

E3D 3D Model Encoding

Specifications Draft version 0.1

Contributors

Jérôme Jacovella-St-Louis, Ecere Corporation

Alexis Naveros, Ecere Corporation

jerome@ecere.com

alexis@ecere.com

Example layout of an E3D 3D Model file

cube1.e3d (468 bytes)

```

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
      E 3 D F
0000 [01 00 0C 00 00 00 45 33 44 46]00 01 00 10 B2 01 00 00 10 10
0020 AC 01 00 00 20 10 0A 00 00 00 01 00 00 00 00 20 38 01 00 00
0040 18 00 00 00 00 28 2E 01 00 00 10 20 00 00 00 00 0C 00[00 00
0060 00 BF 00 00 00 BF 00 00 00 BF,00 00 00 3F 00 00 00 BF 00 00
0080 00 BF,00 00 00 3F 00 00 00 3F 00 00 00 BF,00 00 00 BF 00 00
0100 00 3F 00 00 00 BF,00 00 00 BF 00 00 00 BF 00 00 00 3F,00 00
0120 00 3F 00 00 00 BF 00 00 00 3F,00 00 00 3F 00 00 00 3F 00 00
0140 00 3F,00 00 00 BF 00 00 00 3F 00 00 00 3F,00 00 00 BF 00 00
0160 00 BF 00 00 00 BF,00 00 00 3F 00 00 00 BF 00 00 00 BF,00 00
0180 00 3F 00 00 00 3F 00 00 00 BF,00 00 00 BF 00 00 00 3F 00 00
0200 00 BF,00 00 00 BF 00 00 00 BF 00 00 00 3F,00 00 00 3F 00 00
0220 00 BF 00 00 00 3F,00 00 00 3F 00 00 00 3F 00 00 00 3F,00 00
0240 00 BF 00 00 00 3F 00 00 00 3F,00 00 00 BF 00 00 00 BF 00 00
0260 00 BF,00 00 00 3F 00 00 00 BF 00 00 00 BF,00 00 00 3F 00 00
0280 00 3F 00 00 00 BF,00 00 00 BF 00 00 00 3F 00 00 00 BF,00 00
0300 00 BF 00 00 00 BF 00 00 00 3F,00 00 00 3F 00 00 00 BF 00 00
0320 00 3F,00 00 00 3F 00 00 00 3F 00 00 00 3F,00 00 00 BF 00 00
0340 00 3F 00 00 00 3F]30 10 52 00 00 00 0C 00 00 00[11 00,15 00
0360 ,14 00,11 00,14 00,10 00,00 00,03 00,02 00,00 00,02 00,01 00
0380 .16 00,12 00,13 00.16 00,13 00,17 00.05 00,06 00,07 00.05 00
0400 ,07 00,04 00.09 00,0A 00,0E 00.09 00,0E 00,0D 00.0C 00,0F 00
0420 ,0B 00.0C 00,0B 00,08 00]40 10 12 00 00 00 00 00 00 00 0C 00
0440 00 00 00 00 00 00 00 30 16 00 00 00 10 30 10 00 00 00 20 10
0460 0A 00 00 00 01 00 00 00

```

Legend

[01 00]	Block Type	00 00	Interleaved attribute offset/vertex size
0C 00 00 00	Block Size	[...]	Vertex Data
45 33 44 46]	Format Signature	0C 00 00 00	Faces Count
00 01	Version Number	[...]	Faces Data
01 00 00 00	ID		
18 00 00 00	Vertex Count	FacesMaterials:	
10 20	Interleaved attribute type	00 00 00 00	First face Count
		0C 00 00 00	Material ID
		00 00 00 00	

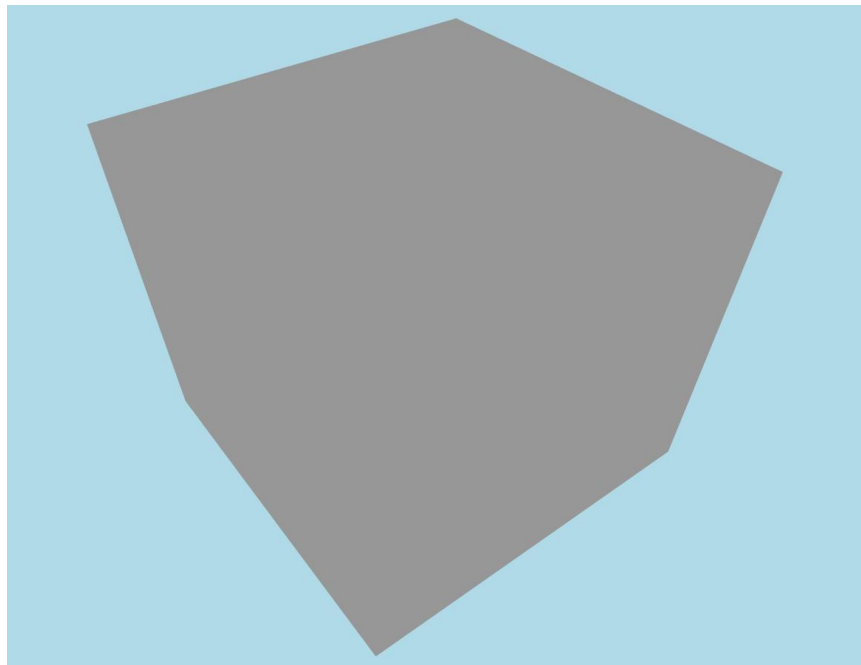
Little-endian throughout (least significant bytes first)

Offset	Block Type	Block Length	Contents	Meaning
0	0x0001 (<i>Version</i>)	0x0000000C (12) bytes [0..11]	E3DF 0x0100 (1, 0)	E3D Version 1.0
12	0x1000 (<i>Meshes</i>)	0x000001B2 (434) bytes [12..445]	<i>sub-blocks</i> : Mesh	1 mesh in this file
18	▶ 0x1010 (<i>Mesh</i>)	0x000001AC (428) bytes [18..445]	<i>sub-blocks</i> : MeshID, Attributes, TriFaces16, FacesMaterials	Mesh description
24	▶▶ 0x1020 (<i>MeshID</i>)	0x0000000A (10) bytes [24..33]	0x00000001	Mesh ID: 1
34	▶▶▶ 0x2000 (<i>Attributes</i>)	0x00000138 (312) bytes [34..345]	0x00000018 (24) <i>sub-blocks</i> : Interleaved	24 vertices, interleaved attributes for each vertex
44	▶▶▶▶ 0x2800 (<i>Interleaved</i>)	0x0000012E (302) bytes [44..345]	0x2010 (<i>Vertices</i>) 0x0000 (0) 0x0000 (0) 0x000C (12) [...vertex data...] (24 vertices)	The interleaved attributes contain only (x,y,z) 32-bit floating-point vertices at offset 0 (0 type ends list of attribute types); for a total of 12 bytes per vertex.
58	Vertex data	(288 bytes) bytes [58..402]	BF000000, BF000000, BF000000, 3F000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, BF000000, 3F000000, BF000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000, BF000000, BF000000, BF000000, 3F000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, BF000000, 3F000000, BF000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000, BF000000, BF000000, BF000000, 3F000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, BF000000, 3F000000, BF000000, BF000000, BF000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000, 3F000000, 3F000000, BF000000, 3F000000, 3F000000,	{-0.5, -0.5, -0.5 }, { 0.5, -0.5, -0.5 }, { 0.5, 0.5, -0.5 }, {-0.5, 0.5, -0.5 }, {-0.5, -0.5, 0.5 }, { 0.5, -0.5, 0.5 }, { 0.5, 0.5, 0.5 }, {-0.5, 0.5, 0.5 }, {-0.5, -0.5, -0.5 }, { 0.5, -0.5, -0.5 }, { 0.5, 0.5, -0.5 }, {-0.5, 0.5, -0.5 }, {-0.5, -0.5, 0.5 }, { 0.5, -0.5, 0.5 }, { 0.5, 0.5, 0.5 }, {-0.5, 0.5, 0.5 }, {-0.5, -0.5, -0.5 }, { 0.5, -0.5, -0.5 }, { 0.5, 0.5, -0.5 }, {-0.5, 0.5, -0.5 }, {-0.5, -0.5, 0.5 }, { 0.5, -0.5, 0.5 }, { 0.5, 0.5, 0.5 }, {-0.5, 0.5, 0.5 }

Although a cube only has 8 vertices, this cube describes 24 vertices so as to be ready for adding additional attributes such as normals, which will differ depending on which face it is being referenced by (because a cube has faces at a square angle and the normals pointing away from the faces are very different therefore not averaged at the shared vertices / corners).

346	▶ 0x1030 (TriFaces16)	0x00000052 (82) bytes [346..427]	0x0000000C (12) [...16-bit tri indices...]	Count of 12 triangle faces described as triplets of indices into attributes (12 faces, 36 indices)
356	<i>Faces data</i>	(72 bytes) bytes [356..427]	0x11, 0x15, 0x14, 0x11, 0x14, 0x10, 0x00, 0x03, 0x02, 0x00, 0x02, 0x01, 0x16, 0x12, 0x13, 0x16, 0x13, 0x17, 0x05, 0x06, 0x07, 0x05, 0x07, 0x04, 0x09, 0x0A, 0x0E, 0x09, 0x0E, 0x0D, 0x0C, 0x0F, 0x0B, 0x0C, 0x0B, 0x08	{ 17, 21, 20 }, { 17,20, 16 }, { 0, 3, 2 }, { 0, 2, 1 }, { 22, 18, 19 }, { 22, 19, 23 }, { 5, 6, 7 }, { 5, 7, 4 }, { 9, 10, 14 }, { 9, 14, 13 }, { 12, 15, 11 }, { 12, 11, 8 } (2 triangles per cube square faces)
428	▶ 0x1040 (Faces Materials)	0x00000012 (18) bytes [428..445]	0x00000000 (0) 0x0000000C (12) 0x00000000 (0)	First face: 0 (indices: × 3) Faces count: 0 (indices: × 3) Material ID: 0 (none)
446	0x3000 (Nodes)	0x00000016 (22) bytes [446..467]	<i>sub-blocks:</i> MeshNode	1 node in this file (instance of a mesh)
452	▶ 0x3010 (MeshNode)	0x00000010 (16) bytes [452..467]	<i>sub-blocks:</i> MeshID	This node references a mesh in the meshes list by ID. Because no transformation is specified, the defaults apply: (1,1,1) scaling; (0,0,0) offset; (w=1,0,0,0) quaternion orientation
458	▶▶ 0x1020 (MeshID)	0x0000000A (10)	0x00000001 (1)	This references mesh ID 1.

cube1.e3d



cube2.e3d (568 bytes) -- This version adds normals to the interleaved attributes
 (with x,y,z packed using 10 bits each)

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	
							E	3	D	F											
0000	[01 00 0C 00 00 00	45 33 44 46]	00 01	00 10	16 02 00 00	10 10															
0020	10 02 00 00	20 10 0A 00 00 00	01 00 00 00	00 20 9C 01 00 00																	
0040	18 00 00 00	00 28 92 01 00 00	10 20 00 00	20 20 0C 00 00 00																	
0060	10 00	[00 00 00 BF 00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0080	00 3F 00 00 00 BF 00 00 00 BF	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0100	00 3F 00 00 00 BF 00 00 00 20	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0120	00 BF 00 00 00 20 00 00 00 BF	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0140	F0 1F 00 00 00 3F 00 00 00 BF	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0160	00 3F 00 00 00 3F 00 00 00 3F	00 00 F0 1F	00 00 00 BF	00 00 00 BF																	
0180	00 3F 00 00 00 3F 00 00 F0 1F	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0200	00 BF 00 02 00 00 00 00 00 3F	00 00 00 BF	00 00 00 BF	00 00 00 BF															FF 01		
0220	00 00 00 00 00 3F 00 00 00 3F	00 00 00 BF	FF 01 00 00 00 00																		
0240	00 BF 00 00 00 3F 00 00 00 BF	00 02 00 00 00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0260	00 BF 00 00 00 3F 00 02 00 00	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0280	00 3F FF 01 00 00 00 00 00 3F	00 00 00 BF	00 00 00 BF	00 00 00 BF															3F FF 01		
0300	00 00 00 00 00 BF 00 00 00 3F	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0320	00 BF 00 00 00 BF 00 00 00 BF	00 00 08 00 00 00 00 3F	00 00 00 BF	00 00 00 BF																	
0340	00 BF 00 00 00 BF 00 00 08 00	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0360	00 BF 00 FC 07 00 00 00 00 BF	00 00 00 BF	00 00 00 BF	00 00 00 BF																FC	
0380	07 00 00 00 00 BF 00 00 00 BF	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0400	00 3F 00 00 00 BF 00 00 00 3F	00 00 08 00 00 00 00 3F	00 00 00 BF	00 00 00 BF																	
0420	00 3F 00 00 00 3F 00 FC 07 00	00 00 00 BF	00 00 00 BF	00 00 00 BF																	
0440	00 3F 00 FC 07 00]	30 10 52 00 00 00	0C 00 00 00	[11 00 15 00																	
0460	14 00 11 00 14 00 10 00 00 00	03 00 02 00 00 00 02 00 01 00																			
0480	16 00 12 00 13 00 16 00 13 00	17 00 05 00 06 00 07 00 05 00																			
0500	07 00 04 00 09 00 0A 00 0E 00	09 00 0E 00 0D 00 0C 00 0F 00																			
0520	0B 00 0C 00 0B 00 08 00]	40 10 12 00 00 00	00 00 00 00	0C 00																	
0540	00 00 00 00 00 00	00 30 16 00 00 00	10 30 10 00 00 00	20 10																	
0560	0A 00 00 00	01 00 00 00																			

The floating-point normal values for the normals are (0 is implied for non-specified component values):

```
{ z = -1.0 }, { z = -1.0 }, { z = -1.0 }, { z = -1.0 },
{ z = 1.0 }, { z = 1.0 }, { z = 1.0 }, { z = 1.0 },
{ x = -1.0 }, { x = 1.0 }, { x = 1.0 }, { x = -1.0 },
{ x = -1.0 }, { x = 1.0 }, { x = 1.0 }, { x = -1.0 },
{ y = -1.0 }, { y = -1.0 }, { y = 1.0 }, { y = 1.0 },
{ y = -1.0 }, { y = -1.0 }, { y = 1.0 }, { y = 1.0 }
```

cube3.e3d (201 bytes) -- This version compresses the data using LZMA (any series of blocks, except the version header block, can be compressed inside an LZMA block). Here the top blocks are compressed in one LZMA block.

```

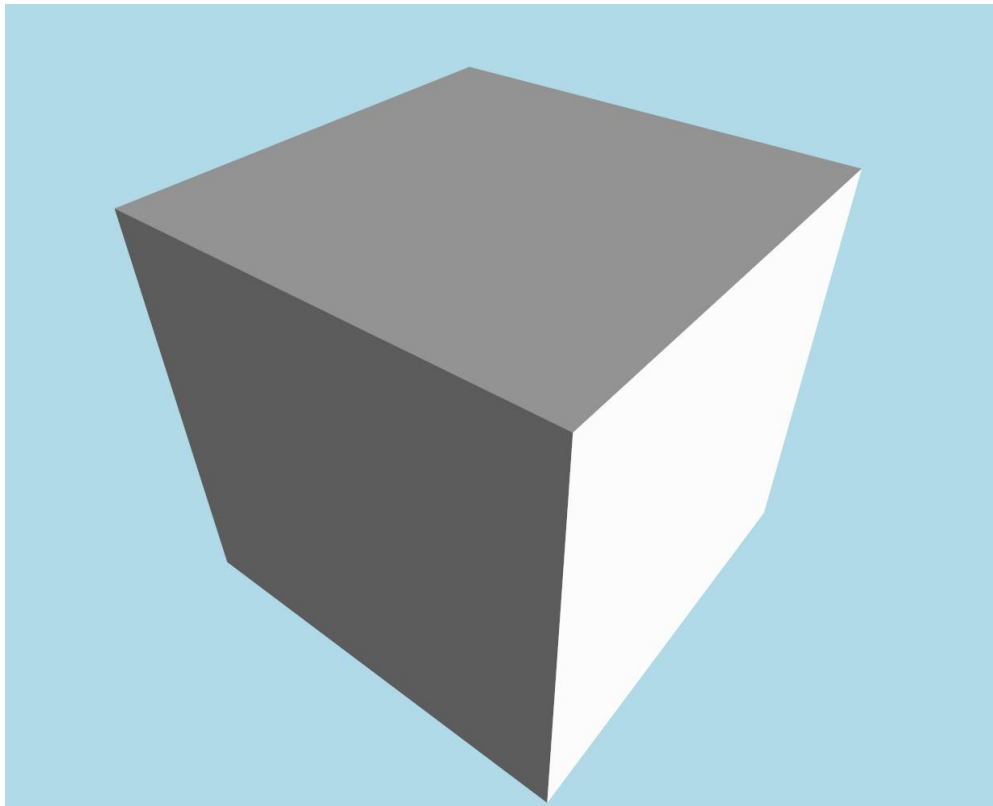
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
      E 3 D F
0000 01 00 0C 00 00 00 45 33 44 46 00 01 10 00 BD 00 00 00 2C 02
0020 00 00 [DC 00 00 00 04 00 00 04 02 B0 15 03 82 28 18 3A 38 A6
0040 99 EC BF 18 10 47 E3 91 48 98 8F 50 22 61 93 3E 8C 6C 88 45
0060 1B FF 72 35 4E 14 9C 47 EF 2C CB 0E F9 9D 2B C7 34 5A 3C 03
0080 20 A6 38 D2 95 83 46 86 AE B5 3D 4C 83 22 EE 11 1A 46 42 C7
0100 52 53 28 12 83 13 D9 BF 2B ED AD B1 68 BF B9 60 DA C7 9D 23
0120 07 73 3A A9 65 B8 6F 82 6D E5 43 57 0B 1D 51 A6 EB 19 D3 68
0140 14 9F DC 26 50 92 3D 9E D4 58 90 95 EF 3B C2 11 C1 85 11 73
0160 D8 4F D2 DC A7 86 8D 3C FA 91 00 8C AB 68 C1 90 73 D7 C9 95
0180 C9 8C A1 60 7F 13 1D 93 5A EC AE AA E9 62 22 F1 06 CB A5 51
0200 41]

```

Legend

[10 00]	Block Type	0x0010 (LZMA)
BD 00 00 00	Block Size	
45 33 44 46]	Format Signature	
00 01	Version Number	
2C 02 00 00	Uncompressed size	0x022C (556 bytes)
[...]	Compressed data (a file with blocks)	12 bytes less (Version block) than 568 bytes of cube2.e3d

cube2.e3d &
cube3.e3d



Detailed description of all block types

Block Type	Value	Other Parent	Children	Description
version	0x0001			uint16: major (high), minor (low)
lzma	0x0010	any	any	size: uint16, compressed data
meshes	0x1000			
▶ mesh	0x1010			
▶ meshID	0x1020	meshNode		
▶ meshBBox	0x1021			float: loX, loY, loZ, hiX, hiY, hiZ
▶ attributes	0x2000			<i>(attribute codes also used for describing interleaved vertices)</i>
▶ vertices	0x2010			
▶ verticesDbl	0x2011			
▶ verticesQ	0x2018			
▶ normals	0x2020			
▶ texCoords	0x2030			
▶ texCoords2	0x2031			
▶ texCoords3	0x2032			
▶ texCoords4	0x2033			
▶ texCoords5	0x2034			
▶ texCoords6	0x2035			
▶ texCoords7	0x2036			
▶ texCoords8	0x2037			
▶ colors	0x2070			
▶ tangentsSign	0x2080			
▶ tangentsBi	0x2081			
▶ skin	0x2090			
▶ interleaved	0x2800			
▶ custom	0x4000: 0x5FFF			
▶ triFaces16	0x1030			
▶ triFaces32	0x1031			
▶ faceMaterials	0x1040			
▶ bones	0x1050			
▶ parts	0x1060			

▶ nodes	0x3000			
▶ meshNode	0x3010			
▶ nodeID	0x3020			
▶ nodeName	0x3021			
▶ scaling	0x3030			
▶ orientation	0x3031			
▶ position	0x3032			
▶ cameraNode	0x3011			
▶ lightNode	0x3012			

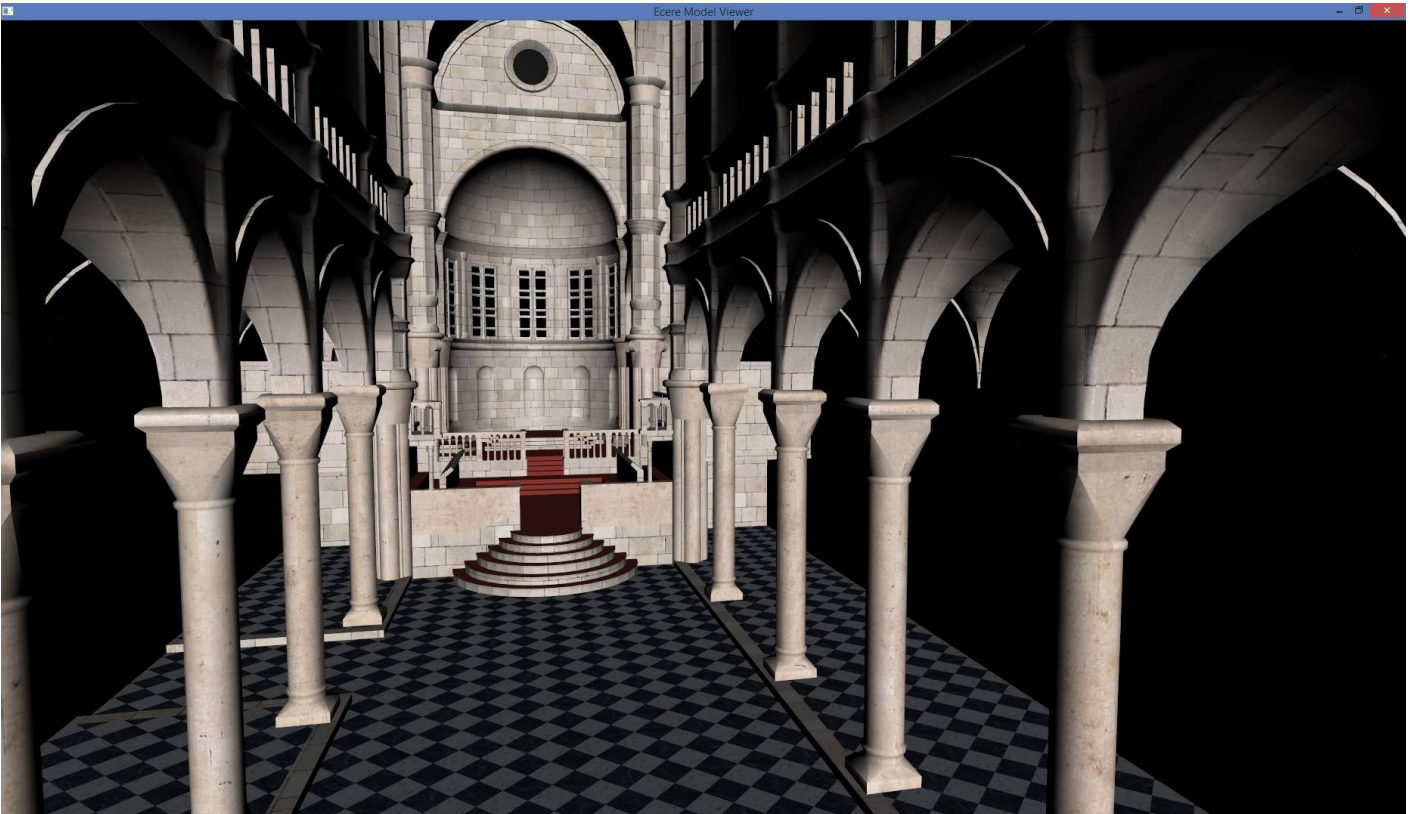
materials	0x8000			
▶ material	0x8010			
▶ materialID	0x8011			
▶ materialName	0x8012			
▶ materialGroup	0x8013			
▶ materialFlags	0x8020			
▶ opacity	0x8021			
▶ refractionRelIndex	0x8022			
▶ reflectivity	0x8023			
▶ phongShininess	0x8024			
▶ diffuse	0x8030			
▶ specular	0x8031			
▶ emissive	0x8032			
▶ ambient	0x8034			
▶ emissiveMap	0x8100			
▶ normalMap	0x8101			
▶ heightMap	0x8102			
▶ ambientOcclusionMap	0x8103			
▶ phongDiffuseMap	0x8200			
▶ phongSpecularMap	0x8201			
▶ phongAmbientMap	0x8202			
▶ pbrRMAbedo	0x8300			
▶ pbrRMRoughnessMetalness	0x8301			
▶ pbrSpecDiffuseMap	0x8400			
▶ pbrSpecSpecularGlossMap	0x8401			
textures	0x9000			
▶ texture	0x9001			
▶ textureID	0x9002			
▶ textureName	0x9003			
▶ texturePNG	0x9101			
▶ textureJPG	0x9102			
▶ textureJPG2K	0x9103			
animations	0xA000			

Sample E3D Models

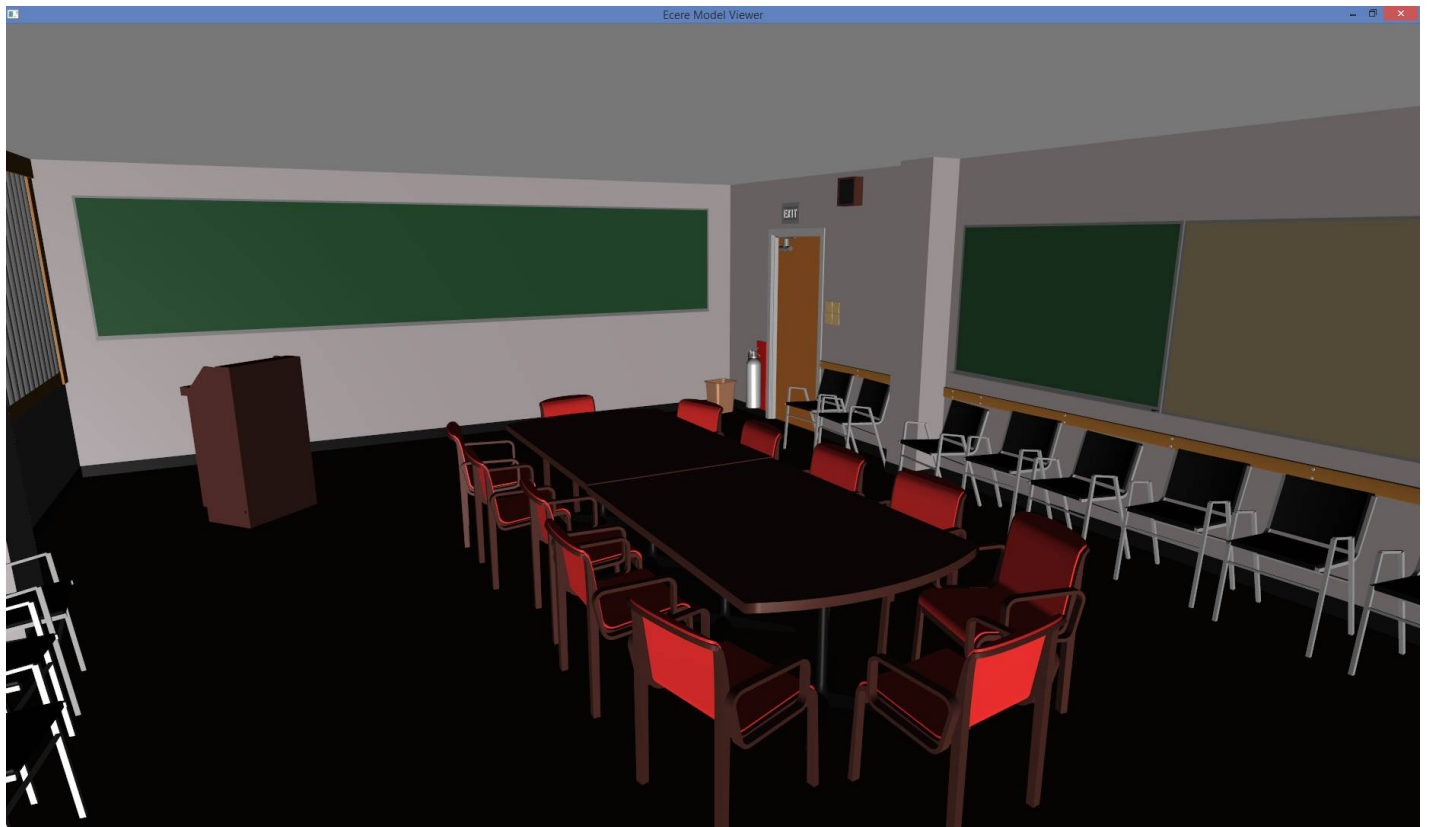




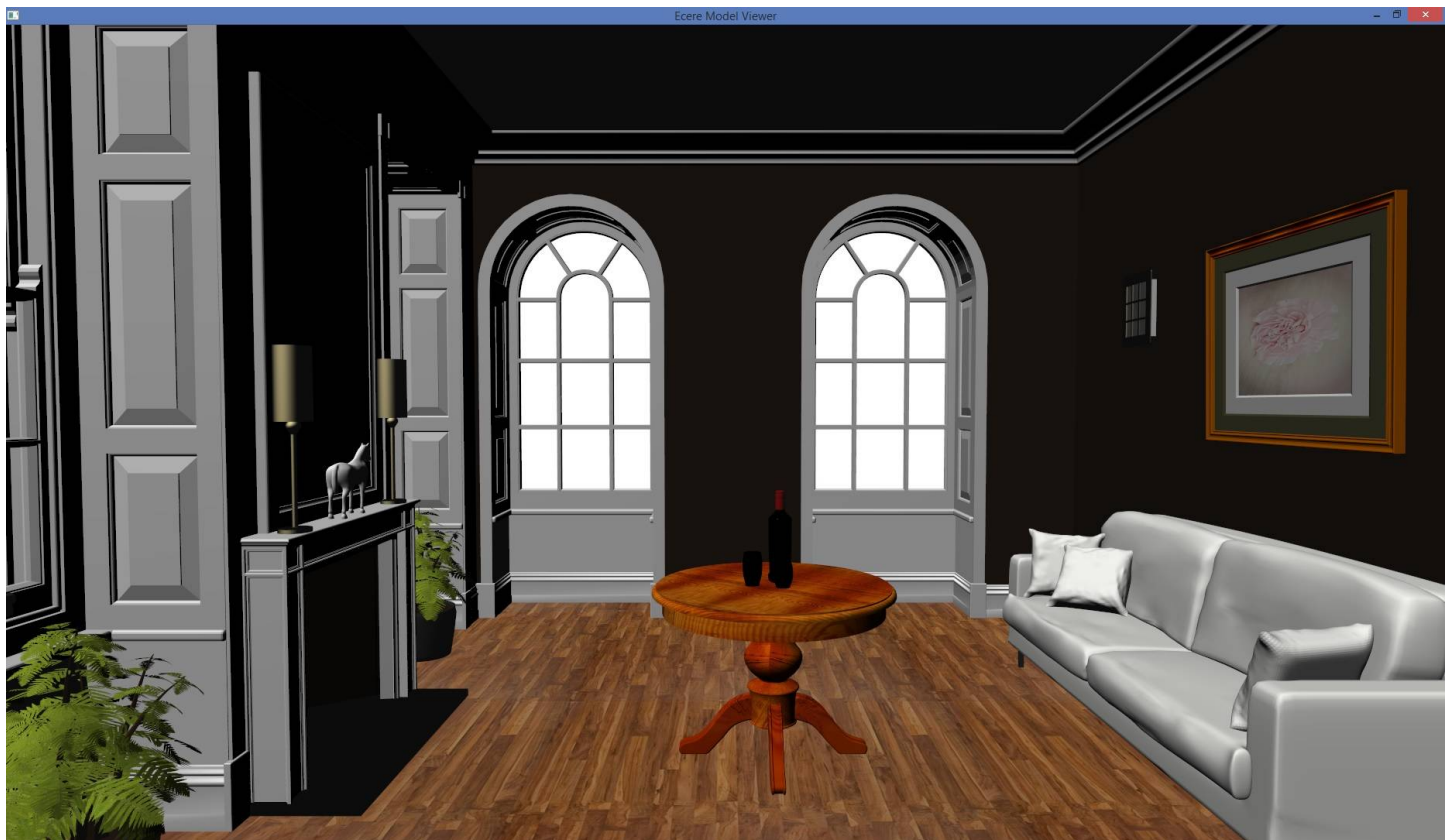
sponza.e3d (14.9 mb - with all textures embedded)



sibenik.e3d (880 kb)



conference.e3d (1.61 mb)



fireplace_room.e3d (2.44 mb)



bedroom.e3d (21.9 mb)

Sources for test 3D Models:

<http://www.crytek.com/cryengine/cryengine3/downloads>

<http://www.alexandre-pestana.com/pbr-textures-sponza/>

<http://casual-effects.com/data/>

<https://github.com/KhronosGroup/glTF-Sample-Models>

[https://github.com/ecere/ecere-sdk/tree/master/samples/3D/ModelViewer/
models](https://github.com/ecere/ecere-sdk/tree/master/samples/3D/ModelViewer/models)

OpenAsset Import Library:

<http://www.assimp.org/>