



GDC



Delta Force World Creation

Cross-Platform Art Pipelines and Tools

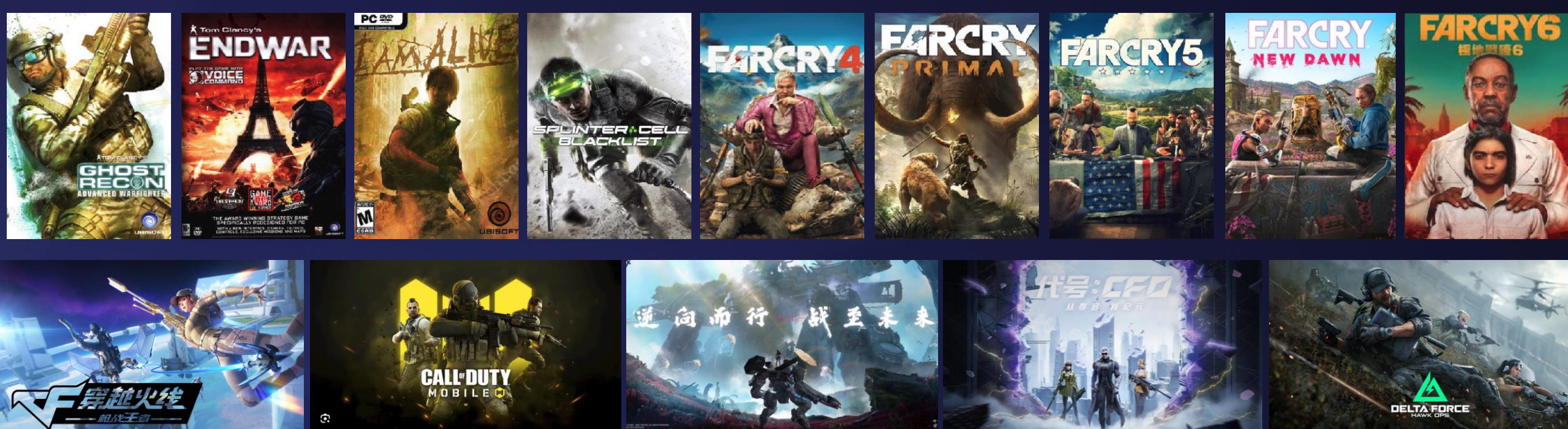
LICHUAN WANG

Technical Artist Team Lead, TiMi Studio Group, Tencent Games

LICHUAN WANG

- Has joined the game industry since 2005
- Worked at Ubisoft Shanghai, Ubisoft Montreal
- Working at Jade studio

Technical Artist Team Lead



01 *Introduction*

Project: Delta Force Brief

02 *Environment Assets Solutions*

Vary for each platform

03 *JADE HUB overview*

In-house pipeline tool Kit

04 *Proceduralism*

World integration cross-platform

05 *Conclusion*

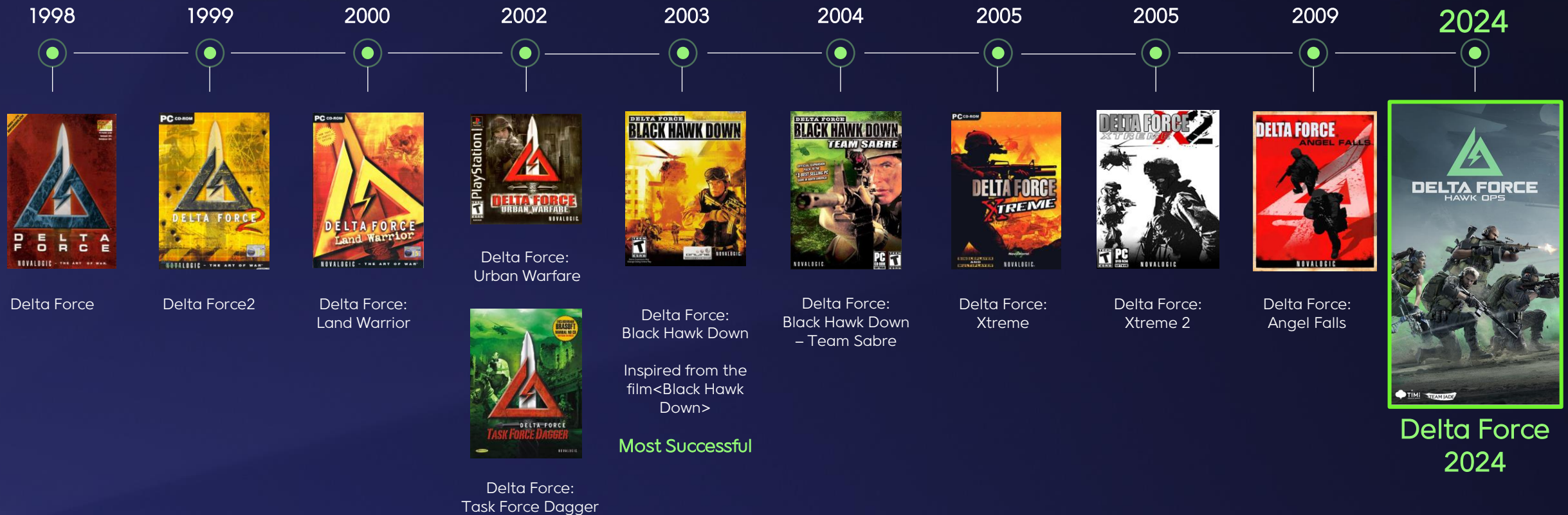
Summary & Lessons Learned



01 *Introduction*

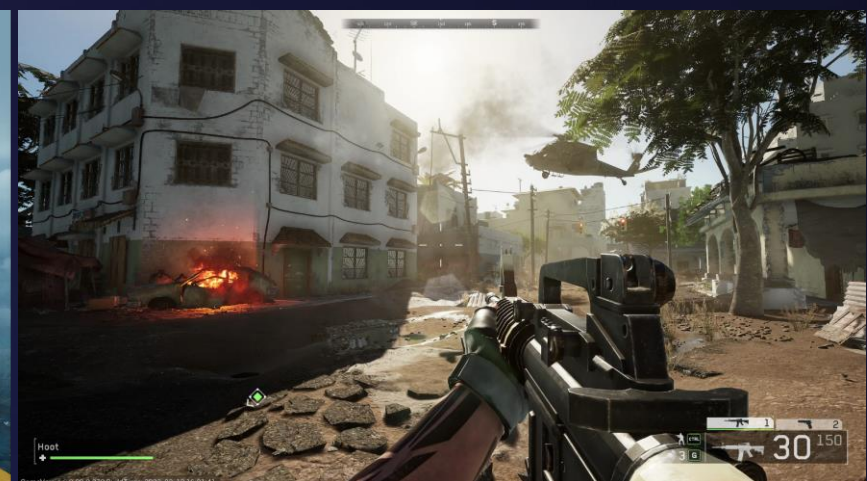
Project: Delta Force Brief

Delta Force Returns After 25 Years



Scope

- Extraction Mode
 - A 10km x 10km Open-world, Squad up and take on other teams or AI-controlled mercenaries and royal guards in the Hazard Operations
- Large-Scale PvP Mode
 - Several 4km x 4km, 2km x 2km Maps, Compete as part of a large team on a massive map, featuring authentic terrains and including military vehicles, tanks, and helicopters in a grand war
- Campaign Mode
 - Remaked Black Hawk Down: Regain that lovin' feeling



Reality & Challenges

- Game Changer for game production (PC & MOBILE)
 - One team, tight schedule
 - Massive content
 - PC version 1 year+
 - 300+ developers
- TWO - platform maintenance
- Artist/Designer training is needed
 - Dev pipeline, content creation workflow, technical details and tools

A Brief of Production

EARLY 2023

PRODUCTION

NOW

- Mobile Data Reset
- Cross-Platform pipeline proto
- Content Create
- Tools implement
- Game Polish
- Performance Optimize

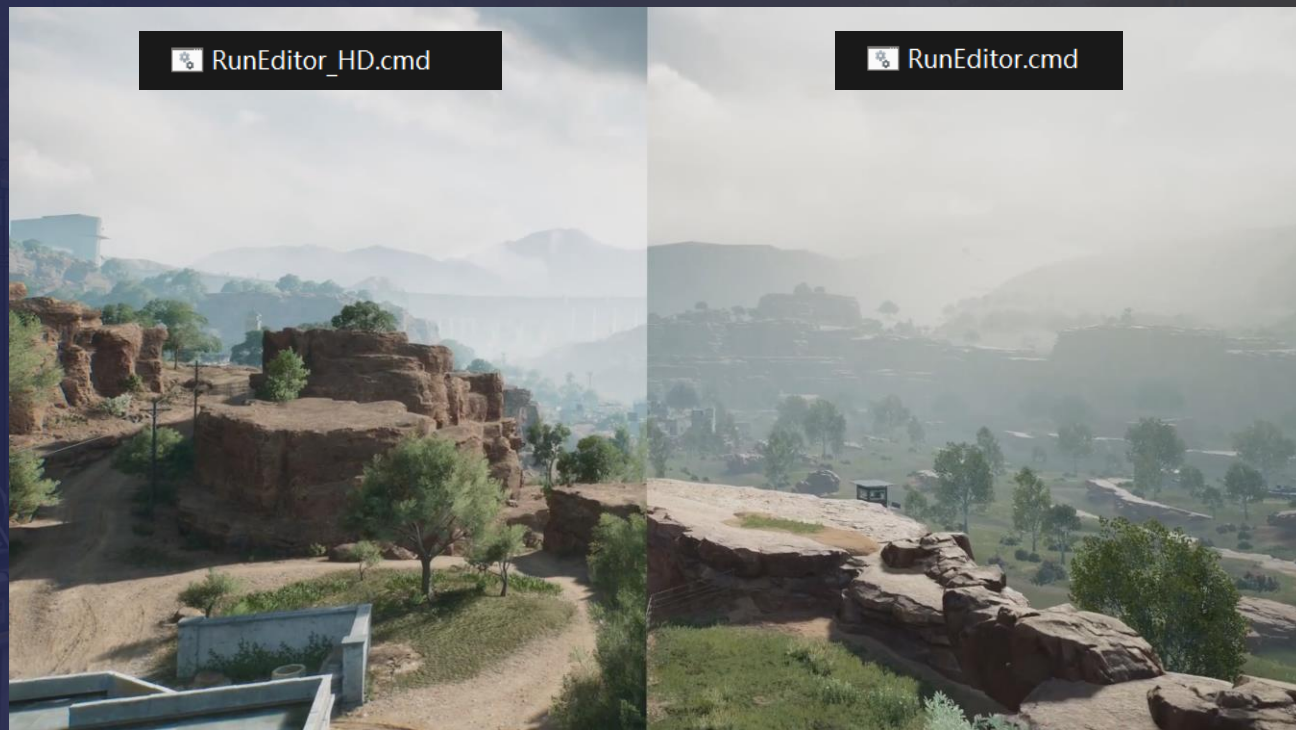
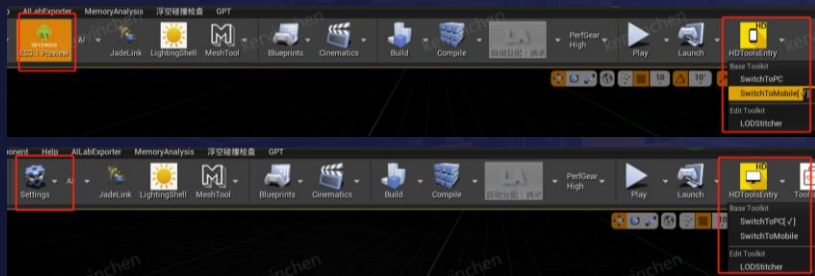


02 *Environment Assets Solutions*

Vary for each platform

Editor Entrance

- Content Creator can work on either platform
 - Mobile entrance
 - PC entrance
- Mobile and PC switchable in the editor



PC

MOBILE

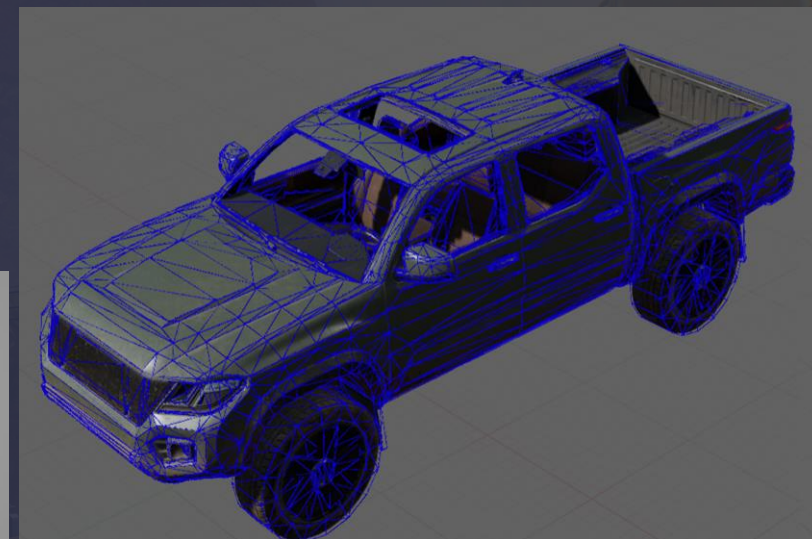
Geometry Management

- Level of details management - LOD chain
- Alternative collision meshes (optional)

PC



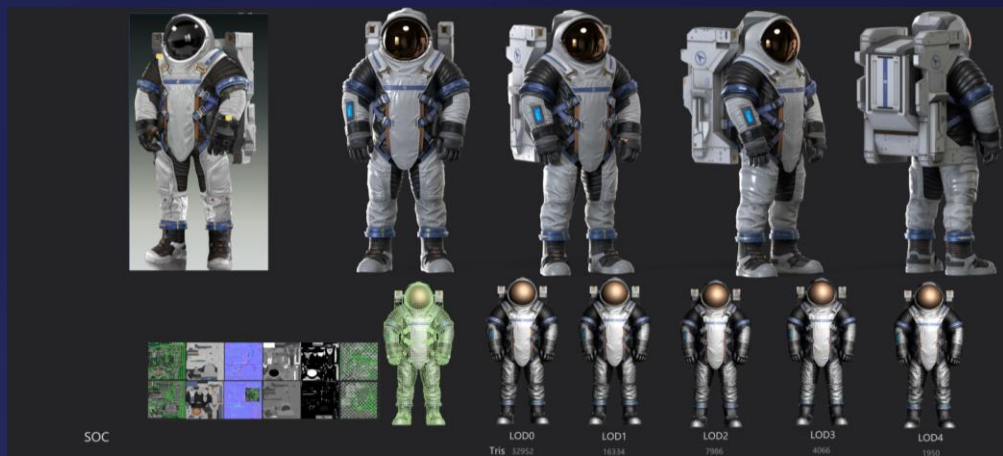
MOBILE



Shading/Material

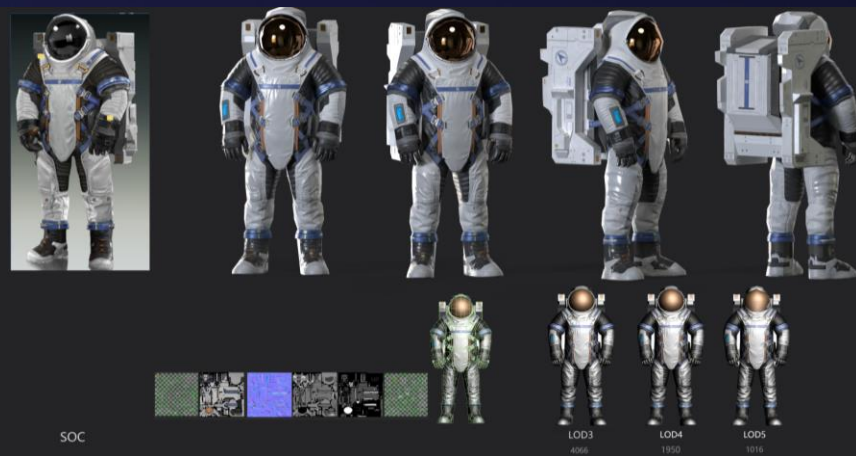
Virtual Material

PC Shader



Deferred Renderer

MOBILE Shader



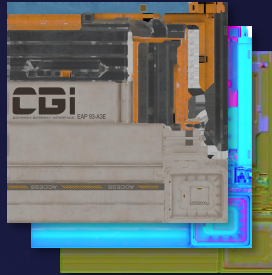
Forward Renderer/ Deferred

Textures

- Texel density
 - PC : 768 px/m
 - Mobile : 128 px/m

6 x 6 = 36 Times !!!

MOBILE



PC



Shading/Material

- Props:
 - PC : Multi-material ID per object (complex shader)
 - Mobile : unique per object (simple shader)



PC



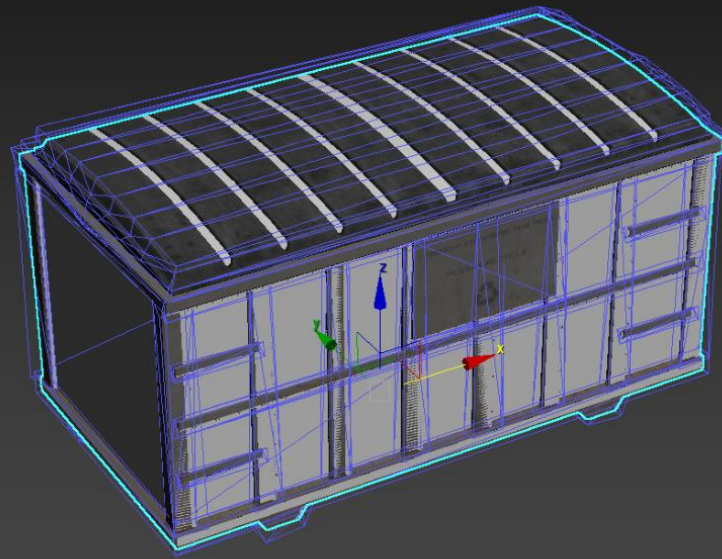
MOBILE

Shading/Material

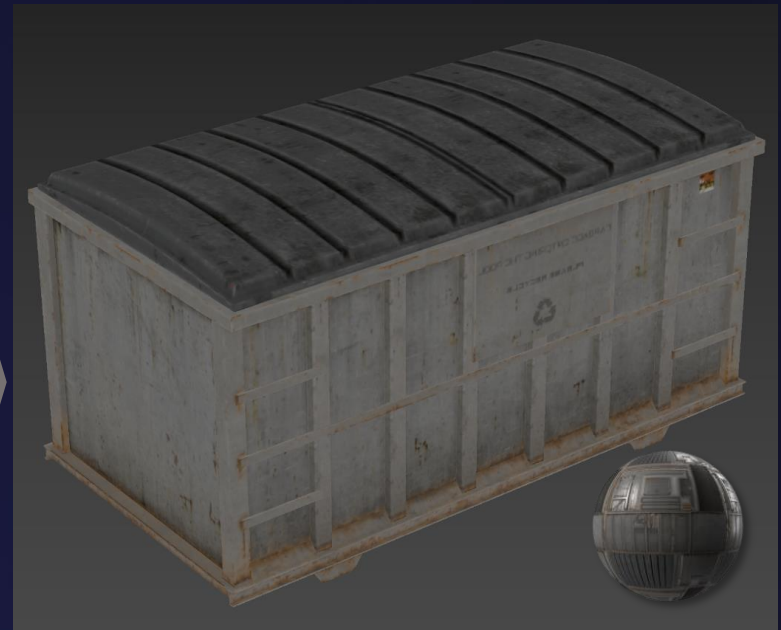
- Restored engine materials in Maya/3dsmax (textures, parameters. etc.)
- Baking to mobile in DCC



PC version
3 Mat IDs



Texture Baking



MOBILE version
1 Mat ID

Shading/Material

- Structures:
 - PC: Multi-material IDs per object (complex materials)
 - Mobile: less material IDs (Simple materials)



PC



MOBILE

Runtime

- Level of Details

PC				MOBILE		
LOD0	LOD1	LOD2	LOD3	LOD4	LOD5	LOD6



PC



MOBILE

PC Exclusively Content

- Hand-placed PC exclusively assets
- Prefabs
- Procedural art tools



PC



MOBILE

BIOME - Vegetation



PC



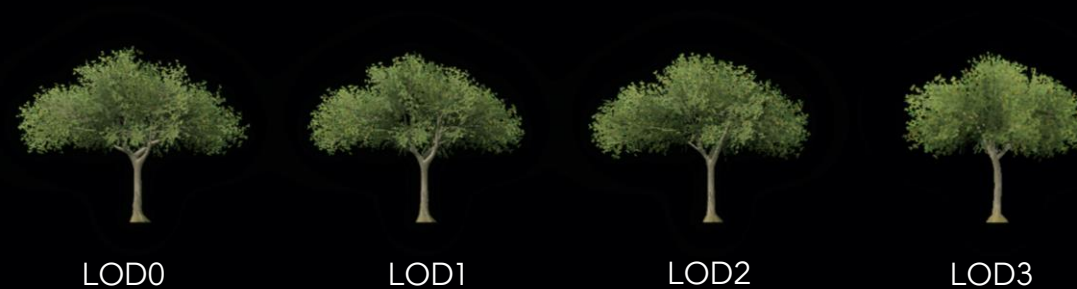
MOBILE

Level Of Details

- PC: Card mesh
- Mobile: Billboard



PC



MOBILE

Level Of Details

- PC: Card mesh
- Mobile: Billboard



LOD0



LOD1



LOD2



LOD3



LOD4



LOD0



LOD1



LOD2



LOD3

PC



LOD0



LOD1



LOD2



LOD3



LOD0



LOD1



LOD2

MOBILE

Billboard

- Mobile
 - Symmetrical
 - Non symmetrical
 - Tilted placement

MESH



BILLBOARD



Symmetrical

MESH



BILLBOARD



Non Symmetrical

MESH



BILLBOARD



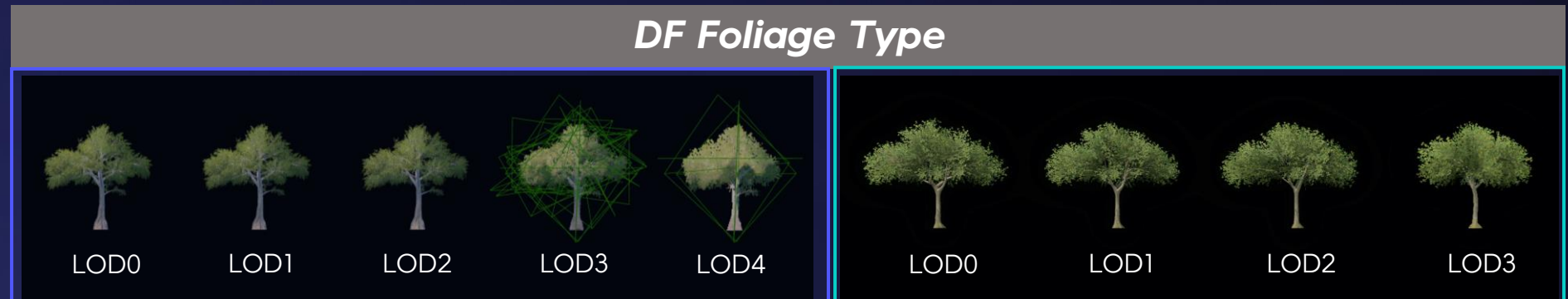
Tilted

Foliage Type Categories

- Shared LOD



- Replaced

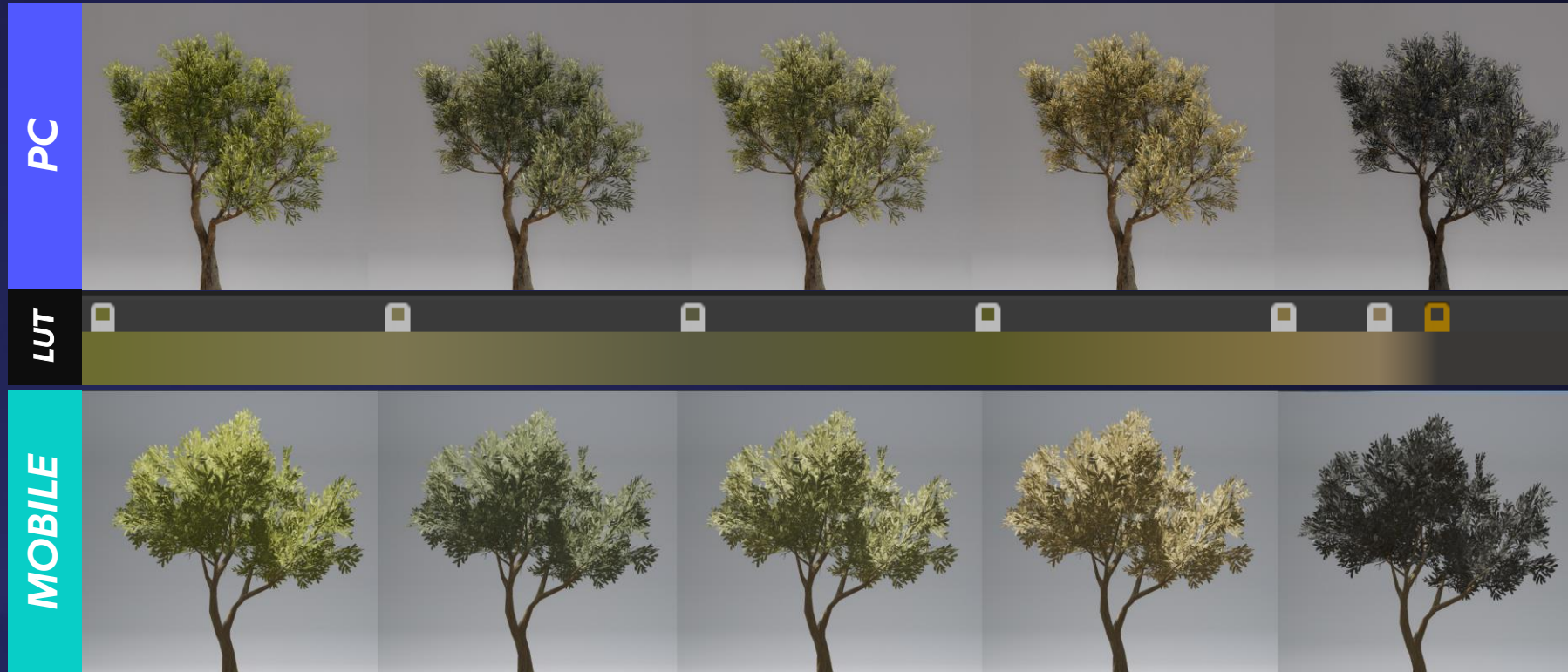


- PC Exclusive



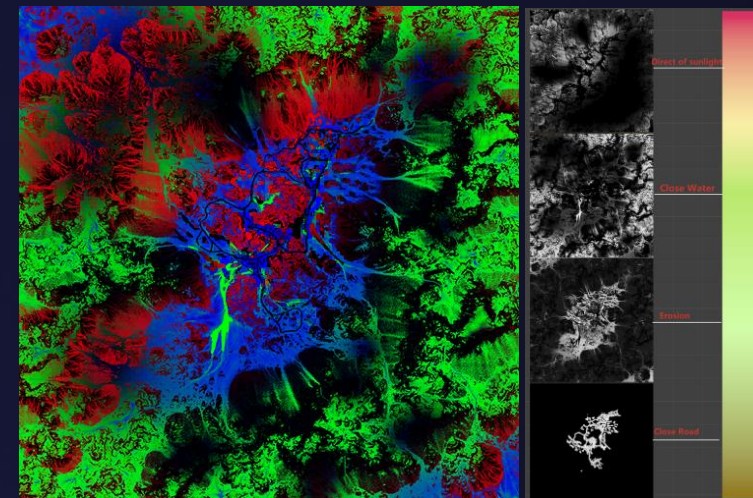
Color Derivation

- Health State – Look Up Table generated for each vegetation assets
 - Four-season states
 - Damage State
- Keep it simple and organized



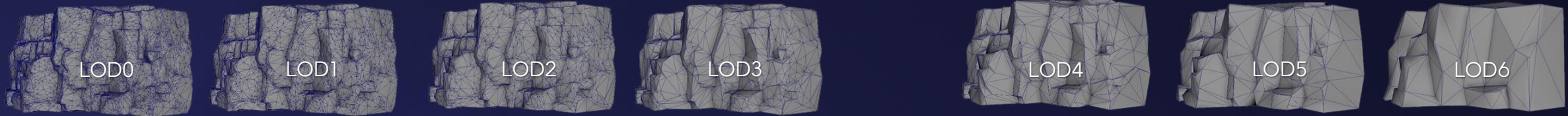
Color Derivation

- Global control – A 10K Global Health texture (streaming-able)
 - Randomness in individual Biome cluster
 - Diversity of the entire biome system



Rock & Cliff

- Level Of Details – LOD Chain



PC



MOBILE

Shading

- Tiling based Layered Materials
- Layered Material with Detail normal
- Dither Blend



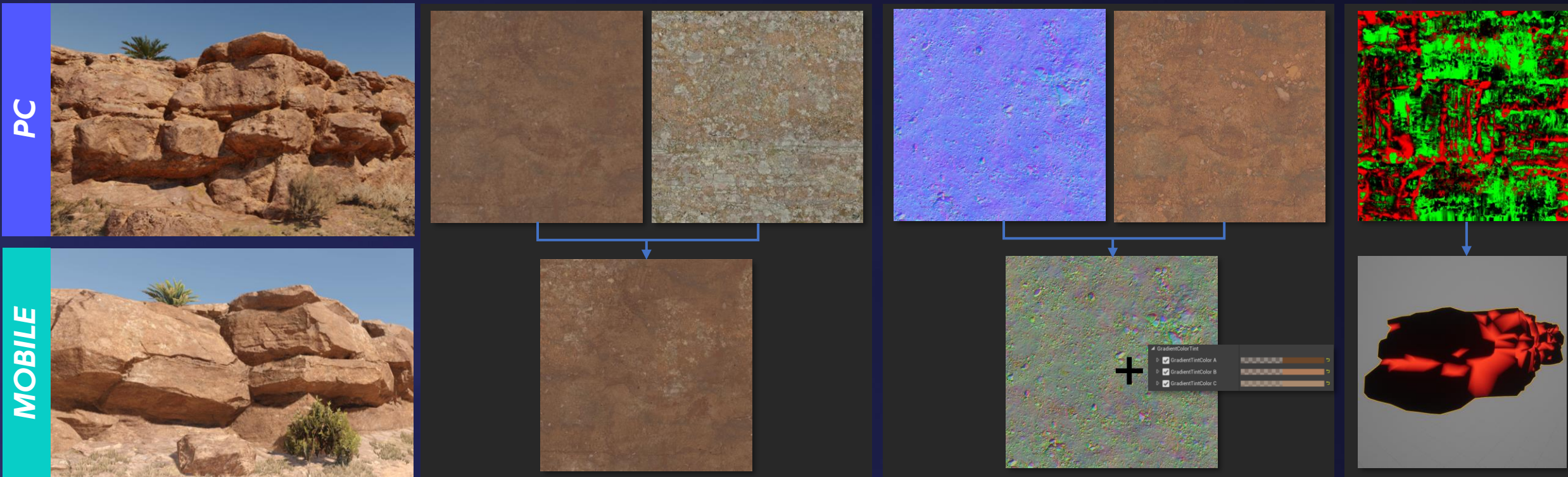
Shading

- Cliff Stain



Shading

- PC to Mobile
 - Blending base layer & moldy layer into one
 - Process color to grayscale gradient map, pack with normal
 - Mask texture converts vertex color



Rock & Cliff

- Material complexity and Texture Sampling



PC	ULTRA								
	HIGH								
	MID								
	LOW								
MOBILE	ULTRA								
	HIGH								
	MID								
	LOW								

03 **JADE HUB Overview**

In-house pipeline tool Kit

What is in Jade Hub

A cross-platform asset pipeline tool kit

- Jade Assets Editor
- Jade Check
- Jade Link
 - Geometry Maya / 3dsmax
 - Substance designer / painter
 - Foliage Automation Tools
 - ...

Collaborations

- Mandate on a few projects
- First shipped with Delta force



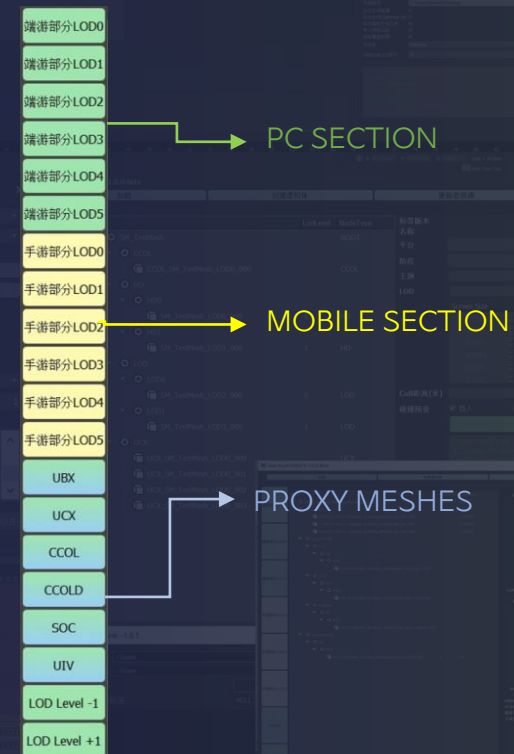
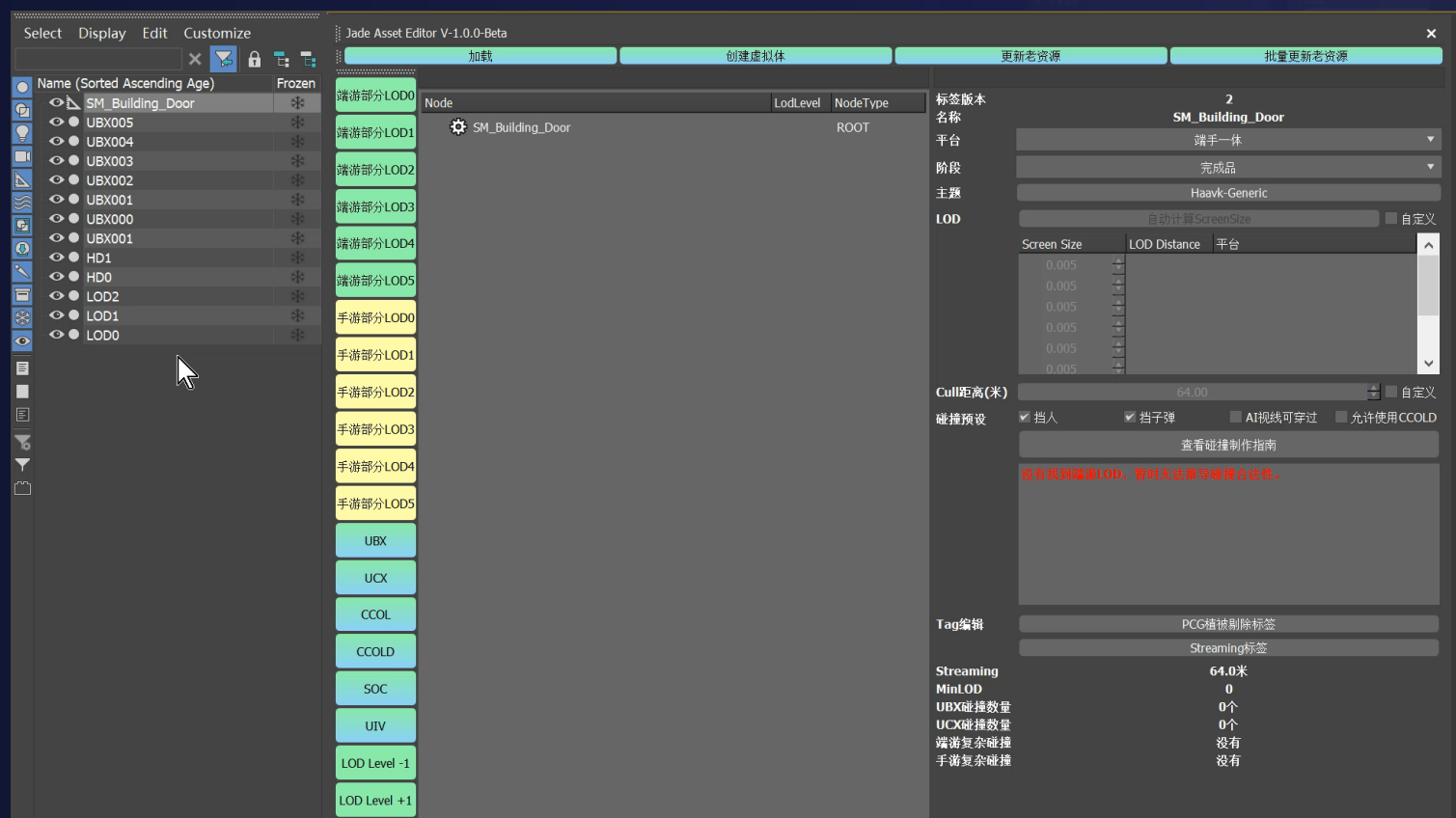
Jade Asset Editor
Cross-platform Data Setup

Jade Check
Asset Validation

Jade Link
DCC & Engine Bridge

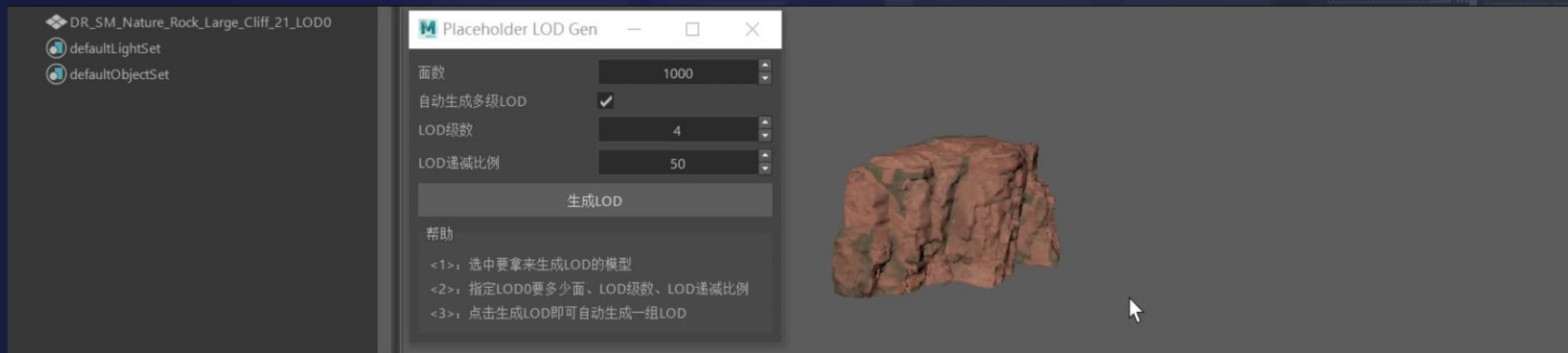
Jade Assets Editor

- Specify asset platform: Shared (PC and Mobile) , Desktop Only
- Asset hierarchy setup and organization



Automate Everything in 1st Pass

- Auto renaming
- Auto LODs
- Auto UVs
- Auto soft occlusion mesh
- Auto collision
- LOD screen size & distance
- Culling distance
- Streaming tag
- ...



Hybrid Solution

- Only as a convenience to make the project work and achieve fast iterations
- Allow Environment artists to override everything

Jade Check

- 41 asset validation processes
- Detailed error report
- Block invalid assets before importing into the game engine

Pivot
position

Pivot
Orientati
on

LOD
Counts

Descending
LOD
triangle

LOD
Distribut
ed

Distance
Between
pivot &
mesh

LOD
Boundin
g

The screenshot displays the Jade Check V-0.5.3-Release interface. The left panel lists 41 validation rules, each with a status indicator (green for pass, yellow for warning, red for error). The right panel shows a detailed error report for the asset 'Industrial_Ventilation_Rock_01', listing various issues such as material ID conflicts and LOD-related errors. A summary at the bottom indicates 5036 actual vertices and 170 standard vertices. The interface also includes a 'Jade Tools' sidebar with options like 'Jade Asset Editor', 'Jade Check', and 'Jade Link'.

Validation Rules (Left Panel):

- 500面以上的复杂碰撞三角面数不能超过模型本身面数
- LOD、SOC、UIV、碰撞必须是可编辑的网格
- LOD不能超过8级
- LOD必须有2U
- LOD必须有光滑组
- LOD链不能缺失其中的某一级
- LOD面数递减, 200面以上的模型50%减面力度
- PC Only模型不要同时做CCOL和CCOLD
- UBX、UCX符合正确的物理材质
- UBX必须是世界空间下横平竖直的BOX
- UCX如果是世界空间下横平竖直的BOX, 必须改成UBX
- UCX必须为凸面体
- UIV必须为凸面体
- 【长或宽大于2米且高大于1米】或【长或宽大于1米且高大于2米】的模型
- 名字零ExterWall的模型可能要制作UIV
- 场景保存路径必须在X:\ProjectD\Game开头的路径内
- 场景单位必须为厘米
- 场景路径不能太长
- 复杂碰撞的物理材质命名必须是物理材质库中的内容
- 多边形不能有超过4边的面
- 小于20厘米的网格可以不需要碰撞体
- 材质不要来自网络盘的纹理, 否则导出时会卡顿, 引擎还有可能崩溃
- 材质命名只能有字母、数字、下划线
- 标签不能打出严重逻辑错误
- 标签符合最新版规范

Error Report (Right Panel):

- UBX_SM_Industrial_Ventilation_Rock_01_LOD0_000 的材质ID不属于任何预定义的物理材质
- UBX_SM_Industrial_Ventilation_Rock_01_LOD0_001 的材质ID不属于任何预定义的物理材质
- UBX_SM_Industrial_Ventilation_Rock_01_LOD0_002 的材质ID不属于任何预定义的物理材质
- SM_Industrial_Ventilation_Rock_01 手滑复杂碰撞面数超过了LOD0面数的36%
- SM_Industrial_Ventilation_Rock_01 端滑复杂碰撞面数超过了LOD0面数的36%
- SM_Industrial_Ventilation_Rock_01_LOD0_000 顶点数估算过高, 超过衡量值的50%
- SM_Industrial_Ventilation_Rock_01_LOD1_000 顶点数估算过高, 超过衡量值的50%
- SM_Industrial_Ventilation_Rock_01_LOD2_000 顶点数估算过高, 超过衡量值的50%
- SM_Industrial_Ventilation_Rock_01_LOD3_000 顶点数估算过高, 超过衡量值的50%

Summary (Bottom):

- 实际顶点数: 5036
- 标准: 170
- 该预估顶点数根据大量模型得到的经验估算而来, 准确的顶点数量以引擎为准, 你也可以忽略该警告

Jade Tools (Right Sidebar):

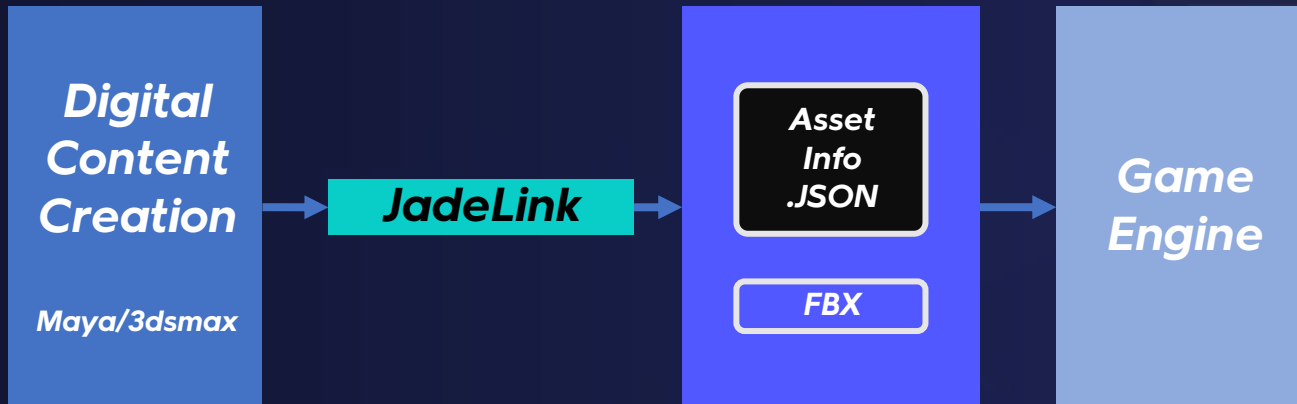
- Jade Asset Editor
- Jade Check
- Jade Link

Jade Link V-1.8.0-Release (Bottom Right):

- 项目: ProjectD
- 分类: EnvAssets
- 引擎路径: \Game
- 本地路径: 3 错误
- 自动生成: 错误
- 自动生成: 错误
- UCX强制: 错误
- 导入网络: 错误
- 强制覆盖: 错误
- 顶点色: 错误
- Lightmap: 错误

Jade Link

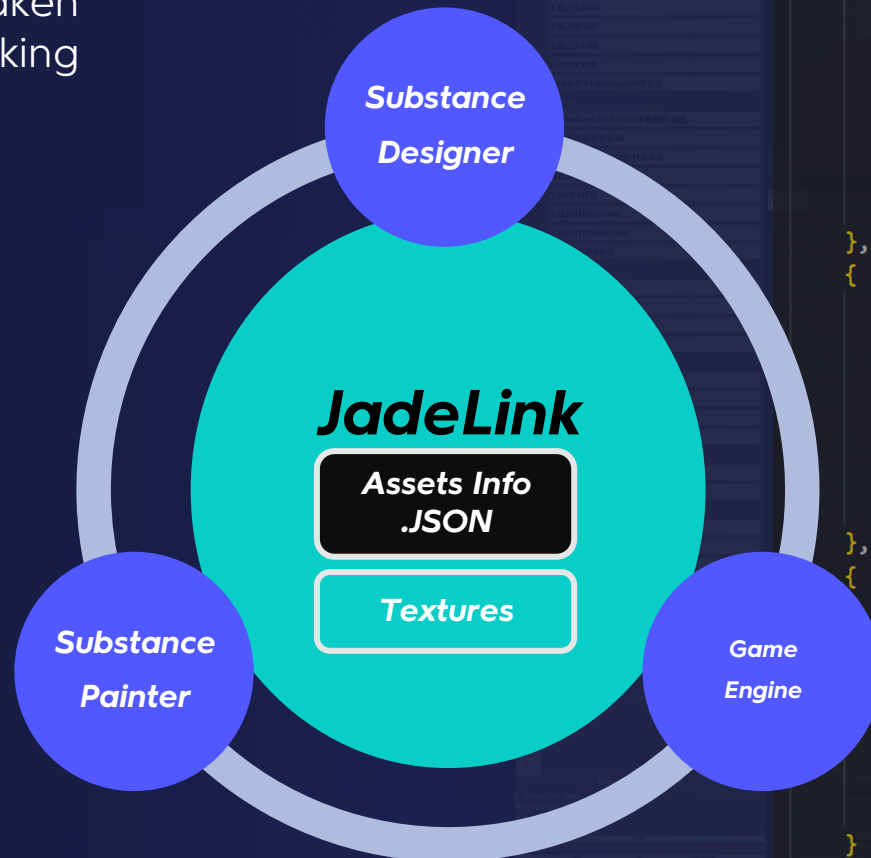
- Jade link is a mandatory process
- Geometry Link - JSON
 - Asset path
 - Referenced materials path
 - Platform
 - Thematic
 - ...



```
"MeshList": [
  {
    "SourceData": {
      "AssetName": "SM_M_DamMain_04_Decal",
      "AssetType": "StaticMesh",
      "ProjectPath": "\\Game",
      "SourcePath": "X:\\ProjectD\\Haavk\\SM_M_DamMain_04_Decal.fbx",
      .....
    },
    "ImportSettings": {
      "GenerateLightmapUVs": false,
      "LightmapCoordinateIndex": 1,
      "VertexColorImportOption": "Replace",
      .....
    },
    "Standardization": {
      "Platform": "Share",
      "Stage": "WIP",
      "Thematics": "Haavk-Industrial",
      "MobileLodIndexOffset": 2,
      "ScreenSize": [ 2.0, 0.75 ],
      "CullingScreenSize": 0.0285,
      "CullingDistance": 512000.0,
      "StreamingDistance": 25600.0,
      "StreamingTag": "MidMeshGroup",
      "PCGExclusionTags": [ "PCGEx_NoBushOverlap" ],
      "CollisionComplexity": "Use Simple Collision As Complex",
      "CollisionPreset": "NoCollision",
      "CCOLMeshPath": "X:\\ProjectD\\Haavk\\CCOL_SM_M_DamMain_04_Decal.fbx",
      .....
    },
    "Validation": {
      "NumLOD": 2,
      "MinLOD": 2,
      "NumUBX": 0,
      "NumUCX": 0,
      .....
    }
  }
],
1,
```

Jade Link SD & SP

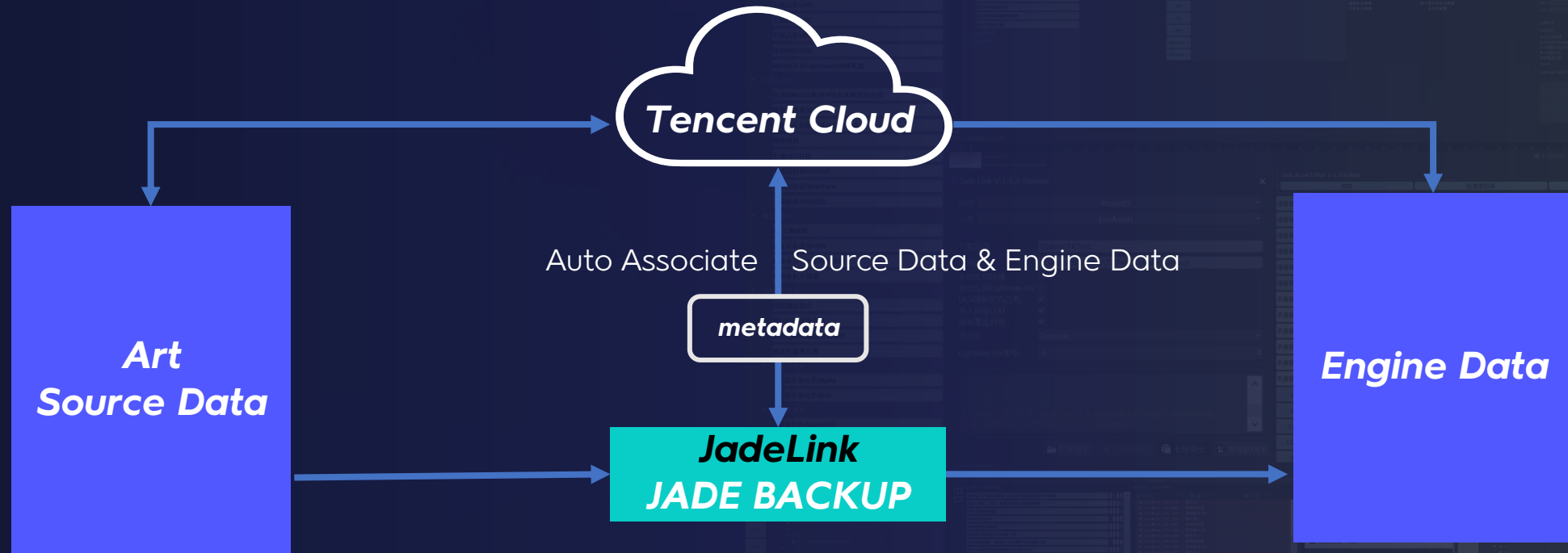
- Jade link SD/SP is a mandatory process
- Texture/Material Link - JSON
 - Material Template taken
 - Texture Channel Packing
 - Material Path
 - Texture Path
 - Platform
 - Thematic
 - ...



```
"Category": "Material",
"MaterialTemplateType": "VM_Scene_BasicMat_Master",
"IsLayerMat": "false",
"MaterialTemplatePath": "/Game/MaterialLib/Materials/Scene/VM_Scene_BasicMat",
"MaterialInstancePath": "/Game/Test/Materials/MI_Base_01",
"MaterialName": "MI_Base_01",
"Thematics": "Haavk-Generic",
"TexturePhysicalType": "Metal",
"TextureList": [
{
  "TextureName": "T_Base_01_C_HD",
  "SourcePath": "X:\\Test\\Textures\\T_Base_01_C_HD.tga",
  "VMTextureType": "BaseColorMap",
  "AssetDCCType": "SP",
  "ProjectPath": "/Game/Test/Textures",
  "Platform": "Desktop"
  ...
},
{
  "TextureName": "T_Base_01_N_HD",
  "SourcePath": "X:\\Test\\Textures\\T_Base_01_N_HD.tga",
  "VMTextureType": "NormalMap",
  "AssetDCCType": "SP",
  "ProjectPath": "/Game/Test/Textures",
  "Platform": "Desktop"
  ...
},
{
  "TextureName": "T_Base_01_MRA_HD",
  "SourcePath": "X:\\Test\\Textures\\T_Base_01_MRA_HD.tga",
  "VMTextureType": "MetalRoughAOMap",
  "AssetDCCType": "SP",
  "ProjectPath": "/Game/Test/Textures",
  "Platform": "Desktop"
  ...
}
]
```

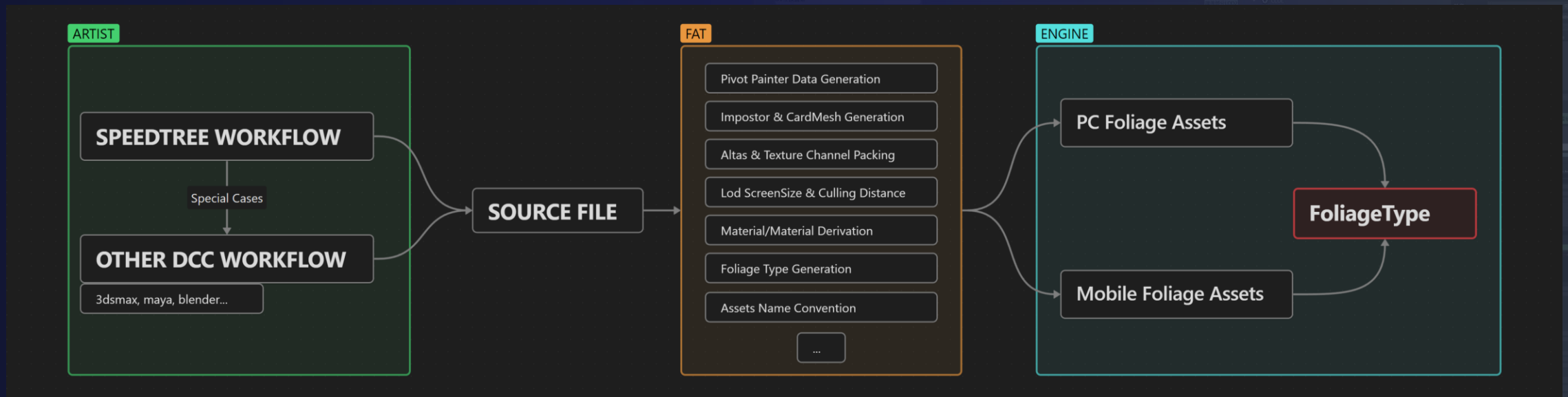

Jade Backup

- Source data backup to Server



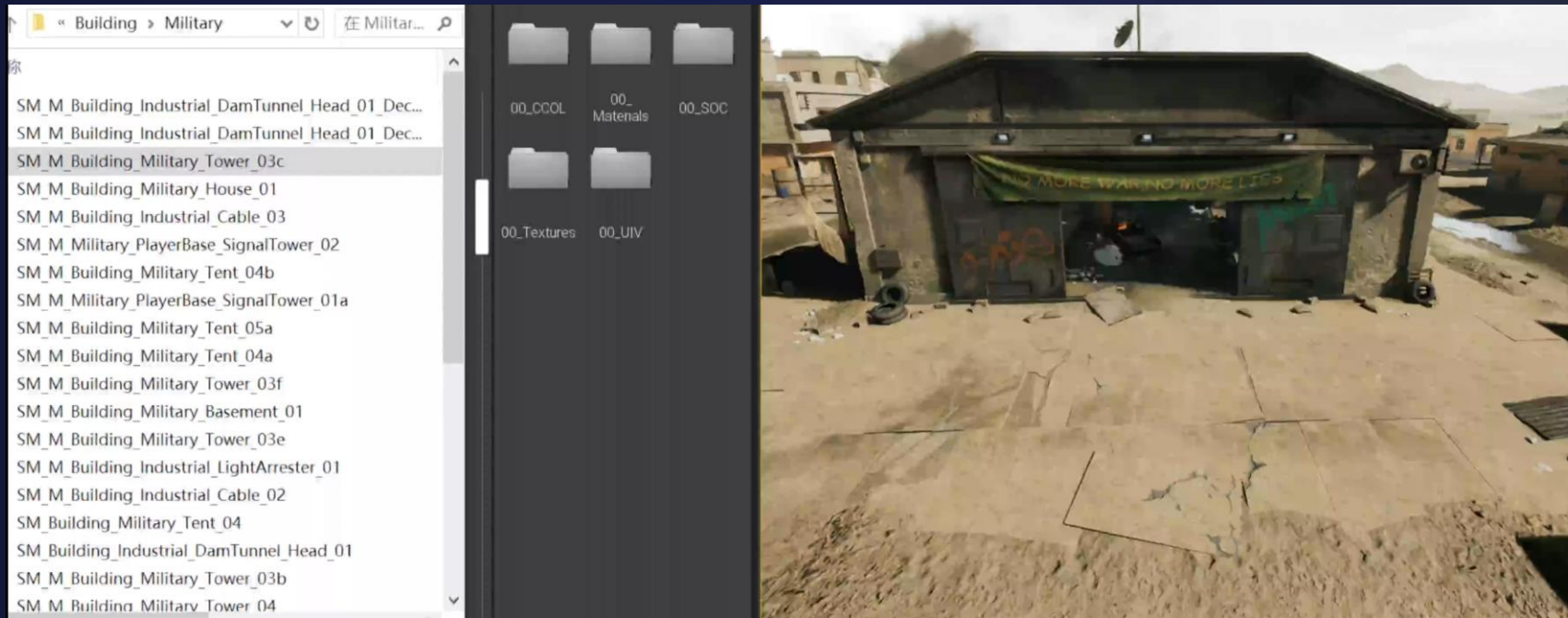
Foliage Automation Tools

- Auto LODs (placeholder) and Name Convention
- Screen Size and Culling Distance Setting
- Pivot Painter reconstruction
- Impostor & Card Mesh generation
- Atlas generation and Texture Channel packing
- Material /Material Derivation generation
- Foliage Type Generation
- ...



Outsourcing

- Clean Compact Editor
 - Assets Data
 - Jade Tools fully implemented





04 *Proceduralism*

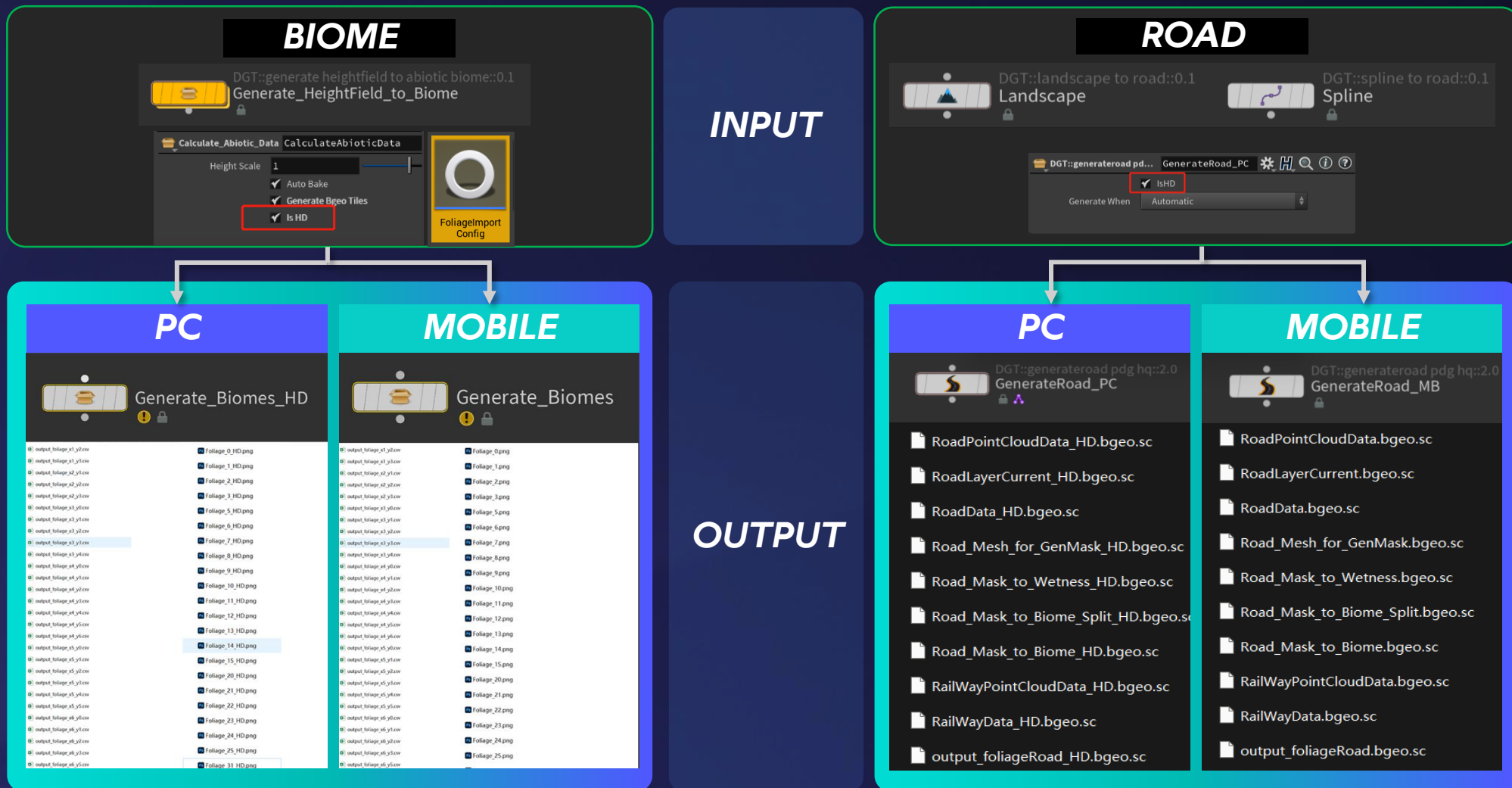
World integration cross-platform

World of Delta Force

- More types of Biome Assets
- More distribution density
- More extra recipes



Pipeline



More Types of Biome Assets



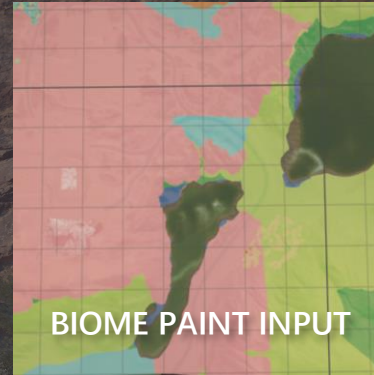
PC RECIPE



MOBILE RECIPE

More Distribution Density

- Biome tools, biome presets
- Same biome paint inputs



PC



MOBILE

More Extra Recipes

- PC exclusive recipe and biome presets



Biome LookDev Process

- Visual Alignments
 - Shading and lighting vary
 - HDA logic differ
- Artistic touches on mobile



PC



MOBILE

Recipes

- PC and Mobile Cluster alignments



PC Cluster



MOBILE Cluster

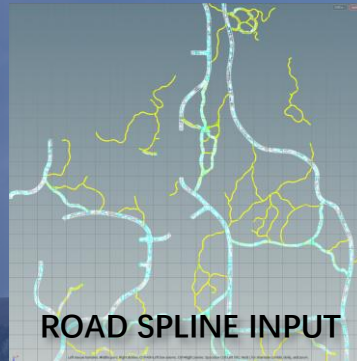
Damage

- Damage Preset of each Biome
- Global Mask controls the area of damage



Road Network

- Road Tools, Spline presets
- Intersection Generations



PC



MOBILE

Road Network

- 2 states for each road
 - Intact state
 - Damage state
- Global Damage Mask control



05 Conclusion

Summary & Lessons learned

Summary

- General Static meshes → LOD Chain with separated shading
- Biome Vegetation → Customized Foliage Type
- Unequal Density → Proceduralism

Lessons learned

- Cost-effective solutions for all platforms
- Strict workflows are the most effective
- Preset everything as much as possible
- Identify content with tags
- Listen to the content creators

DELTA FORCE TEAM



TEAM JADE



DELTA FORCE
HAWK OPS

FOLLOW US! [PLAYDELTAFORCE.COM](https://playdeltaforce.com)

FOR GLOBAL PARTNERSHIP INQUIRIES,
PLEASE REACH OUT TO US AT DELTAFORCE@PROXIMABETA.COM

📍 BOOTH S1127



Thank You



GDC



We are hiring !!!

cherylqiu@tencent.com