Tech Art Bible

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Created: May 23, 2023

Last Updated: August 3, 2023

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Naming Conventions

Asset naming

[**AssetTypePrefix**]_[**AssetName**]_[**Descriptor**]_[**OptionalVariantLetterOrNumber**]

- **AssetTypePrefix** identifies the type of Asset, refer to the below for details.
- **AssetName** is the Asset's name.
- **Descriptor** provides additional context for the Asset, to help identify how it is used. For example, whether a texture is a normal map or an opacity map. *Reference the Texture Descriptor table below.*
- **OptionalVariantLetterOrNumber** is optionally used to differentiate between multiple versions or variations of an Asset.

[Recommended Asset Naming Conventions]
[Naming Conventions - Developers Guide]
[Unreal Engine 4 Asset Naming Conventions]

Prefixes

Commonly used for quick reference are highlighted

Asset	Prefix
GENERAL	
HDRI	HDR_
Material	M_
Material Instance	MI_
Material Function	MF_
Material Parameter Collection	MPC_
Physics Asset	PA_
Physics Material	PM_
Render Target	RT_
Post Process Material	PPM_

Skeletal Mesh	SKM_
Static Mesh	SM_
Texture	T_
Sprite	SP_
Sprite Sheet	SS_
OCIO Profile	OCIO_
BLUEPRINTS	
Actor Component	AC_
Animation Blueprint	ABP_
Blueprint Interface	BI_
Blueprint	BP_
Curve Table	CT_
Data Table	DT_
Enum	E_
Structure	F_
Widget Blueprint	WBP_
PARTICLE EFFECTS	
Particle System (Cascade)	PS_
Niagara Emitter	FXE_
Niagara System	FXS_
Niagara Function	FXF_
SKELETAL MESH ANIMATIONS	
Rig	Rig_
Skeleton	SK_

Montages	AM_
Animation Sequence	AS_
Blend Space	ABS_
IN-CAMERA VFX	
NDisplay Configuration	NDC_
ANIMATION	
Level Sequence	LS_
Sequence Edits	EDIT_
MEDIA	
Media Source	MS_
Media Output	MO_
Media Player	MP_
Media Profile	MPR_
AUDIO	
Reverb Effect	RE_
Sound Attenuation	ATT_
Sound Class	No prefix/suffix. Should be put in a folder called SoundClasses
Sound Mix	Mix_
Sound	S_
Sound Cue	A_*_Cue
Sound Concurrency	_SC (Should be named after a Sound Class)
Sound Wave	A_
OTHER	
Level Snapshots	SNAP_

Remote Control Preset	RCP_
Scene	SCE_

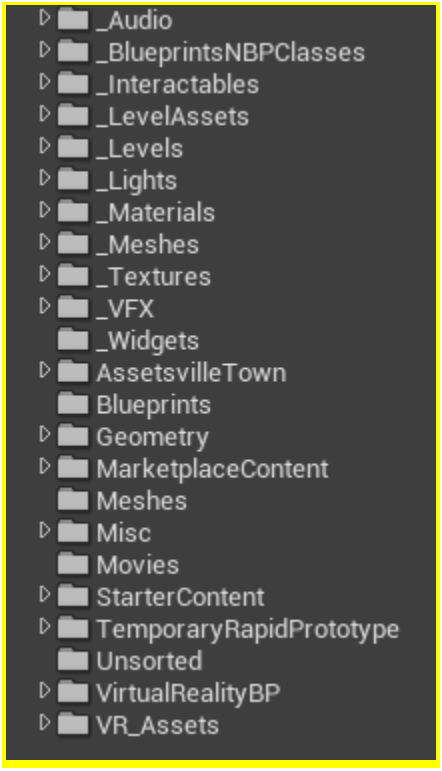
Descriptors

Asset	Descriptor
TEXTURES	
Base Color / Albedo	_BC
Diffuse	_D
Normal	_N
Occlusion Roughness Metallic	_ORM
Specular	_S
Alpha	_A
Emissive	_E

Ex ‘Bob’

Asset Type	Asset Name
Skeletal Mesh	SK_Bob
Material	M_Bob
Texture (Diffuse/Albedo)	T_Bob_D
Texture (Normal)	T_Bob_N
Texture (Evil Diffuse)	T_Bob_Evil_D

Folder naming/structure



With a mess of subfolders under each - we should probably fix that

GitHub - CleanCut/UE4StyleGuide: An attempt to bring consistency to Unreal Engine 4 project style and organization

Proposed Folder Structure

File Types

3D Models: FBX (Poly Limits)

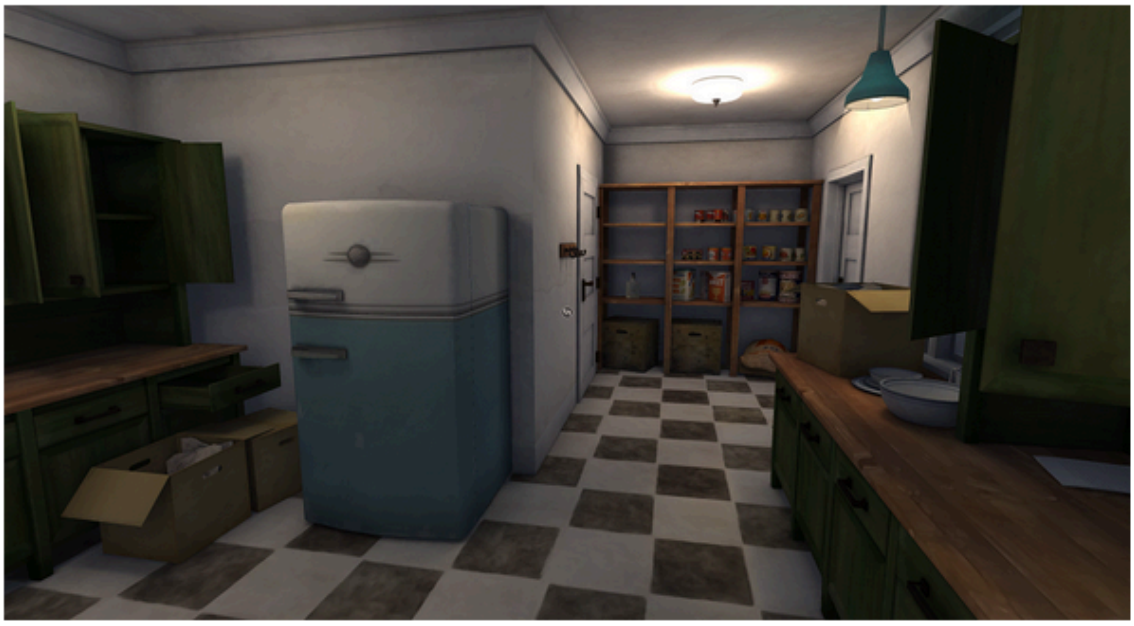
- Import Models/Animations from Blender into Unreal
- Assets Retopology Guideline

Textures: PNG (Texture Size Limits)

- Types of Texture Maps
-

Poly Limits

With that in mind, here are some reasonable targets for Gear VR applications.



This frame is about 30,000 polygons and 40 draw calls.

- 50 – 100 draw calls per frame
- 50k – 100k polygons per frame
- As few textures as possible (but they can be large)
- 1 ~ 3 ms spent in script execution (Unity Update())

Asset Type	**Poly Limit (in triangles)**	**LOD level**
Hero*	8,000 - 30,000	LOD0
~~Hero~~	~~4,000 - 6,000~~	~~LOD1~~
~~Hero~~	~~3,000~~	~~LOD2~~
Large	5,000	LOD0
~~Large~~	~~3,000~~	~~LOD1~~
~~Large~~	~~1,000~~	~~LOD2~~
Small	3,000	LOD0

~~Small~~	~~1,000~~	~~LOD1~~
~~Small~~	~~500~~	~~LOD2~~

*Hero assets are any larger more valuable assets like the family

Levels Of Detail (LOD)

If you need a primer on LODs, this doc is a fair introduction to what LODs are and what goes into making them, what's down below is a more detailed and condensed version of the general LOD making process.

- **Most Assets in the Game Should have LODs**, but you want to carefully balance how many you use as each LOD adds extra calculation overhead:
    - **Don't Use LODs If**: The Mesh is below 50 Tris / The Difference Between The LOD Levels is extremely noticeable.
    - You turn off LODs by setting the number of levels to 1.
- When you make the LODs for your object, *do not rely on the Auto-Generated LOD distances* for the most part, as they are extremely generous. When making LODs:

Choosing a LOD Group:

- These don't really matter much, but for consistency, use the standard:
    - High Detail: Hero Assets
    - Large Props: Large
    - Small Props: Small
    - Foliage: Foliage (Regardless of Being Large or Small)
    - LevelArchitecture: Buildings, Roads, Sidewalks (Just any Infrastructure)

Choosing the Number of LOD Levels

- This will directly correlate to poly count, your going to use your judgement a lot for this, but in general follow this standard:
    - Hero Assets: 6-8 Levels
    - Large: 3-5 Levels
    - Small: 2-3 Levels
    - Foliage: 2-6 Levels*

*Foliage is often very high poly, but degradations in quality can be very obvious with Foliage, so you have to be careful with it.

Choosing the Distance between LOD Levels

- I use a particular method for this, but it is really a feel thing at the end of the day, do it however you want, just make sure to be aggressive with the LODs (but also make sure it isn't very noticeable) The method I use for this is:
    - *Compare LOD 0 and LOD 1* by swapping between them using the Minimum LOD
    - Then *determining the closest distance in which a swap between them looks natural*.
    - After you figure that out, *every successive level should be half of the previous*.
    - After, check it to make sure it looks right, and for big objects, you will want to tighten this up more as each step down is actually exponentially further from the camera, so you could probably push the distance closer in (like instead use a ⅔ step if that works).

Sources:

- Real-time 3D Art Best Practices - Geometry Guide

Manually Setting LOD Distances:

1. First you will need to *Uncheck 'Automatically Calculate LOD Distances'* below where you set the number of LOD Levels.
2. Then you want to go up to the *LOD Picker section and check the box that says 'Custom'*. That will *let you see and edit all of the LOD Levels in their own section.*
3. After that, you can adjust them to your liking.

Texture Sizes

Asset Type	Size
Important - Diffuse (limit these)	2048 x 2048
Important - Normal	1024 x 1024
Important - Occlusion/Roughness/Metallic	512 x 512
Large/ Hero*- Diffuse	1024 x 1024
Large/ Hero - Normal	512 x 512
Large/ Hero - Occlusion/Roughness/Metallic	256 x 256
Small - Diffuse	512 x 512
Small - Normal	256 x 256
Small - Occlusion/Roughness/Metallic	128 x 128

*Hero assets are any larger more valuable assets like the family

- **Texture aspect ratio has to be power of 2** (512x512, 1024x1024), combination is ok (16x4096)
- If normal map does not have a big influence on the result, do not use
- If a roughness map does not have a big influence on the result enable “Fully Rough” within the material properties
- **Alpha channel is expensive, avoid using it** and turn it off in the texture (Compression > Compress without alpha)
    - The second answer in this forum (by Sotalo) explains why, and when to consider using the alpha channel

Materials

If you need an introduction to materials in UE, then you might want to start here:
Intro to Material Creation

Master Materials and Instanced Materials

Each subgroup of instanced materials has a Master Material as their parents.

Subgroup Name	Master	Naming Convention
ChangePaint	M_ChangePaint_Master	MI_ChangePaint_[Color]
Cylinder	M_Cylinder_Master	MI_Cylinder_[Color]
Disintegrate	M_Disintegrate_Master	MI_Disintegrate_[VariantNames]
Disintegrate Face	M_Disintegrate_Face_Master	MI_Disintegrate_Face_[Variant Names]
FairyBody	M_FairyBody_Master	MI_FairyBody_[Color]
Foliage	M_CH_Foliage	MI_CH_[VariantNames]
Gear	M_Gear_Master	MI_Gear_[VariantNumber]
General	M_General_Master	MI_General_[Variant Name]_[Variant Number]
General Tiling	M_GeneralTiling_Master	MI_GeneralTiling_[VarianName]_[VariantNames/VariantNumber]
Ghost	M_Ghost_Master	MI_Ghost_[Color]
PaintTube	M_PaintTube_Master	MI_PaintTube_[Color]
Solid Colors	M_SolidColor_Master	MI_SolidColor_[Color]_[Variant Names]
Wet	M_StreetObjects_Master	MI_[VariantName]_Wet

Creating Unique Materials

- **Avoid** creating unique materials where you can, try to always use one of the games Master Material formats
- The only times it makes sense to create unique materials is when:

    - The material needs a unique functionality which would not frequently be needed by other Materials (don't be afraid to add functionality to the Master Materials *if it's useful*)
    - Functionality would be impossible to integrate into a current Master Material (consider creating a new master material in that case, but in that case consult with your lead and team)
    - Creating a unique material would be significantly more optimized than using a Master Material (unlikely, but it could happen, also consider make a Master Material like before)
- When making any new materials, some things to keep in mind are:
    - **Avoid transparent materials**, it's expensive. If transparency is required use either additive, modular, or mask blend modes. Never use transparent.
    - Each material slot will have a draw call so remove the one that is not using
    - Try to *use as many unlit materials as possible*. If a material is only a color its safe to say that it can be unlit with the diffuse texture connected into the emissive slot with the emissive strength set to anywhere between .3 and .6 will result in a much more efficient material that looks nearly identical.

VR Headsets Compatible with Changeling VR

[Testing and Performance Analysis | Oculus Developers]

- Oculus/Meta Quest
- Oculus/Meta Quest 2
- HTC Vive
- Valve Index
- Rift
- Rift S
- Windows Mixed Reality

Below are some internally-recommended ranges, but results may vary depending on the factors listed above.

Platform	Triangle Count
Quest 1	350k-500k
Quest 2	750k-1.0m

VR Limitations for Tech Art

Basic Optimizations

Post Processing

- Limit post processing effects as much as possible
- 1 simple or highly optimized effect per scene
    - Still run checks when implementing to make sure it isn't tanking frames

Models

- Limit polycount as much as possible and abide by it
- Create LODs for objects*
- Do not use high-detail collider shapes on every single object (or even most objects)
    - It will just tank performance

Lighting

- Always use Static Lights and lightmaps for vr projects
- Limit the amount of dynamic lights to as few as possible, and make sure that they never touch one another
    - 1 to 2 per scene should be your goal
- If you have an outdoor scene, set your directional light to dynamic instead of stationary, then turn on Cascaded Shadow Maps (CSM). You can then adjust the settings to be as simple as possible while still giving you shadows.
- Shadow mapping is a huge help with lighting issues and should be used for Changeling

Links to Tech Art Docs/Spreadsheets

Team List Spreadsheet

- List of all members currently working on Changeling and their teams, interests, and other information

Level Frame Rates

- Playtesting documentation

The History and Timeline of Tech Art

- **May 23rd, 2023 - The Planning of the Purge**

Why did we Purge?

> We had a lot of assets in the game that were either from free asset packs or created by past members of the team. These assets were causing FPS drops due to poly count and quality. We had individual models that were over the on-screen budget individually.

What assets are high-priority to remove? What are we using and what is just camping out in the files?

> The Purge was mostly started to ensure that the game could run smoothly and the project folder wasn't bloated with years worth of work. When the Summer 2023 team started demoing the game when joining the project, we had levels running at around 2fps, just due to various optimization issues. We also had duplicated assets that existed in the content folder that weren't needed. Additionally, there was an issue where we could not find the links to store-bought assets used in Changeling, and there were no docs in the Drive listing where they came from.
>
> Previous teams already had complaints about the organization of the project. We were on year 3 of Changeling's existence and since then, naming conventions had been changed, people had plopped down folders where they could or needed them, and nothing was even remotely documented in the process. We knew what scripts did, but nothing was separated by where it was used, making it a massive task to track everything down.

Do you need to Purge? What's the current status on assets in the project? Do you know where they all came from? What are their poly counts? Are there ways for you to fix what you have already to make it work for the game?

- **May 24th, 2023 - The Warning of the Purge**

Warning to dev team that we will start killing. What assets are they using right now? What assets do they need that need to be entirely redone? Fixed? We made a spreadsheet to make sure the Purge was organized and no one lost things that were essential to their progress. Keep in mind that as long as the names of assets are known, they can be recovered via version control.

- **May 30th, 2023 3pm EST- The Great Purge of Changeling**

Naming convention changes & folder structure were run by Development to ensure they worked for those teams. Files were then sent out to the general Changeling team as reference to the changes occurring in the project. As files had their folders changed, dev team leads were called in to ensure everything made it to the right place.

If you are a future person looking for past states of content in-game, you now have the date & time of the revision that changed the names and locations of most, if not all, content in Changeling.

- **May 31st, 2023 - The Aftermath of the Purge**

We managed to reduce the file size by >1 GB. We also reduced file count for the project to ~8000 and the number continued to fluctuate after as assets were removed & added

- **June 16th, 2023 - The First Playtest**

We had decent upgrades to the performance, but it still wasn't within an acceptable range or stability. Some levels hadn't seen any real improvement overall. We spoke to dev about a massive project cleanup including blueprints. Most blueprints found had extraneous code, were poorly optimized, or were just difficult to read and rushed.

- **June 22nd, 2023 - Engine Changes**

Multiple Engine changes were made to increase performance. The following is a list of all changes made to DefaultEngine.ini

- Forward Shading was activated
- Bloom was deactivated
- Ambient Occlusion was deactivated
- Anti-Aliasing Method was changed to MSAA
- Mobile HDR was deactivated
- Round Robin Occlusion Queries was activated
- Disable vertex fogging in mobile shaders was deactivated
- Maximum number of CSM cascades to render was set to 1
- Custom Depth-Stencil Pass was set to Disable

- **We Re-enabled Custom Depth-Stencil Pass**

Custom Depth-Stencil was unfortunately needed to get around the post-processes already in Changeling as well as the new ones being worked on. We had to turn it back on but it had minimal changes to our overall performance.

- **July 26th, 2023 - Engine Unchanges**

After hitting our desired FPS on most hardware, and deciding that an APK build was effectively impossible for Changeling at this stage, we turned off Forward Shading. It was preventing us from creating some desired effects and didn't give us the boost we

needed anymore. We were also witnessing visual bugs that we did not know how to solve nor did we have the time to solve them. We also dropped explicit support for the Quest 1 as its hardware was severely limiting and impossible to optimize for without gutting the art of the whole game. Deferred no longer caused or contributed to frame rate drops, so we were able to safely make the swap.

Changelog:

- May 23, 2023: Created document & started creating standards for assets & naming conventions (Tech Art Summer 2023)
- May 26, 2023: Tech Art History section added (Rebecca Greene), Folder structure added (Runi Jiang)
- June 1, 2023: Texture & Material limitations added (Runi Jiang)
- June 2, 2023: Prefixes modified & added (Amelia Roberts), Formatting changes (Rebecca Greene)
- June 14, 2023: Texture sizes updated for different texture maps (Dariel Ravelo-Ramos)
- June 21, 2023: Added guidelines for transparency (Dariel Ravelo-Ramos)
- June 23, 2023: Unlit guide added (Dariel Ravelo-Ramos)
- July 21, 2023: Removed Overall Tasks sheet and Asset Purge sheet, History update (Holly Allen)
- August 2, 2023: Updated History section (Holly Allen)
- August 3, 2023: Updated formatting & created Changelog (Holly Allen)
- August 9, 2023: Updated Master Materials and Instanced Materials section (Katarina Tretter)
- July 19, 2024: Quick Updates Regarding Issues with the Oculus Quest Build (Shawn Roller)
- July 30, 2024: Updating The Organization of the Document Based Research from the Summer Term (Shawn Roller)