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Khronos Group, MSF, AOUSD

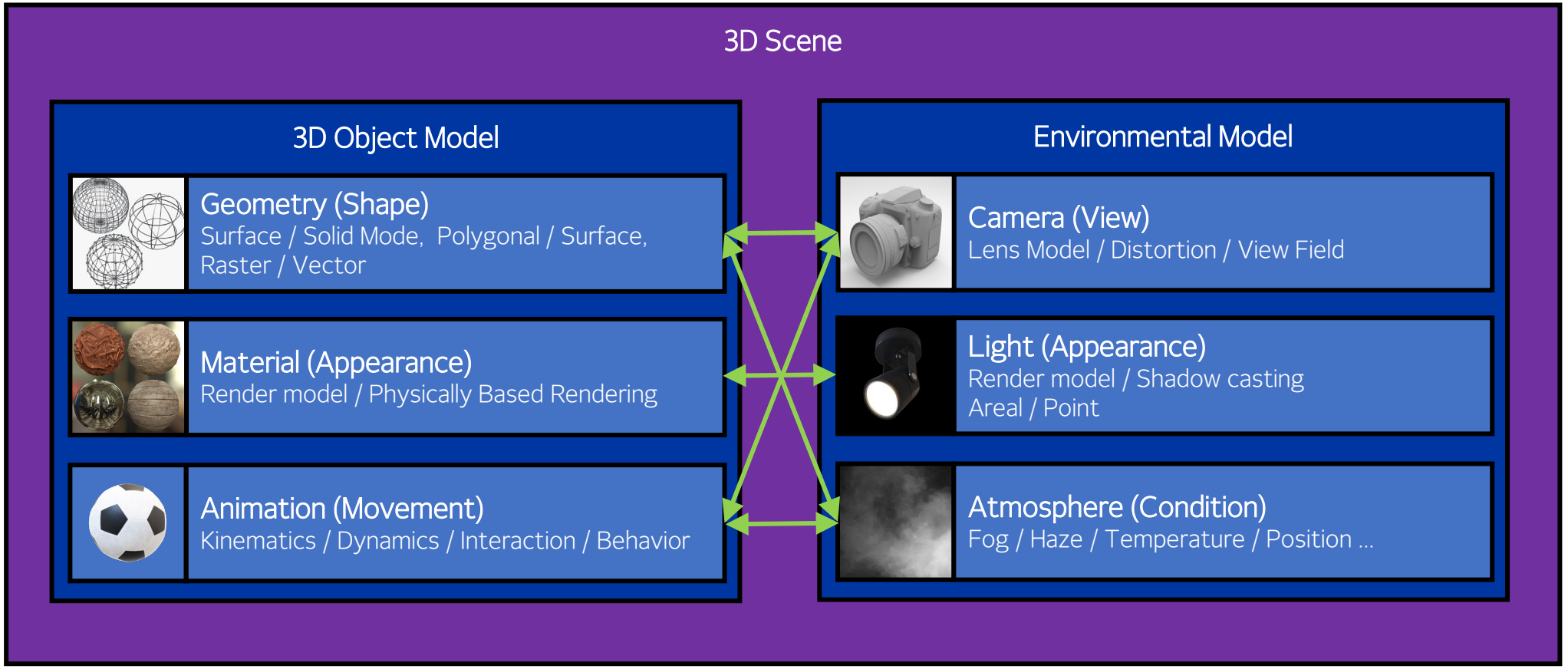
Metaverse 3D Asset 포맷 – glTF 와 USD

Definition to 3D asset

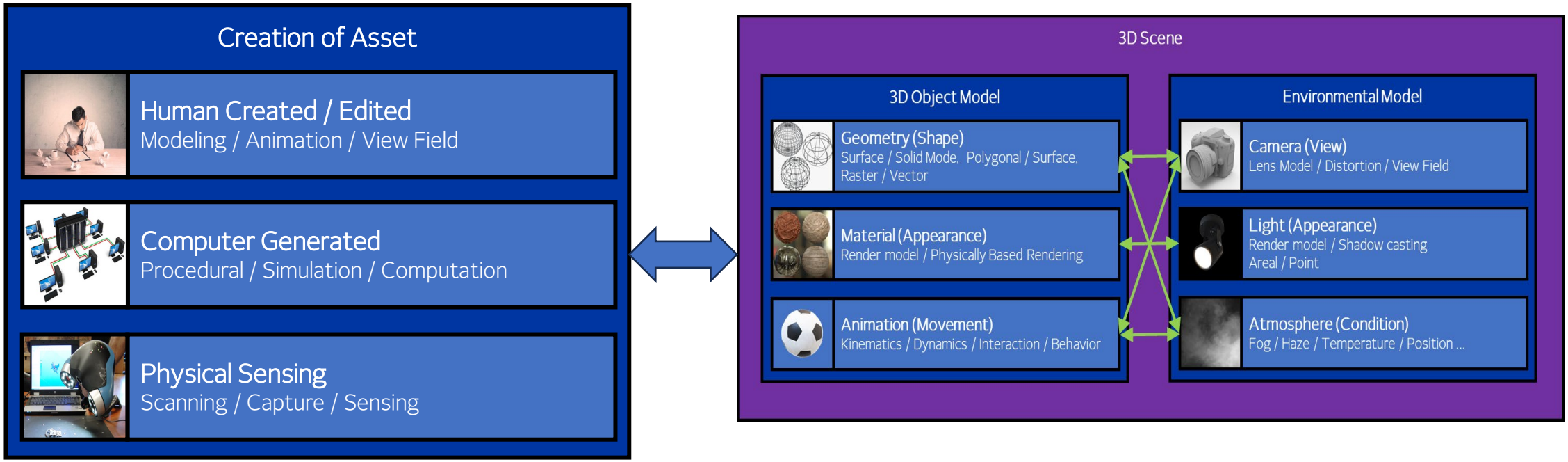
- 3D assets (3D model) are digital files that represent objects or elements in a three-dimensional space. These assets consist of data that defines the shape, texture, and appearance of these objects, allowing them to be rendered and animated in various software applications

(https://www.actionvfx.com/blog/what-are-3d-assets-learn-more-about-3d-models-alembics-vdbs-and-more)

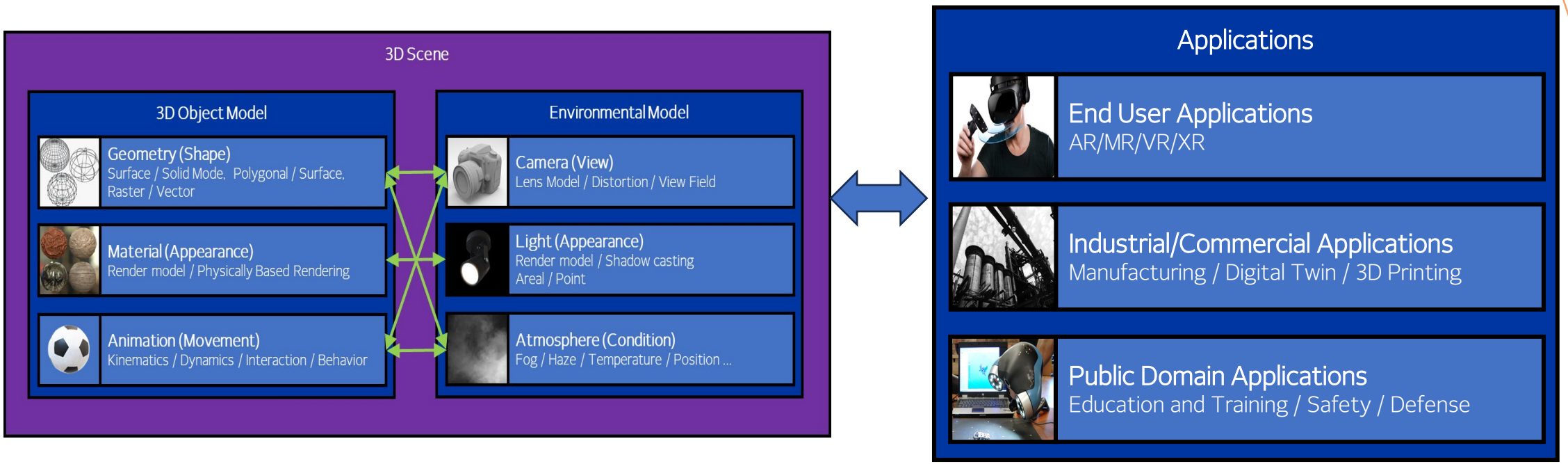
Component of 3D Assets



Creation of 3D Assets



Application of 3D Assets



3D Asset Interoperability is key of success for Metaverse, Digital Twin, Game, AR/MR/XR and ....

Because

Too many workflow, pipelines, tools...

glTF

By Khronos Group, 3D Format Working Group

glTF 2.0 Scene Description Structure

.gltf (JSON)

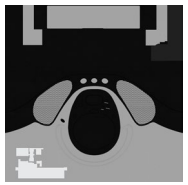
Node hierarchy, PBR material textures, cameras

.bin

Geometry: vertices and indices
Animation: key-frames
Skins: inverse-bind matrices

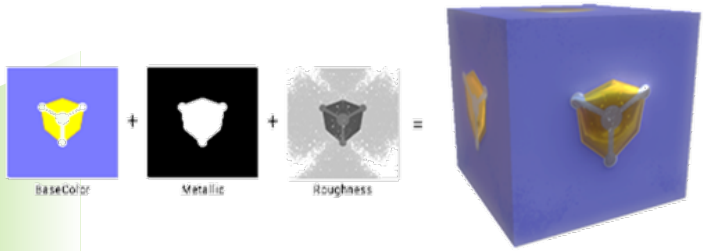
.png
.jpg
.ktx2
Textures

Geometry

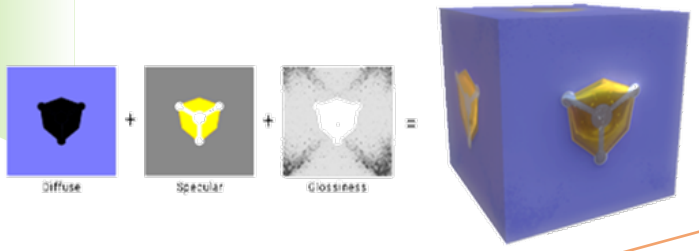


Texture based
PBR materials

Mandatory Metallic-Roughness Materials

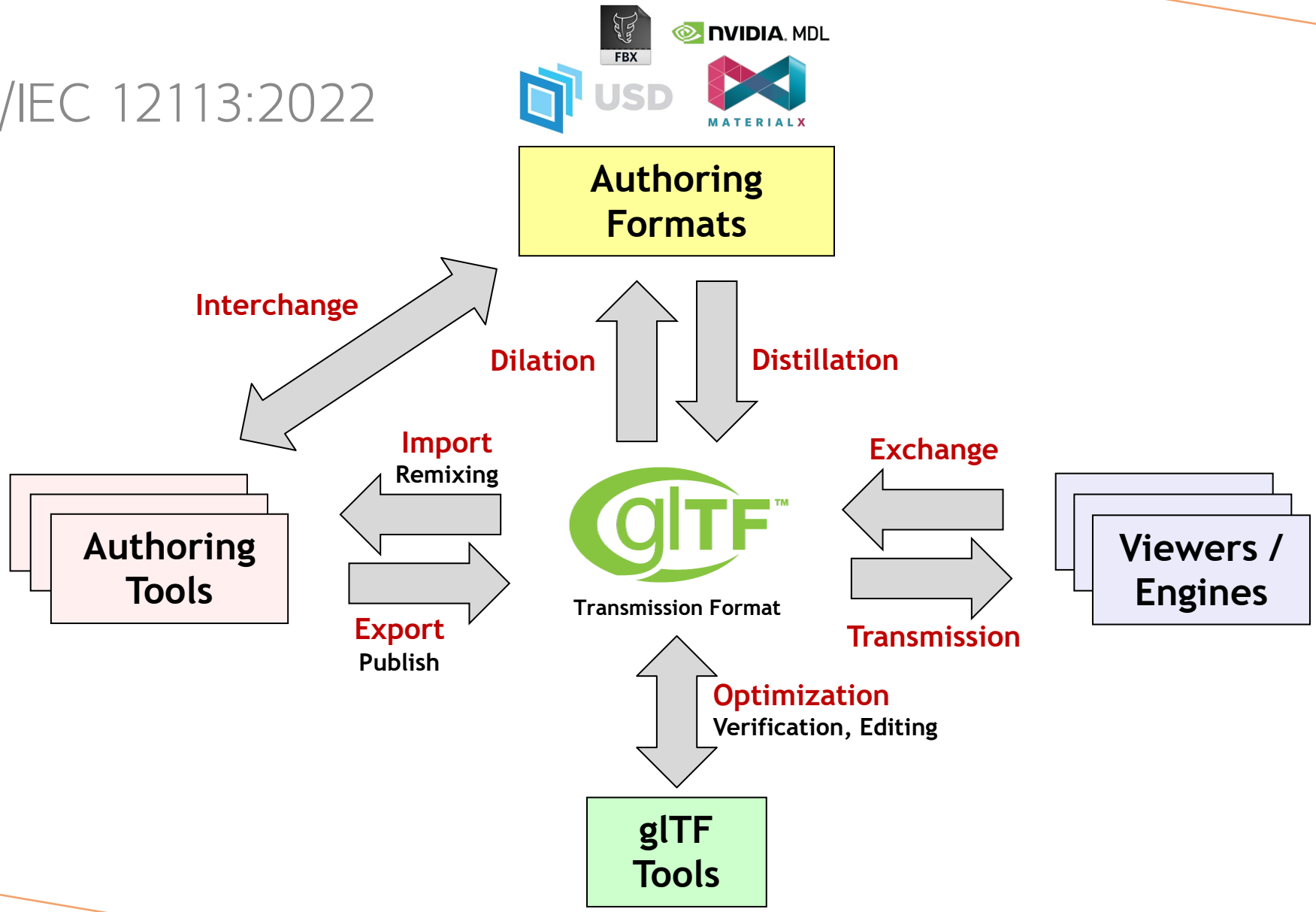


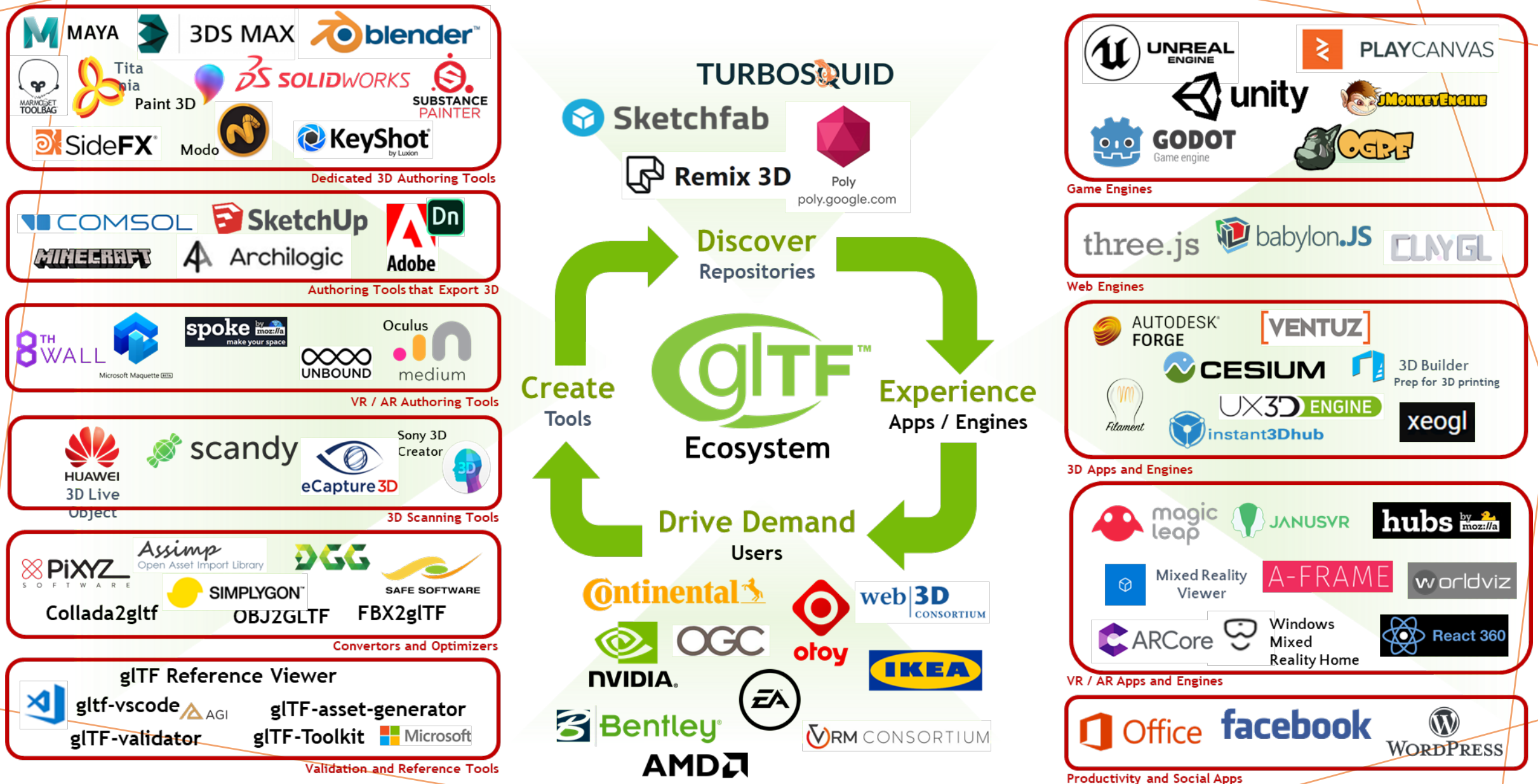
Optional Specular-Glossiness Materials



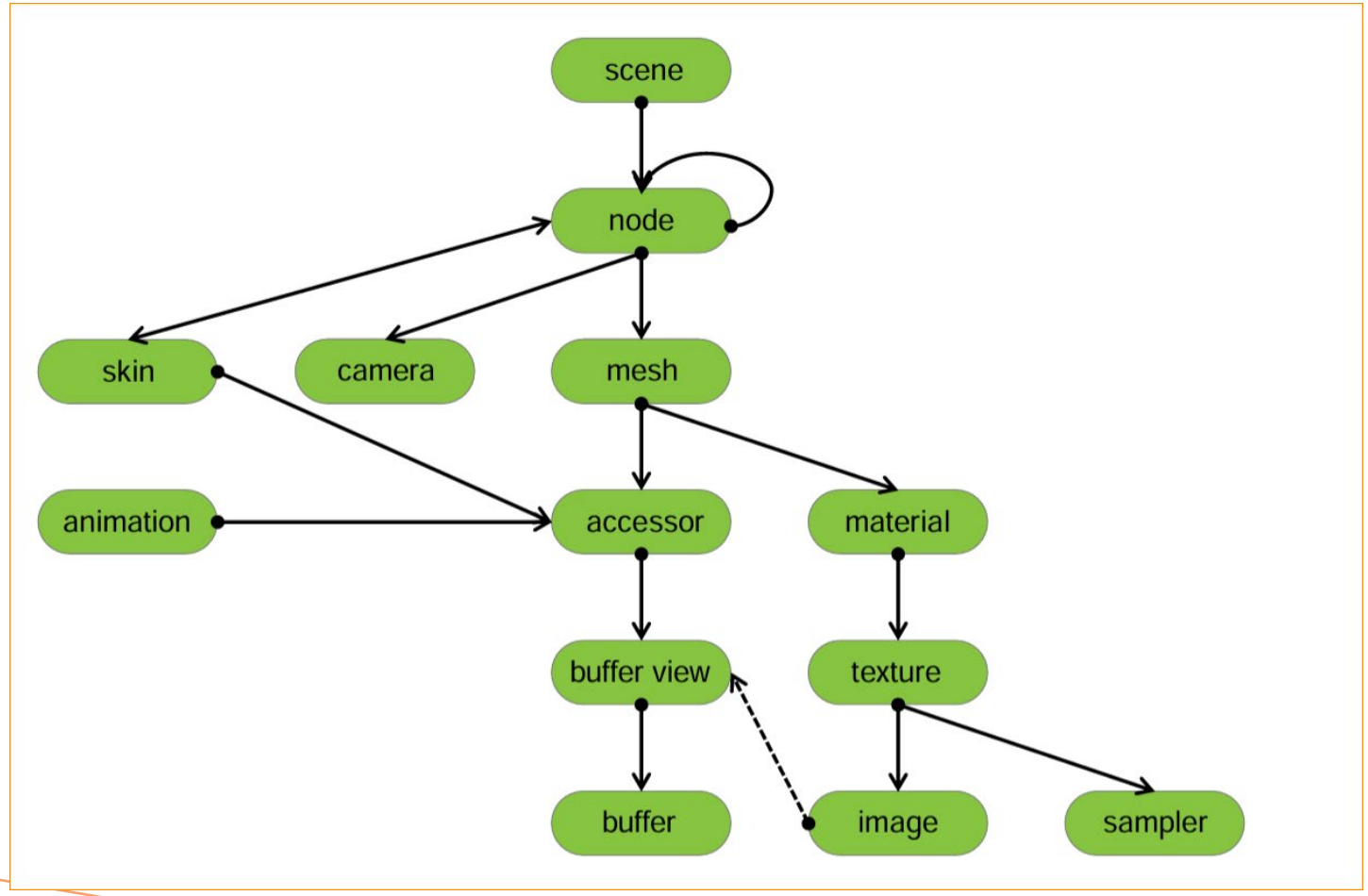
glTF

- ISO/IEC 12113:2022




MAYA
3DS MAX
blender
Tita nia
Paint 3D
SOLIDWORKS
SUBSTANCE PAINTER
MARMOSET TOOLBAG
SideFX
Modo
KeyShot by Luxion
Dedicated 3D Authoring Tools
COMSOL
SketchUp
MINECRAFT
Archilogic
Adobe Dn
Authoring Tools that Export 3D
8TH WALL
Microsoft Maquette
spoke by moz://a make your space
UNBOUND
Oculus
medium
VR / AR Authoring Tools
HUAWEI 3D Live Object
scandy
eCapture 3D
Sony 3D Creator
3D Scanning Tools
PiXYZ SOFTWARE
Assimp Open Asset Import Library
SIMPLYGON
DGG
SAFE SOFTWARE
Collada2gltf
OBJ2GLTF
FBX2glTF
Convertors and Optimizers
glTF Reference Viewer
gltf-vscode
AGI
gltF-validator
glTF-asset-generator
glTF-Toolkit
Microsoft
Validation and Reference Tools
TURBOSQUID
Sketchfab
Remix 3D
Poly
poly.google.com
Discover
Repositories
Create
Tools
glTF™
Ecosystem
Experience
Apps / Engines
Drive Demand
Users
Continental
NVIDIA
OGC
otoy
web3D CONSORTIUM
IKEA
EA
Bentley
AMD
VRM CONSORTIUM
UNREAL ENGINE
PLAYCANVAS
unity
JMONKEYENGINE
GODOT Game engine
OGRE
Game Engines
three.js
babylon.JS
CLAYGL
Web Engines
AUTODESK FORGE
VENTUZ
CESIUM
3D Builder
Prep for 3D printing
Filament
UX3D ENGINE
instant3Dhub
xeogl
3D Apps and Engines
magic leap
JANUSVR
hubs by moz://a
Mixed Reality Viewer
A-FRAME
worldviz
ARCore
Windows Mixed Reality Home
React 360
VR / AR Apps and Engines
Office
facebook
WordPress
Productivity and Social Apps

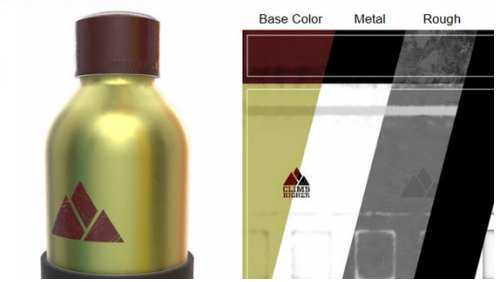
Scene Graph of glTF



glTF PBR

- https://github.khronos.org/glTF-Sample-Viewer-Release/

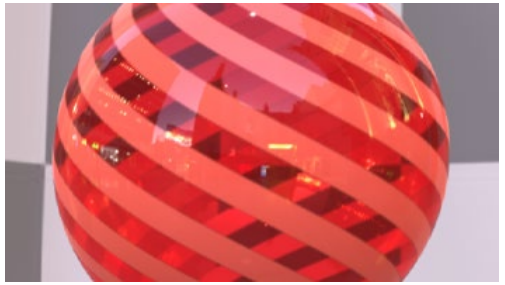
Metal / Rough



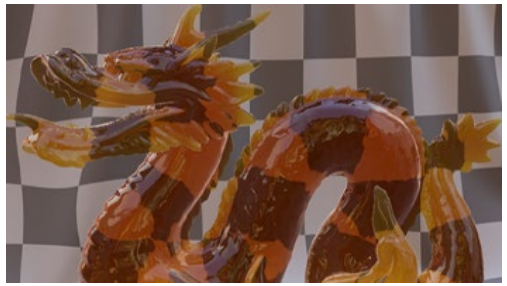
Clearcoat

Sheen

Transmission



Volume

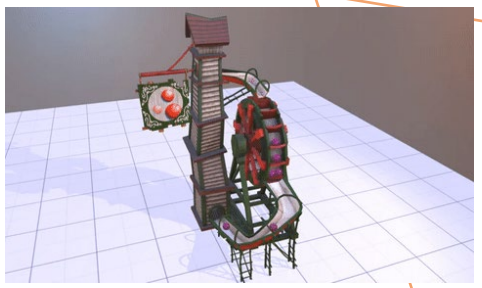


Index of Refraction

Specular

More ...

- Physics - Collision geometry, Motion, Materials, Joints, Filters
- Geospatial collaboration for transmission and display of 3D models, scenes, and interfaces for geospatial applications.
- Compression of mesh and texture
  - Draco - https://github.com/google/draco/tree/gltf_2.0_draco_extension
  - KTX - https://www.khronos.org/ktx/
- Tone mapping - https://modelviewer.dev/examples/tone-mapping

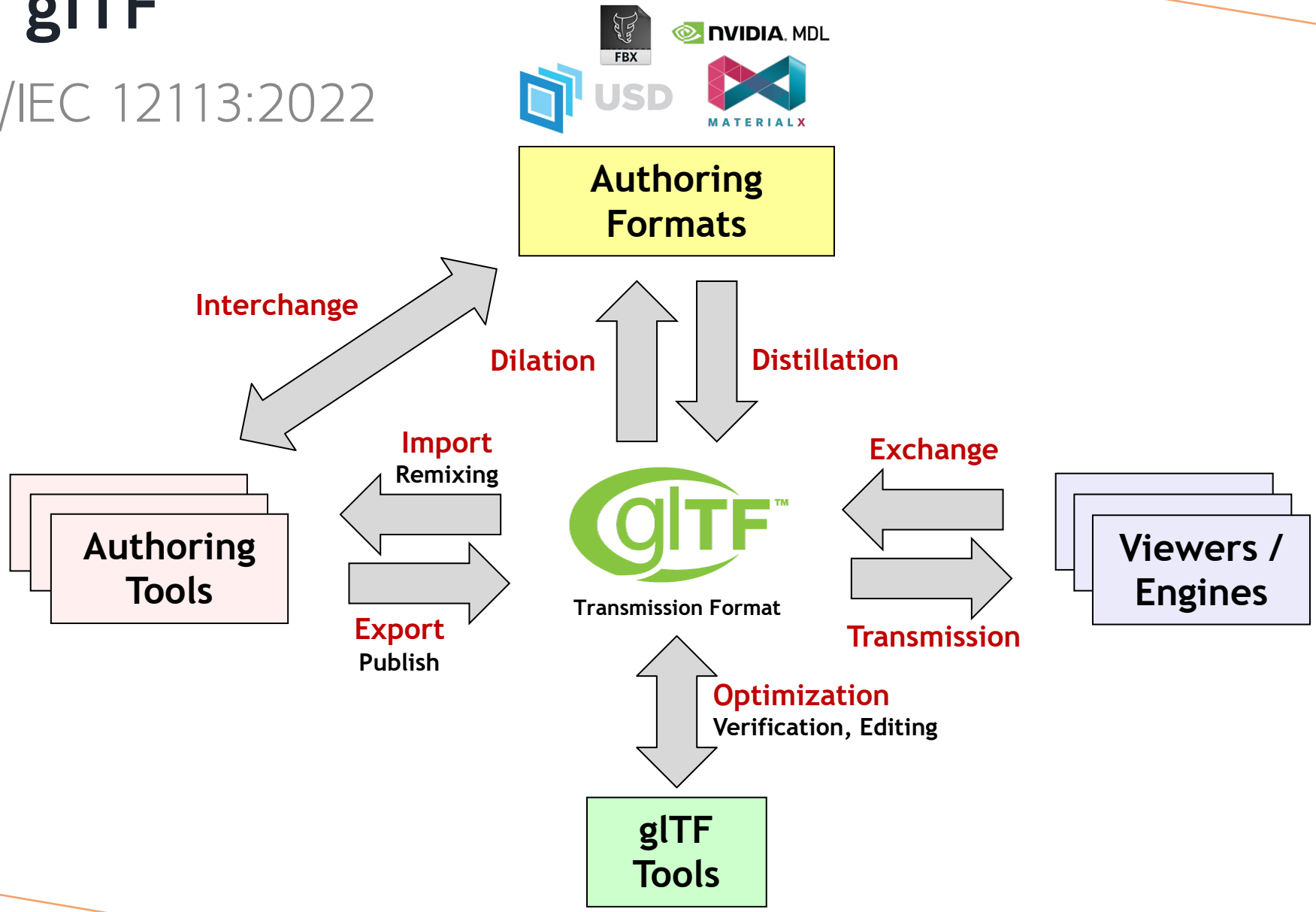


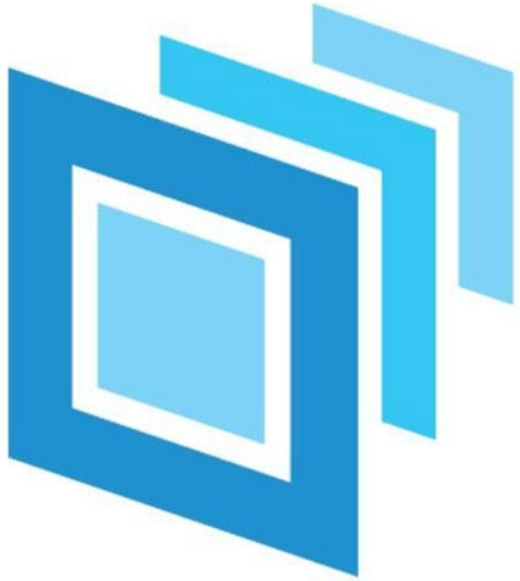
DRACO
3D DATA COMPRESSION

KTX™

Again glTF

- ISO/IEC 12113:2022





USD

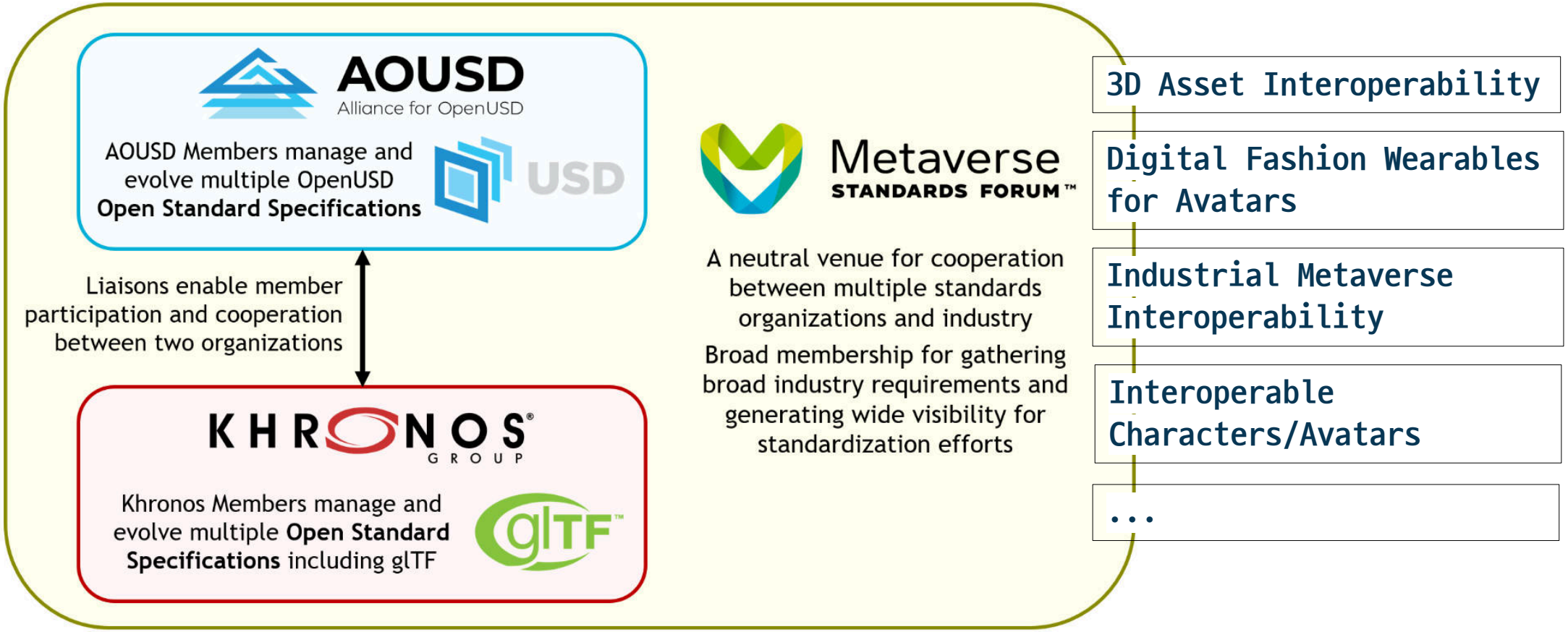
AOUSD

Alliance for OpenUSD

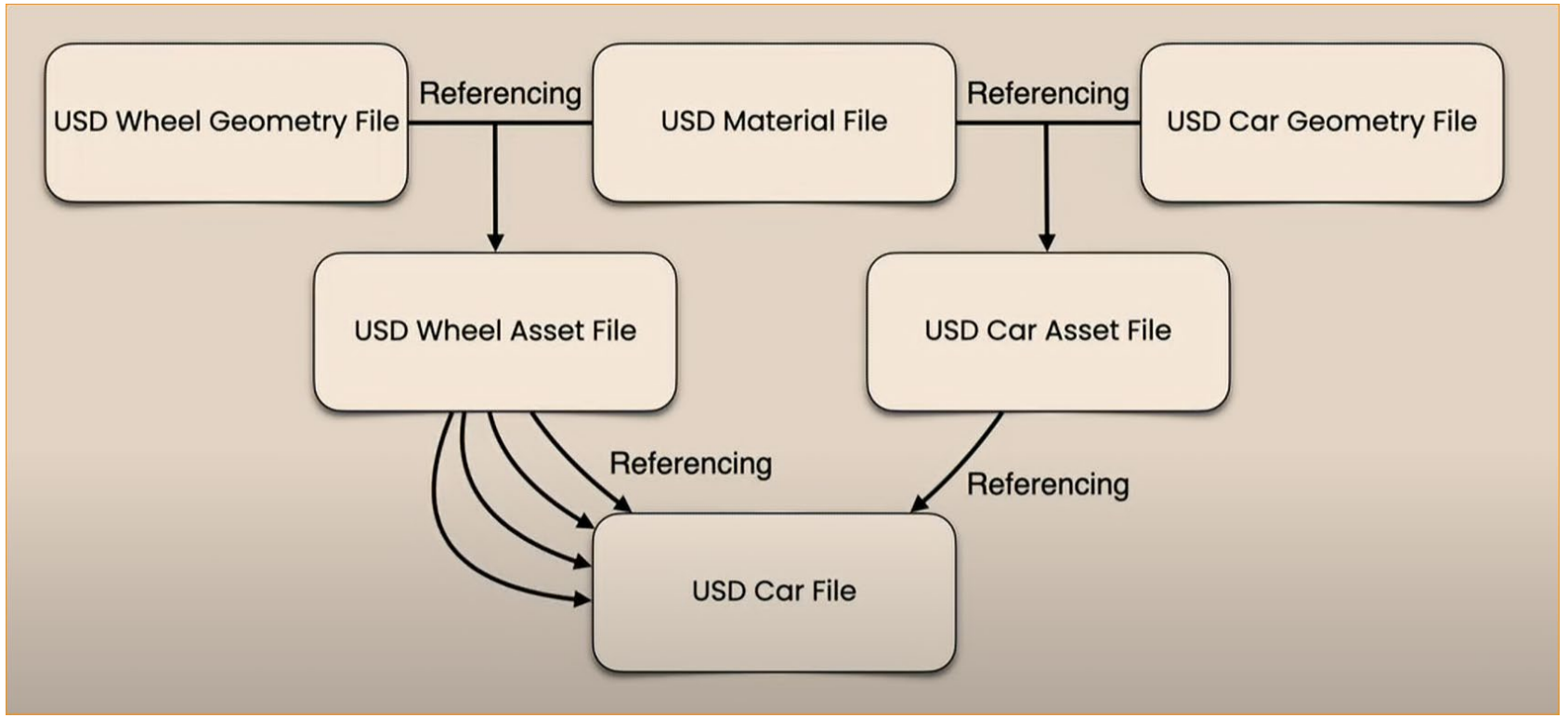
What is USD

- Universal Scene Description by Pixar
- Open Source Project - OpenUSD (openusd.org)
  - License - Modified Apache License
  - Schema and API's
- Standardization Project - AOUSD (aousd,org)
  - standardization, development, evolution, and growth

Related SDO's

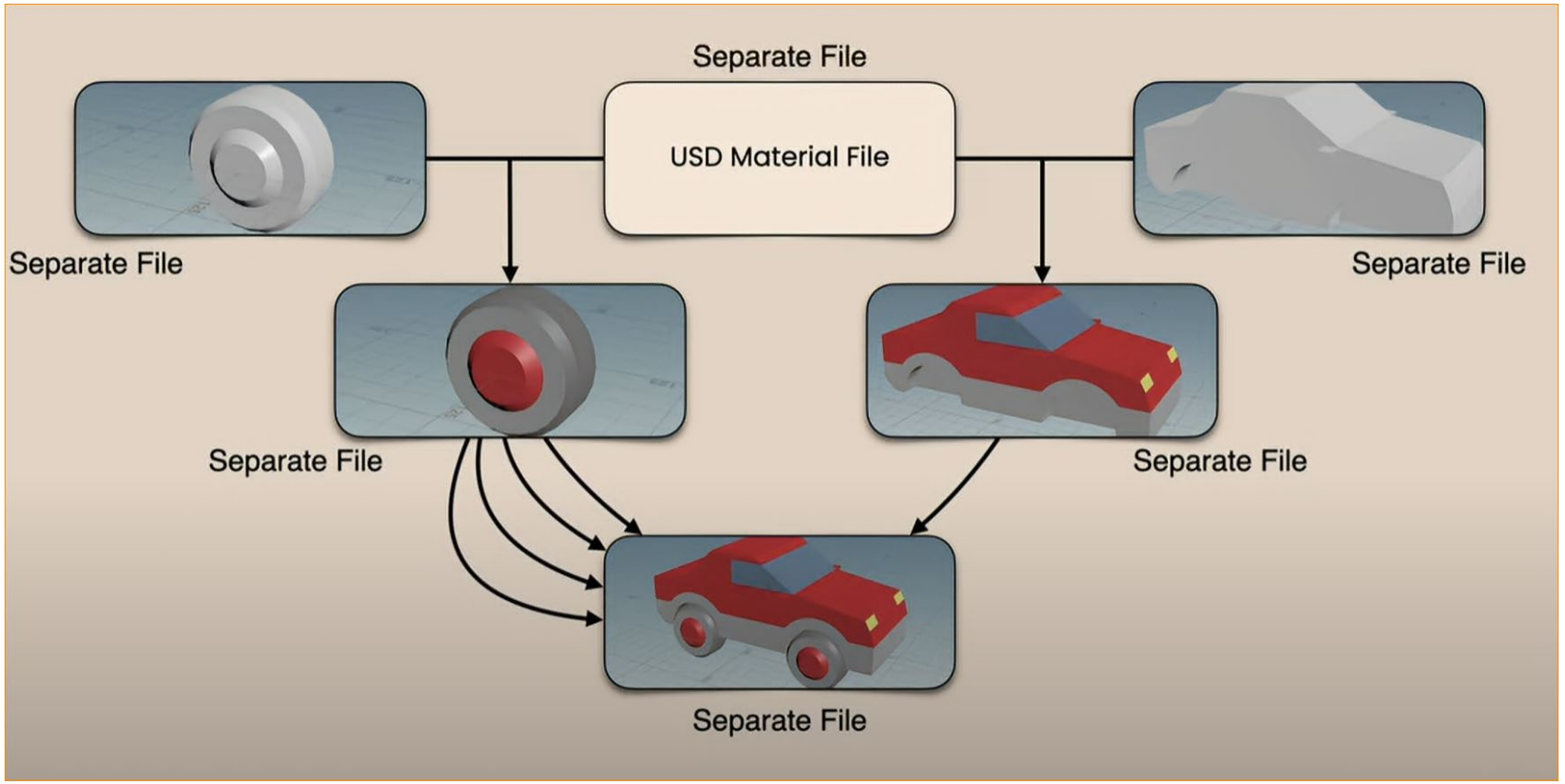


Elementary USD



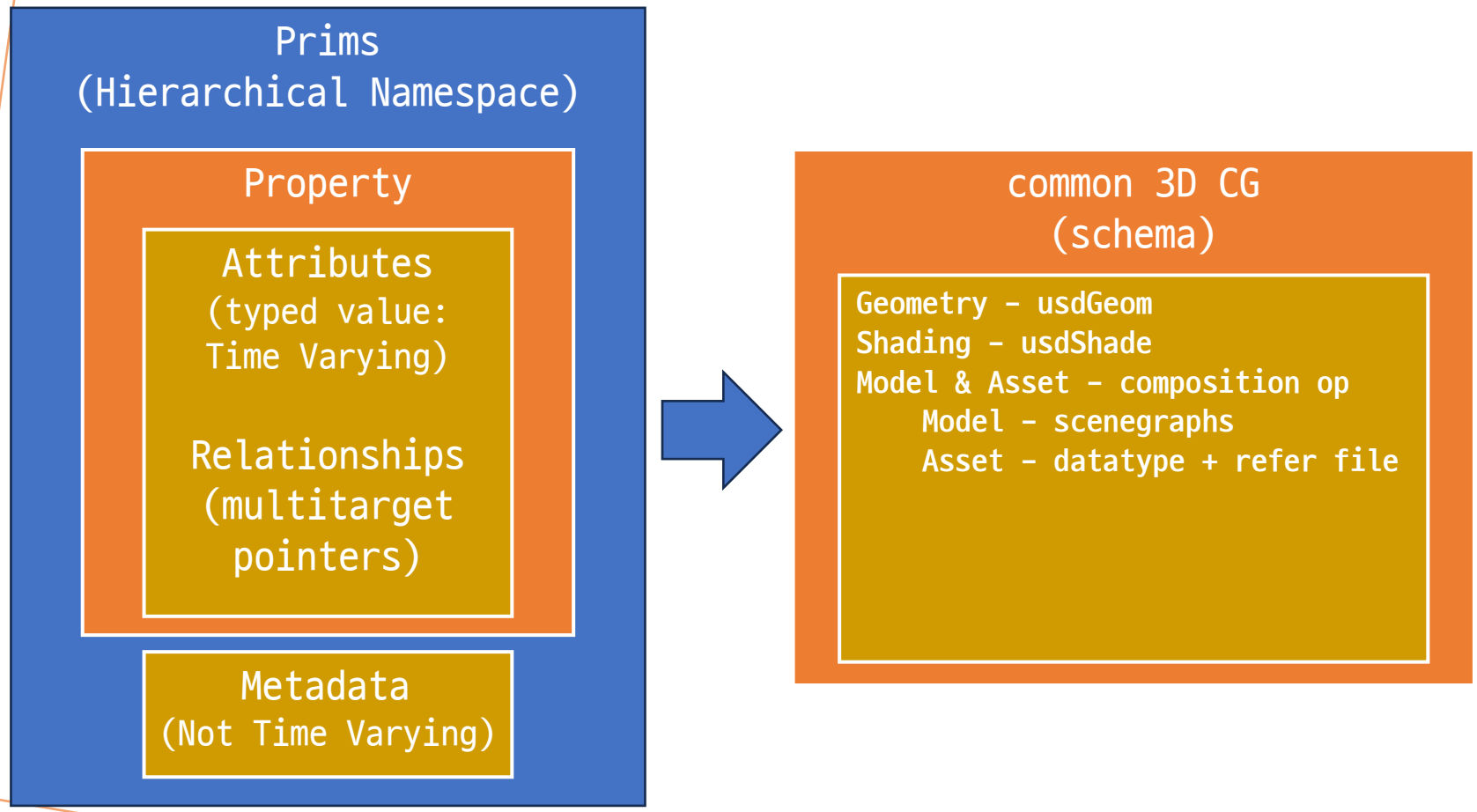
https://www.youtube.com/watch?v=JixC53cQn5U

Elementary USD

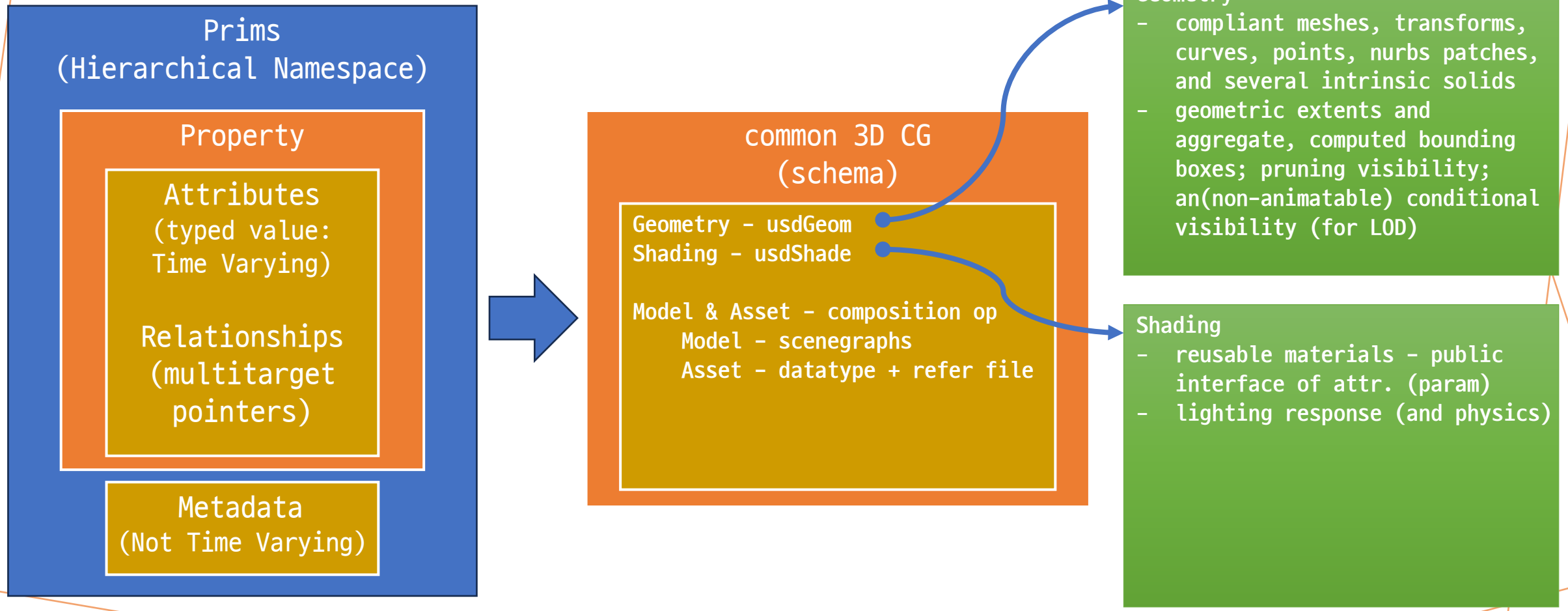


https://www.youtube.com/watch?v=JixC53cQn5U

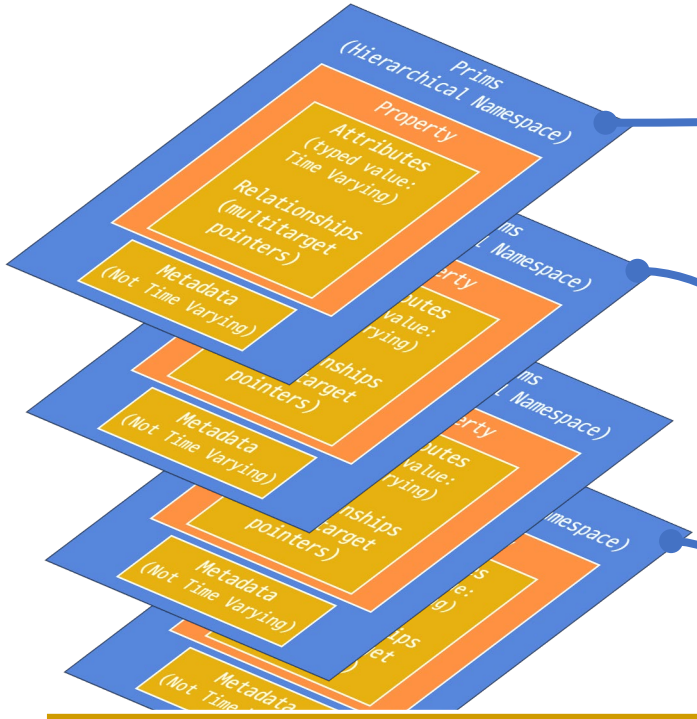
USD Features - Prims (1)



USD Features - Prims (2)



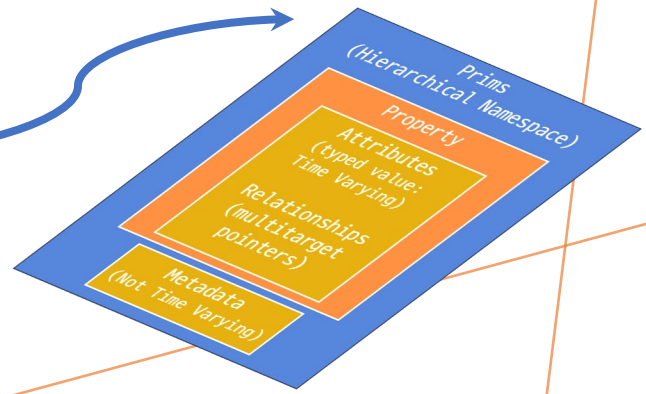
USD Features
- Compose and Override (1)



Payload arc - deferred ref.
→ Selectively load/unload

VariantSets
- Variant selector

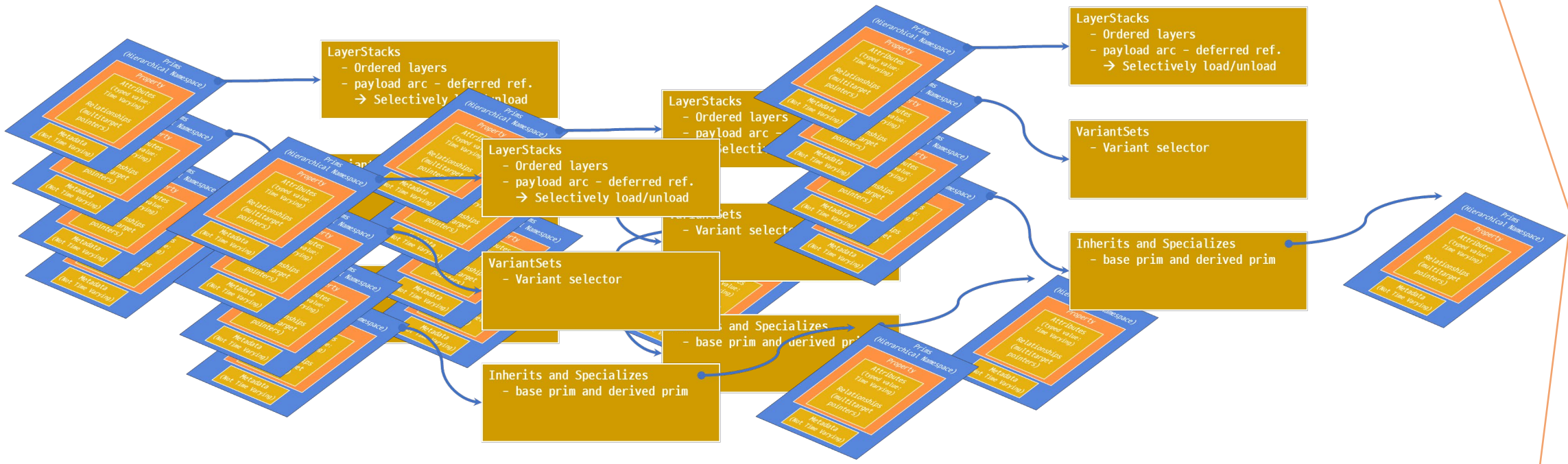
Inherits and Specializes
- base prim and derived prim



Sublayers
- Combine like photoshop layer

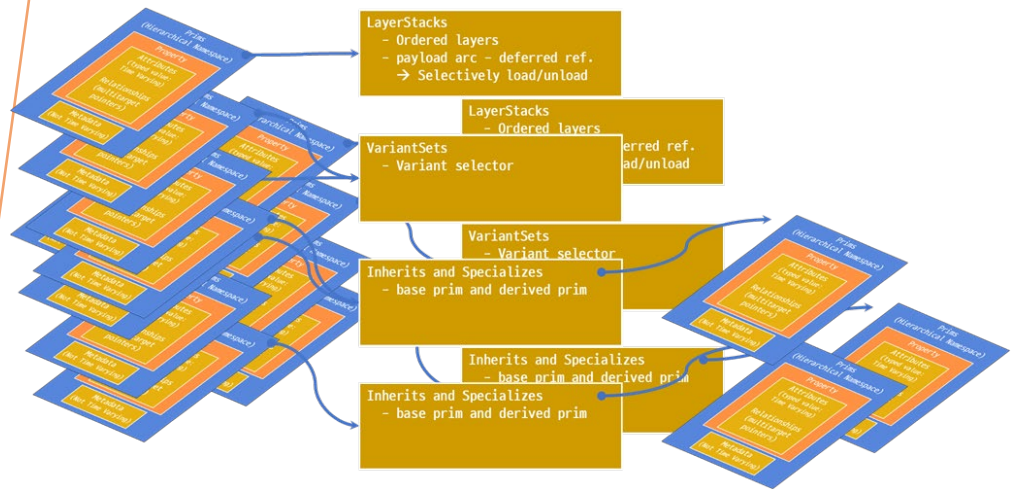
Reference
- Add new items to Scene

USD Features
- Compose and Override (2)



All Operation can be applied To Any Prim, Any Combination
→ Composition engine resolve result graph

USD Features
- Compose and Override (3)



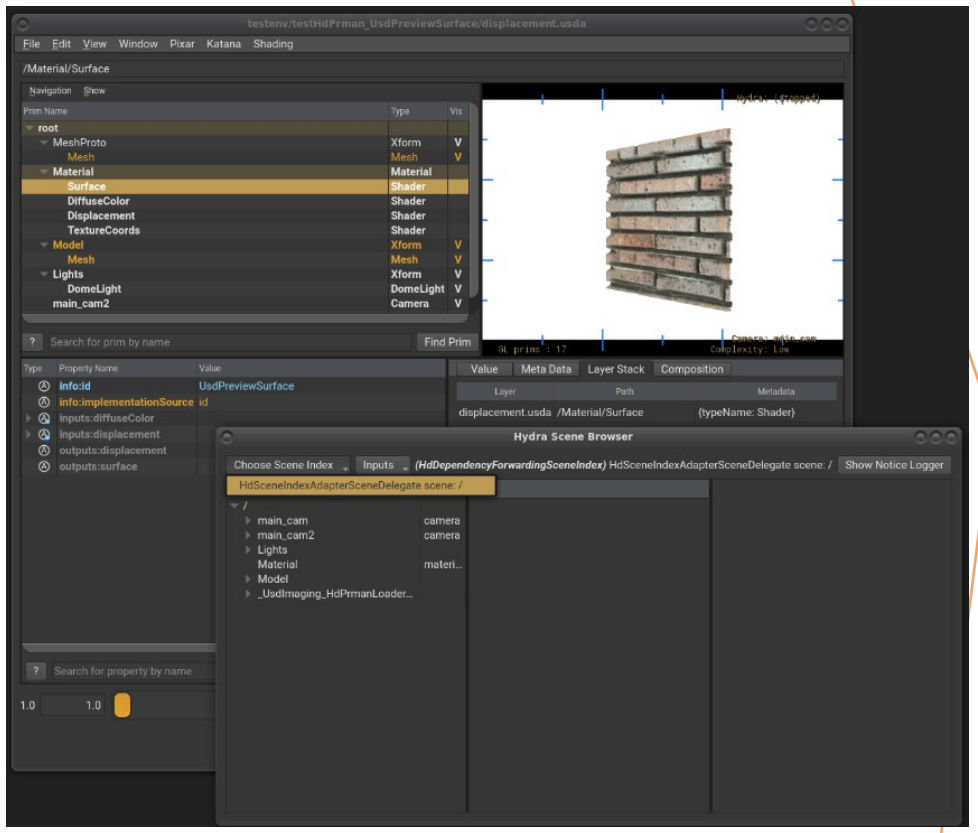
Stronger layer can override weaker layer

- Add new prims including entire subtrees rooted at the added prim
- Deactivate prims , which is USD's method for non-destructive (and reversible) prim/subtree deletion
- Reorder prims, since in some contexts, the namespace-ordering can be meaningful
- Add or remove Variants to an existing VariantSet
- Add or remove entire VariantSets, or targets to inherit or specialize
- Override the value of schema and user-level metadata on a prim or property
- Add new properties to a prim
- Reorder properties on a prim. If not explicitly ordered, properties are enumerated in dictionary order
- Override the value of any attribute (an override value blocks all weaker timeSamples)
- Block the value of an attribute, so that it will appear to have no authored value
- Add, remove, and reorder targets on a relationship or attribute connection

USD Features - Hydra

- Imaging framework with USD
- **scene delegates** - consume data
- **render delegates** - send to renderers

- Renderer
  - NVIDIA Omniverse
  - AMD ProRender
  - Pixar RenderMan
  - ,,,
  - https://openusd.org/release/usd_products.html



Hydra Scene Browser

USD Features - can be extended (1) - Asset Resolution

- ArResolver
- Separation between asset path in USD file and ultimately be loaded

- Naming conventions - search-path in local filesystem (Default)
- Allows - multiple, URI-protocol-dispatched resolver - can stream directly from clouds or databases, procedurally constructed assets in memory

USD Features - can be extended (2) - File formats

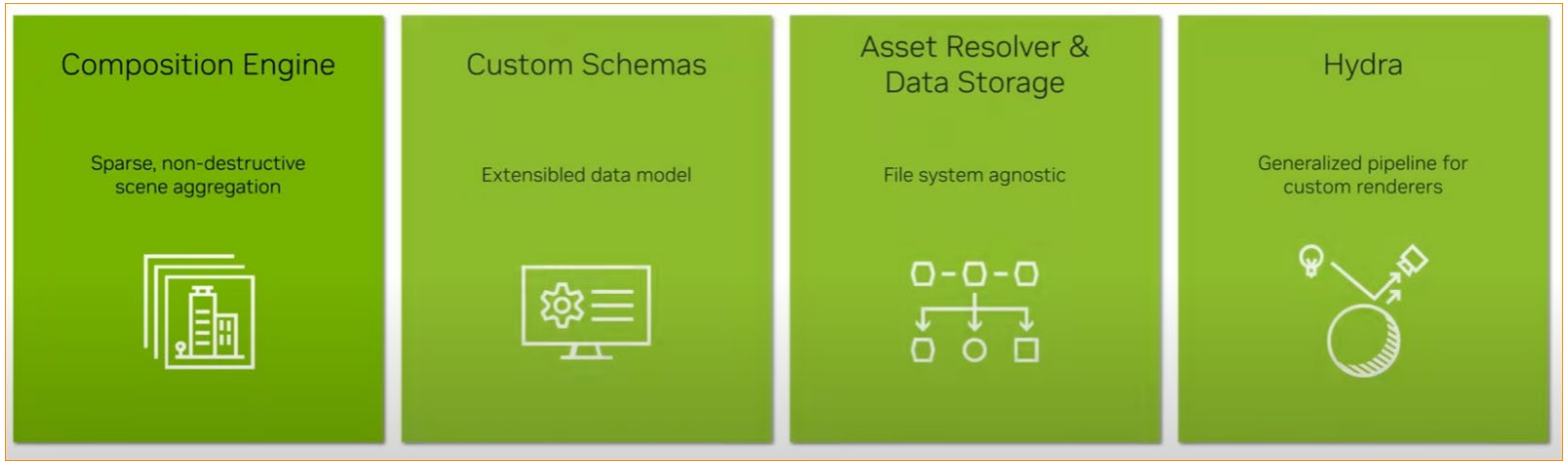
- sddFileFormat
- native file format - usda (text), usdc (binary), and usdz (packaged archive)

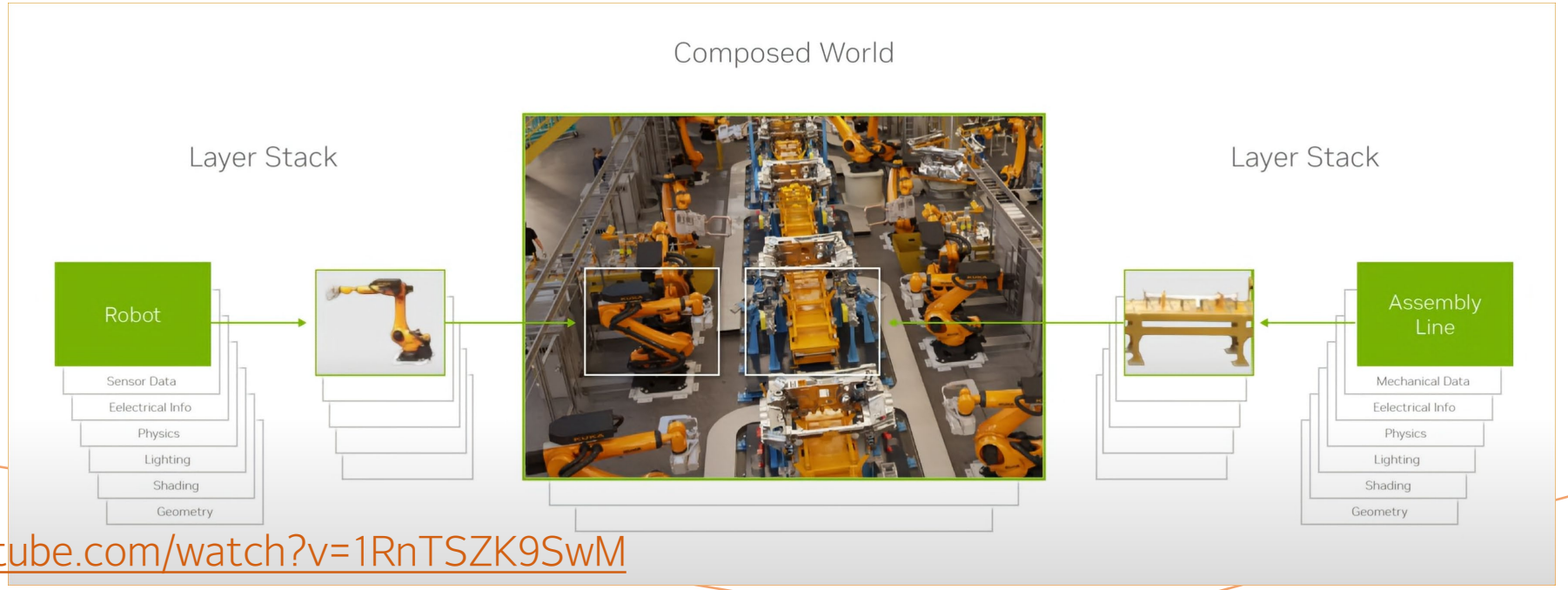
- implementing reading file format
- file format can also be "dynamic" - payload arc - Procedural

USD Features - can be extended (3) - User defined Schemas

- tool for new schemas - C++ classes, python bindings ...
- Add new schema types and API's on your pipeline (package)
  - interact in application-level plug-in
- Teach Hydra - to render them

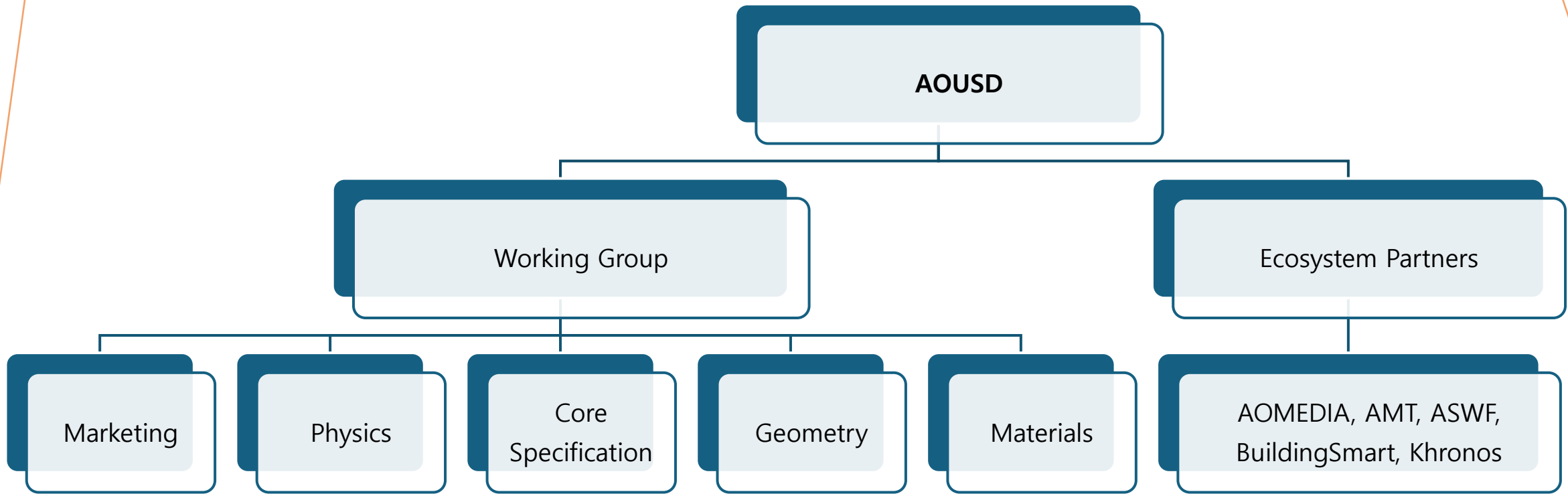
USD 4 key features (by NVIDIA)





https://www.youtube.com/watch?v=1RnTSZK9SwM

AOUSD - Organization



AOUSD Core Spec. WG

Mission

Core Specification WG

Formalize **foundational data models & predictable behaviors of OpenUSD composition & population** in **normative specifications** as an **international cross-industry standard** for **interop & interchange of aggregate datasets** describing **virtual worlds**