# Crealysm_11

Binary 3D scene file format
Data definitions

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## Introduction

The Crealysm_11 engine reads 3D scenes directly in the binary file format described below. The purpose of this custom file format is to maximize runtime performance. The engine's resource manager only adds the full 3D scene as a resource. The individual mesh instances, light sources, camera etc. are basically POD's / not take up mentionworthy memory.

## Key features

- A scene can have up to 256 3D cameras (minimum is 1)
- A scene always has one start/ initial camera defined
- Because the invididual objects within the 3D scene are not added to the resource manager, they don't have a global unique ID (GUID)
  - Using the objects within the scene is done using the vector indices, which are based on the order of the objects in the scene file
- The DDC/ engine tools are responsible for linking game objects to scene objects, e.g. mesh instances or light sources
- Global variables for the scene are included in the file format (e.g. for ambient light)
- Worldspace units: 1.0 = 1 meter

## Version control

- Currently only version 1 of the file format is available
  - the header of the binary file format includes the version, to be able to provide backwards compatibility when future file versions exist

## Platform support

- Usable on platforms using a 'little endian' system
  - Including x86 processor architecture, PC's, PlayStation 4, XBox one
- All used variable type are read and written in fixed width types
  - using <cstdint> (i.e. uint8_t, uint16_t, uint32_t)
  - with the exception of "floating point values" (floats), because currently there's no fixed width float type available

## Data definitions

The table below describes all data elements in the 3D scene file format.

| | Data | Variable type | Size | Comments |
|---|---|---|---|---|
| 0 | Magic header | char array | 24 bytes | Fixed value |
| 1 | File version | uint8_t | 1 byte | Version number( e.g. 1) |
| 2 | Number of cameras | uint8_t | 1 byte | Max 256 |
| 3 | Number of mesh instances | uint16_t | 2 bytes | Max 65535 |
| 4 | Number of point lights | uint8_t | 1 byte | Max 256 |
| 5 | Number of directional lights | uint8_t | 1 byte | Max 256 |
| 6 | Number of spot lights | uint8_t | 1 byte | Max 256 |
| 7 | Number of capsule lights | uint8_t | 1 byte | Max 256 |
| 8 | Start camera ID | uint8_t | 1 byte | Active camera when scene is initialized |
| | **3D cameras** | | | |
| 9 | Position XYZ | float array | 3*4 bytes | |
| 10 | Pitch angle | Float | 4 bytes | X, angle in degrees |
| 11 | Yaw angle | Float | 4 bytes | Y, angle in degrees |
| 12 | Roll angle | Float | 4 bytes | Z, angle in degrees |
| 13 | FOV Y | Float | 4 bytes | Field of view Y-axis, angle in degrees |
| 14 | Near plane | float | 4 bytes | Near plane distance |
| 15 | Far plane | float | 4 bytes | Far plane distance |
| | **Mesh instances** | | | |
| 16 | Mesh ID | uint16_t | 2 bytes | Reference ID to mesh |
| 17 | Position | float array | 3*4 bytes | Worldspace transform |
| 18 | Rotation | float array | 3*4 bytes | Worldspace transform |
| 19 | Scale | float array | 3*4 bytes | Worldspace transform |
| 20 | Dynamic | uint8_t | 1 byte | 0 = no, 1 = yes |
| 21 | Depth enabled | uint8_t | 1 byte | 0 = no, 1 = yes |
| 22 | Affected by light | uint8_t | 1 byte | 0 = no, 1 = yes |
| 23 | Is a collider | uint8_t | 1 byte | 0 = no, 1 = yes |
| | **Directional lights** | | | (lightsource) |
| 24 | Color | | | |
| 25 | Intensity | | | |
| 26 | Dynamic | | | |
| 27 | Casts shadows | | | |
| 28 | Direction | float array | 3*4 bytes | XYZ vector, normalized |
| | **Point lights** | | | (lightsource) |
| 29 | Color | float array | 3*4 bytes | SRGB color of the light |
| 30 | Intensity | float | 4 bytes | Light intensity |
| 31 | Dynamic | uint8_t | 1 byte | 0 = no, 1 = yes |
| 32 | Casts shadows | uint8_t | 1 byte | 0 = no, 1 = yes |
| 33 | Position | float array | 3*4 bytes | World space position |

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|---|---|---|---|---|
| | **Spot lights** | | | (lightsource) |
| 34 | Color | | | |
| 35 | Intensity | | | |
| 36 | Dynamic | | | |
| 37 | Casts shadows | | | |
| 38 | Position | float array | 3*4 bytes | World space position |
| 39 | Direction | float array | 3*4 bytes | XYZ vector, normalized |
| 40 | Range | float | 4 bytes | World space units |
| 41 | Outer angle | float | 4 bytes | Angle in degrees |
| 42 | Inner angle | float | 4 bytes | Angle in degrees |
| 43 | Projected | uint8_t | 1 byte | 0 = no, 1 = yes |
| 43b | Texture ID | uint16_t | 2 bytes | Projected texture |
| 43c | Up vector | float array | 3*4 bytes | XYZ vector, normalized |
| 43d | Aspect ratio | float | 4 bytes | |
| | **Capsule lights** | | | (lightsource) |
| 44 | Color | | | |
| 45 | Intensity | | | |
| 46 | Dynamic | | | |
| 47 | Casts shadows | | | |
| 48 | Position | float array | 3*4 bytes | World space position |
| 49 | Range | float | 4 bytes | World space units |
| 50 | Direction | float array | 3*4 bytes | XYZ vector, normalized |
| 51 | Length | float | 4 bytes | Following direction vector |
| | | | | |
| | Byte counter | uint32_t | 4 bytes | Checksum |