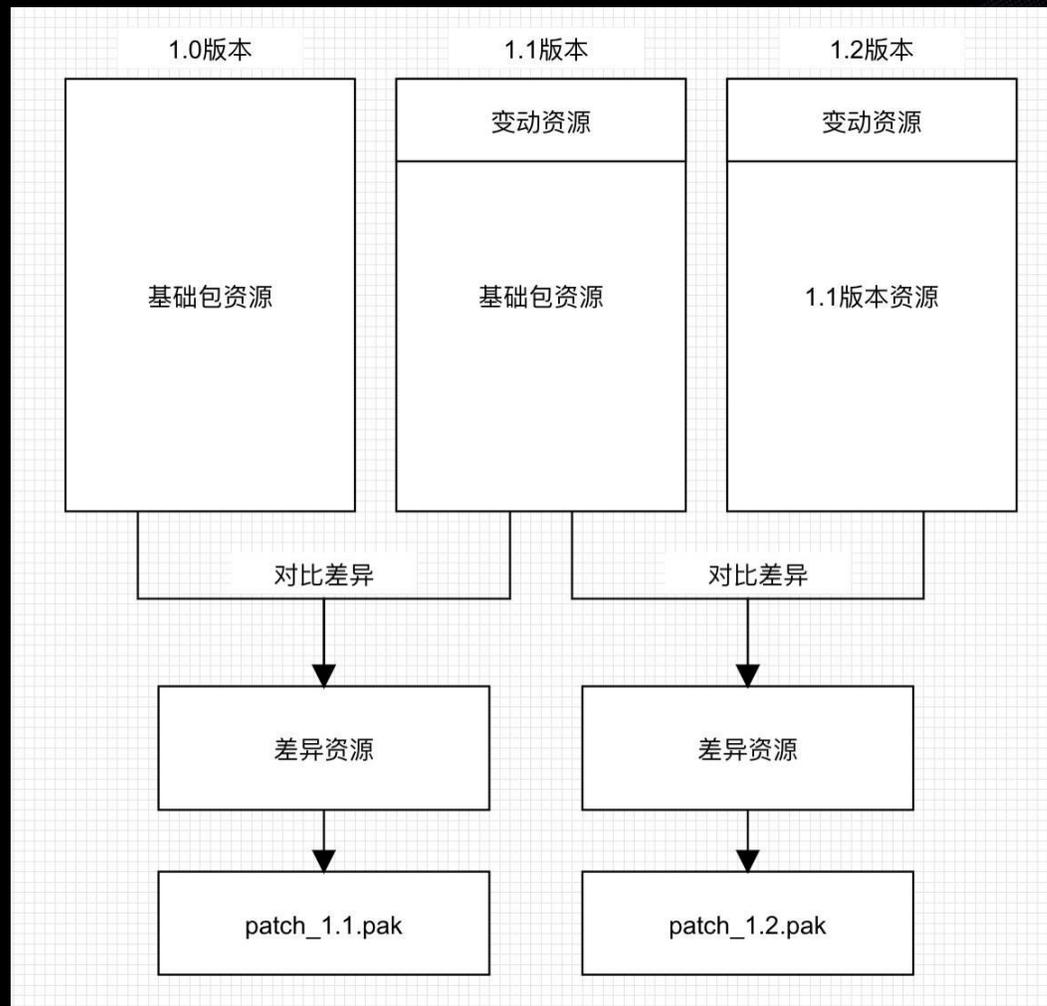
使用热更的资源

UE4热更新版本管理需求:

1. 能够完整记录打出的基础包内的资源信息
2. 开发中能够精确地定位变动的资源
3. 能够在变动的基础上更新完整游戏的资源信息



并且需要支持迭代的方式更新

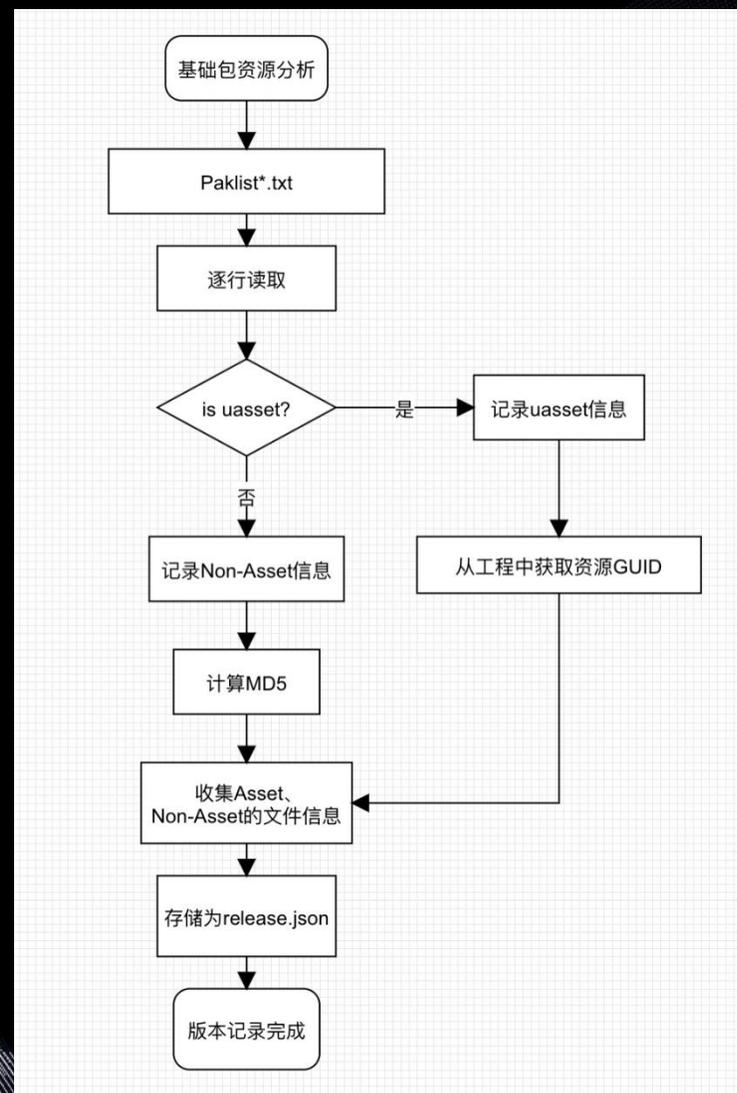


记录游戏包资源信息的思路:

1. 分析UE打包时通过UAT生成的PakList*.txt文件
2. 记录Content内资源信息

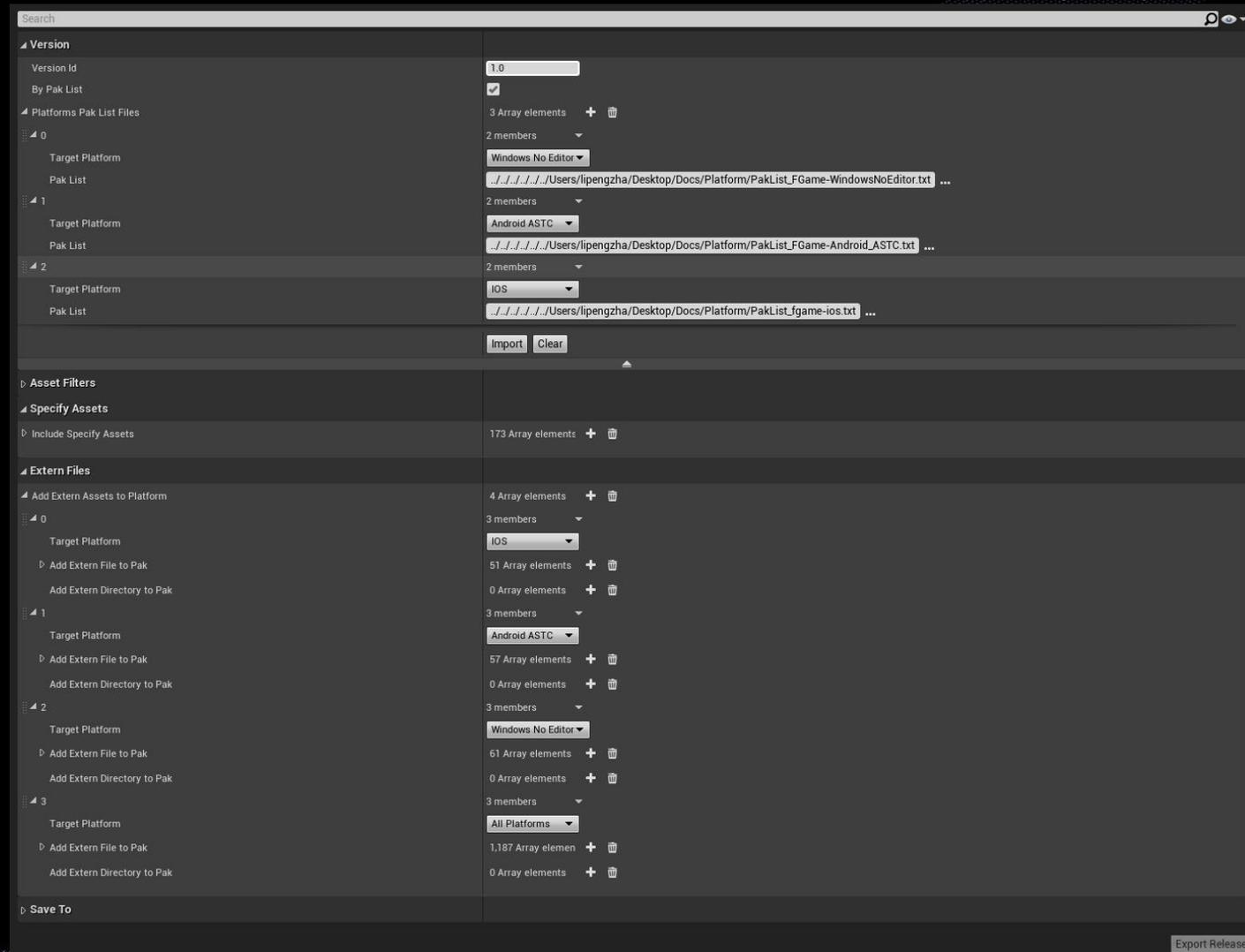
需要注意的问题:

1. 每个平台包含的资源并不一定完全相同
2. 不同平台具有不同的文件 (如Wwise的bnk)



解决多平台基础包内资源不统一的方案

1. 对每个平台的paklist*.txt都进行分析
2. 记录各个平台相同、不同的部分
3. 对全平台生成统一的Release.json



Part Two

UE4热更新：资源管理

哪些内容可以被热更新

打包热更的资源

管理热更新的版本

使用热更的资源



热更Pak包的使用

1. Pak需要挂载(Mount)到游戏中才可以使用
2. Mount时可以给Pak设置优先级(PakOrder)

```
bool UFlibPakHelper::MountPak(const FString& PakPath, int32 PakOrder, const FString& InMountPoint)
{
    bool bMounted = false;
    FPakPlatformFile* PakFileMgr = (FPakPlatformFile*)FPlatformFileManager::Get().GetPlatformFile(FPakPlatformFile::GetType());
    if (!PakFileMgr)
    {
        UE_LOG(LogHotPatcher, Log, TEXT("GetPlatformFile(TEXT(\"PakFile\") is NULL"));
        return false;
    }

    PakOrder = FMath::Max(A: 0, B: PakOrder);
    if (FPaths::FileExists(PakPath) && FPaths::GetExtension(PakPath) == TEXT("pak"))
    {
        const TCHAR* MountPoint = InMountPoint.IsEmpty() ? NULL : InMountPoint.GetCharArray().GetData();
        bMounted = PakFileMgr->Mount(InPakFilename: *PakPath, PakOrder, InPath: MountPoint);
    }

    return bMounted;
}
```

UE4 Pak自动挂载目录

1. Engine/Content/Paks
2. GAME_DIR/Content/Paks
3. GAME_DIR/Saved/Paks

```
int32 FPakPlatformFile::GetPakOrderFromPakFilePath(const FString& PakFilePath)
{
    if (PakFilePath.StartsWith(InPrefix: FString::Printf(Fmt: TEXT("%sPaks/%s-"), *FPaths::ProjectContentDir(), FApp::GetProjectName())))
    {
        return 4;
    }
    else if (PakFilePath.StartsWith(InPrefix: FPaths::ProjectContentDir()))
    {
        return 3;
    }
    else if (PakFilePath.StartsWith(InPrefix: FPaths::EngineContentDir()))
    {
        return 2;
    }
    else if (PakFilePath.StartsWith(InPrefix: FPaths::ProjectSavedDir()))
    {
        return 1;
    }

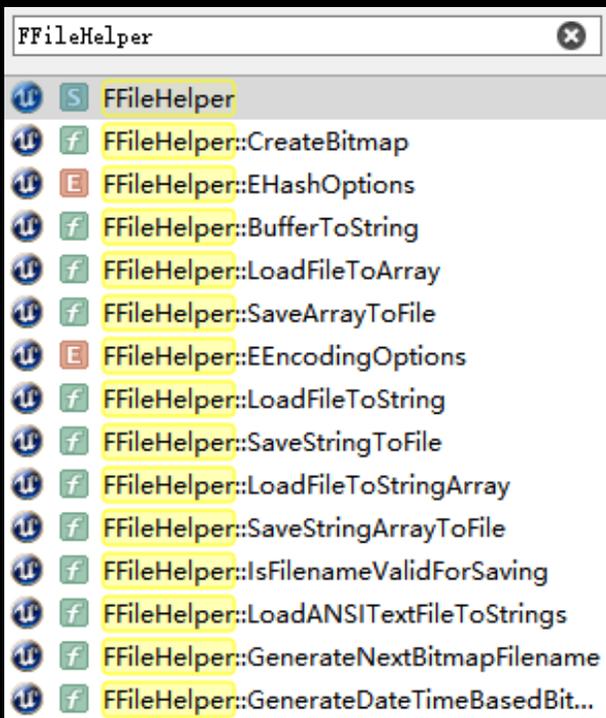
    return 0;
}
```

注：GAME_DIR/Content/Pak/GAME_NAME-*.pak是基础包内Pak的命名规则。

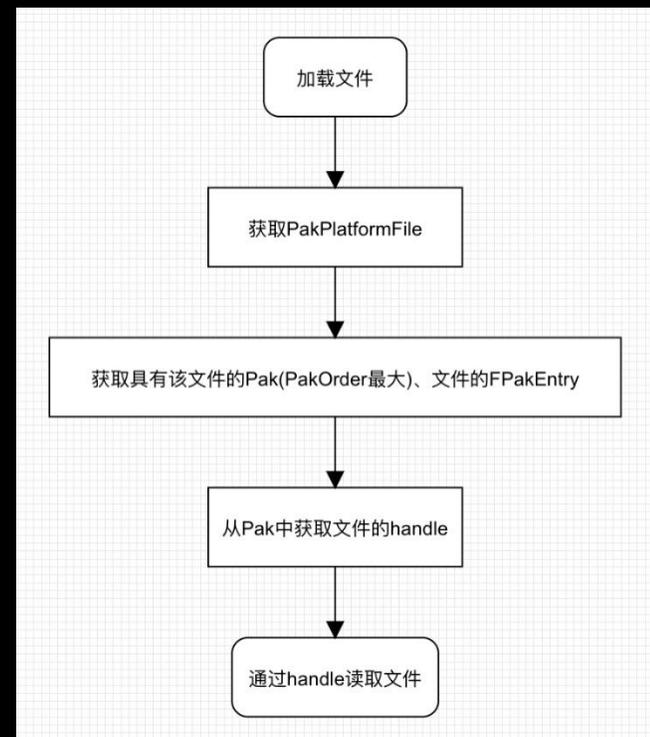
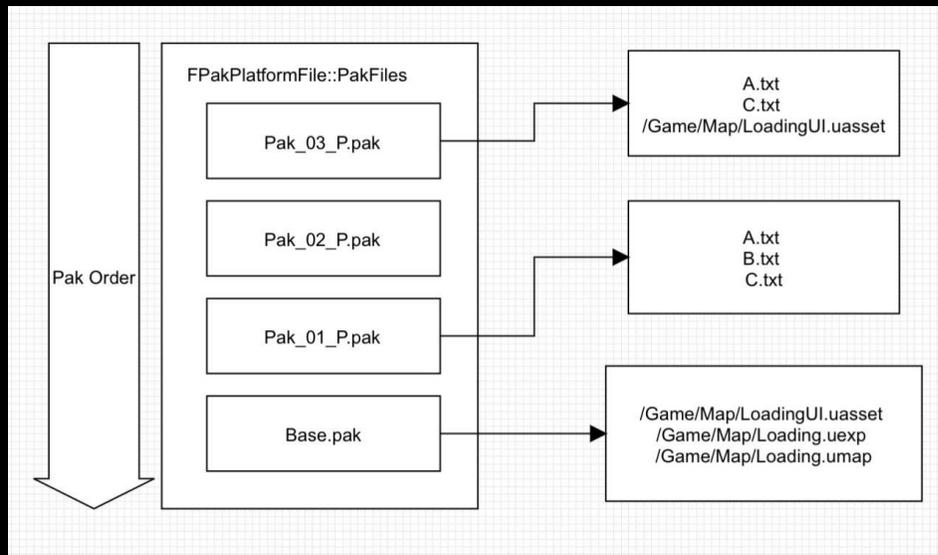
热更完成读取文件

Pak中的文件需要以UFS方式读取:

FFileHelper



UFS文件读取流程



Part Three

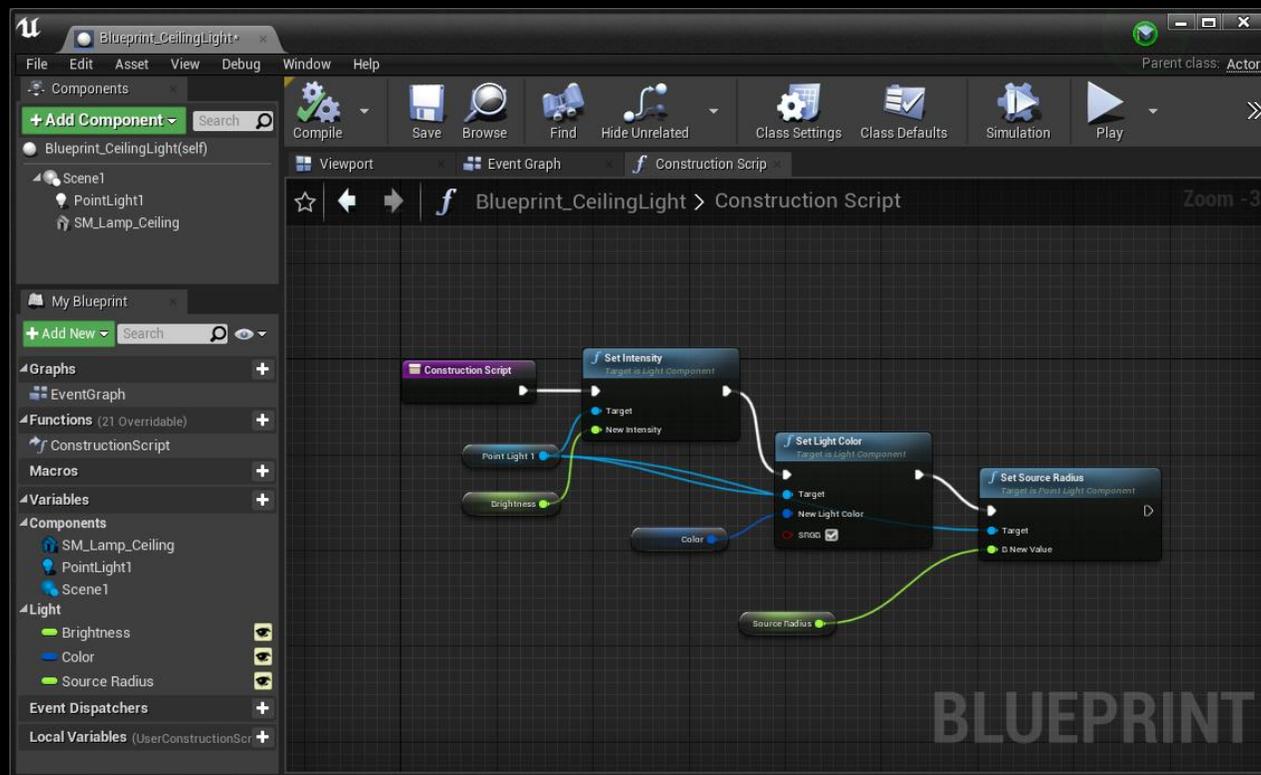
UE4热更新：脚本语言

UE蓝图

集成Lua

UE4中的蓝图

- 蓝图是资源(uasset), 可以被热更新
- 难以merge
- 难以协同开发
- 不方便阅读
- 执行效率不高



文本化的脚本语言：集成Lua

UE4中集成Lua的开源库：

- Tencent UnLua: <https://github.com/Tencent/UnLua>
- Tencent SluaUnreal: <https://github.com/Tencent/sluaunreal>

它们都是基于反射的机制实现，并且提供了静态绑定。

把lua文件以Non-Asset的方式打包至Pak，实现脚本热更新。

我写的UnLua上手文章：[UE4 热更新：基于 UnLua 的 Lua 编程指南](#)

Part Four

UE4热更新：下载与验证

Pak资源包的管理与下载

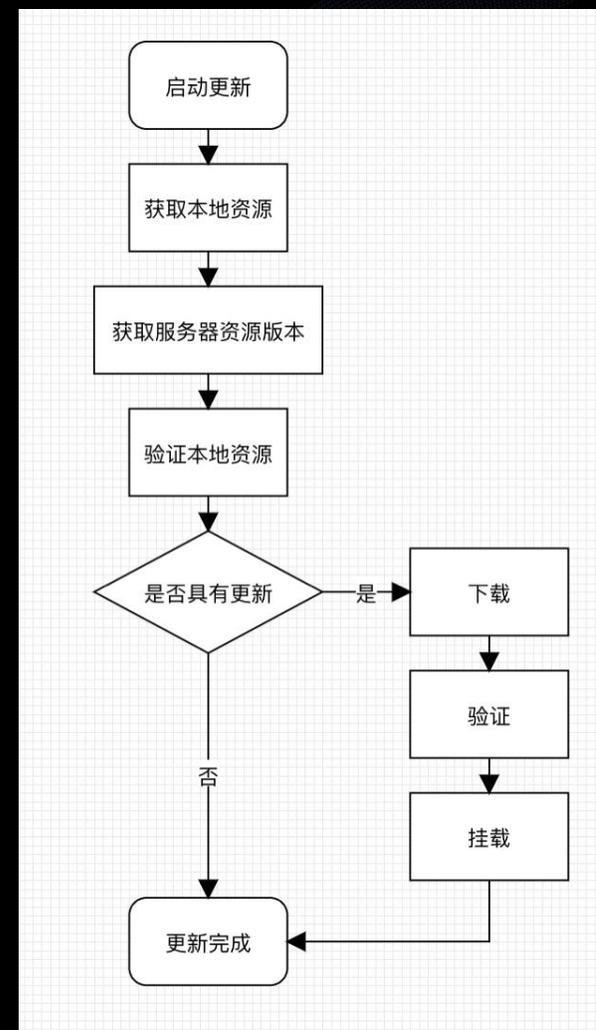
验证Pak的合法性

热更新包的版本管理

流程:

1. 记录所有可更新版本的信息
2. 记录Pak文件MD5/大小等信息
3. 运行时请求列表与本地比对
4. 分析出需要下载的文件
5. 按照版本顺序挂载pak

```
{  
  "0.1.0.0" : [  
  ],  
  "0.1.0.1" : [  
    {  
      "File": "0.1.0.1_Asset_WindowsNoEditor.pak",  
      "HASH": "d659ad86f04cb2bfa83172a4f31fd477",  
      "Size": 314788123  
    },  
    {  
      "File": "0.1.0.1_Lua_WindowsNoEditor.pak",  
      "HASH": "6626bb9e5c126bc18571c9547510a57c",  
      "Size": 4372  
    }  
  ]  
}
```



热更新包的下载

需要的服务：

1. 自建HTTP服务
2. OSS对象存储
3. Dolphin等游戏下载服务

客户端下载方案：

1. 使用HTTP模块发起下载请求
2. OpenSSL提供的MD5计算
3. 实现分块下载、边下载边计算MD5



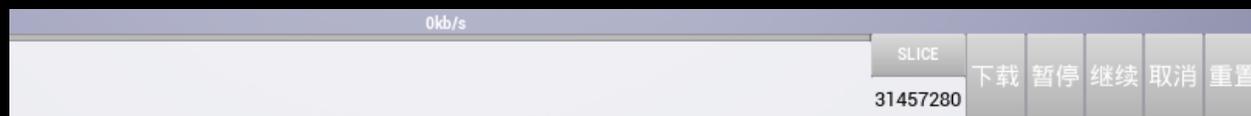
UE的开源下载库

开源仓库:

ue4-downloadtoolkit: <https://github.com/hxhb/ue4-downloadtoolkit>

功能简介:

- 基于HTTP
- 支持Win/Mac/Android/iOS
- 支持边下边存盘
- 支持分块下载
- 支持暂停/继续
- 支持边下边计算MD5



Part Four

UE4热更新：下载与验证

Pak资源包的管理与下载

验证Pak的合法性

Pak的验证

需求:

1. 下载的完整度验证
2. 是否是被认证的Pak

```
"WindowsNoEditor": [  
  {  
    "fileName": "StartContent_WindowsNoEditor_001_P.pak",  
    "md5": "d659ad86f04cb2bfa83172a4f31fd477",  
    "fileSize": 314788123  
  }  
]
```

方案:

1. 下载时计算文件MD5进行验证
2. 打包pak时启用signing



The screenshot shows the Unreal Engine signing configuration interface. On the left, the 'Signing' section is expanded, showing options for 'Signing Public Exponent', 'Signing Modulus', 'Signing Private Exponent', and 'Enable Pak Signing' (checked). On the right, there are buttons for 'Generate New Signing Keys' and 'Clear Signing Key', along with input fields for the signing keys. Below this, a file explorer window shows the directory 'PakTester > WindowsNoEditor > Blank425 > Content > Paks'. The file explorer contains two files: 'Blank425-WindowsNoEditor.pak' (76,611 KB) and 'Blank425-WindowsNoEditor.sig' (6 KB).

名称	修改日期	类型	大小
Blank425-WindowsNoEditor.pak	2020/10/29 16:49	PAK 文件	76,611 KB
Blank425-WindowsNoEditor.sig	2020/10/29 16:49	SIG 文件	6 KB

Part Five

UE4热更新：需要注意的问题

UE4.25+加载Pak资源丢失材质 UMG子控件变动父控件不生效



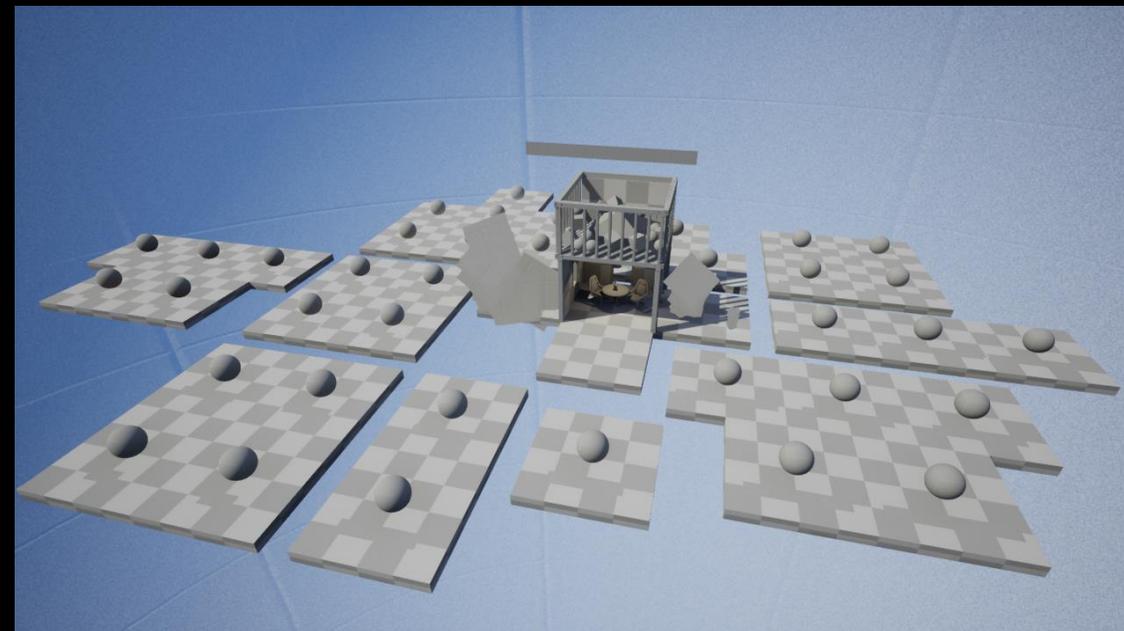
2020

虚幻引擎技术开放日
Unreal Open Day Online

正常显示



丢失材质





Share Material Shader Code

Shared Material Native Library

Ini Key BlackList

Ini Section BlackList 0 Array elements + -

By default shader code gets saved inline inside material assets, enabling this option will store only shader code once as individual files. This will reduce overall package size but might increase loading time

Shader加载失败，使用默认材质。

```
[2020.10.27-05.26.07:487] [724]LogStreaming: Display: Flushing async loaders.
[2020.10.27-05.26.07:487] [724]LogPakFile: New pak file D:\PakTester\StartContent_WindowsNoEditor.pak added to pak precacher.
[2020.10.27-05.26.07:514] [724]LogShaders: Error: Missing shader resource for hash '573B46995CF056A92A413E817EF9DD63CBA4828' for shader platform 0 in the shader library
[2020.10.27-05.26.07:517] [724]LogShaders: Error: Missing shader resource for hash '609FEA02144EB27A2820929706DA329EF5154C4' for shader platform 0 in the shader library
[2020.10.27-05.26.07:518] [724]LogShaders: Error: Missing shader resource for hash '1EBD7E8594D07D0AEEB72BA638AF78D630501012' for shader platform 0 in the shader library
[2020.10.27-05.26.07:518] [724]LogShaders: Error: Missing shader resource for hash '6813A3F430E35A5858A31EE23C206594F19D3BD' for shader platform 0 in the shader library
[2020.10.27-05.26.07:519] [724]LogShaders: Error: Missing shader resource for hash 'B2348F5FC377AF07BC9CBBE4093DFE30E990C5' for shader platform 0 in the shader library
[2020.10.27-05.26.07:520] [724]LogShaders: Error: Missing shader resource for hash 'F8C2460AAS8D8C9968E4BDD06995F5FC4CE0E538' for shader platform 0 in the shader library
[2020.10.27-05.26.07:534] [724]LogShaders: Error: Missing shader resource for hash 'DF42FA3D089A3141742891CEE88364045F64A0A' for shader platform 0 in the shader library
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[2020.10.27-05.26.07:548] [724]LogShaders: Error: Missing shader resource for hash 'C0C8BFD6104161CE6C6F28C6AF5F40866A20B7580' for shader platform 0 in the shader library
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[2020.10.27-05.26.07:549] [724]LogShaders: Error: Missing shader resource for hash '1524FA0A191F8FC0C644D9CAB1706E0489752ED6F' for shader platform 0 in the shader library
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[2020.10.27-05.26.07:578] [724]LogShaders: Error: Missing shader resource for hash '3CA3595D04F24F36CF89493AA766303D2C7F283' for shader platform 0 in the shader library
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[2020.10.27-05.26.07:580] [724]LogShaders: Error: Missing shader resource for hash '081E6276C4629C0E0A3013FFFA4F4D4326511C' for shader platform 0 in the shader library
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[2020.10.27-05.26.07:589] [724]LogMaterial: Error: Tried to access an uncooked shader map ID in a cooked application
[2020.10.27-05.26.07:589] [724]LogMaterial: Warning: Invalid shader map ID caching shaders for 'M_Fire_SubUV', will use default material.
[2020.10.27-05.26.07:589] [724]LogMaterial: Can't compile M_Fire_SubUV with cooked content, will use default material instead
[2020.10.27-05.26.07:589] [724]LogMaterial: Warning: /Game/StarterContent/Particles/Materials/M_Fire_SubUV_M_Fire_SubUV: Failed to compile Material for platform PCDD3D_SMS, Default Material will be used in game.
[2020.10.27-05.26.07:591] [724]LogMaterial: Error: Tried to access an uncooked shader map ID in a cooked application
[2020.10.27-05.26.07:591] [724]LogMaterial: Warning: Invalid shader map ID caching shaders for 'M_Spark', will use default material.
[2020.10.27-05.26.07:591] [724]LogMaterial: Can't compile M_Spark with cooked content, will use default material instead
[2020.10.27-05.26.07:593] [724]LogMaterial: Warning: /Game/StarterContent/Particles/Materials/M_Spark_M_Spark: Failed to compile Material for platform PCDD3D_SMS, Default Material will be used in game.
[2020.10.27-05.26.07:593] [724]LogMaterial: Error: Tried to access an uncooked shader map ID in a cooked application
[2020.10.27-05.26.07:593] [724]LogMaterial: Warning: Invalid shader map ID caching shaders for 'M_Radial_Gradient', will use default material.
[2020.10.27-05.26.07:594] [724]LogMaterial: Can't compile M_Radial_Gradient with cooked content, will use default material instead
[2020.10.27-05.26.07:594] [724]LogMaterial: Warning: /Game/StarterContent/Particles/Materials/M_Radial_Gradient_M_Radial_Gradient: Failed to compile Material for platform PCDD3D_SMS, Default Material will be used in game.
```

解决方案:

1. Mount之后加载一遍最新的Shaderbytecode

```
void UFlibPatchParserHelper::ReloadShaderbytecode()  
{  
    FShaderCodeLibrary::OpenLibrary( Name: "Global", Directory: FPaths::ProjectContentDir());  
    FShaderCodeLibrary::OpenLibrary(FApp::GetProjectName(), Directory: FPaths::ProjectContentDir());  
}
```

2. Cook资源时不要开启Share Material Shader code

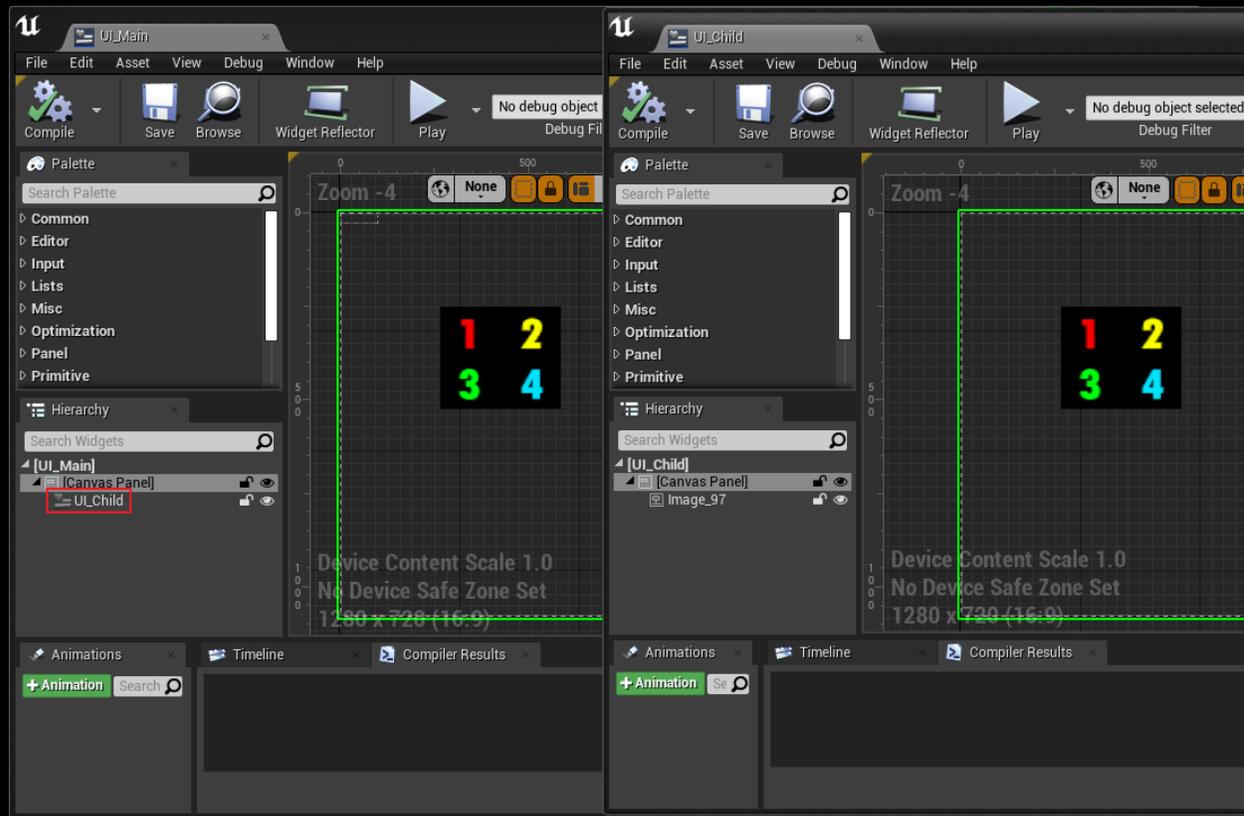
Part Four

UE4热更新：需要注意的问题

UE4.25+加载Pak资源丢失材质 UMG子控件变动父控件不生效

复现流程:

1. UI_Main中添加的子控件UI_Child
2. 打出初始安装包
3. 修改UI_Child保存
4. 打包子UI_Child为Pak
5. 在初始包基础上挂载Pak
6. 游戏中UI_Main不生效





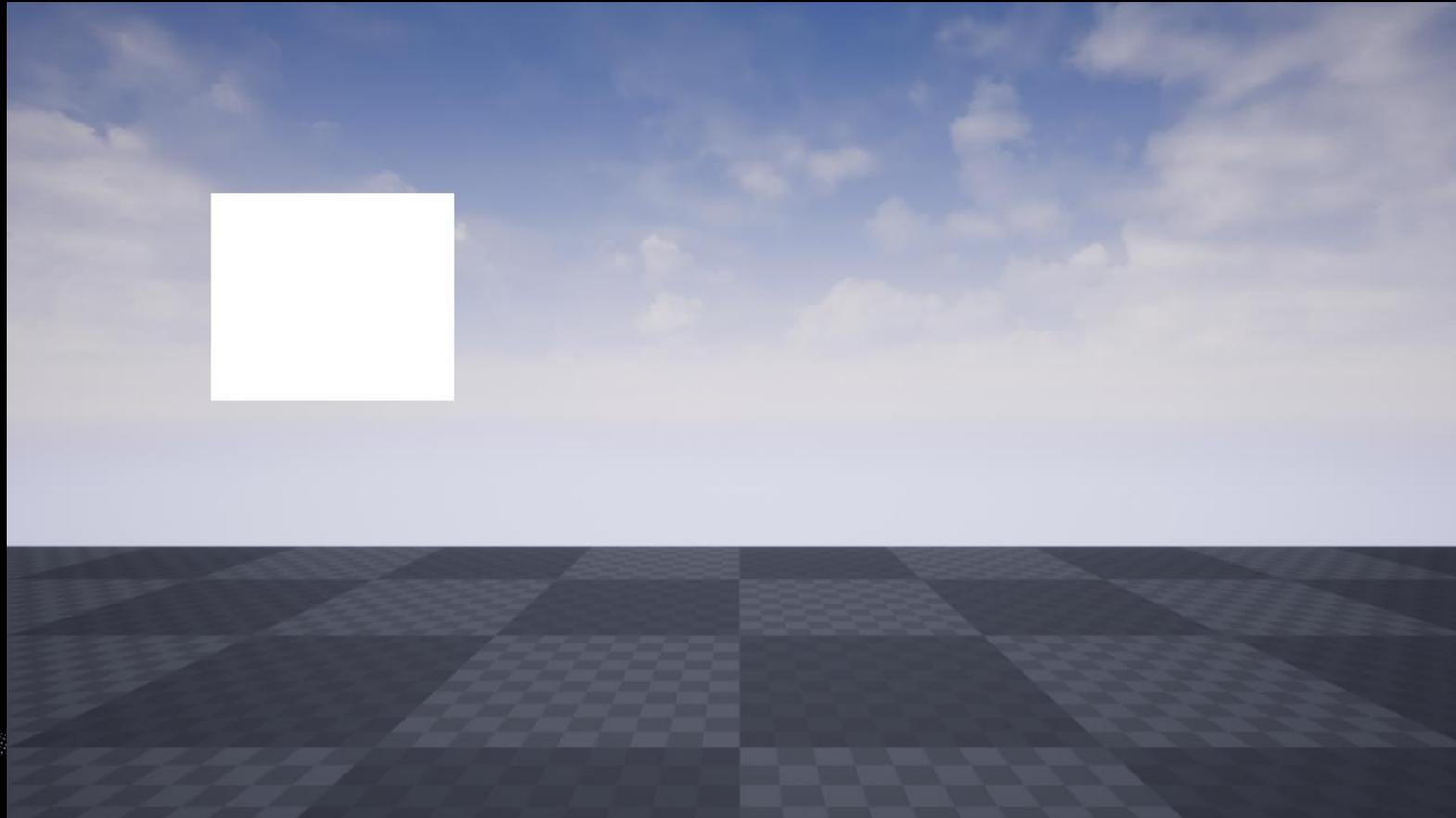
只打包子控件

2020

虚幻引擎技术开放日
Unreal Open Day Online

MountedPaks	
Pak:../Blank425/Content/Paks/Blank425-WindowsNoEditor.pak	Order: 0
Pak:D:\PakTester\Package\UI_Child_Only\WindowsNoEditor\UI_Child_Only_WindowsNoEditor_001_P.pak	Order: -1
kTester\Package\UI_Child_Only\WindowsNoEditor\UI_Child_Only_WindowsNoEditor_001_P.pak	LoadPak
../Blank425/Content/Tester/UI_Child.uasset	
../Blank425/Content/Tester/UI_Child.uexp	
../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.uasset	
../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.ubulk	
../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.uexp	

Order	Mount
100	
Shaderbytecode	
/GAME/TESTER/NEWMAP	
LoadMap	





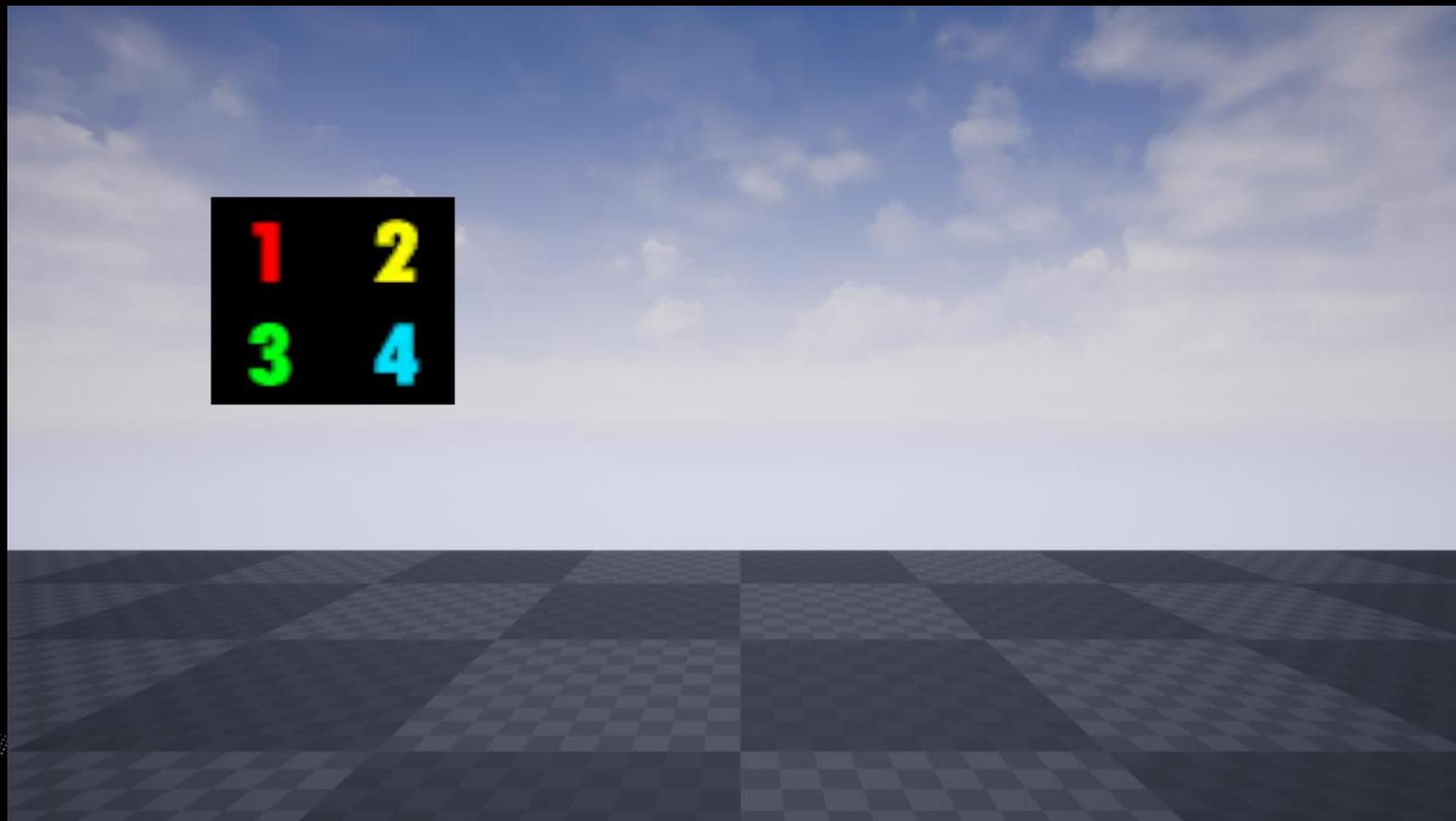
打包子控件、父控件

2020

虚幻引擎技术开放日
Unreal Open Day Online

MountedPaks	
Pak:/Blank425/Content/Paks/Blank425-WindowsNoEditor.pak	Order: 0
Pak: D:\PakTester\Package\UI_Child_Ref\WindowsNoEditor\UI_Child_Ref_WindowsNoEditor_001_P.pak	Order: -1
PakTester\Package\UI_Child_Ref\WindowsNoEditor\UI_Child_Ref_WindowsNoEditor_001_P.pak	LoadPak
<ul style="list-style-type: none"> ../Blank425/Content/Tester/UI_Child.uasset ../Blank425/Content/Tester/UI_Child.uexp ../Blank425/Content/Tester/UI_Main.uasset ../Blank425/Content/Tester/UI_Main.uexp ../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.uasset ../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.ubulk ../Engine/Content/Functions/Engine_MaterialFunctions02/ExampleContent/Textures/flipbook.uexp 	

Order	Mount
100	
Shaderbytecode	
/GAME/TESTER/NEWMAP	
LoadMap	

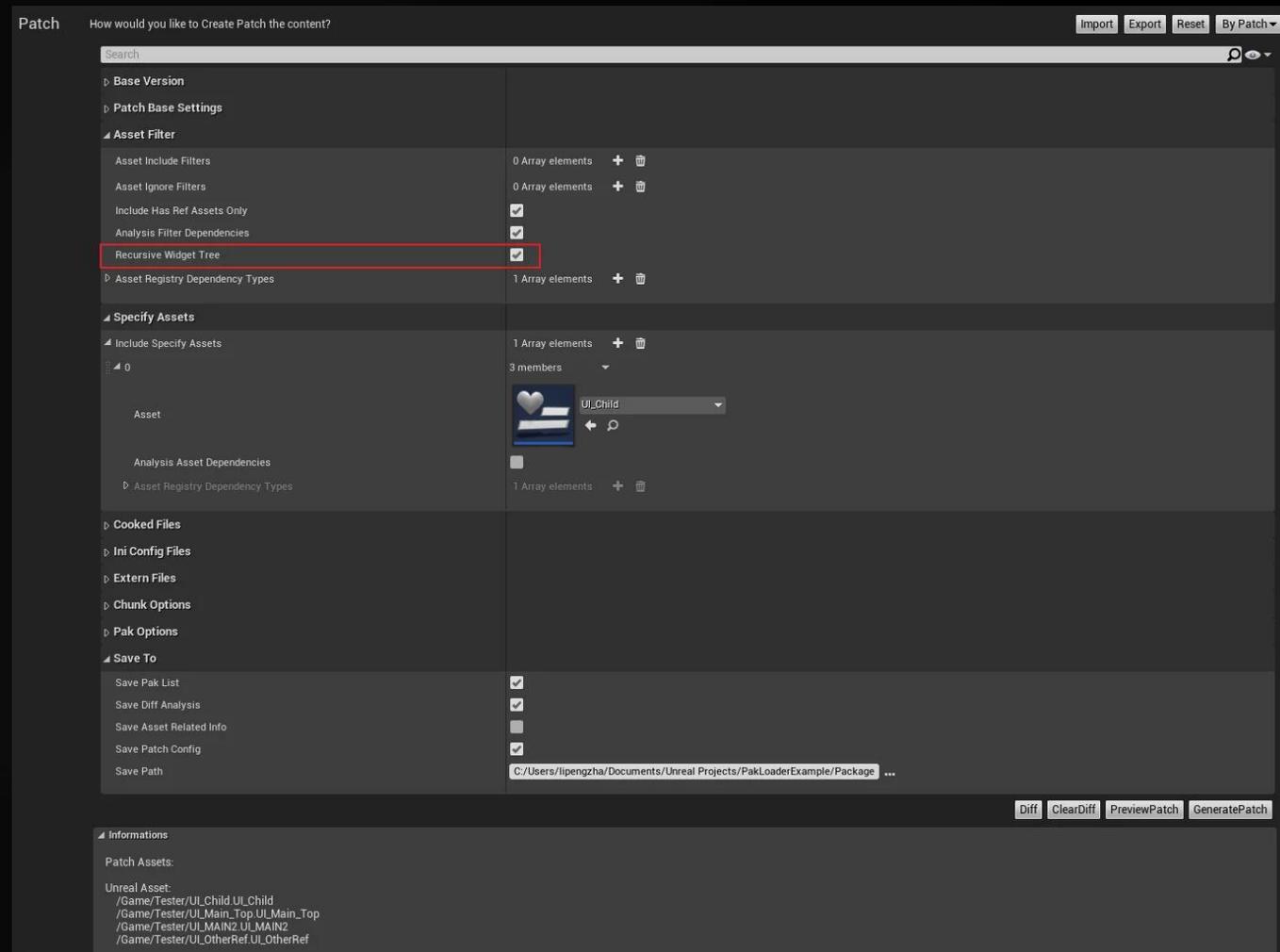


问题分析:

- UMG的子控件是以Instanced方式创建的
- Compile子控件蓝图会导致父控件WidgetTree变动
- 但没有造成父控件资源的变动

HotPatcher的解决方案

- 生成Patch时提供了Recursive Widget Tree选项
- 遍历引用被变动UMG的父级UMG资源
- 把这些资源一起打包到当前Patch的pak中





2020

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THANK YOU

