X3D C/C++/C# Language Bindings (Updates)

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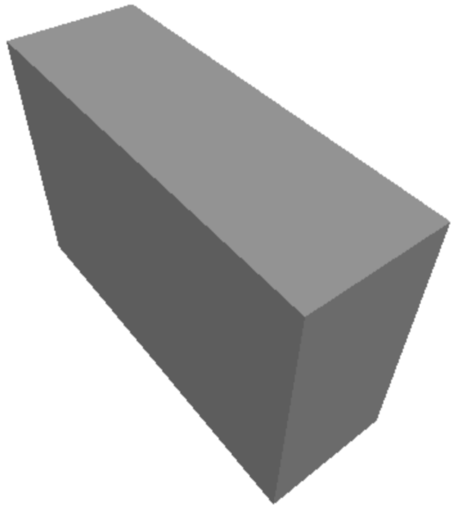
Status of Work

- ISO/IEC 19777-3 X3D C Language Binding
  - NP submitted
- ISO/IEC 19777-4 X3D C++ Language Binding
  - NP submitted
- ISO/IEC 19777-5 X3D C# Language Binding
  - NP vote ended

C/C++/C# Language Binding Concepts

- What is C/C++ / C# language binding?
  - X3D scene access interface using C, C++ and C# languages
    - Specify 19775-2 X3D Scene Access Interface using C, C++, C# languages
  - Development of C, C++/C# programs using X3D data types and functions
  - X3D scene read, update, store, and exchange in C, C++/C# applications
- Scope
  - Provides a browser implementation independent way of accessing a browser's capabilities via the languages
  - Provides a set of implementation independent base classes and interfaces that represent possible interactions with an X3D scene through an SAI
  - Provides a C, C++ and C# API format for X3D scene access

A Simple Example of X3D Scene Access API



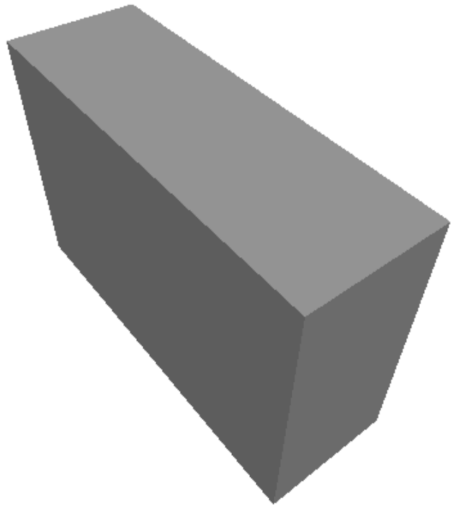
getX3D	setX3D
getScene	setScene
getBackground	setBackground
getViewpoint	setViewpoint
getShape	setShape
getBox	setBox
getApperance	setApperance
getMaterial	setMaterial

X3D Scene Access Interface (SAI)

```
<X3D>
<Scene>
   <Background skyColor='1 1 1'/>
   <Viewpoint description='Book View'
orientation='-0.747 -0.624 -0.231 1.05' position='-
1.81 3.12 2.59'/>
   <Shape>
      <Box size='1 2 3'/>
      <Appearance>
         <Material/>
      </Appearance>
   </Shape>
</Scene>
</X3D>
```

X3D

A Sample of X3D Scene Access API (C++)



getX3D	setX3D
getScene	setScene
getBackground	setBackground
getViewpoint	setViewpoint
getShape	setShape
getBox	setBox
getApperance	setApperance
getMaterial	setMaterial

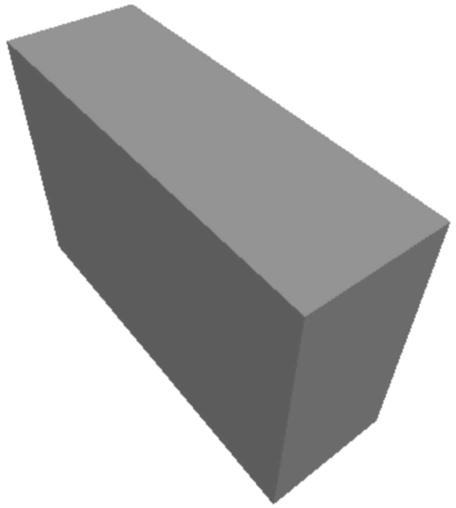
X3D Scene Access Interface (SAI)

```
getX3D (&pX3D)
getScene(&pScene)
getBackground(&pBackground)
getViewpoint(&pViewpoint)
getShape(&pShape)
getBox(&pBox)
getApperance(&pAppearance)
getMaterial(&pMaterial)
```

```
setX3D (pX3D)
setScene(pScene)
setBackground(pBackground)
setViewpoint(pViewpoint)
setShape(pShape)
setBox(pBox)
setApperance(pAppearance)
setMaterial(pMaterial)
```

X3D C++ encoding

A Sample of X3D Scene Access API (C#)



getX3D	setX3D
getScene	setScene
getBackground	setBackground
getViewpoint	setViewpoint
getShape	setShape
getBox	setBox
getApperance	setApperance
getMaterial	setMaterial

X3D Scene Access Interface (SAI)

```
getX3D (pX3D)
getScene(pScene)
getBackground(pBackground)
getViewpoint(pViewpoint)
getShape(pShape)
getBox(pBox)
getApperance(pAppearance)
getMaterial(pMaterial)
```

```
setX3D (pX3D)
setScene(pScene)
setBackground(pBackground)
setViewpoint(pViewpoint)
setShape(pShape)
setBox(pBox)
setApperance(pAppearance)
setMaterial(pMaterial)
```

X3D C# encoding

X3D C++ Binding Viewer Program Example

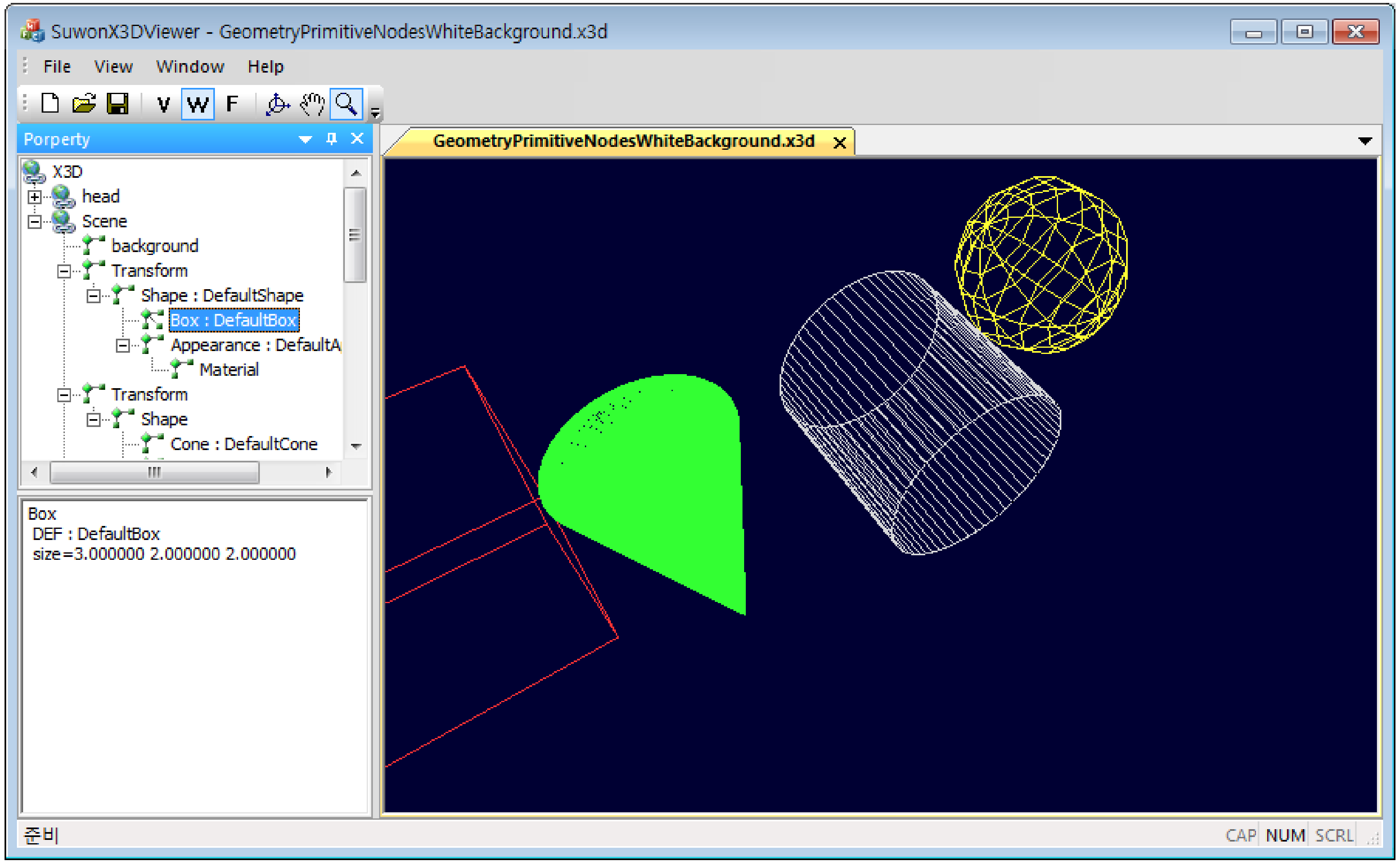
1. SuwonX3DBindingViewer
   1) Load X3DLib.dll
   2) Parse an X3D file with X3DLib
   3) Read, update, draw, and store the X3D file using X3DLib classes

2. X3DLib.dll
   1) Parse an X3D file
   2) Insert the parsed X3D into an internal class
   3) Provide an interface to read X3D

SuwonX3DBindingViewer (X3D C++ Binding Viewer)

X3D Tree View

Property View



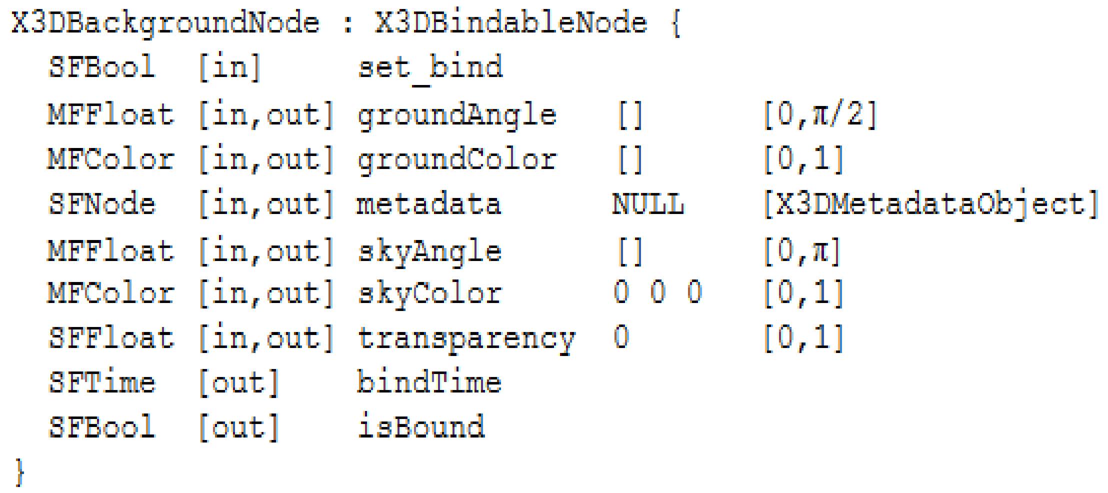
Box
DEF : DefaultBox
size=3.000000 2.000000 2.000000

X3D C++ Binding Class Structure (Partial)

- CX3DLib
  - CX3DScene
    - CBackground
    - CViewpoint
    - CTransform
    - CShape
      - CAppearance
        - CMaterial
      - CX3DGeometryNode
        - CSphere
        - CCylinder
        - CCone
        - CBox
        - IndexedFaceSet

Background

```
//C.3.6 Background
/** Background defines a concrete node interface that extends interface X3DBackgroundNode. */

class AFX_EXT_CLASS CBackground : public CX3DBackgroundNode
{
		DECLARE_DYNAMIC(CBackground);
public:
		CBackground();
		virtual ~CBackground();
//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return array of String results array [] from MFString inputOutput field named "backUrl" */
		CString* getBackUrl ();

		/** Return number of primitive values in "backUrl" array */
		int getNumBackUrl ();

		/** Assign String array [] to MFString inputOutput field named "backUrl" */
		void setBackUrl (CString* values, int size);
```



```
X3DBackgroundNode : X3DBindableNode {
  SFBool  [in]      set_bind
  MFFloat [in,out]  groundAngle   []      [0,π/2]
  MFColor [in,out]  groundColor   []      [0,1]
  SFNode  [in,out]  metadata      NULL    [X3DMetadataObject]
  MFFloat [in,out]  skyAngle      []      [0,π]
  MFColor [in,out]  skyColor      0 0 0   [0,1]
  SFFloat [in,out]  transparency  0       [0,1]
  SFTime  [out]     bindTime
  SFBool  [out]     isBound
}
```

Background

```
/** Assign single String value [] as the MFString array for inputOutput field named "backUrl" */
void setBackUrl (CString value);

/** Return array of String results array [] from MFString inputOutput field named "bottomUrl" */
CString* getBottomUrl ();

/** Return number of primitive values in "bottomUrl" array */
int getNumBottomUrl ();

/** Assign String array [] to MFString inputOutput field named "bottomUrl" */
void setBottomUrl (CString* values, int size);

/** Assign single String value [] as the MFString array for inputOutput field named "bottomUrl" */
void setBottomUrl (CString value);

/** Return array of String results array [] from MFString inputOutput field named "frontUrl" */
CString* getFrontUrl ();

/** Return number of primitive values in "frontUrl" array */
int getNumFrontUrl ();

/** Assign String array [] to MFString inputOutput field named "frontUrl" */
void setFrontUrl (CString* values, int size);
```

Background

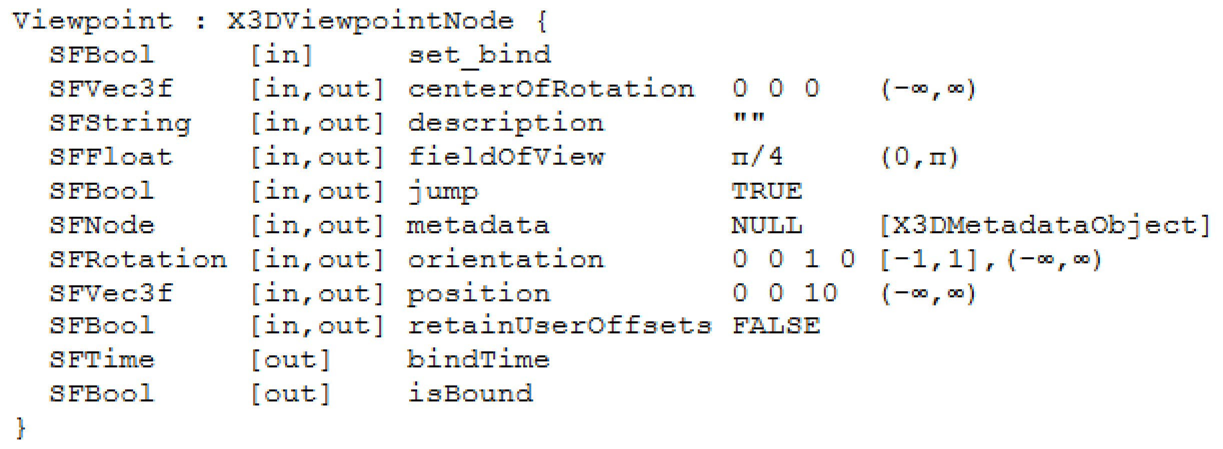
```
/** Assign single String value [] as the MFString array for inputOutput field named "frontUrl" */
void setFrontUrl (CString value);

/** Return array of String results array [] from MFString inputOutput field named "leftUrl" */
CString* getLeftUrl ();

/** Return number of primitive values in "leftUrl" array */
int getNumLeftUrl ();

/** Assign String array [] to MFString inputOutput field named "leftUrl" */
void setLeftUrl (CString* values, int size);

/** Assign single String value [] as the MFString array for inputOutput field named "leftUrl" */
void setLeftUrl (CString value);

/** Return array of String results array [] from MFString inputOutput field named "rightUrl" */
CString* getRightUrl ();

/** Return number of primitive values in "rightUrl" array */
int getNumRightUrl ();

/** Assign String array [] to MFString inputOutput field named "rightUrl" */
void setRightUrl (CString* values, int size);
```

Background

```
        /** Assign single String value [] as the MFString array for inputOutput field named "rightUrl" */
        void setRightUrl (CString value);

        /** Return array of String results array [] from MFString inputOutput field named "topUrl" */
        CString* getTopUrl ();

        /** Return number of primitive values in "topUrl" array */
        int getNumTopUrl ();

        /** Assign String array [] to MFString inputOutput field named "topUrl" */
        void setTopUrl (CString* values, int size);

        /** Assign single String value [] as the MFString array for inputOutput field named "topUrl" */
        void setTopUrl (CString value);
}
```

Viewpoint

```
//C.3.242 Viewpoint
/** Viewpoint defines a concrete node interface that extends interface X3DViewpointNode. */
class AFX_EXT_CLASS CViewpoint : public CX3DViewpointNode
{
		DECLARE_DYNAMIC(CViewpoint);
public:
		CViewpoint();
		virtual ~CViewpoint();
//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return array of 3-tuple float results array in radians from SFVec3f inputOutput field named "centerOfRotation" */
		float* getCenterOfRotation ();

		/** Assign 3-tuple float array in radians to SFVec3f inputOutput field named "centerOfRotation" */
		void setCenterOfRotation (float* value);
```



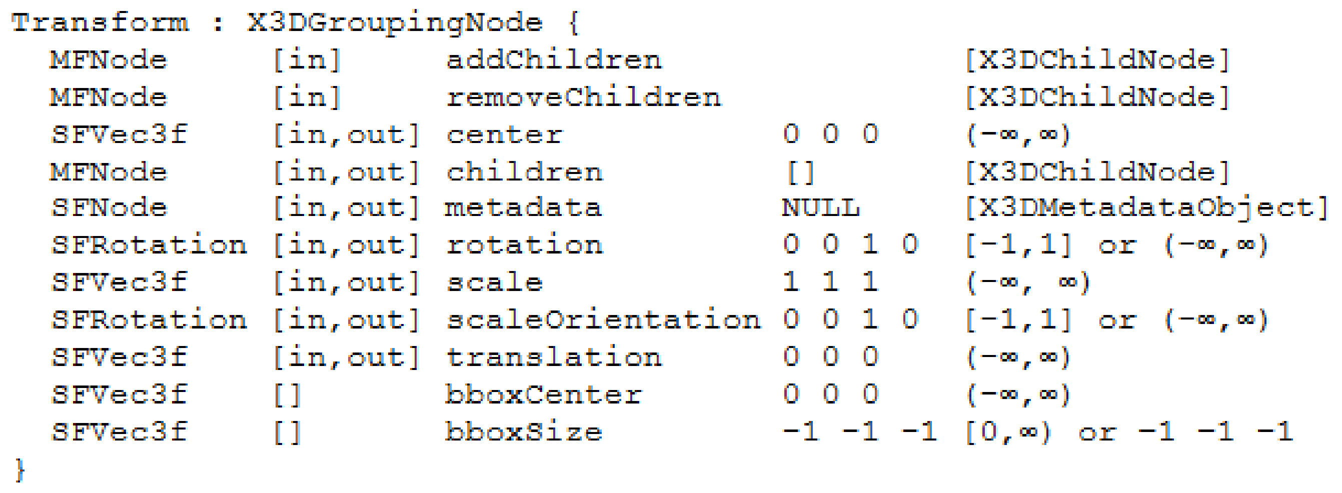
```
Viewpoint : X3DViewpointNode {
  SFBool      [in]     set_bind
  SFVec3f     [in,out] centerOfRotation  0 0 0    (-∞,∞)
  SFString    [in,out] description       ""
  SFFloat     [in,out] fieldOfView       π/4      (0,π)
  SFBool      [in,out] jump              TRUE
  SFNode      [in,out] metadata          NULL     [X3DMetadataObject]
  SFRotation  [in,out] orientation       0 0 1 0  [-1,1],(-∞,∞)
  SFVec3f     [in,out] position          0 0 10   (-∞,∞)
  SFBool      [in,out] retainUserOffsets FALSE
  SFTime      [out]    bindTime
  SFBool      [out]    isBound
}
```

Viewpoint

```
        /** Return float result [] from SFFloat inputOutput field named "fieldOfView" */
        float getFieldOfView ();

        /** Assign float value [] to SFFloat inputOutput field named "fieldOfView" */
        void setFieldOfView (float value);

        /** Return array of 3-tuple float results array [] from SFVec3f inputOutput field named "position" */
        float* getPosition ();

        /** Assign 3-tuple float array [] to SFVec3f inputOutput field named "position" */
        void setPosition (float* value);
}
```

Transform

```
//C.3.232 Transform
/** Transform defines a concrete node interface that extends interface X3DGroupingNode. */

class AFX_EXT_CLASS CTransform : public CX3DGroupingNode
{
        DECLARE_DYNAMIC(CTransform);

public:
        CTransform();
        virtual ~CTransform();

//Implimentation
public:
        virtual void Draw();
        virtual CString toXMLString();
        virtual CString getPropertyString();

        /** Return array of 3-tuple float results array [] from SFVec3f inputOutput field named "center" */
        float* getCenter ();

        /** Assign 3-tuple float array [] to SFVec3f inputOutput field named "center" */
        void setCenter (float* value);
```



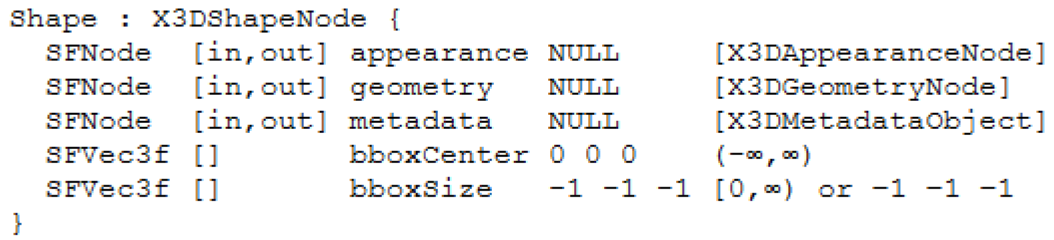
```
Transform : X3DGroupingNode {
  MFNode      [in]     addChildren                      [X3DChildNode]
  MFNode      [in]     removeChildren                   [X3DChildNode]
  SFVec3f     [in,out] center           0 0 0           (-∞,∞)
  MFNode      [in,out] children         []              [X3DChildNode]
  SFNode      [in,out] metadata         NULL            [X3DMetadataObject]
  SFRotation  [in,out] rotation         0 0 1 0         [-1,1] or (-∞,∞)
  SFVec3f     [in,out] scale            1 1 1           (-∞, ∞)
  SFRotation  [in,out] scaleOrientation 0 0 1 0         [-1,1] or (-∞,∞)
  SFVec3f     [in,out] translation      0 0 0           (-∞,∞)
  SFVec3f     []       bboxCenter       0 0 0           (-∞,∞)
  SFVec3f     []       bboxSize         -1 -1 -1        [0,∞) or -1 -1 -1
}
```

Transform

```
        /** Return array of 4-tuple float results array in radians from SFRotation inputOutput field named "rotation" */
        float* getRotation ();

        /** Assign 4-tuple float array in radians to SFRotation inputOutput field named "rotation" */
        void setRotation (float* value);

        /** Return array of 3-tuple float results array [] from SFVec3f inputOutput field named "scale" */
        float* getScale ();

        /** Assign 3-tuple float array [] to SFVec3f inputOutput field named "scale" */
        void setScale (float* value);

        /** Return array of 4-tuple float results array in radians from SFRotation inputOutput field named "scaleOrientation" */
        float* getScaleOrientation ();

        /** Assign 4-tuple float array in radians to SFRotation inputOutput field named "scaleOrientation" */
        void setScaleOrientation (float* value);

        /** Return array of 3-tuple float results array [] from SFVec3f inputOutput field named "translation" */
        float* getTranslation ();

        /** Assign 3-tuple float array [] to SFVec3f inputOutput field named "translation" */
        void setTranslation (float* value);
}
```

Shape

```
//C.3.199 Shape
/** Shape defines a concrete node interface that extends interface X3DShapeNode. */
class AFX_EXT_CLASS CShape : public CX3DShapeNode
{
		DECLARE_DYNAMIC(CShape);
public:
		CShape();
		virtual ~CShape();

//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return X3DAppearanceNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput
field named "appearance" */
		void getAppearance (CX3DNode result);

		/** Assign X3DAppearanceNode value (using a properly typed node) to SFNode inputOutput field named "appearance" */
		void setAppearance (CX3DAppearanceNode node);
```



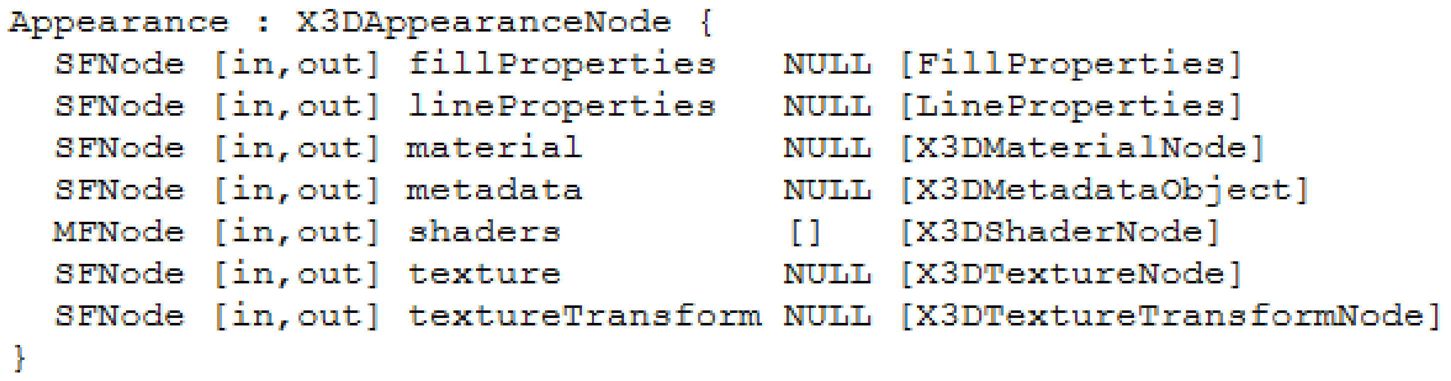
```
Shape : X3DShapeNode {
  SFNode  [in,out] appearance NULL     [X3DAppearanceNode]
  SFNode  [in,out] geometry   NULL     [X3DGeometryNode]
  SFNode  [in,out] metadata   NULL     [X3DMetadataObject]
  SFVec3f []       bboxCenter 0 0 0    (-∞,∞)
  SFVec3f []       bboxSize   -1 -1 -1 [0,∞) or −1 −1 −1
}
```

Shape

```
		/** Assign X3DAppearanceNode value (using a properly typed protoInstance) */
		void setAppearance (CX3DPrototypeInstance protoInstance);

		/** Return X3DGeometryNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field
named "geometry" */
		void getGeometry (CX3DNode result);

		/** Assign X3DGeometryNode value (using a properly typed node) to SFNode inputOutput field named "geometry" */
		void setGeometry (CX3DGeometryNode node);

		/** Assign X3DGeometryNode value (using a properly typed protoInstance) */
		void setGeometry (CX3DPrototypeInstance protoInstance);
}
```

Appearance

```
//C.3.2 Appearance
/** Appearance defines a concrete node interface that extends interface X3DAppearanceNode. */
class AFX_EXT_CLASS CAppearance : public CX3DAppearanceNode
{
            DECLARE_DYNAMIC(CAppearance);
public:
            CAppearance();
            virtual ~CAppearance();

//Implimentation
public:
            virtual void Draw();
            virtual CString toXMLString();
            virtual CString getPropertyString();

            /** Return array of X3DShaderNode results array (using a properly typed node array or X3DPrototypeInstance array) from
MFNode inputOutput field named "shaders" */
            CX3DNode* getShaders ();

            /** Return number of nodes in "shaders" array */
            int getNumShaders ();

            /** Assign X3DShaderNode array (using a properly typed node array) to MFNode inputOutput field named "shaders" */
            void setShaders (CX3DShaderNode* nodes, int size);
```



```
Appearance : X3DAppearanceNode {
  SFNode [in,out] fillProperties   NULL [FillProperties]
  SFNode [in,out] lineProperties   NULL [LineProperties]
  SFNode [in,out] material         NULL [X3DMaterialNode]
  SFNode [in,out] metadata         NULL [X3DMetadataObject]
  MFNode [in,out] shaders          []   [X3DShaderNode]
  SFNode [in,out] texture          NULL [X3DTextureNode]
  SFNode [in,out] textureTransform NULL [X3DTextureTransformNode]
}
```

Appearance

```
        /** Assign single X3DShaderNode value (using a properly typed node) as the MFNode array for inputOutput field named "shaders" */
        void setShaders (CX3DShaderNode node);

        /** Assign X3DShaderNode array (using a properly typed protoInstance array) to MFNode inputOutput field named "shaders" */
        void setShaders (CX3DPrototypeInstance node);

        /** Assign X3DShaderNode array (using a properly typed node array) to MFNode inputOutput field named "shaders" */
        void setShaders (CX3DNode* nodes, int size);

        /** Return FillProperties result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named
"fillProperties" */
        void getFillProperties (CX3DNode result);

        /** Assign FillProperties value (using a properly typed node) to SFNode inputOutput field named "fillProperties" */
        void setFillProperties (CFillProperties node);

        /** Assign FillProperties value (using a properly typed protoInstance) */
        void setFillProperties (CX3DPrototypeInstance protoInstance);

        /** Return LineProperties result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named
"lineProperties" */
        void getLineProperties (CX3DNode result);
```

Appearance

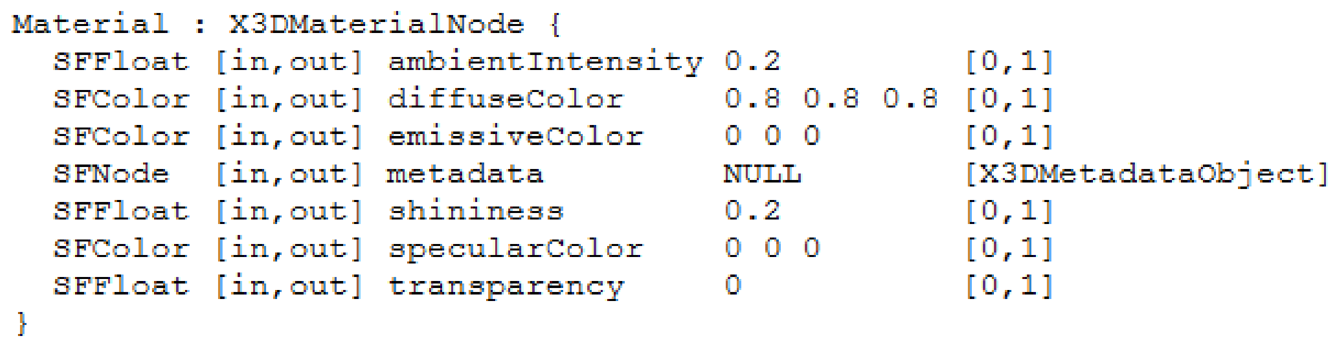
```
        /** Assign LineProperties value (using a properly typed node) to SFNode inputOutput field named "lineProperties" */
        void setLineProperties (CLineProperties node);

        /** Assign LineProperties value (using a properly typed protoInstance) */
        void setLineProperties (CX3DPrototypeInstance protoInstance);

        /** Return X3DMaterialNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named 
"material" */
        void getMaterial (CX3DNode result);

        /** Assign X3DMaterialNode value (using a properly typed node) to SFNode inputOutput field named "material" */
        void setMaterial (CX3DMaterialNode node);

        /** Assign X3DMaterialNode value (using a properly typed protoInstance) */
        void setMaterial (CX3DPrototypeInstance protoInstance);

        /** Return X3DTextureNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named 
"texture" */
        void getTexture (CX3DNode result);

        /** Assign X3DTextureNode value (using a properly typed node) to SFNode inputOutput field named "texture" */
        void setTexture (CX3DTextureNode node);
```

Appearance

```
		/** Assign X3DTextureNode value (using a properly typed protoInstance) */
		void setTexture (CX3DPrototypeInstance protoInstance);

		/** Return X3DTextureTransformNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field
named "textureTransform" */
		void getTextureTransform (CX3DNode result);

		/** Assign X3DTextureTransformNode value (using a properly typed node) to SFNode inputOutput field named "textureTransform" */
		void setTextureTransform (CX3DTextureTransformNode node);

		/** Assign X3DTextureTransformNode value (using a properly typed protoInstance) */
		void setTextureTransform (CX3DPrototypeInstance protoInstance);
}
```

Material

```
//C.3.121 Material
/** Material defines a concrete node interface that extends interface X3DMaterialNode. */
class AFX_EXT_CLASS CMaterial : public CX3DMaterialNode
{
        DECLARE_DYNAMIC(CMaterial);
public:
        CMaterial();
        virtual ~CMaterial();
//Implimentation
public:
        virtual void Draw();
        virtual CString toXMLString();
        virtual CString getPropertyString();

        /** Return float result [] from intensityType type inputOutput field named "ambientIntensity" */
        float getAmbientIntensity ();

        /** Assign float value [] to intensityType type inputOutput field named "ambientIntensity" */
        void setAmbientIntensity (float value);

        /** Return array of 3-tuple float results array using RGB values [0..1] from SFColor inputOutput field named "diffuseColor" */
        float* getDiffuseColor ();
        /** Assign 3-tuple float array using RGB values [0..1] to SFColor inputOutput field named "diffuseColor" */
        void setDiffuseColor (float* color);
```



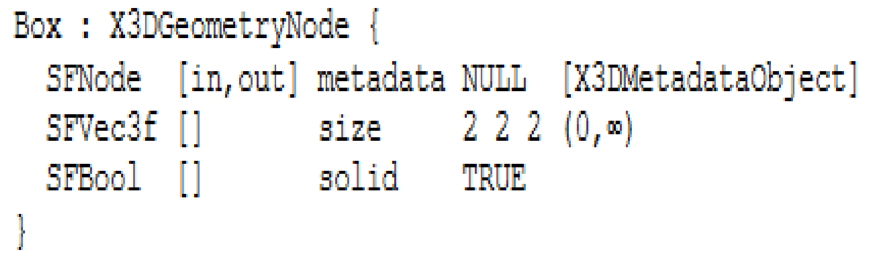
```
Material : X3DMaterialNode {
  SFFloat [in,out] ambientIntensity 0.2         [0,1]
  SFColor [in,out] diffuseColor     0.8 0.8 0.8 [0,1]
  SFColor [in,out] emissiveColor    0 0 0       [0,1]
  SFNode  [in,out] metadata         NULL        [X3DMetadataObject]
  SFFloat [in,out] shininess        0.2         [0,1]
  SFColor [in,out] specularColor    0 0 0       [0,1]
  SFFloat [in,out] transparency     0           [0,1]
}
```

Material

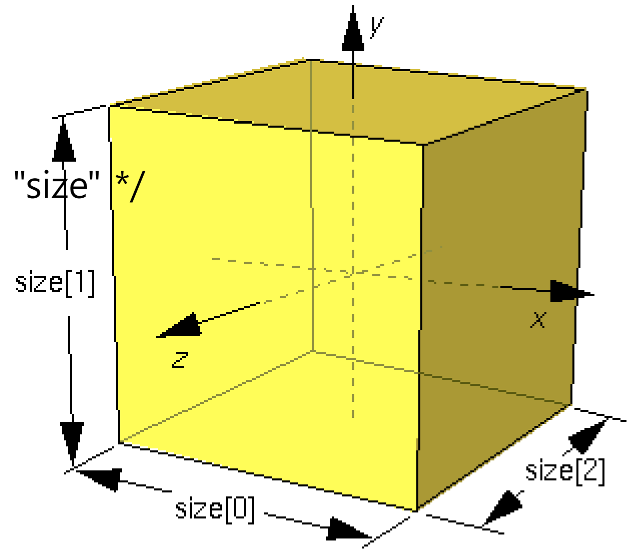
```
        /** Return array of 3-tuple float results array using RGB values [0..1] from SFColor inputOutput field named "emissiveColor" */
        float* getEmissiveColor ();

        /** Assign 3-tuple float array using RGB values [0..1] to SFColor inputOutput field named "emissiveColor" */
        void setEmissiveColor (float* color);

        /** Return float result [] from intensityType type inputOutput field named "shininess" */
        float getShininess ();

        /** Assign float value [] to intensityType type inputOutput field named "shininess" */
        void setShininess (float value);

        /** Return array of 3-tuple float results array using RGB values [0..1] from SFColor inputOutput field named "specularColor" */
        float* getSpecularColor ();

        /** Assign 3-tuple float array using RGB values [0..1] to SFColor inputOutput field named "specularColor" */
        void setSpecularColor (float* color);

        /** Return float result [] from intensityType type inputOutput field named "transparency" */
        float getTransparency ();

        /** Assign float value [] to intensityType type inputOutput field named "transparency" */
        void setTransparency (float value);
}
```

Box

```
//C.3.16 Box
/** Box defines a concrete node interface that extends interface X3DGeometryNode. */
class AFX_EXT_CLASS CBox : public CX3DGeometryNode
{
            DECLARE_DYNAMIC(CBox);
public:
            CBox();
            virtual ~CBox();
//Implimentation
public:
            virtual void Draw();
            virtual CString toXMLString();
            virtual CString getPropertyString();
            /** Return array of 3-tuple float results array [] from SFVec3f initializeOnly field named "size" */
            float* getSize ();
            /** Assign 3-tuple float array [] to SFVec3f initializeOnly field named "size" */
            void setSize (float* value);
            /** Return boolean result from SFBool initializeOnly field named "solid" */
            bool getSolid ();
            /** Assign boolean value to SFBool initializeOnly field named "solid" */
            void setSolid (bool value);
}
```

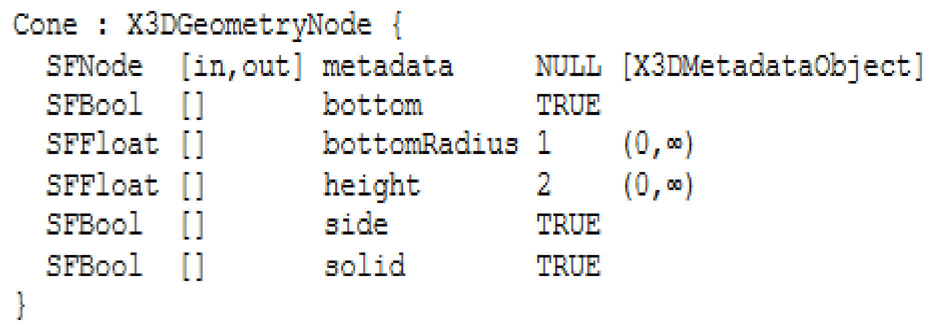


```
Box : X3DGeometryNode {
  SFNode  [in,out] metadata NULL  [X3DMetadataObject]
  SFVec3f []       size     2 2 2 (0,∞)
  SFBool  []       solid    TRUE
}
```



Cone

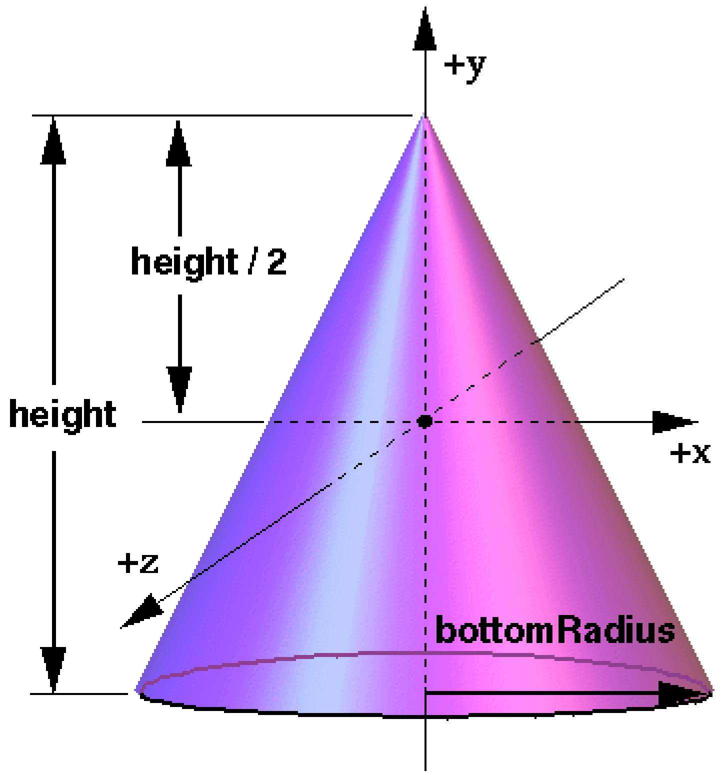
```
//C.3.40 Cone
/** Cone defines a concrete node interface that extends interface X3DGeometryNode. */

class AFX_EXT_CLASS CCone : public CX3DGeometryNode
{
		DECLARE_DYNAMIC(CCone);
public:
		CCone();
		virtual ~CCone();
//Implementation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return float result [] from  type initializeOnly field named "bottomRadius" */
		float getBottomRadius ();

		/** Assign float value [] to  type initializeOnly field named "bottomRadius" */
		void setBottomRadius (float value);
```



```
Cone : X3DGeometryNode {
  SFNode  [in,out] metadata     NULL [X3DMetadataObject]
  SFBool  []       bottom       TRUE
  SFFloat []       bottomRadius 1    (0,∞)
  SFFloat []       height       2    (0,∞)
  SFBool  []       side         TRUE
  SFBool  []       solid        TRUE
}
```

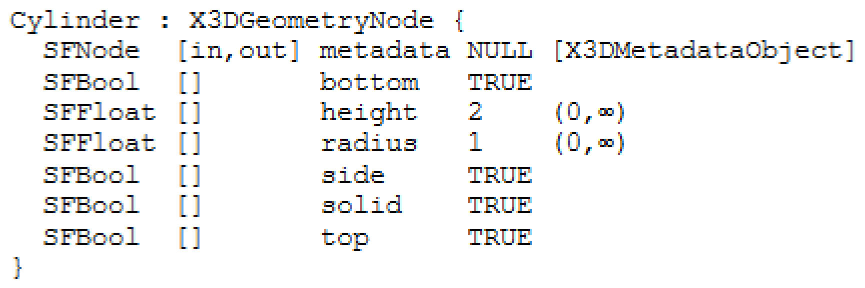
Cone

```
/** Return float result [] from  type initializeOnly field named "height" */
float getHeight ();
/** Assign float value [] to  type initializeOnly field named "height" */
void setHeight (float value);
/** Return boolean result from SFBool initializeOnly field named "side" */
bool getSide ();

/** Assign boolean value to SFBool initializeOnly field named "side" */
void setSide (bool value);

/** Return boolean result from SFBool initializeOnly field named "bottom" */
bool getBottom ();

/** Assign boolean value to SFBool initializeOnly field named "bottom" */
void setBottom (bool value);

/** Return boolean result from SFBool initializeOnly field named "solid" */
bool getSolid ();

/** Assign boolean value to SFBool initializeOnly field named "solid" */
void setSolid (bool value);
}
```



Cylinder

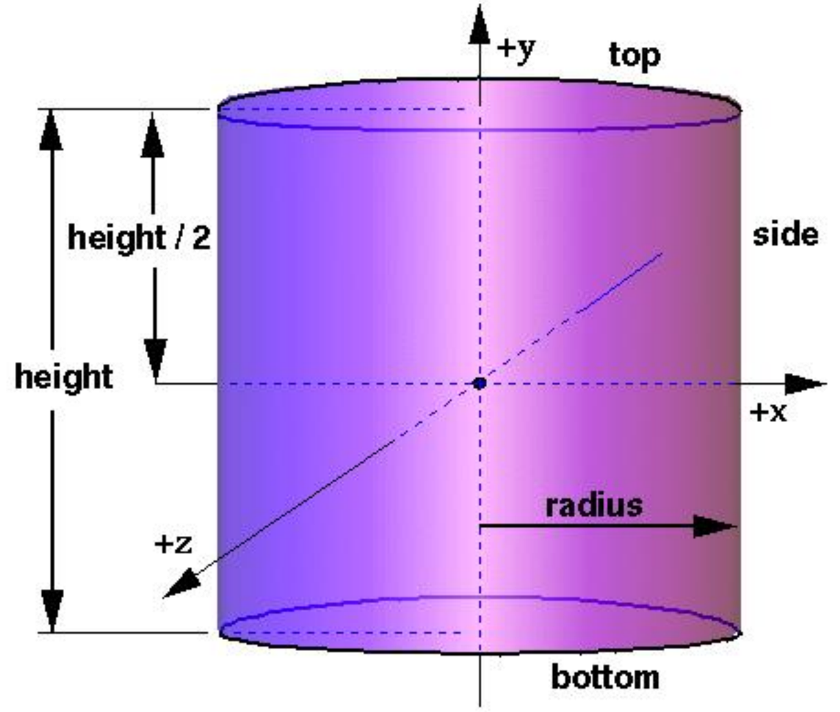
```
//C.3.52 Cylinder
/** Cylinder defines a concrete node interface that extends interface X3DGeometryNode. */

class AFX_EXT_CLASS CCylinder : public CX3DGeometryNode
{
		DECLARE_DYNAMIC(CCylinder);
public:
		CCylinder();
		virtual ~CCylinder();
//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return boolean result from SFBool initializeOnly field named "bottom" */
		bool getBottom ();

		/** Assign boolean value to SFBool initializeOnly field named "bottom" */
		void setBottom (bool value);

		/** Return float result [] from  type initializeOnly field named "height" */
		float getHeight ();
```



```
Cylinder : X3DGeometryNode {
  SFNode   [in,out] metadata NULL [X3DMetadataObject]
  SFBool   []       bottom   TRUE
  SFFloat  []       height   2    (0,∞)
  SFFloat  []       radius   1    (0,∞)
  SFBool   []       side     TRUE
  SFBool   []       solid    TRUE
  SFBool   []       top      TRUE
}
```

Cylinder

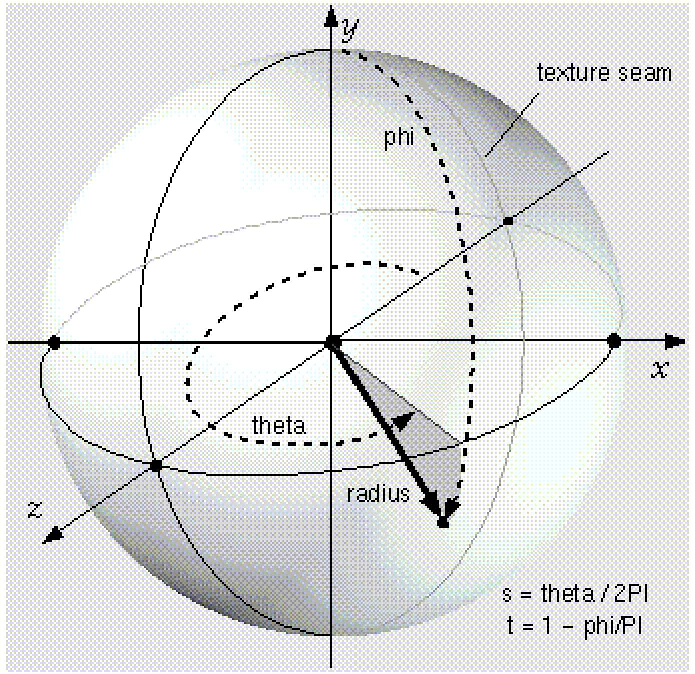
```
        /** Assign float value [] to  type initializeOnly field named "height" */
        void setHeight (float value);
        /** Return float result [] from  type initializeOnly field named "radius" */
        float getRadius ();

        /** Assign float value [] to  type initializeOnly field named "radius" */
        void setRadius (float value);
        /** Return boolean result from SFBool initializeOnly field named "side" */
        bool getSide ();

        /** Assign boolean value to SFBool initializeOnly field named "side" */
        void setSide (bool value);

        /** Return boolean result from SFBool initializeOnly field named "top" */
        bool getTop ();
        /** Assign boolean value to SFBool initializeOnly field named "top" */
        void setTop (bool value);

        /** Return boolean result from SFBool initializeOnly field named "solid" */
        bool getSolid ();
        /** Assign boolean value to SFBool initializeOnly field named "solid" */
        void setSolid (bool value);
}
```



Sphere

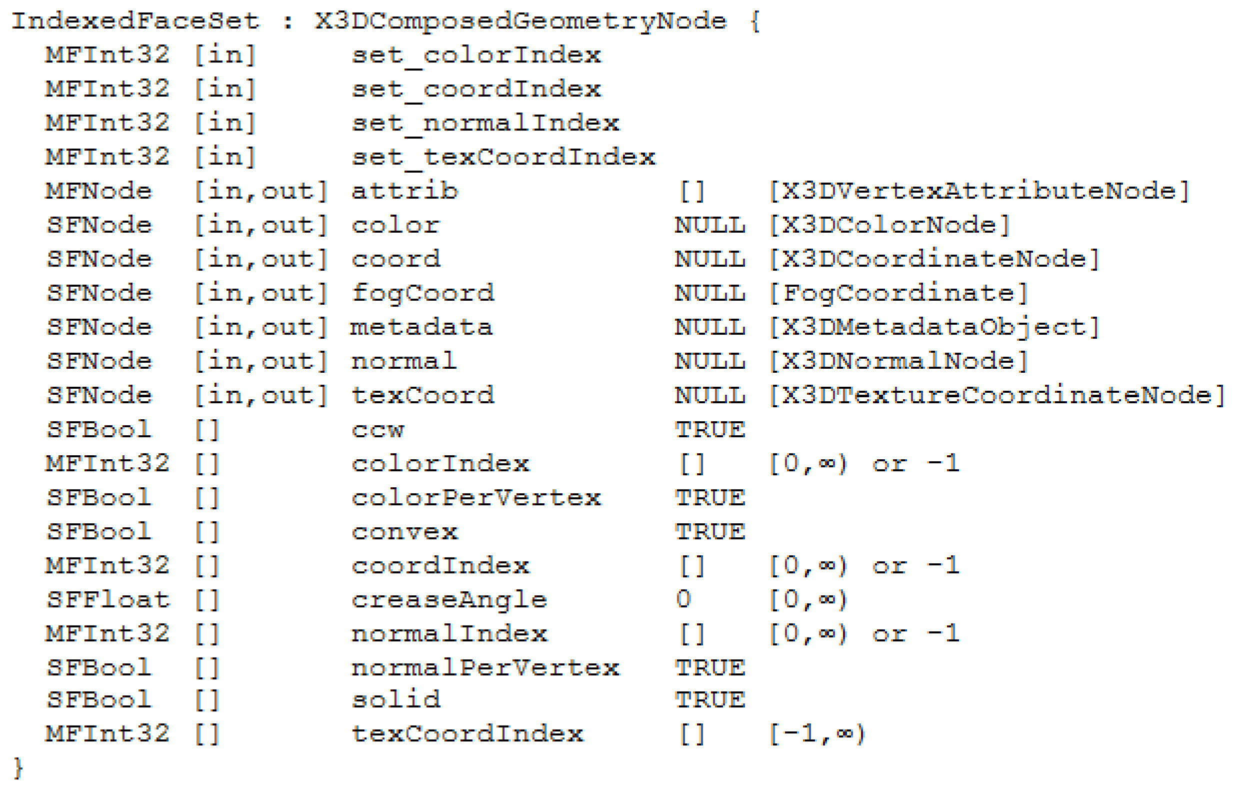
```
//C.3.205 Sphere
/** Sphere defines a concrete node interface that extends interface X3DGeometryNode. */
class AFX_EXT_CLASS CSphere : public CX3DGeometryNode
{
		DECLARE_DYNAMIC(CSphere);
public:
		CSphere();
		virtual ~CSphere();
//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();
		/** Return float result [] from  type initializeOnly field named "radius" */
		float getRadius ();
		/** Assign float value [] to  type initializeOnly field named "radius" */
		void setRadius (float value);
		/** Return boolean result from SFBool initializeOnly field named "solid" */
		bool getSolid ();
		/** Assign boolean value to SFBool initializeOnly field named "solid" */
		void setSolid (bool value);
}
```

```
Sphere : X3DGeometryNode {
  SFNode   [in,out] metadata NULL [X3DMetadataObject]
  SFFloat  []       radius   1    (0,∞)
  SFBool   []       solid    TRUE
}
```



IndexedFaceSet

```
//C.3.98 IndexedFaceSet
/** IndexedFaceSet defines a concrete node interface that extends interface X3DComposedGeometryNode. */

class AFX_EXT_CLASS CIndexedFaceSet : public CX3DComposedGeometryNode
{
        DECLARE_DYNAMIC(CIndexedFaceSet);

public:
        CIndexedFaceSet();
        virtual ~CIndexedFaceSet();

//Implimentation
public:
        virtual void Draw();
        virtual CString toXMLString();
        virtual CString getPropertyString();

        /** Assign MFInt32 value using RGB values [0..1] to
            MFInt32 inputOnly field named "set_colorIndex" */
        void setColorIndex (int32_t* colors, int size);
```



```
IndexedFaceSet : X3DComposedGeometryNode {
  MFInt32 [in]     set_colorIndex
  MFInt32 [in]     set_coordIndex
  MFInt32 [in]     set_normalIndex
  MFInt32 [in]     set_texCoordIndex
  MFNode  [in,out] attrib            []   [X3DVertexAttributeNode]
  SFNode  [in,out] color             NULL [X3DColorNode]
  SFNode  [in,out] coord             NULL [X3DCoordinateNode]
  SFNode  [in,out] fogCoord          NULL [FogCoordinate]
  SFNode  [in,out] metadata          NULL [X3DMetadataObject]
  SFNode  [in,out] normal            NULL [X3DNormalNode]
  SFNode  [in,out] texCoord          NULL [X3DTextureCoordinateNode]
  SFBool  []       ccw               TRUE
  MFInt32 []       colorIndex        []   [0,∞) or -1
  SFBool  []       colorPerVertex    TRUE
  SFBool  []       convex            TRUE
  MFInt32 []       coordIndex        []   [0,∞) or -1
  SFFloat []       creaseAngle       0    [0,∞)
  MFInt32 []       normalIndex       []   [0,∞) or -1
  SFBool  []       normalPerVertex   TRUE
  SFBool  []       solid             TRUE
  MFInt32 []       texCoordIndex     []   [-1,∞)
}
```

IndexedFaceSet

```
/** Assign single SFInt32 value using RGB values [0..1] as the MFInt32 array for inputOnly field named "set_colorIndex" */
void setColorIndex (int32_t color);

/** Assign MFInt32 value [] to MFInt32 inputOnly field named "set_coordIndex" */
void setCoordIndex (int32_t* values, int size);

/** Assign single SFInt32 value [] as the MFInt32 array for inputOnly field named "set_coordIndex" */
void setCoordIndex (int32_t value);

/** Assign MFInt32 value [] to MFInt32 inputOnly field named "set_normalIndex" */
void setNormalIndex (int32_t* values, int size);

/** Assign single SFInt32 value [] as the MFInt32 array for inputOnly field named "set_normalIndex" */
void setNormalIndex (int32_t value);

/** Assign MFInt32 value [] to MFInt32 inputOnly field named "set_texCoordIndex" */
void setTexCoordIndex (int32_t* values, int size);

/** Assign single SFInt32 value [] as the MFInt32 array for inputOnly field named "set_texCoordIndex" */
void setTexCoordIndex (int32_t value);
```

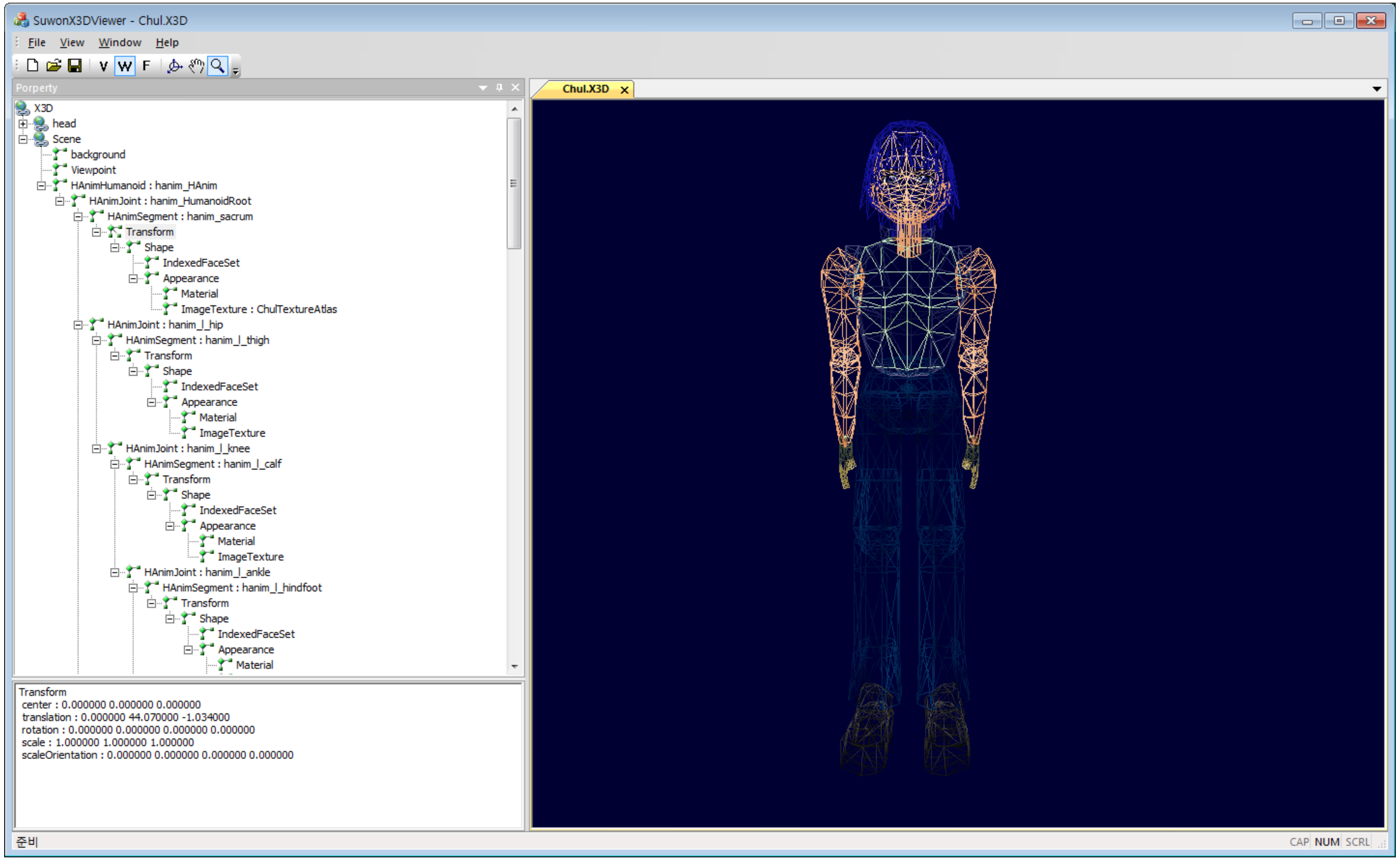
IndexedFaceSet

```
/** Return boolean result from SFBool initializeOnly field named "convex" */
bool getConvex ();

/** Assign boolean value to SFBool initializeOnly field named "convex" */
void setConvex (bool value);

/** Return float result in radians from  type initializeOnly field named "creaseAngle" */
float getCreaseAngle ();

/** Assign float value in radians to  type initializeOnly field named "creaseAngle" */
void setCreaseAngle (float angle);

/** Return MFInt32 result using RGB values [0..1] from MFInt32 initializeOnly field named "colorIndex" */
int32_t* getColorIndex ();

/** Return number of primitive values in "colorIndex" array */
int getNumColorIndex ();

/** Return MFInt32 result [] from MFInt32 initializeOnly field named "coordIndex" */
int32_t* getCoordIndex ();
```

IndexedFaceSet

```
        /** Return number of primitive values in "coordIndex" array */
        int getNumCoordIndex ();

        /** Return MFInt32 result [] from MFInt32 initializeOnly field named "normalIndex" */
        int32_t* getNormalIndex ();

        /** Return number of primitive values in "normalIndex" array */
        int getNumNormalIndex ();

        /** Return MFInt32 result [] from MFInt32 initializeOnly field named "texCoordIndex" */
        int32_t* getTexCoordIndex ();

        /** Return number of primitive values in "texCoordIndex" array */
        int getNumTexCoordIndex ();
}
```

IndexedFaceSet Sample



```
X3D
  head
  Scene
    background
    Viewpoint
    HAnimHumanoid : hanim_HAnim
      HAnimJoint : hanim_HumanoidRoot
        HAnimSegment : hanim_sacrum
          Transform
            Shape
              IndexedFaceSet
              Appearance
                Material
                ImageTexture : ChulTextureAtlas
        HAnimJoint : hanim_l_hip
          HAnimSegment : hanim_l_thigh
            Transform
              Shape
                IndexedFaceSet
                Appearance
                  Material
                  ImageTexture
          HAnimJoint : hanim_l_knee
            HAnimSegment : hanim_l_calf
              Transform
                Shape
                  IndexedFaceSet
                  Appearance
                    Material
                    ImageTexture
            HAnimJoint : hanim_l_ankle
              HAnimSegment : hanim_l_hindfoot
                Transform
                  Shape
                    IndexedFaceSet
                    Appearance
                      Material
```

```
Transform
center : 0.000000 0.000000 0.000000
translation : 0.000000 44.070000 -1.034000
rotation : 0.000000 0.000000 0.000000 0.000000
scale : 1.000000 1.000000 1.000000
scaleOrientation : 0.000000 0.000000 0.000000 0.000000
```

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X3DComposedGeometryNode (IndexedFaceSet Public Node)

```
//B.2.9 X3DComposedGeometryNode
/** X3DComposedGeometryNode defines an abstract node interface that extends interfaces X3DNode.
* Composed geometry nodes produce renderable geometry, can contain Color Coordinate Normal TextureCoordinate, and are contained by a Shape node. */

class AFX_EXT_CLASS CX3DComposedGeometryNode : public CX3DGeometryNode
{
		DECLARE_DYNAMIC(CX3DComposedGeometryNode);

public:
		CX3DComposedGeometryNode();
		virtual ~CX3DComposedGeometryNode();

//Implimentation
public:
		virtual void Draw();
		virtual CString toXMLString();
		virtual CString getPropertyString();

		/** Return bool result from SFBool initializeOnly field named "ccw" */
		bool getCcw ();
```

X3DComposedGeometryNode (IndexedFaceSet Public Node)

```
/** Assign bool value to SFBool initializeOnly field named "ccw" */
void setCcw (bool value);

/** Return bool result from SFBool initializeOnly field named "colorPerVertex" */
bool getColorPerVertex ();

/** Assign bool value to SFBool initializeOnly field named "colorPerVertex" */
void setColorPerVertex (bool color);

/** Return bool result from SFBool initializeOnly field named "normalPerVertex" */
bool getNormalPerVertex ();

/** Assign bool value to SFBool initializeOnly field named "normalPerVertex" */
void setNormalPerVertex (bool value);

/** Return bool result from SFBool initializeOnly field named "solid" */
bool getSolid ();

/** Assign bool value to SFBool initializeOnly field named "solid" */
void setSolid (bool value);
```

X3DComposedGeometryNode (IndexedFaceSet Public Node)

```
		/** Return array of X3DVertexAttributeNode results array (using a properly typed node array or X3DPrototypeInstance array) from MFNode inputOutput field named "attrib" */
		CX3DNode* getAttrib ();

		/** Return number of nodes in "attrib" array */
		int getNumAttrib ();

		/** Assign X3DVertexAttributeNode array (using a properly typed node array) to MFNode inputOutput field named "attrib" */
		void setAttrib (CX3DVertexAttributeNode* nodes);

		/** Assign single X3DVertexAttributeNode value (using a properly typed node) as the MFNode array for inputOutput field named "attrib" */
		void setAttrib (CX3DVertexAttributeNode node);

		/** Assign X3DVertexAttributeNode array (using a properly typed protoInstance array) to MFNode inputOutput field named "attrib" */
		void setAttrib (CX3DPrototypeInstance node);

		/** Assign X3DVertexAttributeNode array (using a properly typed node array) to MFNode inputOutput field named "attrib" */
		void setAttrib (CX3DNode* nodes);

		/** Return X3DColorNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named "color" */
		void getColor (CX3DNode result);
```

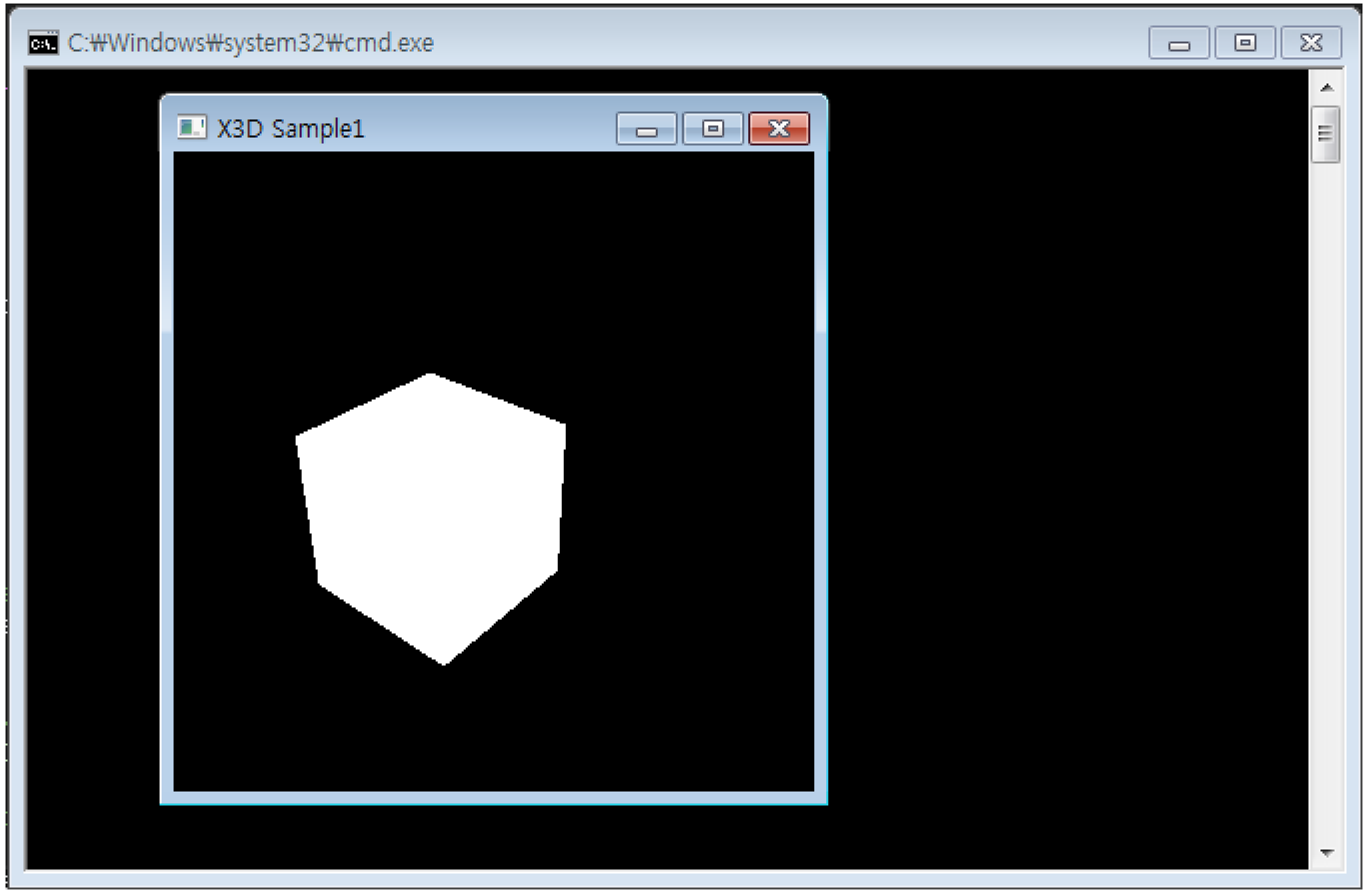
X3DComposedGeometryNode (IndexedFaceSet Public Node)

```
		/** Assign X3DColorNode value (using a properly typed node) to SFNode inputOutput field named "color" */
		void setColor (CX3DColorNode color);

		/** Assign X3DColorNode value (using a properly typed protoInstance) */
		void setColor (CX3DPrototypeInstance protoInstance);

		/** Return X3DCoordinateNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named
"coord" */
		//CX3DNode* getCoord ();
		void getCoord (CX3DNode result);

		/** Assign X3DCoordinateNode value (using a properly typed node) to SFNode inputOutput field named "coord" */
		void setCoord (CX3DCoordinateNode node);

		/** Assign X3DCoordinateNode value (using a properly typed protoInstance) */
		void setCoord (CX3DPrototypeInstance protoInstance);

		/** Return FogCoordinate result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named
"fogCoord" */
		void getFogCoord (CX3DNode result);

		/** Assign FogCoordinate value (using a properly typed node) to SFNode inputOutput field named "fogCoord" */
		void setFogCoord (CFogCoordinate node);
```

X3DComposedGeometryNode (IndexedFaceSet Public Node)

```
        /** Assign FogCoordinate value (using a properly typed protoInstance) */
        void setFogCoord (CX3DPrototypeInstance protoInstance);

        /** Return X3DNormalNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field named
"normal" */
        //CX3DNode* getNormal ();
        void getNormal (CX3DNode result);

        /** Assign X3DNormalNode value (using a properly typed node) to SFNode inputOutput field named "normal" */
        void setNormal (CX3DNormalNode node);

        /** Assign X3DNormalNode value (using a properly typed protoInstance) */
        void setNormal (CX3DPrototypeInstance protoInstance);

        /** Return X3DTextureCoordinateNode result (using a properly typed node or X3DPrototypeInstance) from SFNode inputOutput field
named "texCoord" */
        void getTexCoord (CX3DNode result);

        /** Assign X3DTextureCoordinateNode value (using a properly typed node) to SFNode inputOutput field named "texCoord" */
        void setTexCoord (CX3DTextureCoordinateNode node);

        /** Assign X3DTextureCoordinateNode value (using a properly typed protoInstance) */
        void setTexCoord (CX3DPrototypeInstance protoInstance);
}
```

X3D C++ Binding Sample



X3D C++ Binding Sample Source (Win32)

```
#include <glut.h>
#include "..₩X3DLib₩X3DLib.h"

#ifdef _DEBUG
#define new DEBUG_NEW
#endif


CWinApp theApp;
using namespace std;
CX3DScene* m_pScene = NULL;

void changeSize(int w, int h) {

    if(h == 0)
        h = 1;

    float ratio = 1.0* w / h;

    // Reset the coordinate system before modifying
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h);
```

Include GLUT Library

Include X3D C++ Library

X3D C++ Binding Sample Source (Win32)

```
// Set the correct perspective.
    gluPerspective(45,ratio,1,1000);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
    gluLookAt(5.0,5.0,5.0,
              0.0,0.0,-1.0,
              0.0f,1.0f,0.0f);
}

void DrawNode(CX3DNode *pNode)
{
        if(pNode==NULL)
                return;

        ::glPushMatrix();
        if (pNode->isType(NODE_SHAPE))
                ((CX3DShapeNode*)pNode)->geometry->Draw();

        ::glPopMatrix();
}

void renderScene(void)
{
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
    glPushMatrix();
```

X3D C++ Binding Sample Source (Win32)

```
int nCount = m_pScene->m_Objects.GetCount();
		for(int i=0; i<nCount; i++)
		{
			CX3DNode* pChild =(CX3DNode*)(m_pScene->m_Objects).GetAt(i);
			if (pChild)
				DrawNode(pChild);
		}

  glPopMatrix();
  glutSwapBuffers();
}


void initialize(void)
{
		m_pScene = new CX3DScene();

		CX3DShapeNode* shape = new CX3DShapeNode;
		CBox* box = new CBox;
		shape->setGeometry((CX3DGeometryNode*)box);

		m_pScene->AddNode(shape, NULL);
}
```

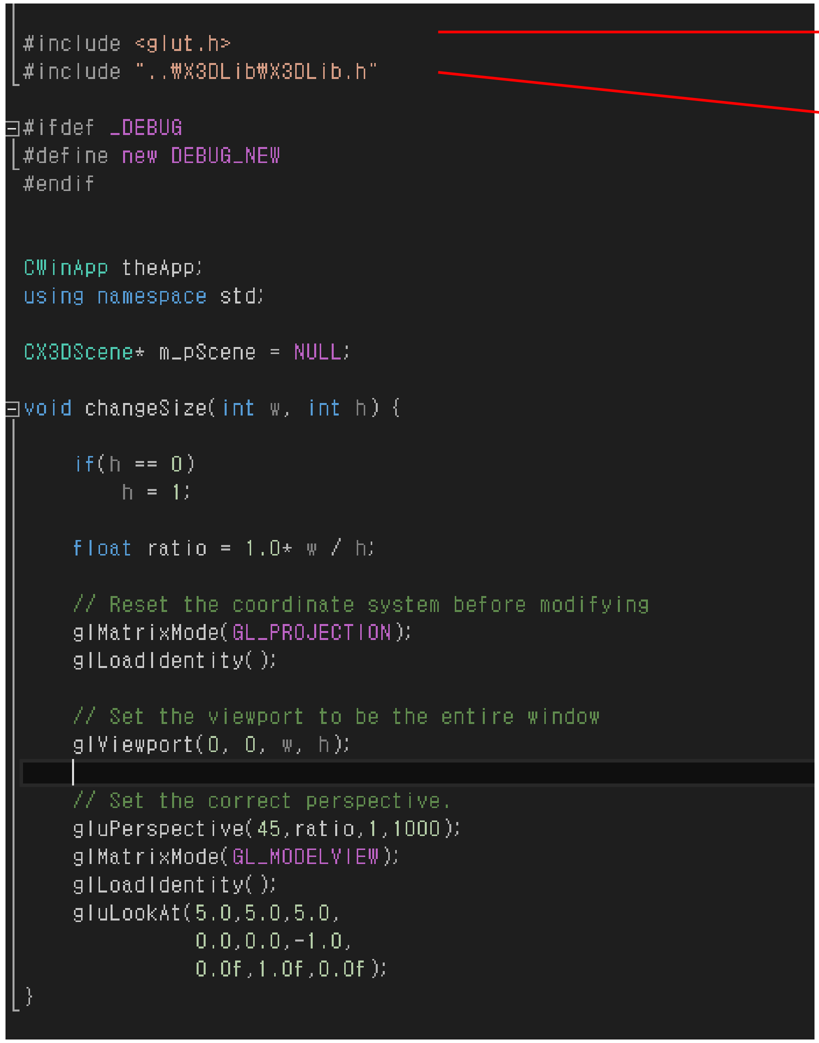
X3D C++ Binding Sample Source (Win32)

```
int _tmain(int argc, TCHAR* argv[], TCHAR* envp[])
{
		int nRetCode = 0;

		HMODULE hModule = ::GetModuleHandle(NULL);

		if (hModule != NULL)
		{
				if (!AfxWinInit(hModule, NULL, ::GetCommandLine(), 0))
				{
						_tprintf(_T("심각한 오류: MFC를 초기화하지 못했습니다.₩n"));
						nRetCode = 1;
				}
				else
				{
						glutInit(&argc, argv);
						glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA);
						glutInitWindowPosition(100,100);
						glutInitWindowSize(320,320);
						glutCreateWindow("X3D Sample1");

						initialize();

						glutDisplayFunc(renderScene);
						glutIdleFunc(renderScene);
						glutReshapeFunc(changeSize);
```

X3D C++ Binding Sample Source (Win32)

```
                                        glutMainLoop();
                              }
                    }
          else
                    {
                              _tprintf(_T("심각한 오류: GetModuleHandle 실패₩n"));
                              nRetCode = 1;
                    }


                    return nRetCode;
}
```

X3D C++ Binding Sample Source (Win32)



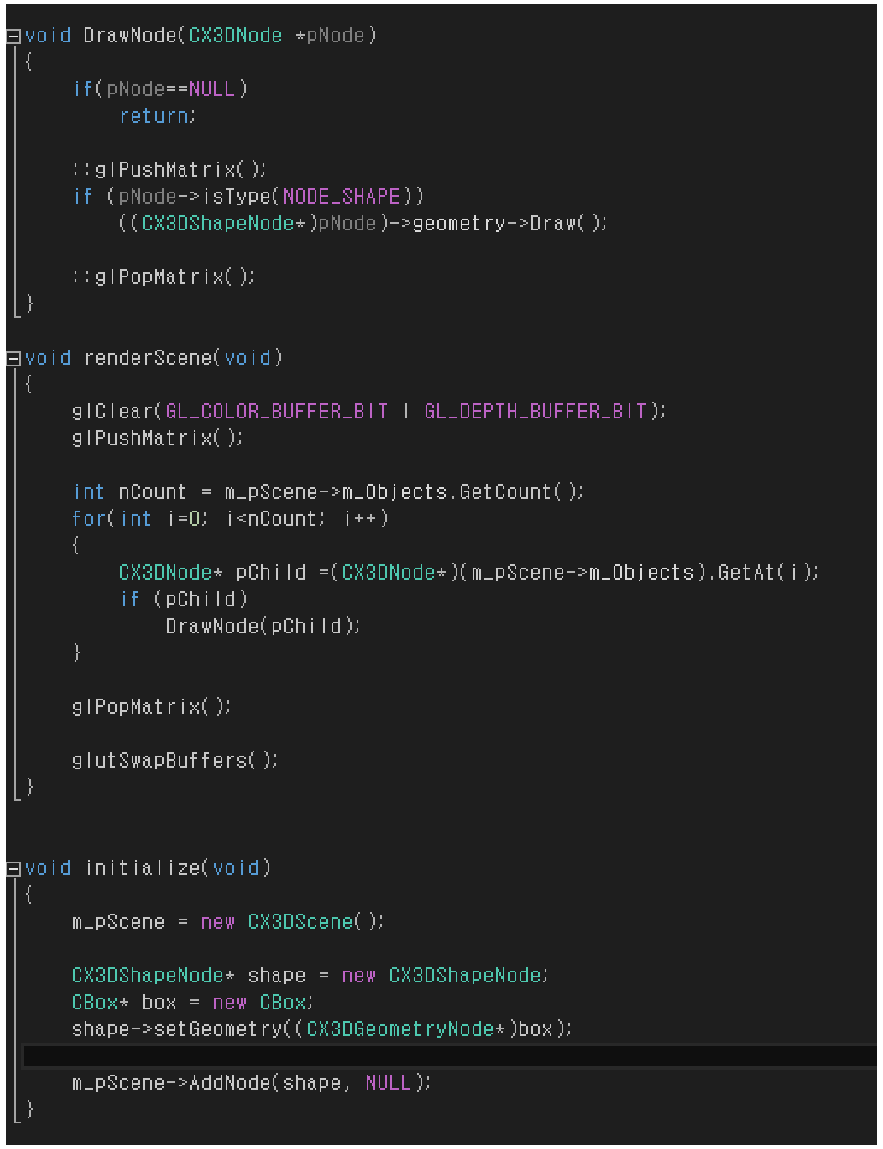
```
#include <glut.h>
#include "..₩X3DLib₩X3DLib.h"

#ifdef _DEBUG
#define new DEBUG_NEW
#endif


CWinApp theApp;
using namespace std;

CX3DScene* m_pScene = NULL;

void changeSize(int w, int h) {

    if(h == 0)
        h = 1;

    float ratio = 1.0* w / h;

    // Reset the coordinate system before modifying
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();

    // Set the viewport to be the entire window
    glViewport(0, 0, w, h);

    // Set the correct perspective.
    gluPerspective(45,ratio,1,1000);
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
    gluLookAt(5.0,5.0,5.0,
              0.0,0.0,-1.0,
              0.0f,1.0f,0.0f);
}
```

Include GLUT Library

Include X3D C++ Library

Window size changed

X3D C++ Binding Sample Source (Win32)



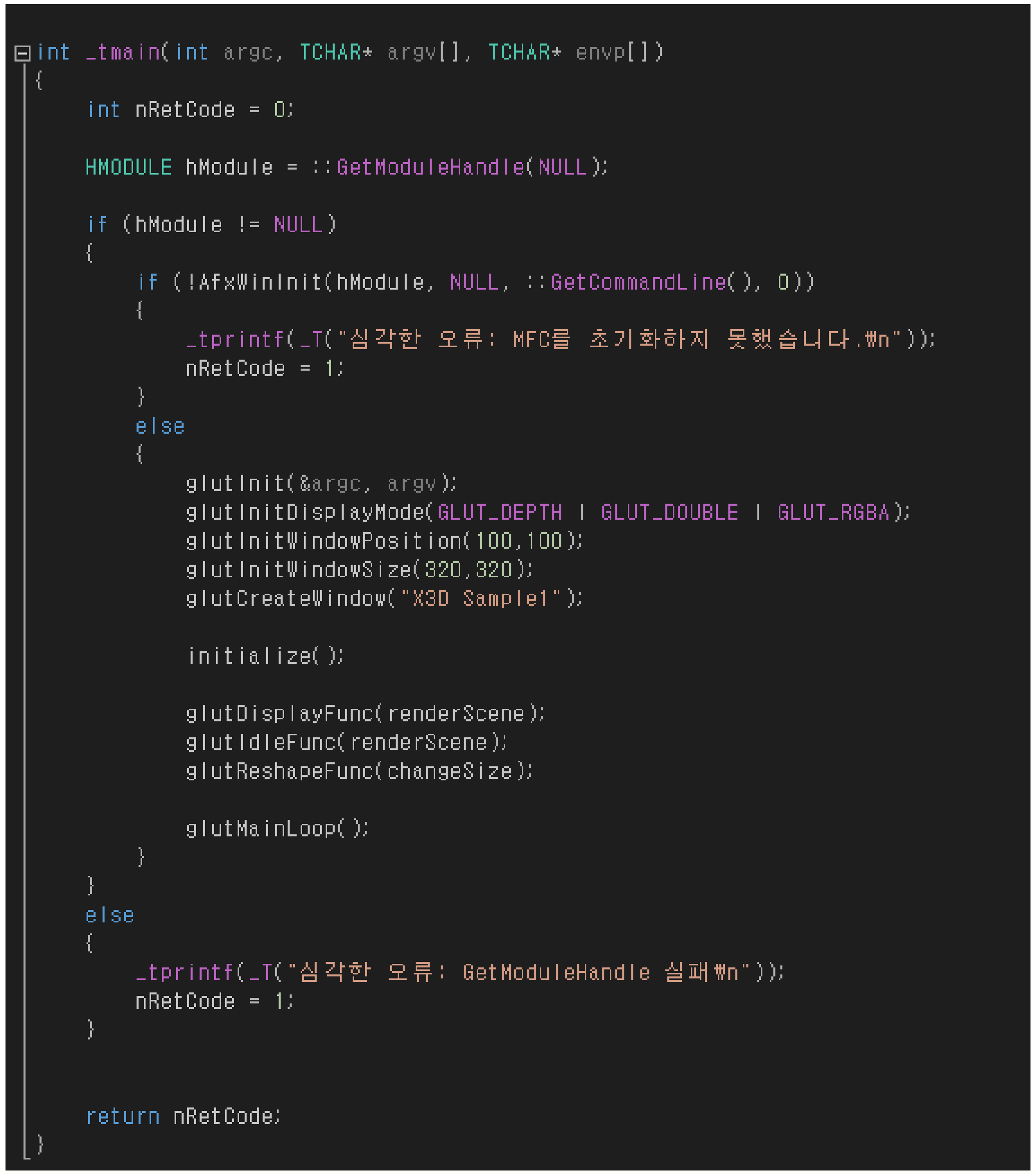
```
void DrawNode(CX3DNode *pNode)
{
    if(pNode==NULL)
        return;

    ::glPushMatrix();
    if (pNode->isType(NODE_SHAPE))
        ((CX3DShapeNode*)pNode)->geometry->Draw();

    ::glPopMatrix();
}

void renderScene(void)
{
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);
    glPushMatrix();

    int nCount = m_pScene->m_Objects.GetCount();
    for(int i=0; i<nCount; i++)
    {
        CX3DNode* pChild =(CX3DNode*)(m_pScene->m_Objects).GetAt(i);
        if (pChild)
            DrawNode(pChild);
    }

    glPopMatrix();

    glutSwapBuffers();
}


void initialize(void)
{
    m_pScene = new CX3DScene();

    CX3DShapeNode* shape = new CX3DShapeNode;
    CBox* box = new CBox;
    shape->setGeometry((CX3DGeometryNode*)box);

    m_pScene->AddNode(shape, NULL);
}
```

Draw a Box

Draw Child Nodes

Create a Box

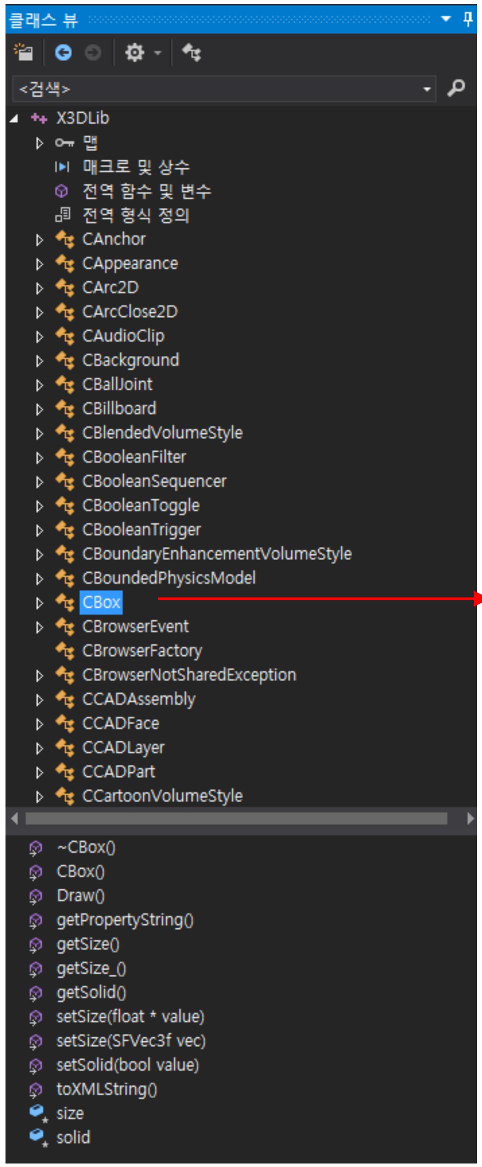
X3D C++ Binding Sample Source (Win32)



```
int _tmain(int argc, TCHAR* argv[], TCHAR* envp[])
{
    int nRetCode = 0;

    HMODULE hModule = ::GetModuleHandle(NULL);

    if (hModule != NULL)
    {
        if (!AfxWinInit(hModule, NULL, ::GetCommandLine(), 0))
        {
            _tprintf(_T("심각한 오류: MFC를 초기화하지 못했습니다.₩n"));
            nRetCode = 1;
        }
        else
        {
            glutInit(&argc, argv);
            glutInitDisplayMode(GLUT_DEPTH | GLUT_DOUBLE | GLUT_RGBA);
            glutInitWindowPosition(100,100);
            glutInitWindowSize(320,320);
            glutCreateWindow("X3D Sample1");

            initialize();

            glutDisplayFunc(renderScene);
            glutIdleFunc(renderScene);
            glutReshapeFunc(changeSize);

            glutMainLoop();
        }
    }
    else
    {
        _tprintf(_T("심각한 오류: GetModuleHandle 실패₩n"));
        nRetCode = 1;
    }


    return nRetCode;
}
```

Create a Window and initialization

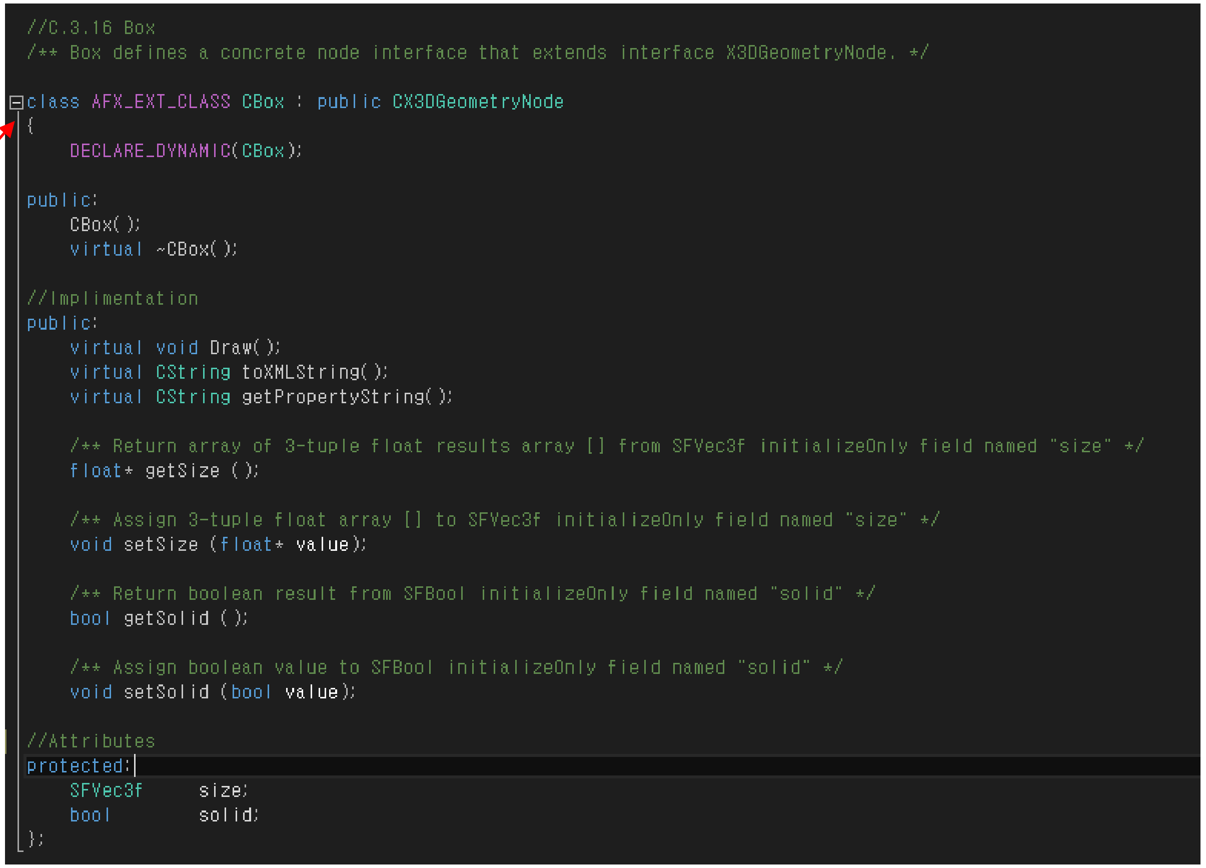
X3D C++ Library



```
클래스 뷰
<검색>
X3DLib
  맵
  매크로 및 상수
  전역 함수 및 변수
  전역 형식 정의
  CAnchor
  CAppearance
  CArc2D
  CArcClose2D
  CAudioClip
  CBackground
  CBallJoint
  CBillboard
  CBlendedVolumeStyle
  CBooleanFilter
  CBooleanSequencer
  CBooleanToggle
  CBooleanTrigger
  CBoundaryEnhancementVolumeStyle
  CBoundedPhysicsModel
  CBox
  CBrowserEvent
  CBrowserFactory
  CBrowserNotSharedException
  CCADAssembly
  CCADFace
  CCADLayer
  CCADPart
  CCartoonVolumeStyle

~CBox()
CBox()
Draw()
getPropertyString()
getSize()
getSize_()
getSolid()
setSize(float * value)
setSize(SFVec3f vec)
setSolid(bool value)
toXMLString()
size
solid
```

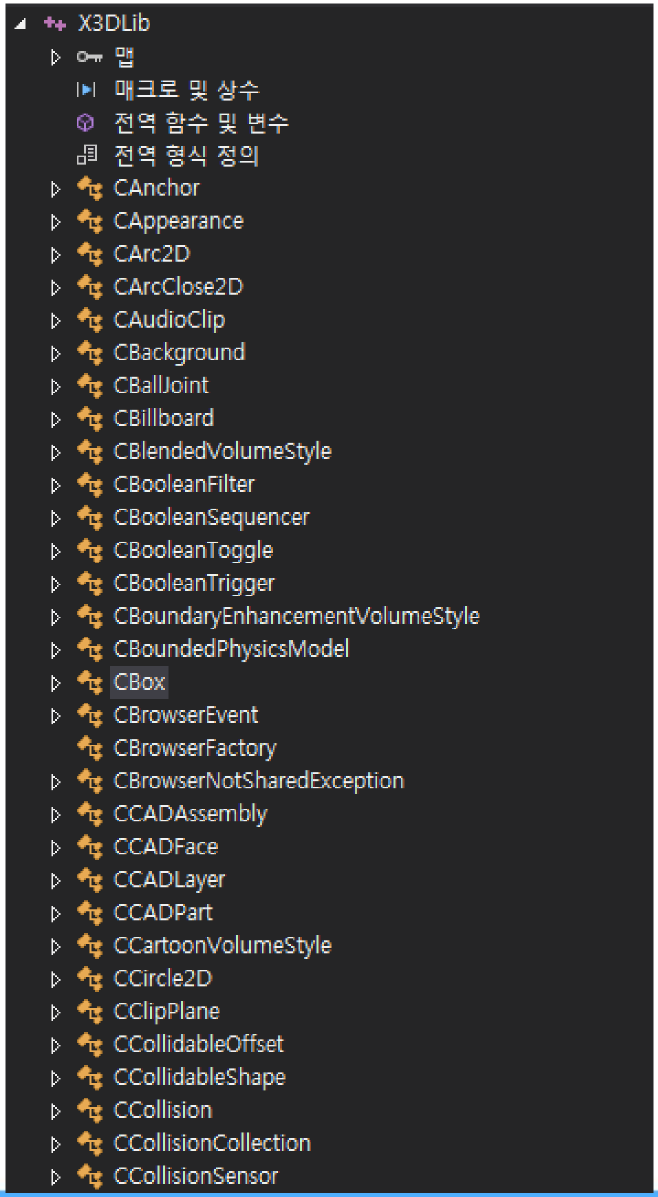
Box Node CBox Class

CBox Class function

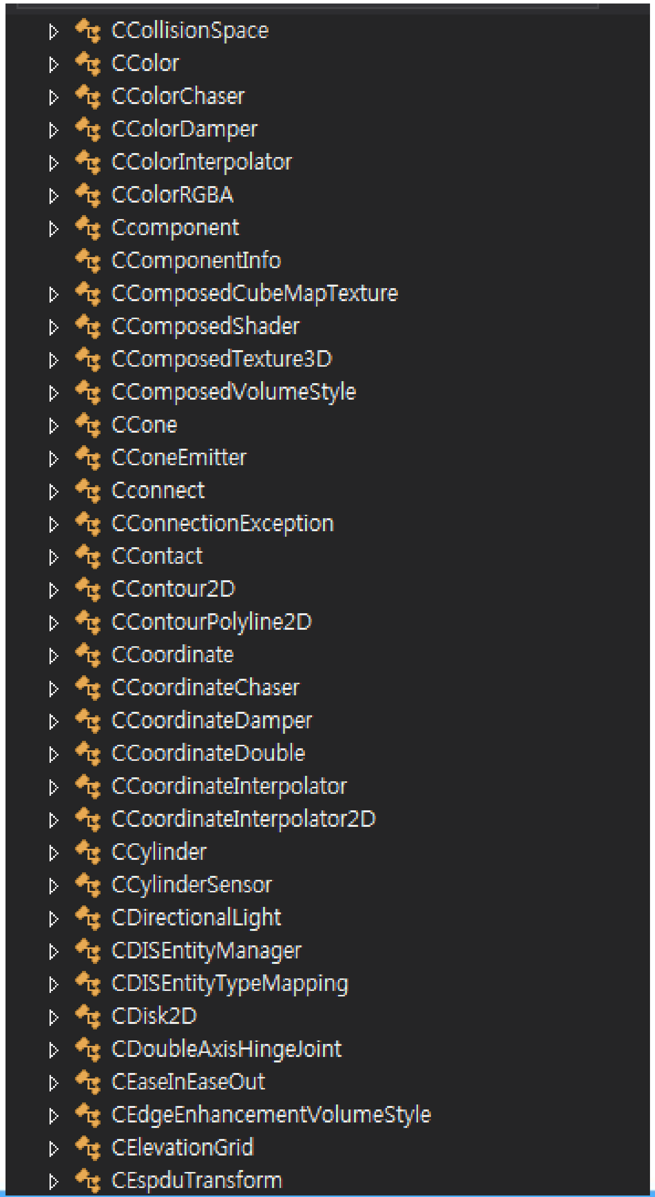


```cpp
//C.3.16 Box
/** Box defines a concrete node interface that extends interface X3DGeometryNode. */

class AFX_EXT_CLASS CBox : public CX3DGeometryNode
{
    DECLARE_DYNAMIC(CBox);

public:
    CBox( );
    virtual ~CBox( );

//Implimentation
public:
    virtual void Draw( );
    virtual CString toXMLString( );
    virtual CString getPropertyString( );

    /** Return array of 3-tuple float results array [] from SFVec3f initializeOnly field named "size" */
    float* getSize ( );

    /** Assign 3-tuple float array [] to SFVec3f initializeOnly field named "size" */
    void setSize (float* value);

    /** Return boolean result from SFBool initializeOnly field named "solid" */
    bool getSolid ( );

    /** Assign boolean value to SFBool initializeOnly field named "solid" */
    void setSolid (bool value);

//Attributes
protected:
    SFVec3f     size;
    bool        solid;
};
```

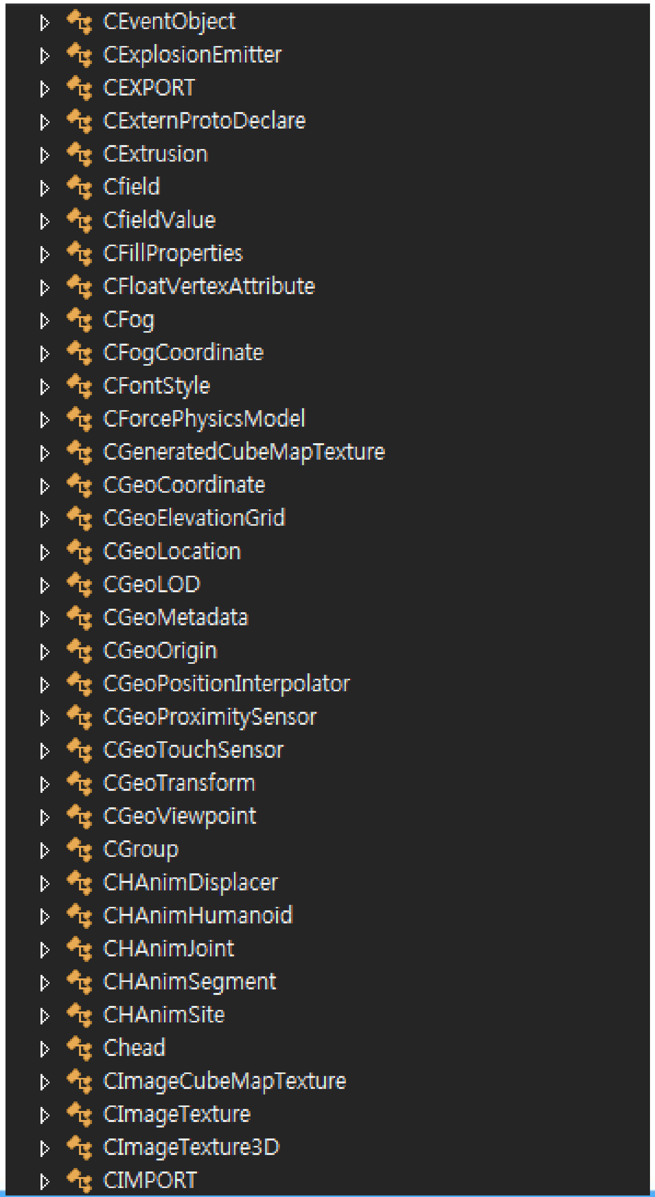
X3D C++ Library



X3DLib
- 맵
- 매크로 및 상수
- 전역 함수 및 변수
- 전역 형식 정의
- CAnchor
- CAppearance
- CArc2D
- CArcClose2D
- CAudioClip
- CBackground
- CBallJoint
- CBillboard
- CBlendedVolumeStyle
- CBooleanFilter
- CBooleanSequencer
- CBooleanToggle
- CBooleanTrigger
- CBoundaryEnhancementVolumeStyle
- CBoundedPhysicsModel
- CBox
- CBrowserEvent
- CBrowserFactory
- CBrowserNotSharedException
- CCADAssembly
- CCADFace
- CCADLayer
- CCADPart
- CCartoonVolumeStyle
- CCircle2D
- CClipPlane
- CCollidableOffset
- CCollidableShape
- CCollision
- CCollisionCollection
- CCollisionSensor

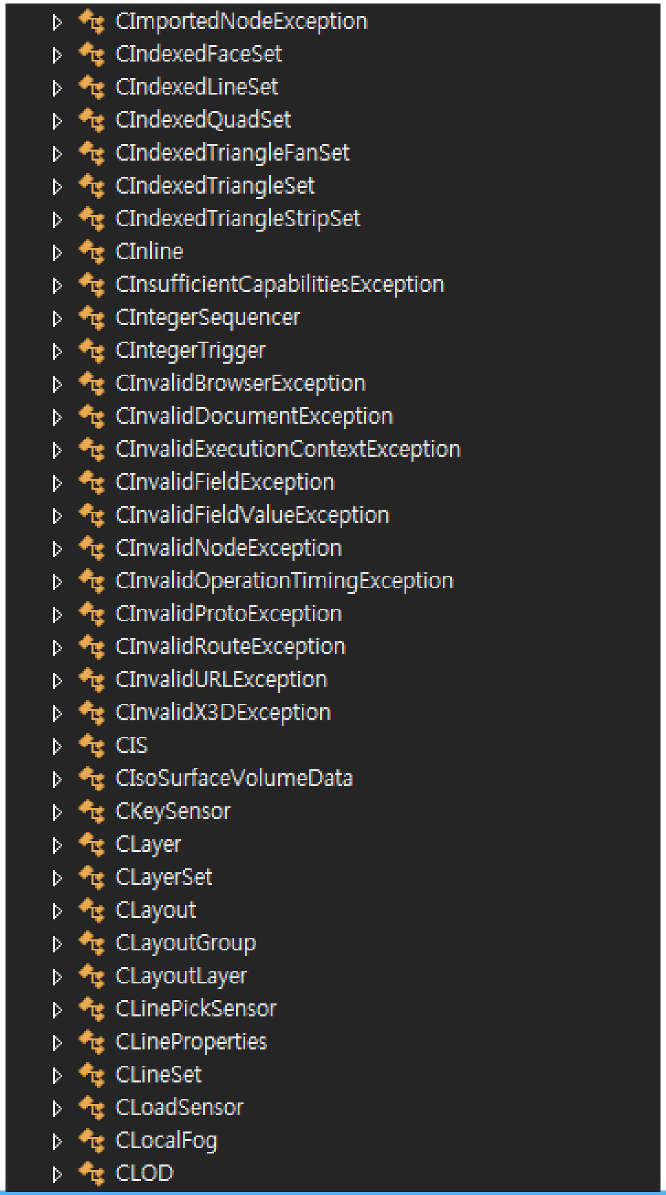


- CCollisionSpace
- CColor
- CColorChaser
- CColorDamper
- CColorInterpolator
- CColorRGBA
- Ccomponent
- CComponentInfo
- CComposedCubeMapTexture
- CComposedShader
- CComposedTexture3D
- CComposedVolumeStyle
- CCone
- CConeEmitter
- Cconnect
- CConnectionException
- CContact
- CContour2D
- CContourPolyline2D
- CCoordinate
- CCoordinateChaser
- CCoordinateDamper
- CCoordinateDouble
- CCoordinateInterpolator
- CCoordinateInterpolator2D
- CCylinder
- CCylinderSensor
- CDirectionalLight
- CDISEntityManager
- CDISEntityTypeMapping
- CDisk2D
- CDoubleAxisHingeJoint
- CEaseInEaseOut
- CEdgeEnhancementVolumeStyle
- CElevationGrid
- CEspduTransform

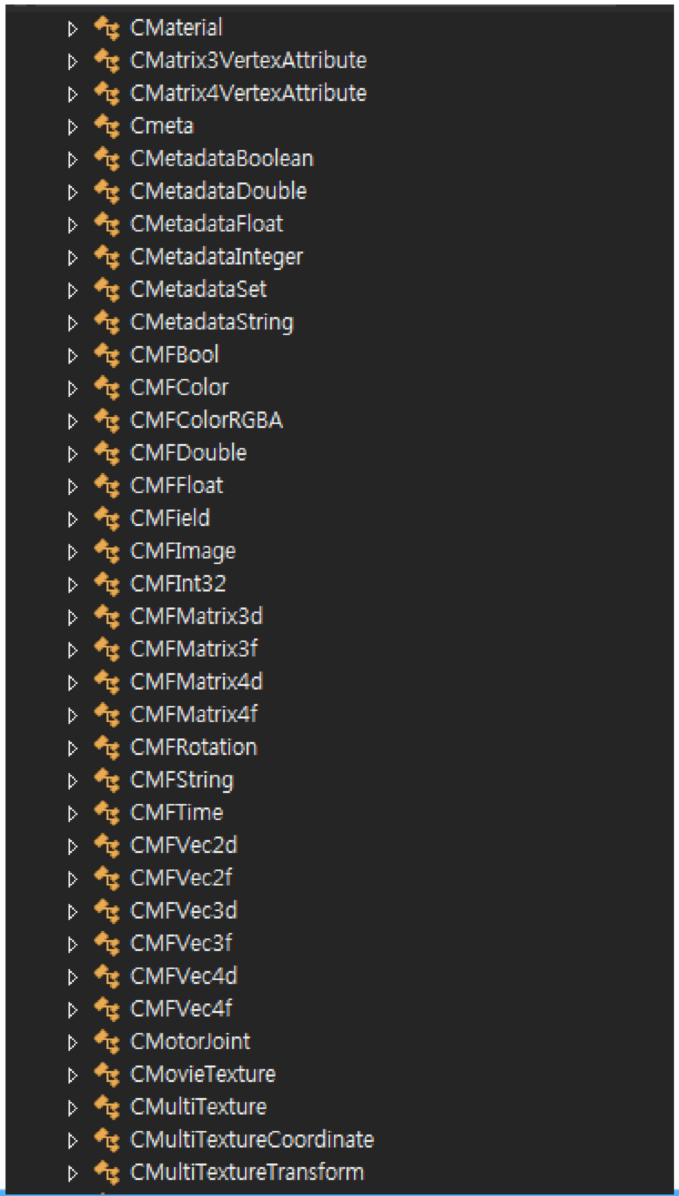


- CEventObject
- CExplosionEmitter
- CEXPORT
- CExternProtoDeclare
- CExtrusion
- Cfield
- CfieldValue
- CFillProperties
- CFloatVertexAttribute
- CFog
- CFogCoordinate
- CFontStyle
- CForcePhysicsModel
- CGeneratedCubeMapTexture
- CGeoCoordinate
- CGeoElevationGrid
- CGeoLocation
- CGeoLOD
- CGeoMetadata
- CGeoOrigin
- CGeoPositionInterpolator
- CGeoProximitySensor
- CGeoTouchSensor
- CGeoTransform
- CGeoViewpoint
- CGroup
- CHAnimDisplacer
- CHAnimHumanoid
- CHAnimJoint
- CHAnimSegment
- CHAnimSite
- Chead
- CImageCubeMapTexture
- CImageTexture
- CImageTexture3D
- CIMPORT

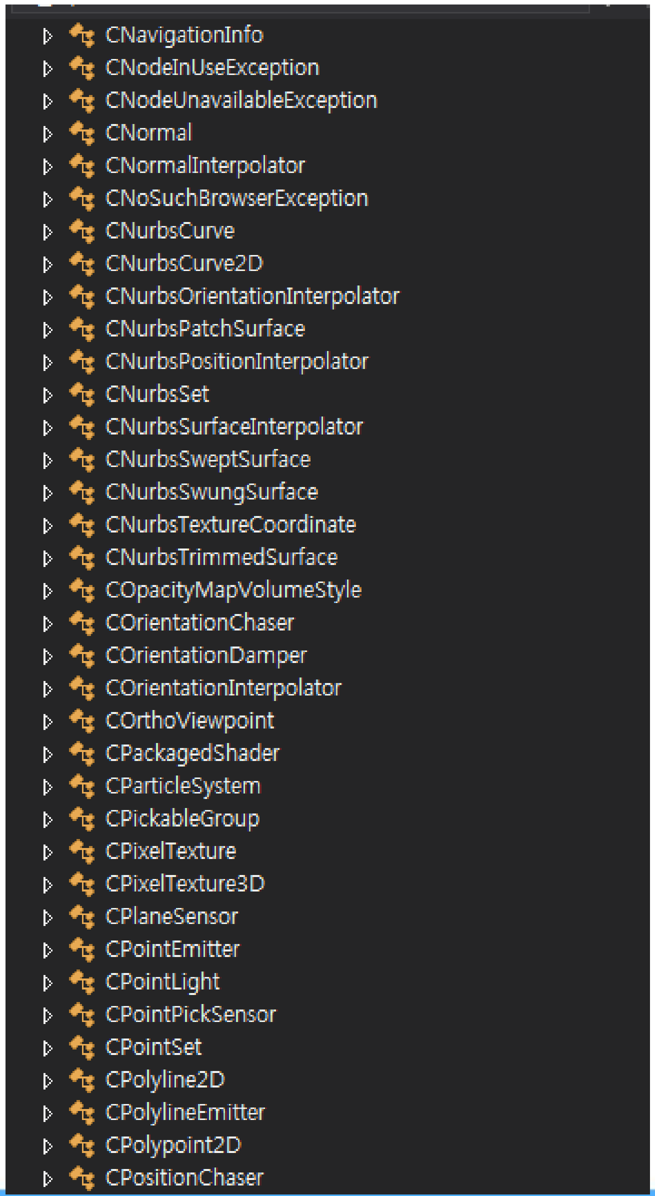
X3D C++ Library



- CImportedNodeException
- CIndexedFaceSet
- CIndexedLineSet
- CIndexedQuadSet
- CIndexedTriangleFanSet
- CIndexedTriangleSet
- CIndexedTriangleStripSet
- CInline
- CInsufficientCapabilitiesException
- CIntegerSequencer
- CIntegerTrigger
- CInvalidBrowserException
- CInvalidDocumentException
- CInvalidExecutionContextException
- CInvalidFieldException
- CInvalidFieldValueException
- CInvalidNodeException
- CInvalidOperationTimingException
- CInvalidProtoException
- CInvalidRouteException
- CInvalidURLException
- CInvalidX3DException
- CIS
- CIsoSurfaceVolumeData
- CKeySensor
- CLayer
- CLayerSet
- CLayout
- CLayoutGroup
- CLayoutLayer
- CLinePickSensor
- CLineProperties
- CLineSet
- CLoadSensor
- CLocalFog
- CLOD

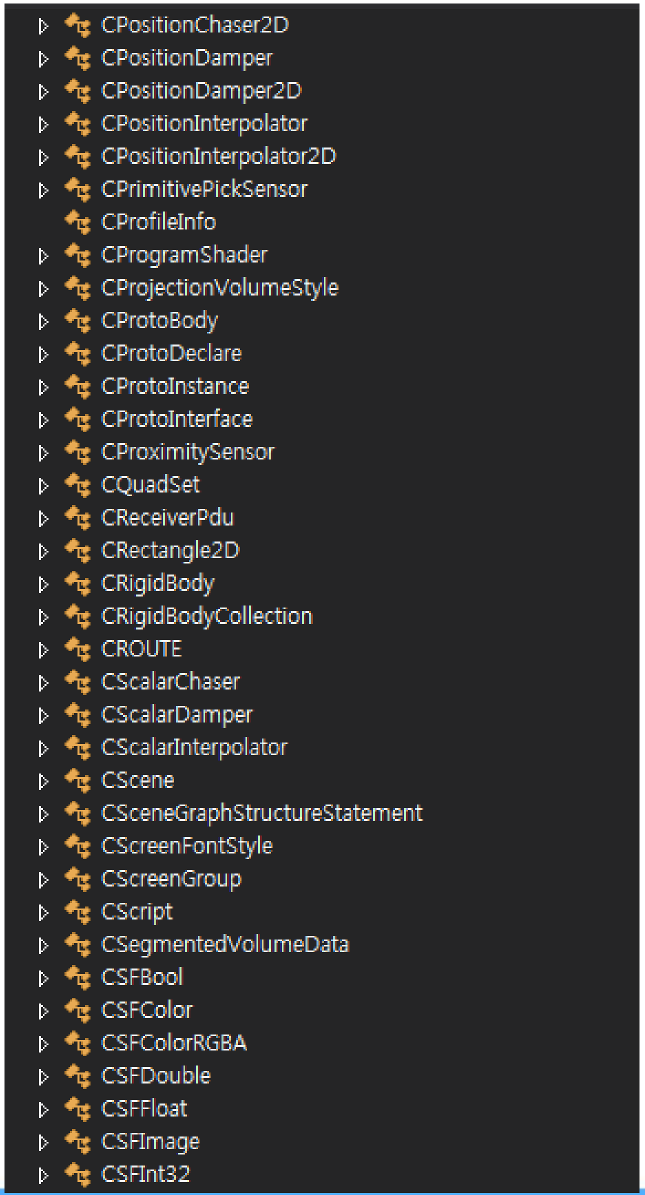


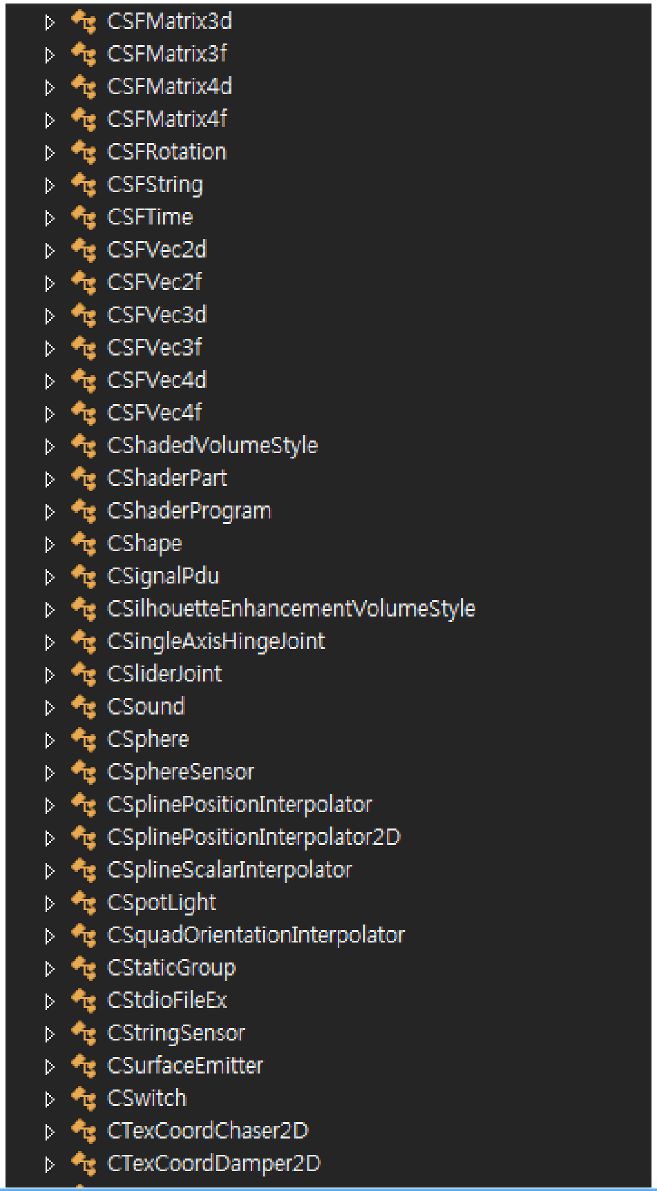
- CMaterial
- CMatrix3VertexAttribute
- CMatrix4VertexAttribute
- Cmeta
- CMetadataBoolean
- CMetadataDouble
- CMetadataFloat
- CMetadataInteger
- CMetadataSet
- CMetadataString
- CMFBool
- CMFColor
- CMFColorRGBA
- CMFDouble
- CMFFloat
- CMField
- CMFImage
- CMFInt32
- CMFMatrix3d
- CMFMatrix3f
- CMFMatrix4d
- CMFMatrix4f
- CMFRotation
- CMFString
- CMFTime
- CMFVec2d
- CMFVec2f
- CMFVec3d
- CMFVec3f
- CMFVec4d
- CMFVec4f
- CMotorJoint
- CMovieTexture
- CMultiTexture
- CMultiTextureCoordinate
- CMultiTextureTransform

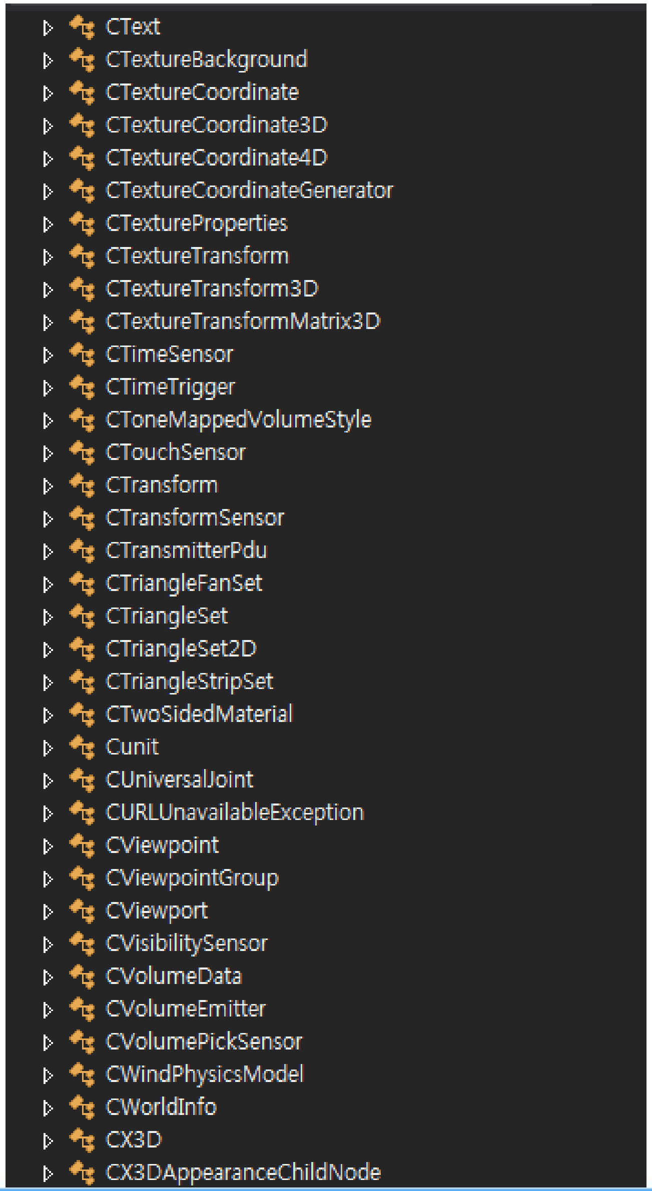


- CNavigationInfo
- CNodeInUseException
- CNodeUnavailableException
- CNormal
- CNormalInterpolator
- CNoSuchBrowserException
- CNurbsCurve
- CNurbsCurve2D
- CNurbsOrientationInterpolator
- CNurbsPatchSurface
- CNurbsPositionInterpolator
- CNurbsSet
- CNurbsSurfaceInterpolator
- CNurbsSweptSurface
- CNurbsSwungSurface
- CNurbsTextureCoordinate
- CNurbsTrimmedSurface
- COpacityMapVolumeStyle
- COrientationChaser
- COrientationDamper
- COrientationInterpolator
- COrthoViewpoint
- CPackagedShader
- CParticleSystem
- CPickableGroup
- CPixelTexture
- CPixelTexture3D
- CPlaneSensor
- CPointEmitter
- CPointLight
- CPointPickSensor
- CPointSet
- CPolyline2D
- CPolylineEmitter
- CPolypoint2D
- CPositionChaser

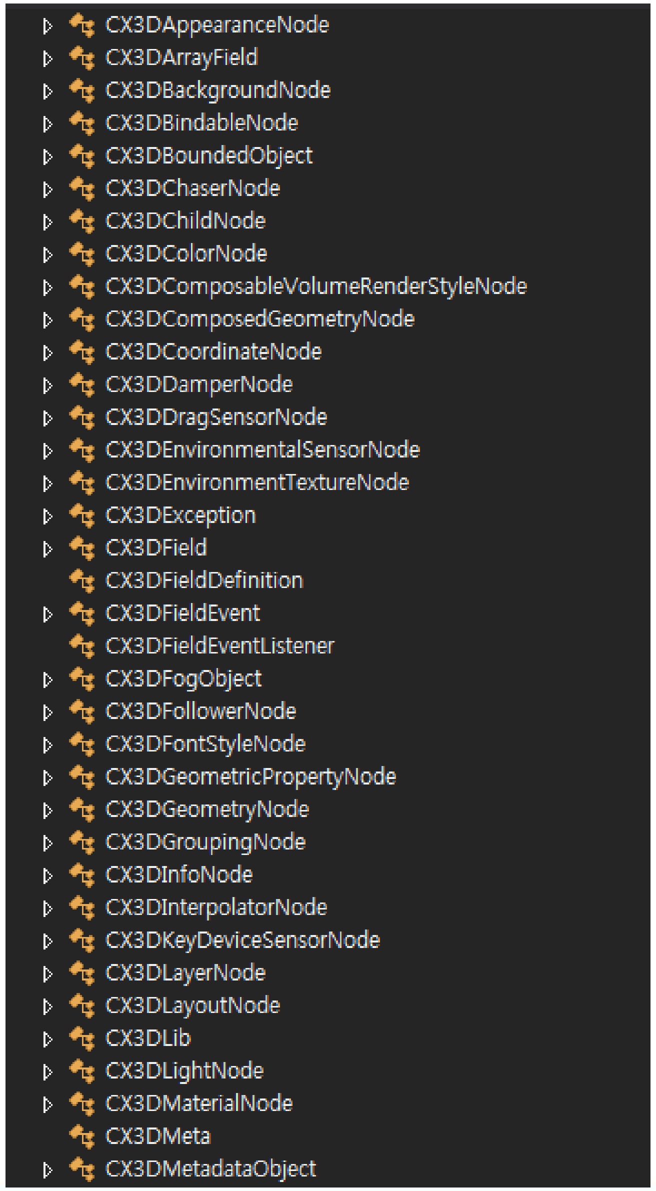
X3D C++ Library


CPositionChaser2D
CPositionDamper
CPositionDamper2D
CPositionInterpolator
CPositionInterpolator2D
CPrimitivePickSensor
CProfileInfo
CProgramShader
CProjectionVolumeStyle
CProtoBody
CProtoDeclare
CProtoInstance
CProtoInterface
CProximitySensor
CQuadSet
CReceiverPdu
CRectangle2D
CRigidBody
CRigidBodyCollection
CROUTE
CScalarChaser
CScalarDamper
CScalarInterpolator
CScene
CSceneGraphStructureStatement
CScreenFontStyle
CScreenGroup
CScript
CSegmentedVolumeData
CSFBool
CSFColor
CSFColorRGBA
CSFDouble
CSFFloat
CSFImage
CSFInt32

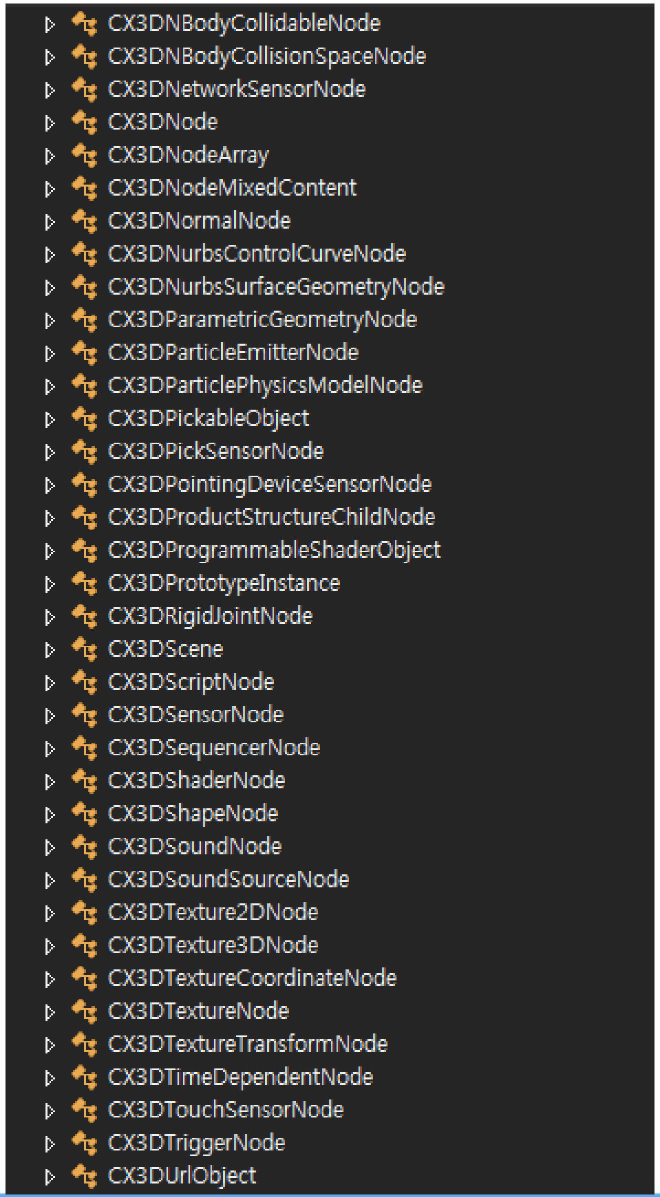

CSFMatrix3d
CSFMatrix3f
CSFMatrix4d
CSFMatrix4f
CSFRotation
CSFString
CSFTime
CSFVec2d
CSFVec2f
CSFVec3d
CSFVec3f
CSFVec4d
CSFVec4f
CShadedVolumeStyle
CShaderPart
CShaderProgram
CShape
CSignalPdu
CSilhouetteEnhancementVolumeStyle
CSingleAxisHingeJoint
CSliderJoint
CSound
CSphere
CSphereSensor
CSplinePositionInterpolator
CSplinePositionInterpolator2D
CSplineScalarInterpolator
CSpotLight
CSquadOrientationInterpolator
CStaticGroup
CStdioFileEx
CStringSensor
CSurfaceEmitter
CSwitch
CTexCoordChaser2D
CTexCoordDamper2D


CText
CTextureBackground
CTextureCoordinate
CTextureCoordinate3D
CTextureCoordinate4D
CTextureCoordinateGenerator
CTextureProperties
CTextureTransform
CTextureTransform3D
CTextureTransformMatrix3D
CTimeSensor
CTimeTrigger
CToneMappedVolumeStyle
CTouchSensor
CTransform
CTransformSensor
CTransmitterPdu
CTriangleFanSet
CTriangleSet
CTriangleSet2D
CTriangleStripSet
CTwoSidedMaterial
Cunit
CUniversalJoint
CURLUnavailableException
CViewpoint
CViewpointGroup
CViewport
CVisibilitySensor
CVolumeData
CVolumeEmitter
CVolumePickSensor
CWindPhysicsModel
CWorldInfo
CX3D
CX3DAppearanceChildNode

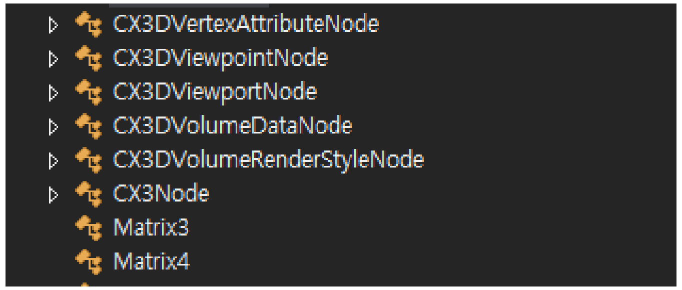
X3D C++ Library



- CX3DAppearanceNode
- CX3DArrayField
- CX3DBackgroundNode
- CX3DBindableNode
- CX3DBoundedObject
- CX3DChaserNode
- CX3DChildNode
- CX3DColorNode
- CX3DComposableVolumeRenderStyleNode
- CX3DComposedGeometryNode
- CX3DCoordinateNode
- CX3DDamperNode
- CX3DDragSensorNode
- CX3DEnvironmentalSensorNode
- CX3DEnvironmentTextureNode
- CX3DException
- CX3DField
- CX3DFieldDefinition
- CX3DFieldEvent
- CX3DFieldEventListener
- CX3DFogObject
- CX3DFollowerNode
- CX3DFontStyleNode
- CX3DGeometricPropertyNode
- CX3DGeometryNode
- CX3DGroupingNode
- CX3DInfoNode
- CX3DInterpolatorNode
- CX3DKeyDeviceSensorNode
- CX3DLayerNode
- CX3DLayoutNode
- CX3DLib
- CX3DLightNode
- CX3DMaterialNode
- CX3DMeta
- CX3DMetadataObject

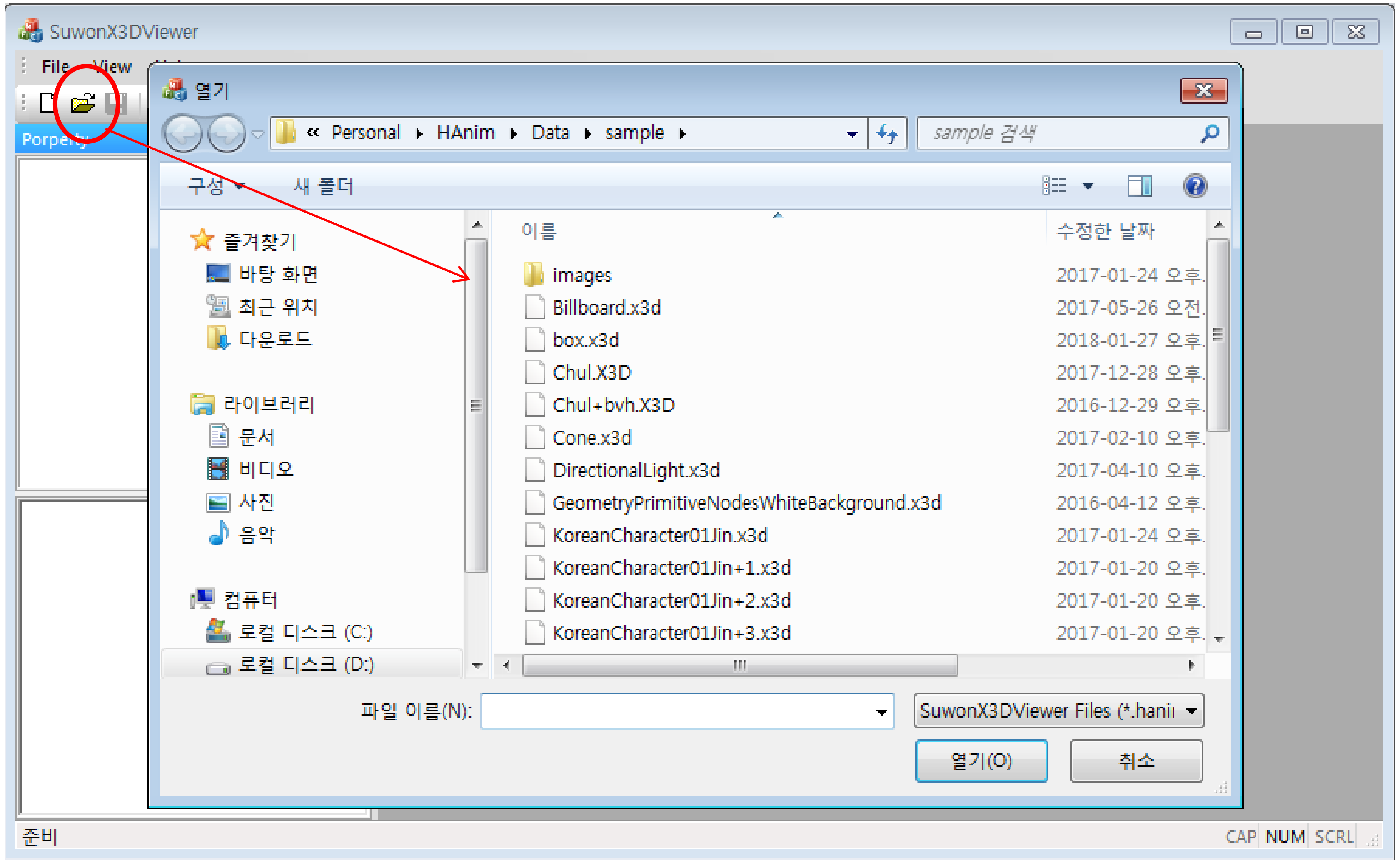


- CX3DNBodyCollidableNode
- CX3DNBodyCollisionSpaceNode
- CX3DNetworkSensorNode
- CX3DNode
- CX3DNodeArray
- CX3DNodeMixedContent
- CX3DNormalNode
- CX3DNurbsControlCurveNode
- CX3DNurbsSurfaceGeometryNode
- CX3DParametricGeometryNode
- CX3DParticleEmitterNode
- CX3DParticlePhysicsModelNode
- CX3DPickableObject
- CX3DPickSensorNode
- CX3DPointingDeviceSensorNode
- CX3DProductStructureChildNode
- CX3DProgrammableShaderObject
- CX3DPrototypeInstance
- CX3DRigidJointNode
- CX3DScene
- CX3DScriptNode
- CX3DSensorNode
- CX3DSequencerNode
- CX3DShaderNode
- CX3DShapeNode
- CX3DSoundNode
- CX3DSoundSourceNode
- CX3DTexture2DNode
- CX3DTexture3DNode
- CX3DTextureCoordinateNode
- CX3DTextureNode
- CX3DTextureTransformNode
- CX3DTimeDependentNode
- CX3DTouchSensorNode
- CX3DTriggerNode
- CX3DUrlObject



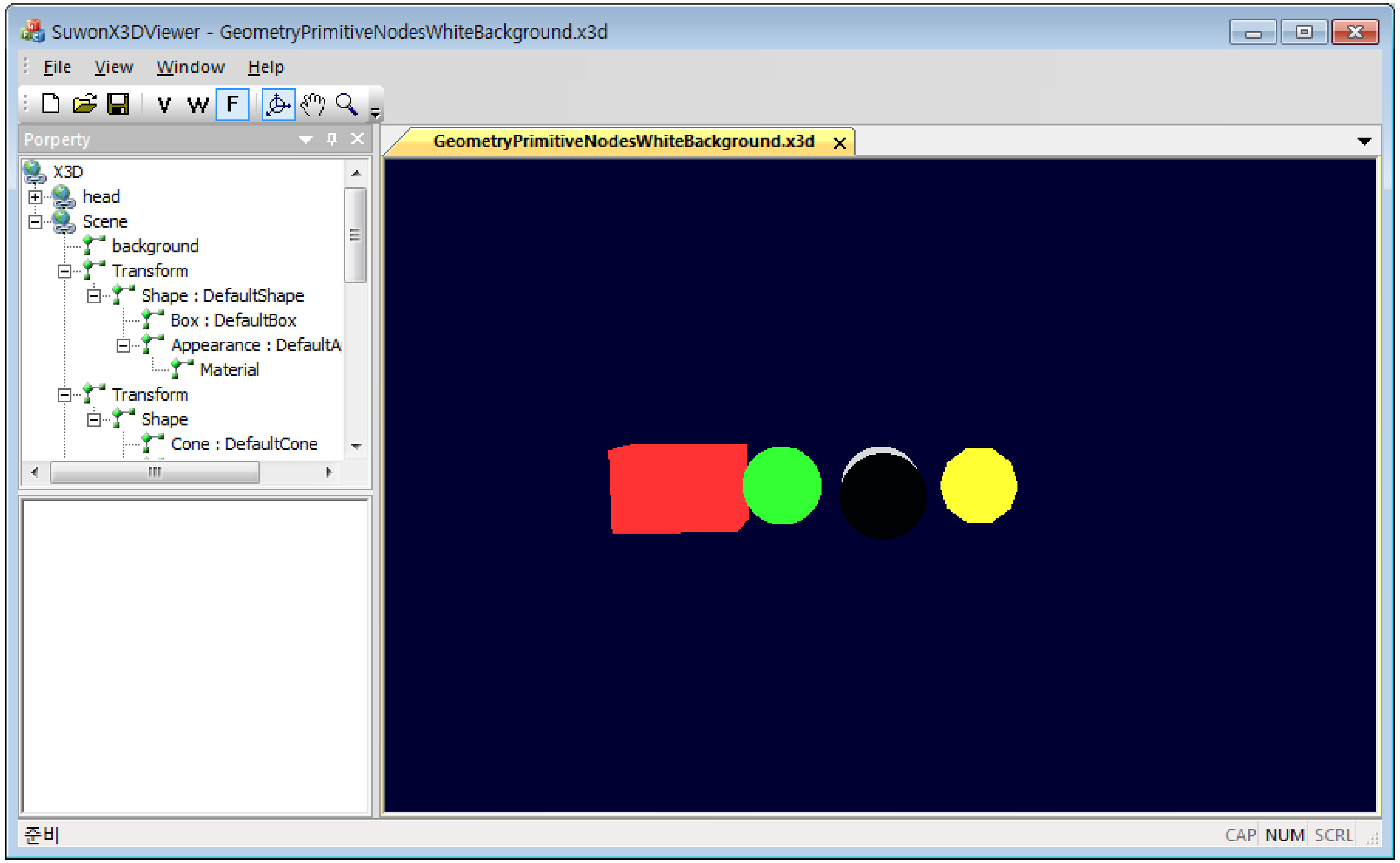
- CX3DVertexAttributeNode
- CX3DViewpointNode
- CX3DViewportNode
- CX3DVolumeDataNode
- CX3DVolumeRenderStyleNode
- CX3Node
- Matrix3
- Matrix4

X3D C++ Binding Viewer (X3D File Open)



이름	수정한 날짜
images	2017-01-24 오후
Billboard.x3d	2017-05-26 오전
box.x3d	2018-01-27 오후
Chul.X3D	2017-12-28 오후
Chul+bvh.X3D	2016-12-29 오후
Cone.x3d	2017-02-10 오후
DirectionalLight.x3d	2017-04-10 오후
GeometryPrimitiveNodesWhiteBackground.x3d	2016-04-12 오후
KoreanCharacter01Jin.x3d	2017-01-24 오후
KoreanCharacter01Jin+1.x3d	2017-01-20 오후
KoreanCharacter01Jin+2.x3d	2017-01-20 오후
KoreanCharacter01Jin+3.x3d	2017-01-20 오후

X3D C++ Binding Viewer (X3D Load)


SuwonX3DViewer - GeometryPrimitiveNodesWhiteBackground.x3d

File View Window Help

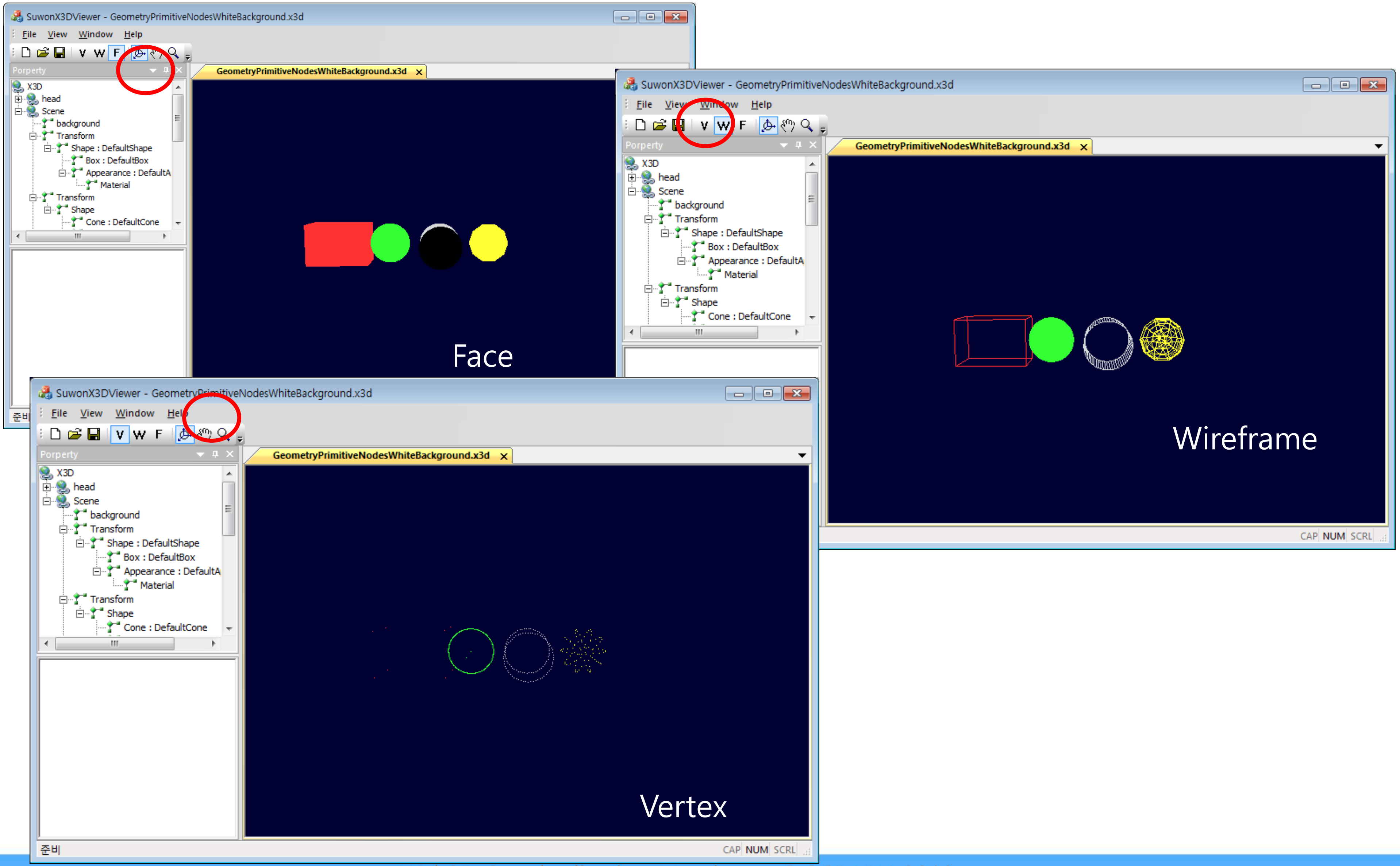
Porperty

GeometryPrimitiveNodesWhiteBackground.x3d

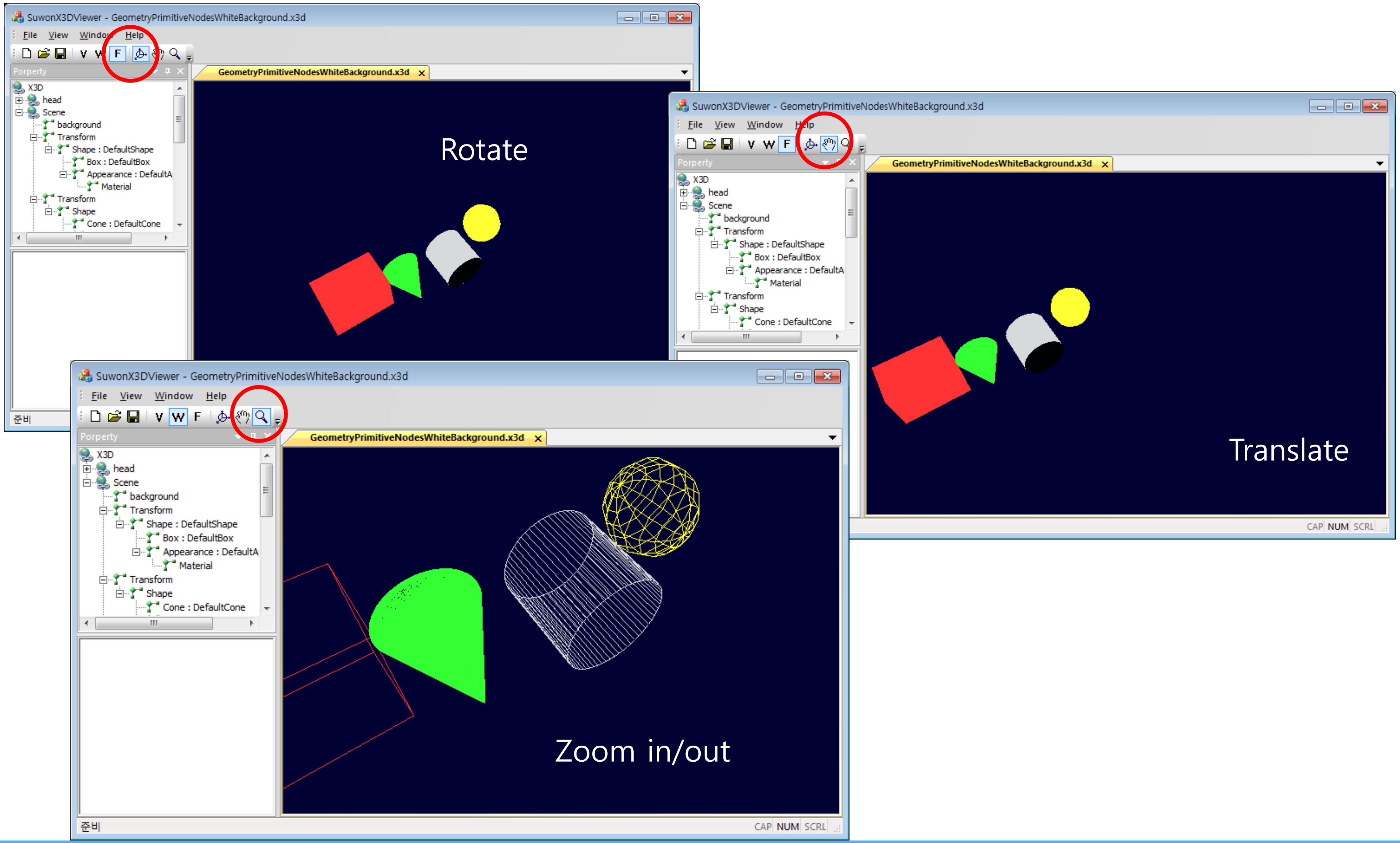
```
X3D
  head
  Scene
    background
    Transform
      Shape : DefaultShape
        Box : DefaultBox
        Appearance : DefaultA
          Material
    Transform
      Shape
        Cone : DefaultCone
```

준비 CAP NUM SCRL

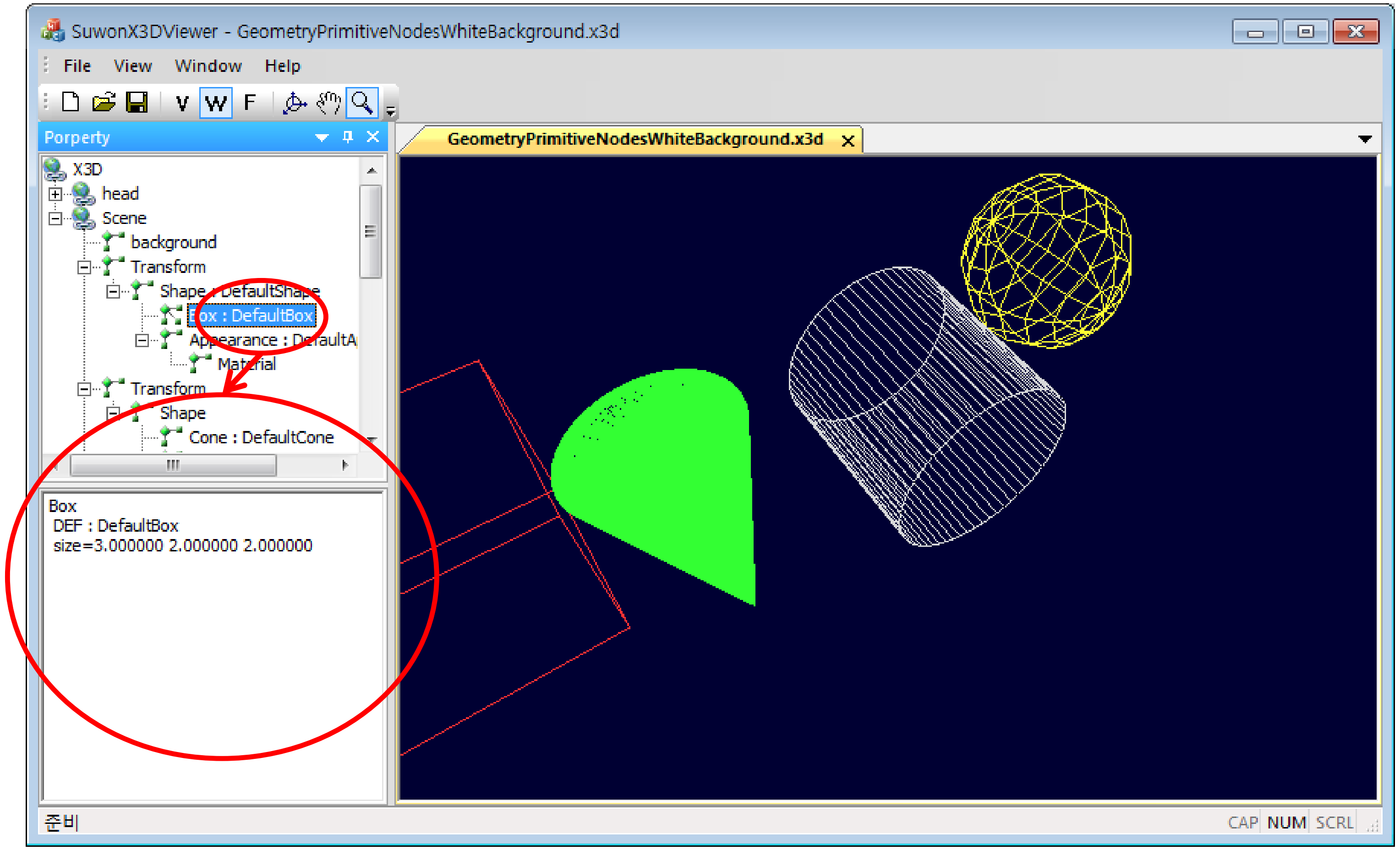
X3D C++ Binding Viewer (Viewer Mode)



X3D C++ Binding Viewer (Viewer Mode)

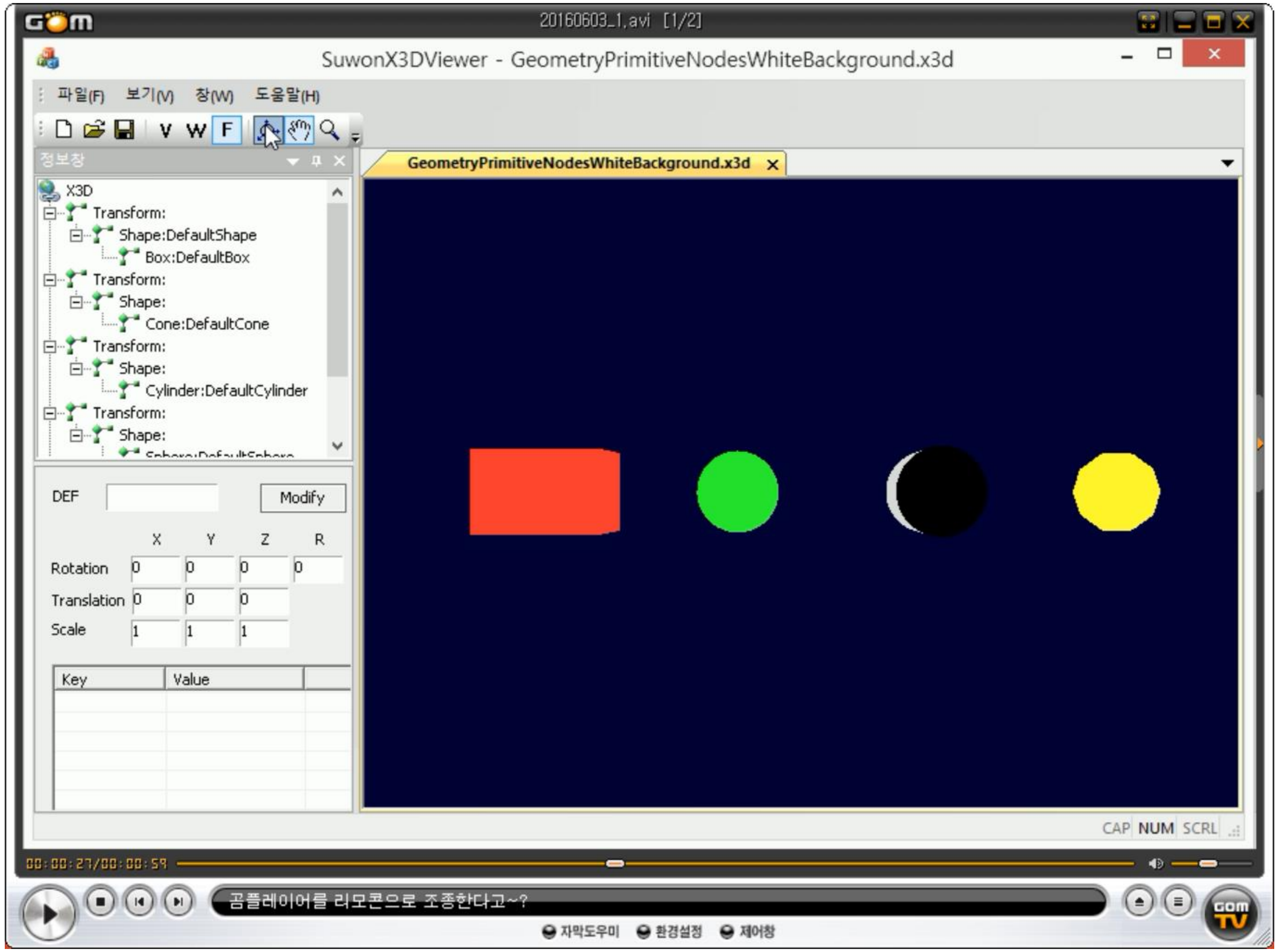


X3D C++ Binding Viewer (Property Window)

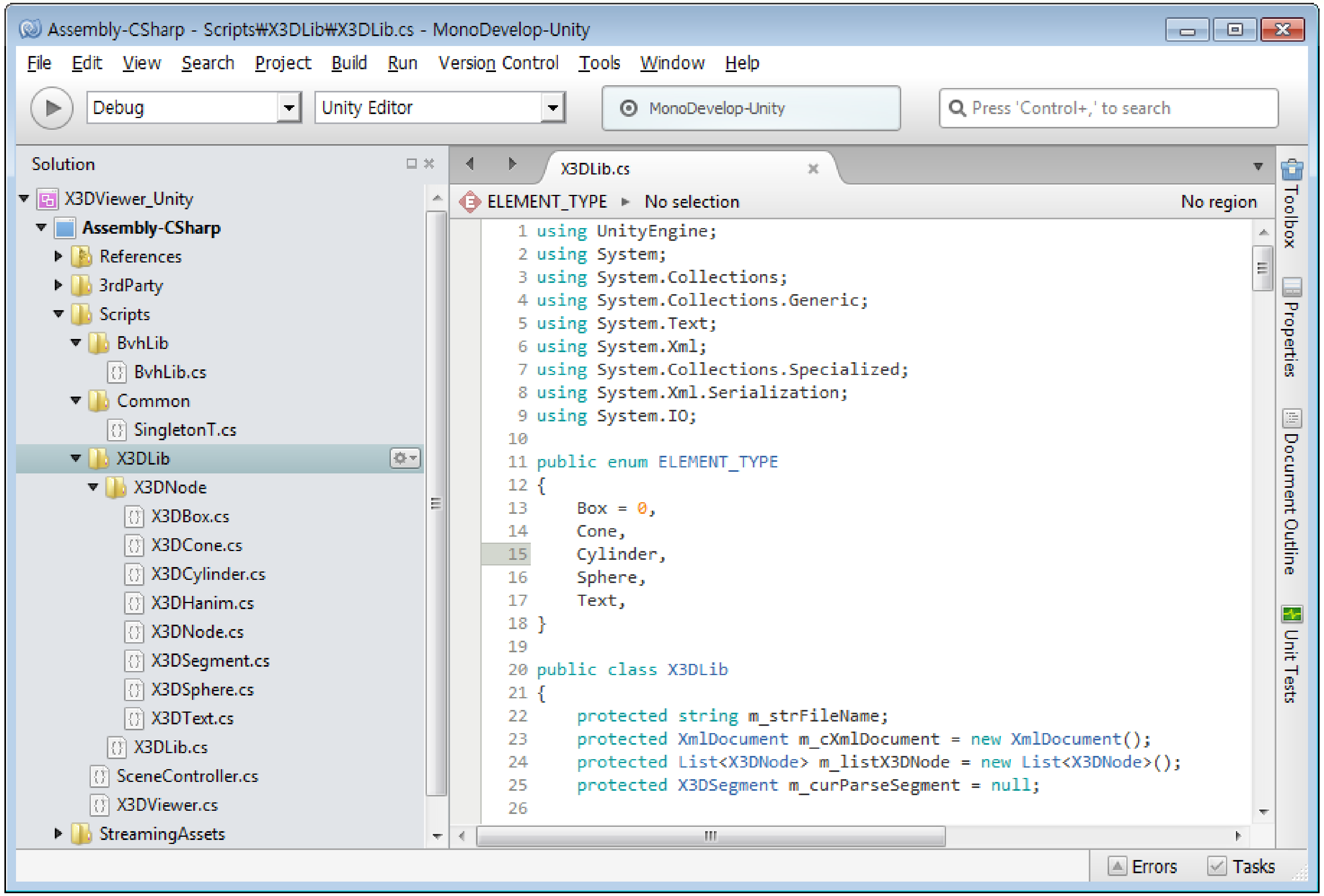


Box
DEF : DefaultBox
size=3.000000 2.000000 2.000000

X3D C++ Binding Viewer Demo

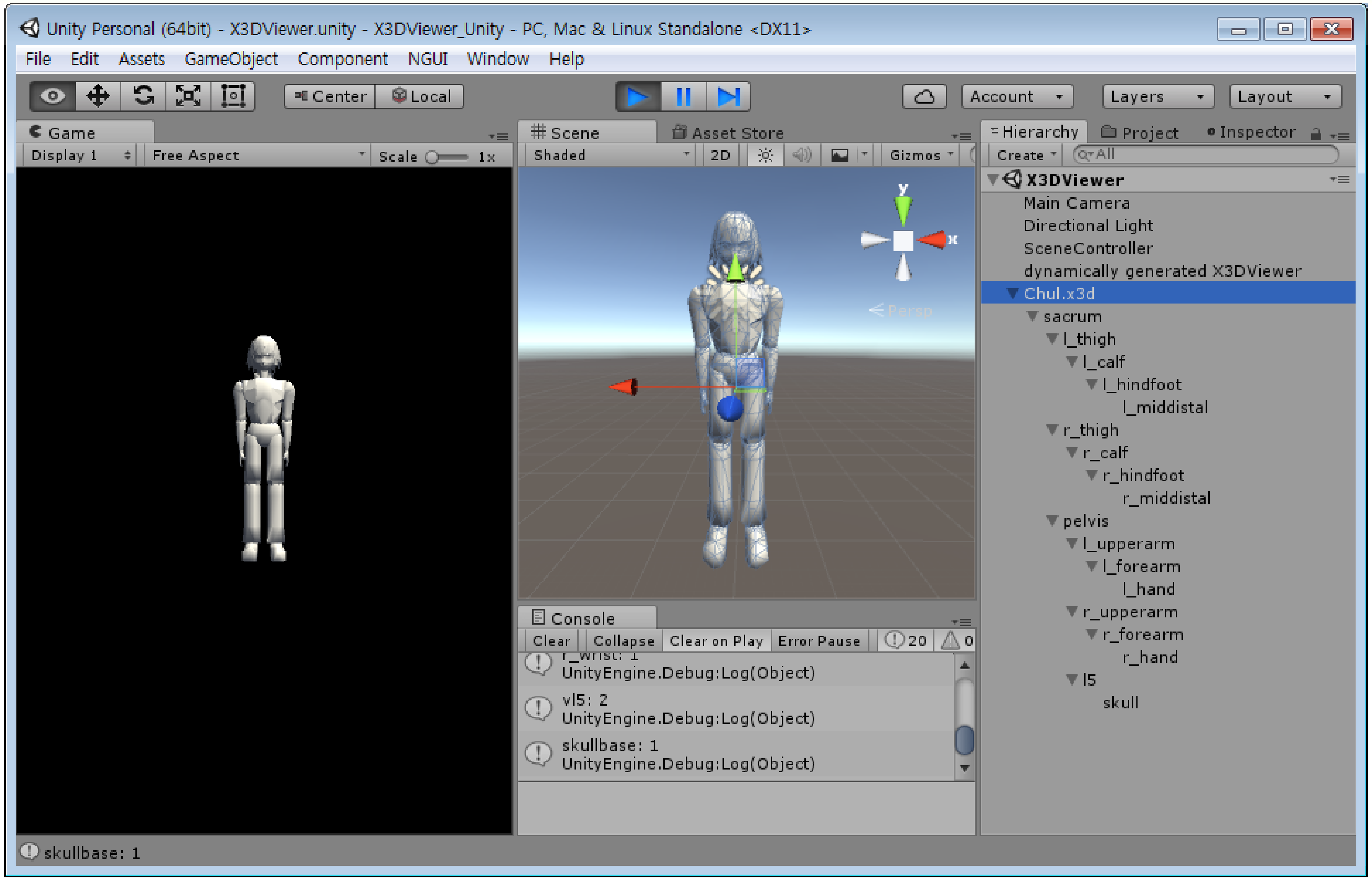


X3D C# Binding Viewer (Unity)



```
using UnityEngine;
using System;
using System.Collections;
using System.Collections.Generic;
using System.Text;
using System.Xml;
using System.Collections.Specialized;
using System.Xml.Serialization;
using System.IO;

public enum ELEMENT_TYPE
{
    Box = 0,
    Cone,
    Cylinder,
    Sphere,
    Text,
}

public class X3DLib
{
    protected string m_strFileName;
    protected XmlDocument m_cXmlDocument = new XmlDocument();
    protected List<X3DNode> m_listX3DNode = new List<X3DNode>();
    protected X3DSegment m_curParseSegment = null;

```

X3D C# Binding Viewer (Unity)


Unity Personal (64bit) - X3DViewer.unity - X3DViewer_Unity - PC, Mac & Linux Standalone <DX11>
File Edit Assets GameObject Component NGUI Window Help
Center Local
Account Layers Layout
Game Display 1 Free Aspect Scale 1x
Scene Asset Store Shaded 2D Gizmos
Persp
Hierarchy Project Inspector
Create All

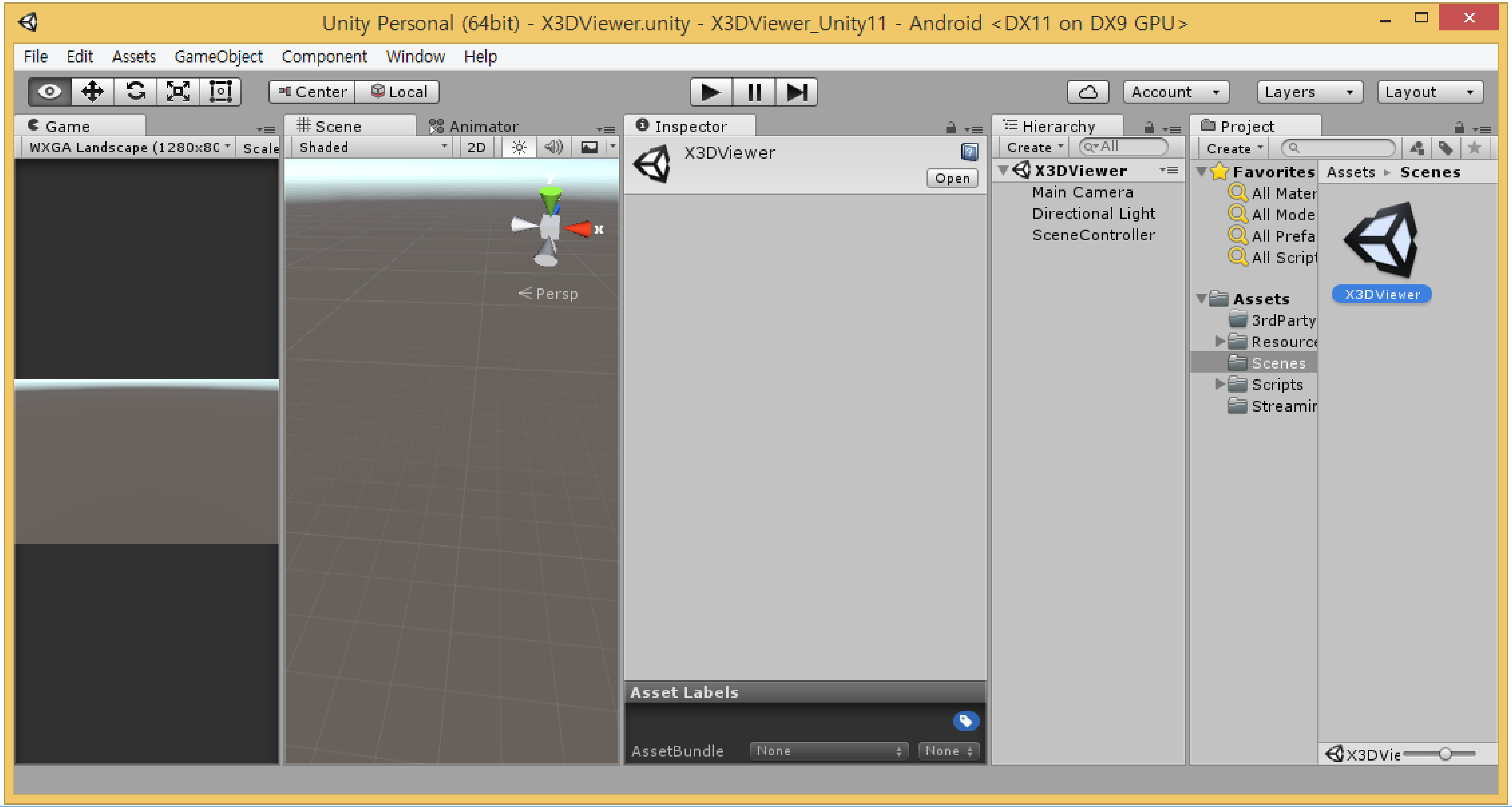
X3DViewer
- Main Camera
- Directional Light
- SceneController
- dynamically generated X3DViewer
- Chul.x3d
  - sacrum
    - l_thigh
      - l_calf
        - l_hindfoot
          - l_middistal
    - r_thigh
      - r_calf
        - r_hindfoot
          - r_middistal
    - pelvis
      - l_upperarm
        - l_forearm
          - l_hand
      - r_upperarm
        - r_forearm
          - r_hand
      - l5
        - skull

Console: Clear Collapse Clear on Play Error Pause 20 0

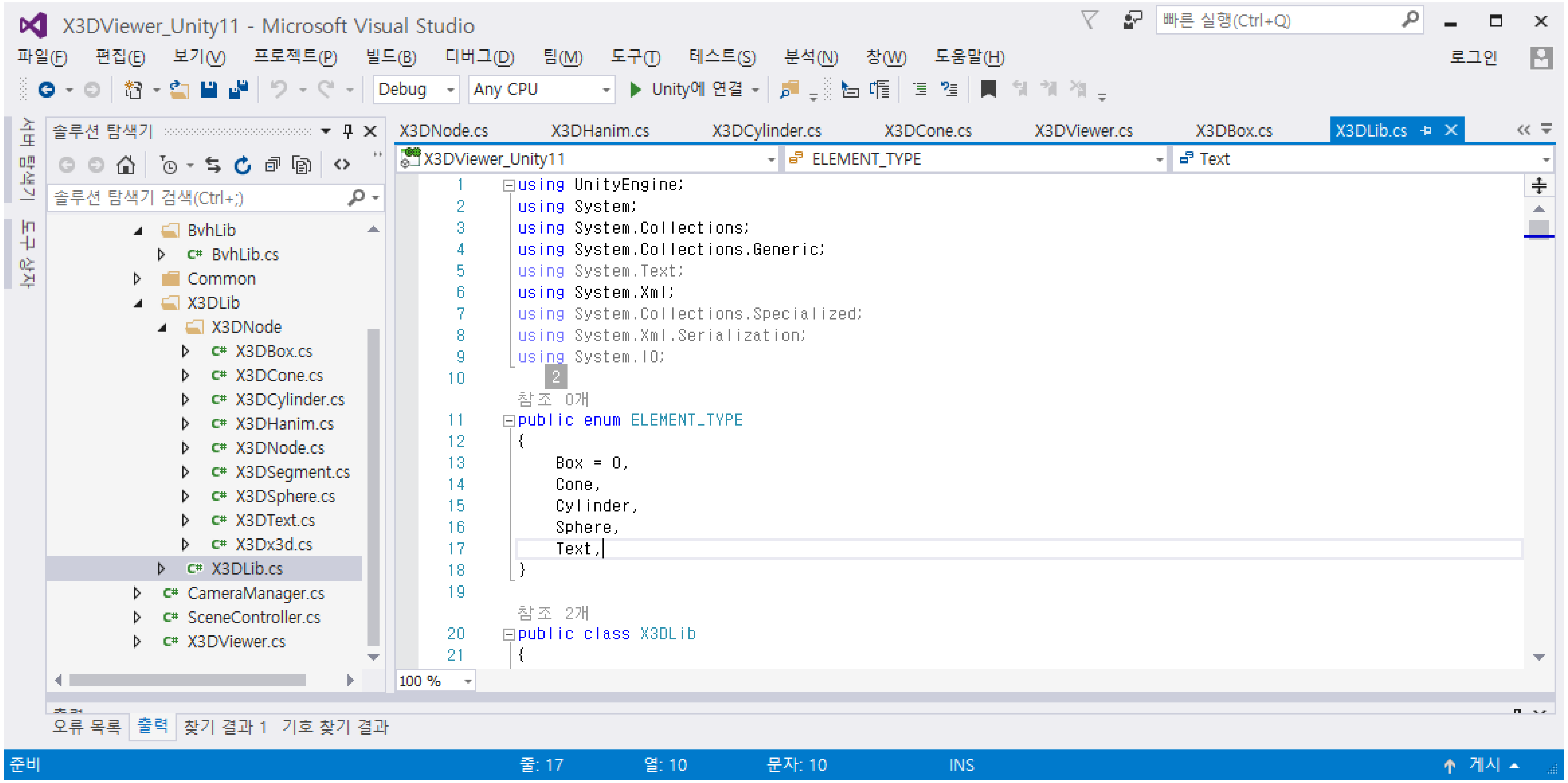
```
r_wrist: 1
UnityEngine.Debug:Log(Object)
vl5: 2
UnityEngine.Debug:Log(Object)
skullbase: 1
UnityEngine.Debug:Log(Object)
```

skullbase: 1

X3D C# Binding Viewer (Unity)

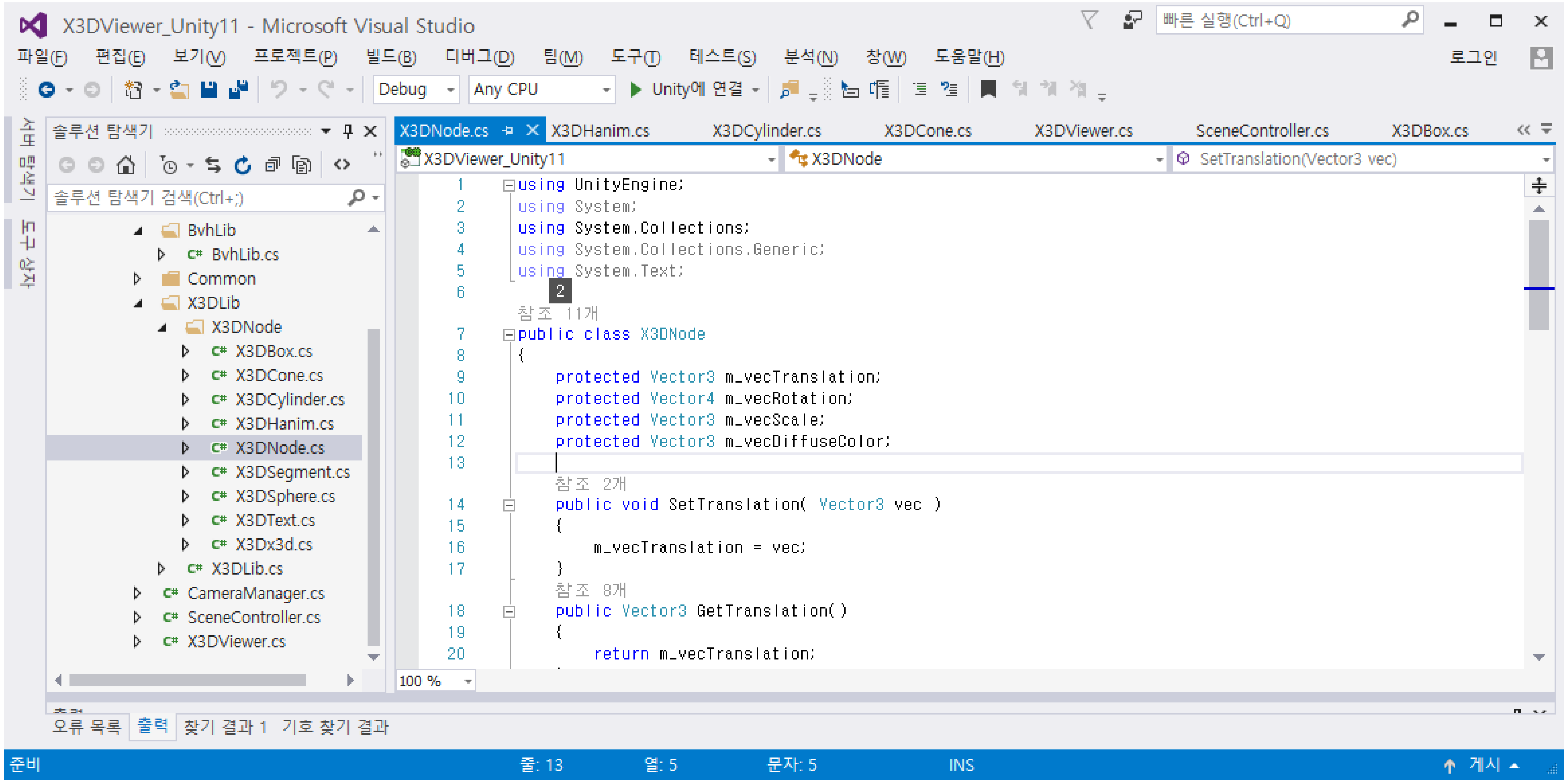


Lib Class


X3DViewer_Unity11 - Microsoft Visual Studio
파일(F) 편집(E) 보기(V) 프로젝트(P) 빌드(B) 디버그(D) 팀(M) 도구(T) 테스트(S) 분석(N) 창(W) 도움말(H)
Debug
Any CPU
Unity에 연결
솔루션 탐색기
BvhLib
BvhLib.cs
Common
X3DLib
X3DNode
X3DBox.cs
X3DCone.cs
X3DCylinder.cs
X3DHanim.cs
X3DNode.cs
X3DSegment.cs
X3DSphere.cs
X3DText.cs
X3Dx3d.cs
X3DLib.cs
CameraManager.cs
SceneController.cs
X3DViewer.cs
X3DNode.cs X3DHanim.cs X3DCylinder.cs X3DCone.cs X3DViewer.cs X3DBox.cs X3DLib.cs
X3DViewer_Unity11
ELEMENT_TYPE
Text
오류 목록 출력 찾기 결과 1 기호 찾기 결과
준비 줄: 17 열: 10 문자: 10 INS

```
using UnityEngine;
using System;
using System.Collections;
using System.Collections.Generic;
using System.Text;
using System.Xml;
using System.Collections.Specialized;
using System.Xml.Serialization;
using System.IO;

참조 0개
public enum ELEMENT_TYPE
{
    Box = 0,
    Cone,
    Cylinder,
    Sphere,
    Text,
}

참조 2개
public class X3DLib
{
```

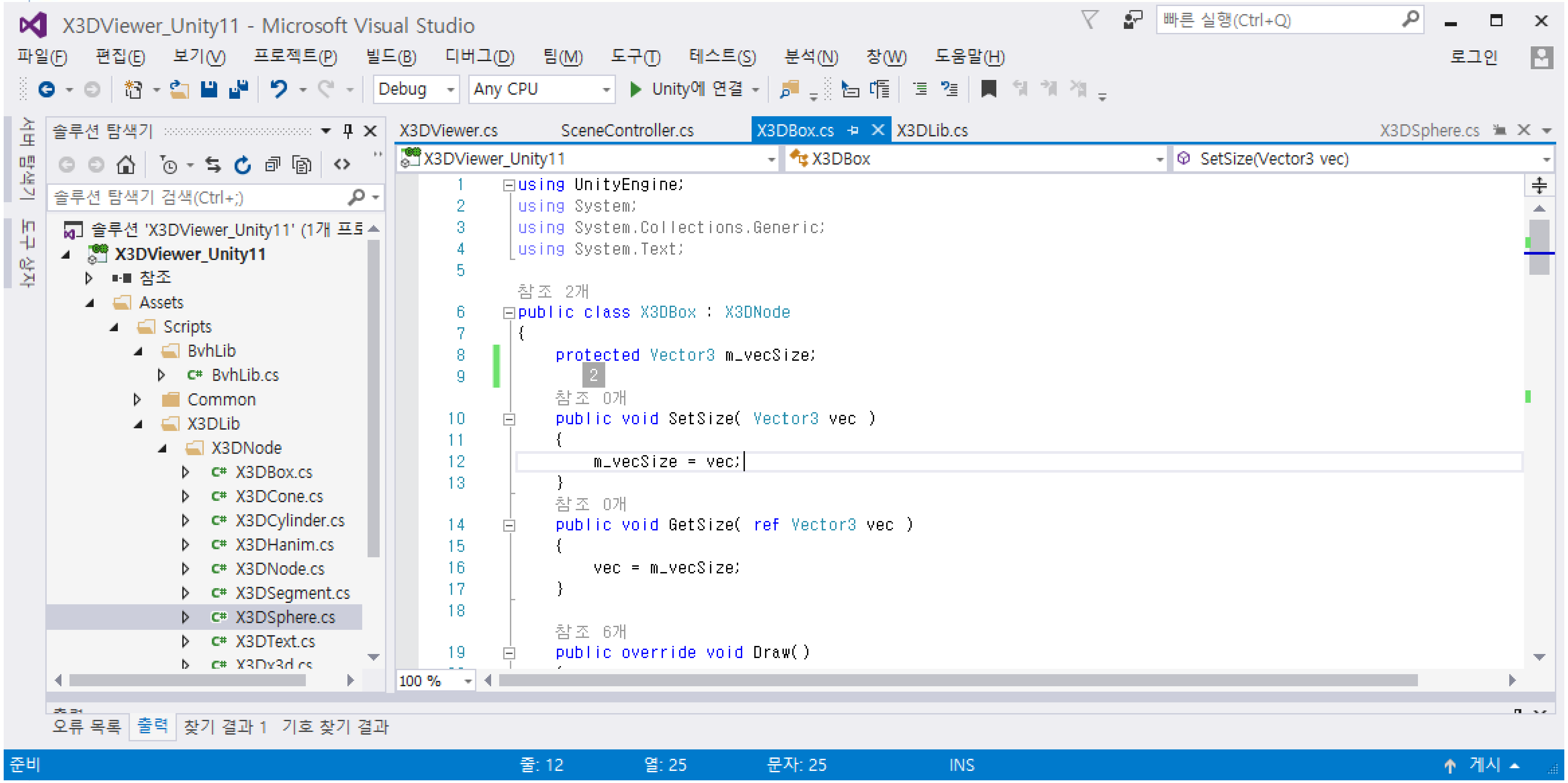
Base Node



X3DViewer_Unity11 - Microsoft Visual Studio
파일(F) 편집(E) 보기(V) 프로젝트(P) 빌드(B) 디버그(D) 팀(M) 도구(T) 테스트(S) 분석(N) 창(W) 도움말(H)
Debug
Any CPU
Unity에 연결
솔루션 탐색기
BvhLib
BvhLib.cs
Common
X3DLib
X3DNode
X3DBox.cs
X3DCone.cs
X3DCylinder.cs
X3DHanim.cs
X3DNode.cs
X3DSegment.cs
X3DSphere.cs
X3DText.cs
X3Dx3d.cs
X3DLib.cs
CameraManager.cs
SceneController.cs
X3DViewer.cs
X3DNode.cs X3DHanim.cs X3DCylinder.cs X3DCone.cs X3DViewer.cs SceneController.cs X3DBox.cs
X3DViewer_Unity11
X3DNode
SetTranslation(Vector3 vec)
오류 목록 출력 찾기 결과 1 기호 찾기 결과
준비 줄: 13 열: 5 문자: 5 INS

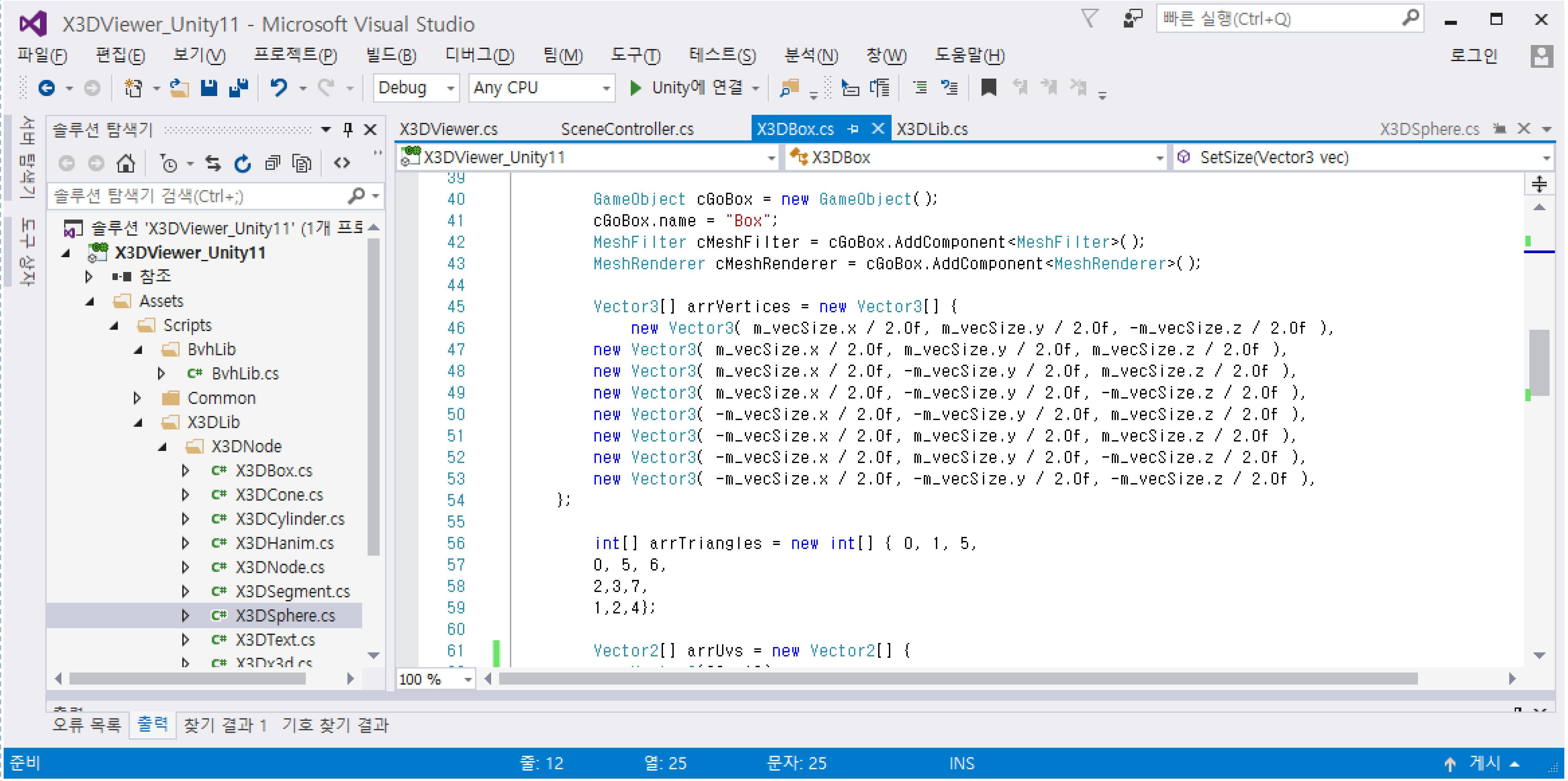
```
using UnityEngine;
using System;
using System.Collections;
using System.Collections.Generic;
using System.Text;

참조 11개
public class X3DNode
{
    protected Vector3 m_vecTranslation;
    protected Vector4 m_vecRotation;
    protected Vector3 m_vecScale;
    protected Vector3 m_vecDiffuseColor;

    참조 2개
    public void SetTranslation( Vector3 vec )
    {
        m_vecTranslation = vec;
    }
    참조 8개
    public Vector3 GetTranslation()
    {
        return m_vecTranslation;
```

Box Class



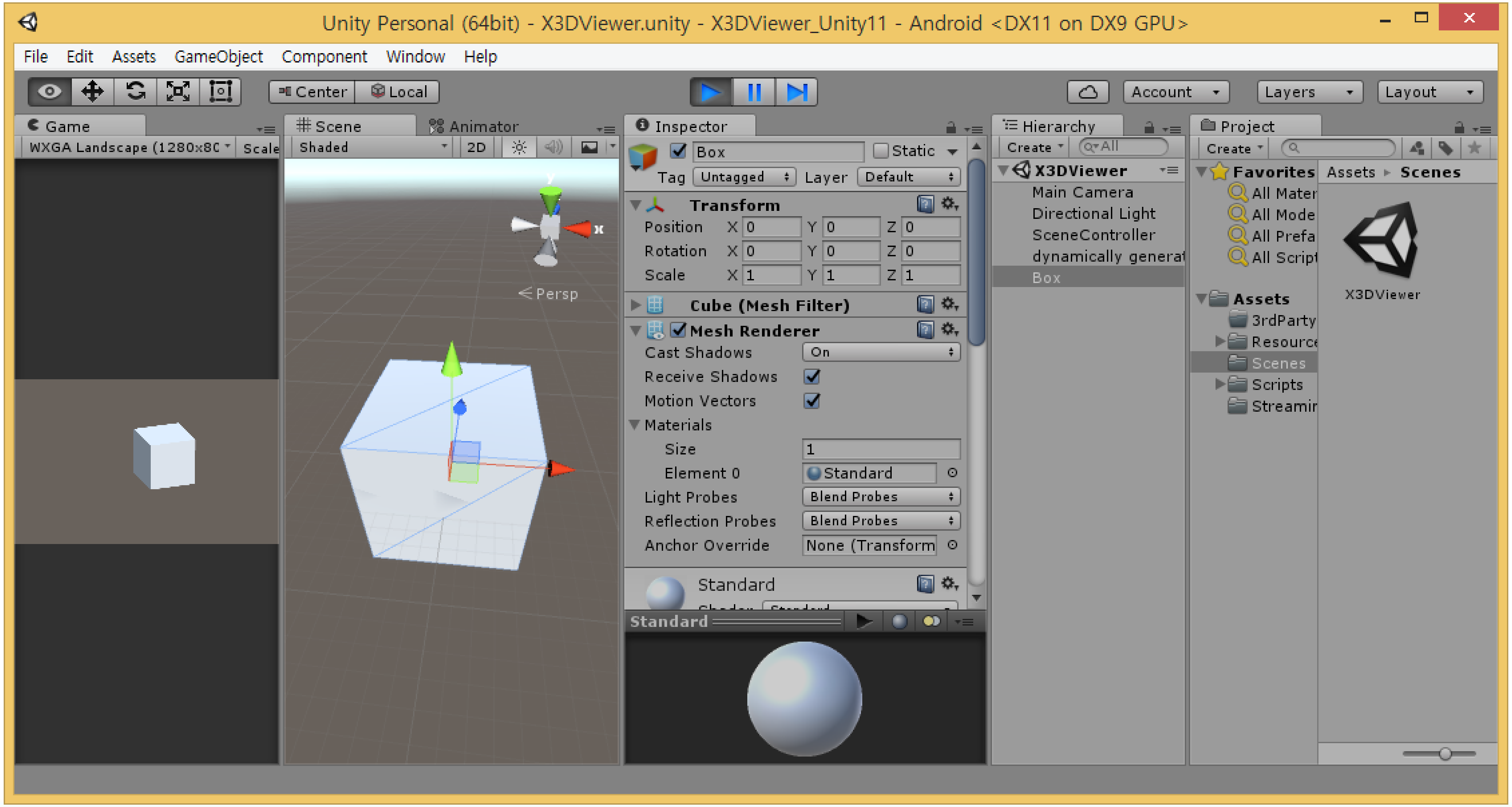
```
using UnityEngine;
using System;
using System.Collections.Generic;
using System.Text;

참조 2개
public class X3DBox : X3DNode
{
    protected Vector3 m_vecSize;

    참조 0개
    public void SetSize( Vector3 vec )
    {
        m_vecSize = vec;
    }
    참조 0개
    public void GetSize( ref Vector3 vec )
    {
        vec = m_vecSize;
    }

    참조 6개
    public override void Draw()
```

Box Class



```
        GameObject cGoBox = new GameObject();
        cGoBox.name = "Box";
        MeshFilter cMeshFilter = cGoBox.AddComponent<MeshFilter>();
        MeshRenderer cMeshRenderer = cGoBox.AddComponent<MeshRenderer>();

        Vector3[] arrVertices = new Vector3[] {
            new Vector3( m_vecSize.x / 2.0f, m_vecSize.y / 2.0f, -m_vecSize.z / 2.0f ),
        new Vector3( m_vecSize.x / 2.0f, m_vecSize.y / 2.0f, m_vecSize.z / 2.0f ),
        new Vector3( m_vecSize.x / 2.0f, -m_vecSize.y / 2.0f, m_vecSize.z / 2.0f ),
        new Vector3( m_vecSize.x / 2.0f, -m_vecSize.y / 2.0f, -m_vecSize.z / 2.0f ),
        new Vector3( -m_vecSize.x / 2.0f, -m_vecSize.y / 2.0f, m_vecSize.z / 2.0f ),
        new Vector3( -m_vecSize.x / 2.0f, m_vecSize.y / 2.0f, m_vecSize.z / 2.0f ),
        new Vector3( -m_vecSize.x / 2.0f, m_vecSize.y / 2.0f, -m_vecSize.z / 2.0f ),
        new Vector3( -m_vecSize.x / 2.0f, -m_vecSize.y / 2.0f, -m_vecSize.z / 2.0f ),
    };

        int[] arrTriangles = new int[] { 0, 1, 5,
        0, 5, 6,
        2,3,7,
        1,2,4};

        Vector2[] arrUvs = new Vector2[] {
```

Box Class



Unity Personal (64bit) - X3DViewer.unity - X3DViewer_Unity11 - Android <DX11 on DX9 GPU>

File Edit Assets GameObject Component Window Help

Inspector

Box | Static

Tag Untagged | Layer Default

Transform

Position X 0 Y 0 Z 0

Rotation X 0 Y 0 Z 0

Scale X 1 Y 1 Z 1

Cube (Mesh Filter)

Mesh Renderer

Cast Shadows On

Receive Shadows ✓

Motion Vectors ✓

Materials

Size 1

Element 0 Standard

Light Probes Blend Probes

Reflection Probes Blend Probes

Anchor Override None (Transform

Standard

Hierarchy

X3DViewer
- Main Camera
- Directional Light
- SceneController
- dynamically generat
- Box

Project

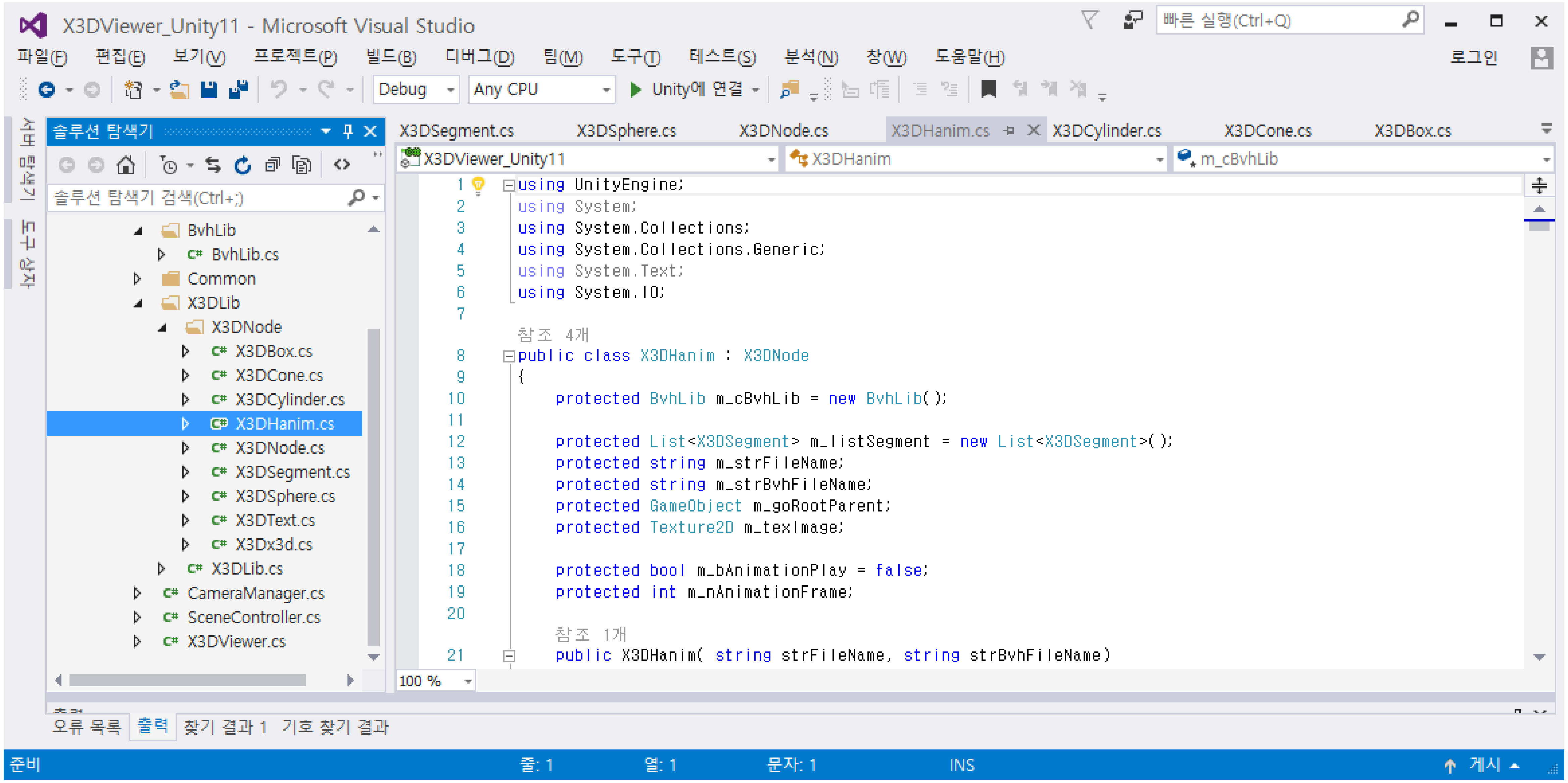
Favorites
- All Mater
- All Mode
- All Prefa
- All Script

Assets
- 3rdParty
- Resource
- Scenes
- Scripts
- Streamir

Assets ▸ Scenes

X3DViewer

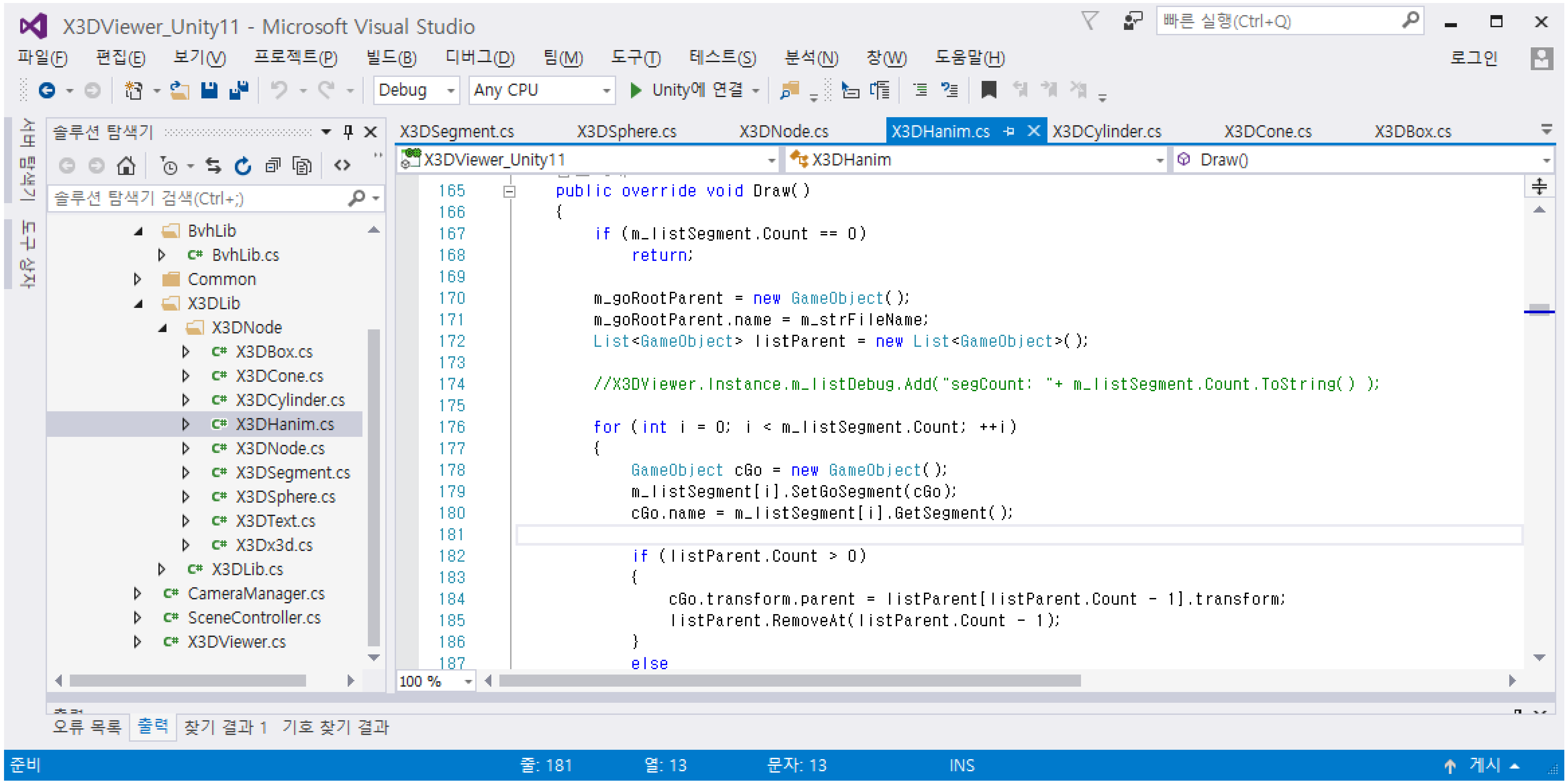
H-Anim Class



X3DViewer_Unity11 - Microsoft Visual Studio
파일(F) 편집(E) 보기(V) 프로젝트(P) 빌드(B) 디버그(D) 팀(M) 도구(T) 테스트(S) 분석(N) 창(W) 도움말(H)
Debug
Any CPU
Unity에 연결
솔루션 탐색기
BvhLib
BvhLib.cs
Common
X3DLib
X3DNode
X3DBox.cs
X3DCone.cs
X3DCylinder.cs
X3DHanim.cs
X3DNode.cs
X3DSegment.cs
X3DSphere.cs
X3DText.cs
X3Dx3d.cs
X3DLib.cs
CameraManager.cs
SceneController.cs
X3DViewer.cs
X3DSegment.cs X3DSphere.cs X3DNode.cs X3DHanim.cs X3DCylinder.cs X3DCone.cs X3DBox.cs
오류 목록 출력 찾기 결과 1 기호 찾기 결과
준비 줄: 1 열: 1 문자: 1 INS

```
using UnityEngine;
using System;
using System.Collections;
using System.Collections.Generic;
using System.Text;
using System.IO;

참조 4개
public class X3DHanim : X3DNode
{
    protected BvhLib m_cBvhLib = new BvhLib();

    protected List<X3DSegment> m_listSegment = new List<X3DSegment>();
    protected string m_strFileName;
    protected string m_strBvhFileName;
    protected GameObject m_goRootParent;
    protected Texture2D m_texImage;

    protected bool m_bAnimationPlay = false;
    protected int m_nAnimationFrame;

    참조 1개
    public X3DHanim( string strFileName, string strBvhFileName)
```

H-Anim Class

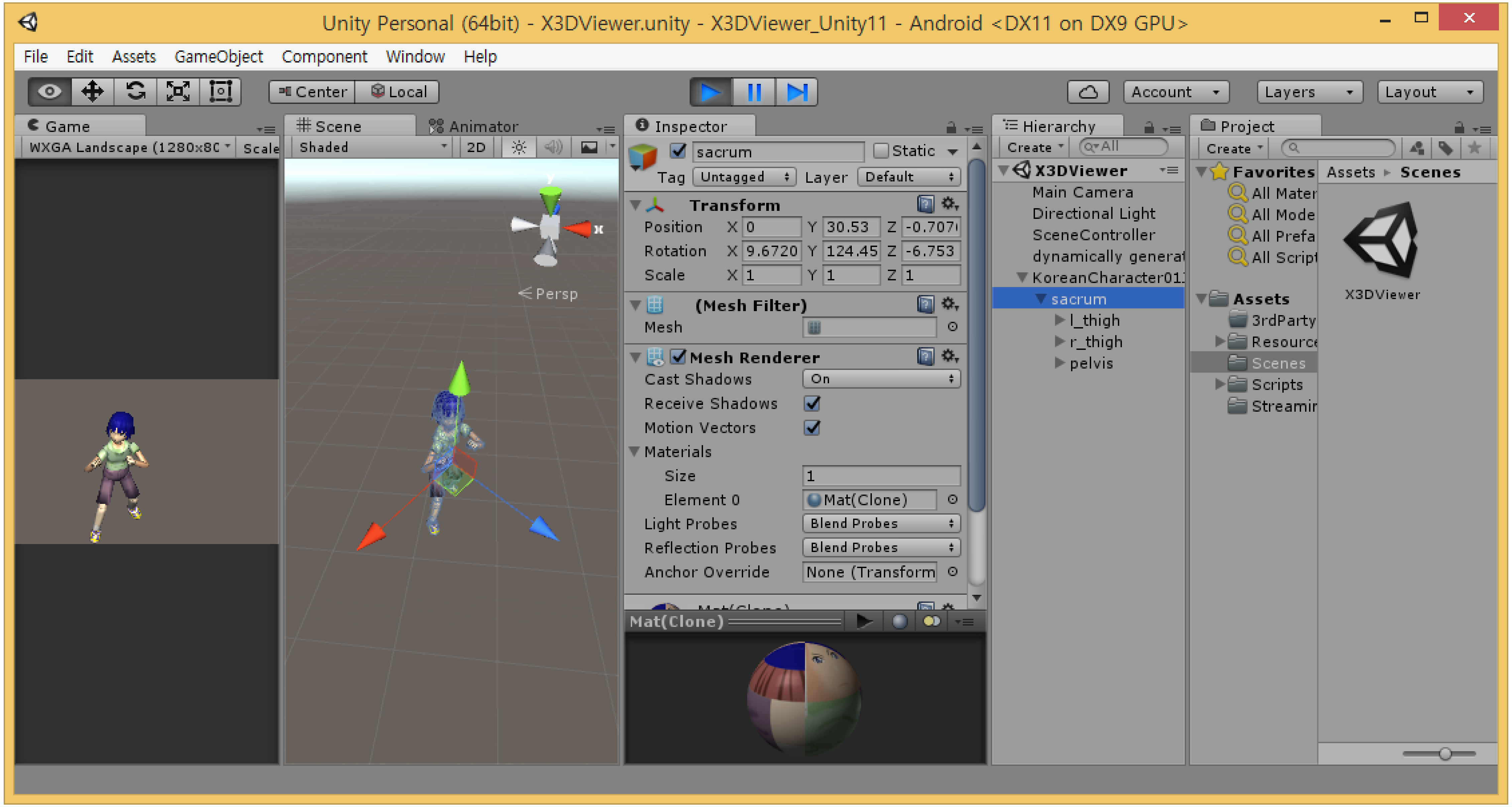


X3DViewer_Unity11 - Microsoft Visual Studio

```
        public override void Draw()
        {
            if (m_listSegment.Count == 0)
                return;

            m_goRootParent = new GameObject();
            m_goRootParent.name = m_strFileName;
            List<GameObject> listParent = new List<GameObject>();

            //X3DViewer.Instance.m_listDebug.Add("segCount: "+ m_listSegment.Count.ToString() );

            for (int i = 0; i < m_listSegment.Count; ++i)
            {
                GameObject cGo = new GameObject();
                m_listSegment[i].SetGoSegment(cGo);
                cGo.name = m_listSegment[i].GetSegment();

                if (listParent.Count > 0)
                {
                    cGo.transform.parent = listParent[listParent.Count - 1].transform;
                    listParent.RemoveAt(listParent.Count - 1);
                }
                else
```

파일(F) 편집(E) 보기(V) 프로젝트(P) 빌드(B) 디버그(D) 팀(M) 도구(T) 테스트(S) 분석(N) 창(W) 도움말(H)
Debug
Any CPU
Unity에 연결
솔루션 탐색기
BvhLib
BvhLib.cs
Common
X3DLib
X3DNode
X3DBox.cs
X3DCone.cs
X3DCylinder.cs
X3DHanim.cs
X3DNode.cs
X3DSegment.cs
X3DSphere.cs
X3DText.cs
X3Dx3d.cs
X3DLib.cs
CameraManager.cs
SceneController.cs
X3DViewer.cs
X3DSegment.cs X3DSphere.cs X3DNode.cs X3DHanim.cs X3DCylinder.cs X3DCone.cs X3DBox.cs
X3DViewer_Unity11
X3DHanim
Draw()
오류 목록 출력 찾기 결과 1 기호 찾기 결과
준비 줄: 181 열: 13 문자: 13 INS

H-Anim Character Animation



sacrum ✓ Static
Tag Untagged Layer Default

Transform

Position	X	0	Y	30.53	Z	-0.707
Rotation	X	9.6720	Y	124.45	Z	-6.753
Scale	X	1	Y	1	Z	1

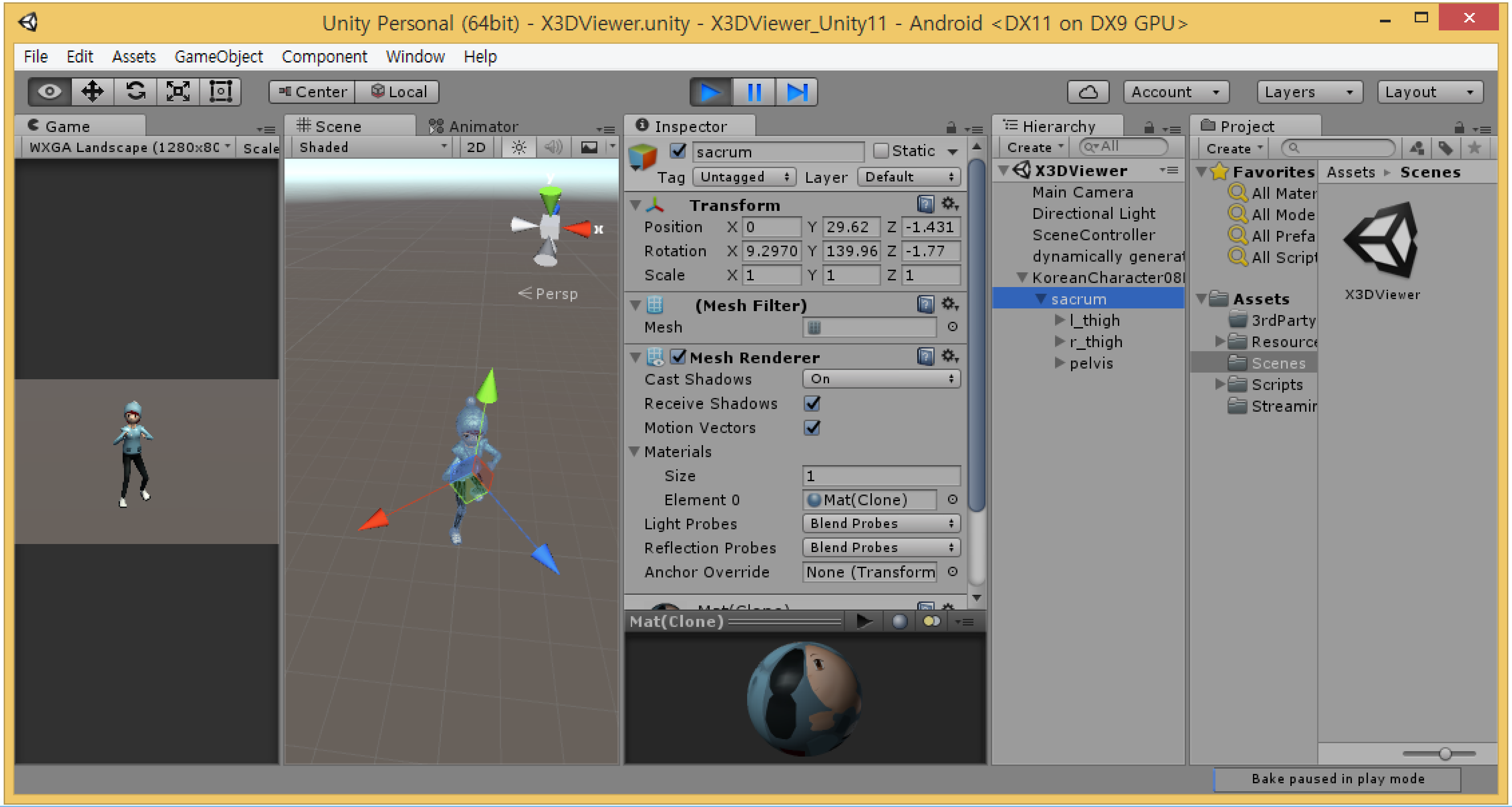
(Mesh Filter)
Mesh

Mesh Renderer

Cast Shadows	On
Receive Shadows	✓
Motion Vectors	✓
Materials	
Size	1
Element 0	Mat(Clone)
Light Probes	Blend Probes
Reflection Probes	Blend Probes
Anchor Override	None (Transform

Mat(Clone)

H-Anim Character Animation (Video)



Unity Personal (64bit) - X3DViewer.unity - X3DViewer_Unity11 - Android <DX11 on DX9 GPU>

File Edit Assets GameObject Component Window Help

Inspector

sacrum Static
Tag Untagged Layer Default

Transform
Position X 0 Y 29.62 Z -1.431
Rotation X 9.2970 Y 139.96 Z -1.77
Scale X 1 Y 1 Z 1

(Mesh Filter)
Mesh

Mesh Renderer
Cast Shadows On
Receive Shadows ✓
Motion Vectors ✓
Materials
Size 1
Element 0 Mat(Clone)
Light Probes Blend Probes
Reflection Probes Blend Probes
Anchor Override None (Transform

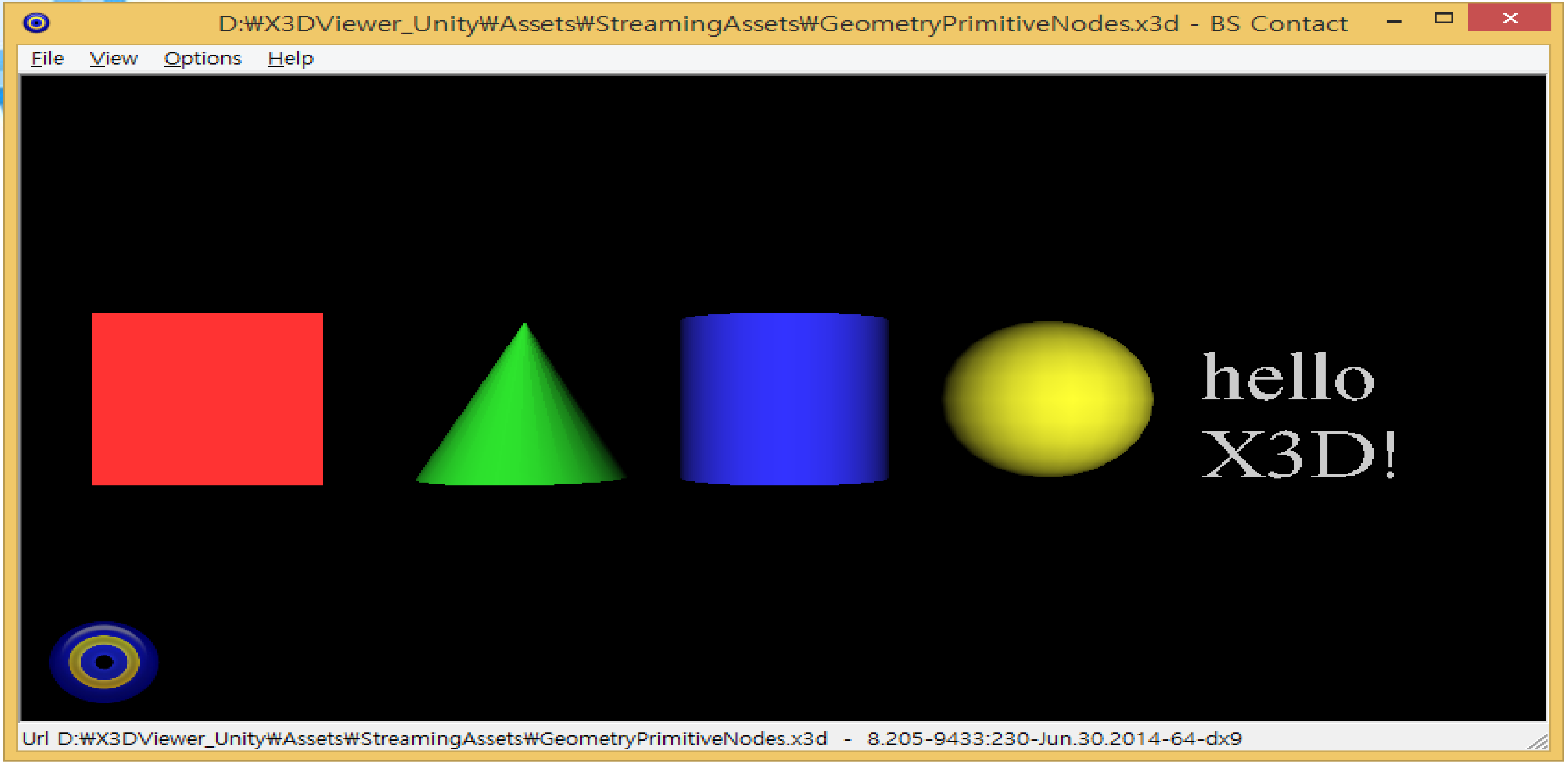
Mat(Clone)

Hierarchy
Create All
X3DViewer
Main Camera
Directional Light
SceneController
dynamically generat
KoreanCharacter08
sacrum
l_thigh
r_thigh
pelvis

Project
Create
Favorites
All Mater
All Mode
All Prefa
All Script
Assets
3rdParty
Resource
Scenes
Scripts
Streamir
Assets ▸ Scenes
X3DViewer

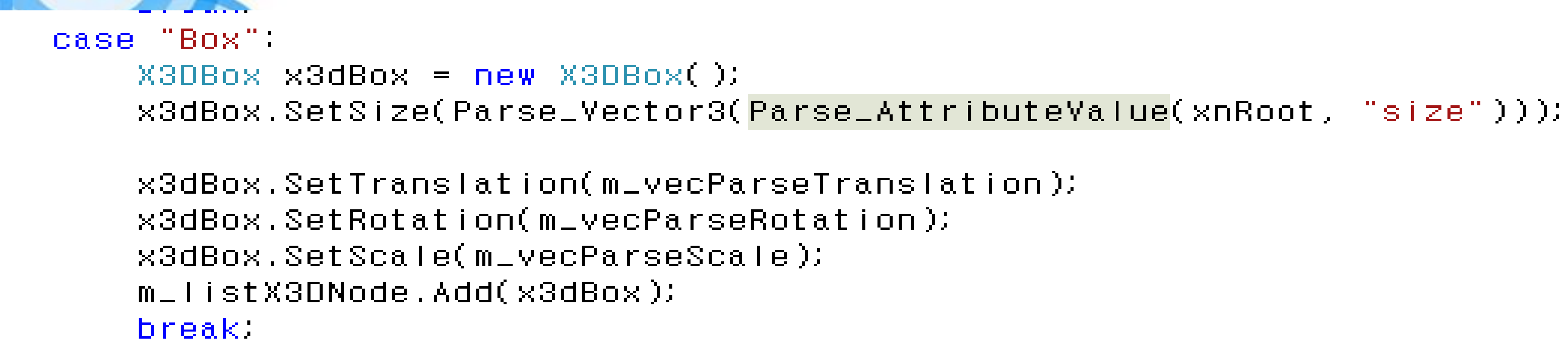
Bake paused in play mode

GeometryPrimitiveNodes.x3d


D:₩X3DViewer_Unity₩Assets₩StreamingAssets₩GeometryPrimitiveNodes.x3d - BS Contact

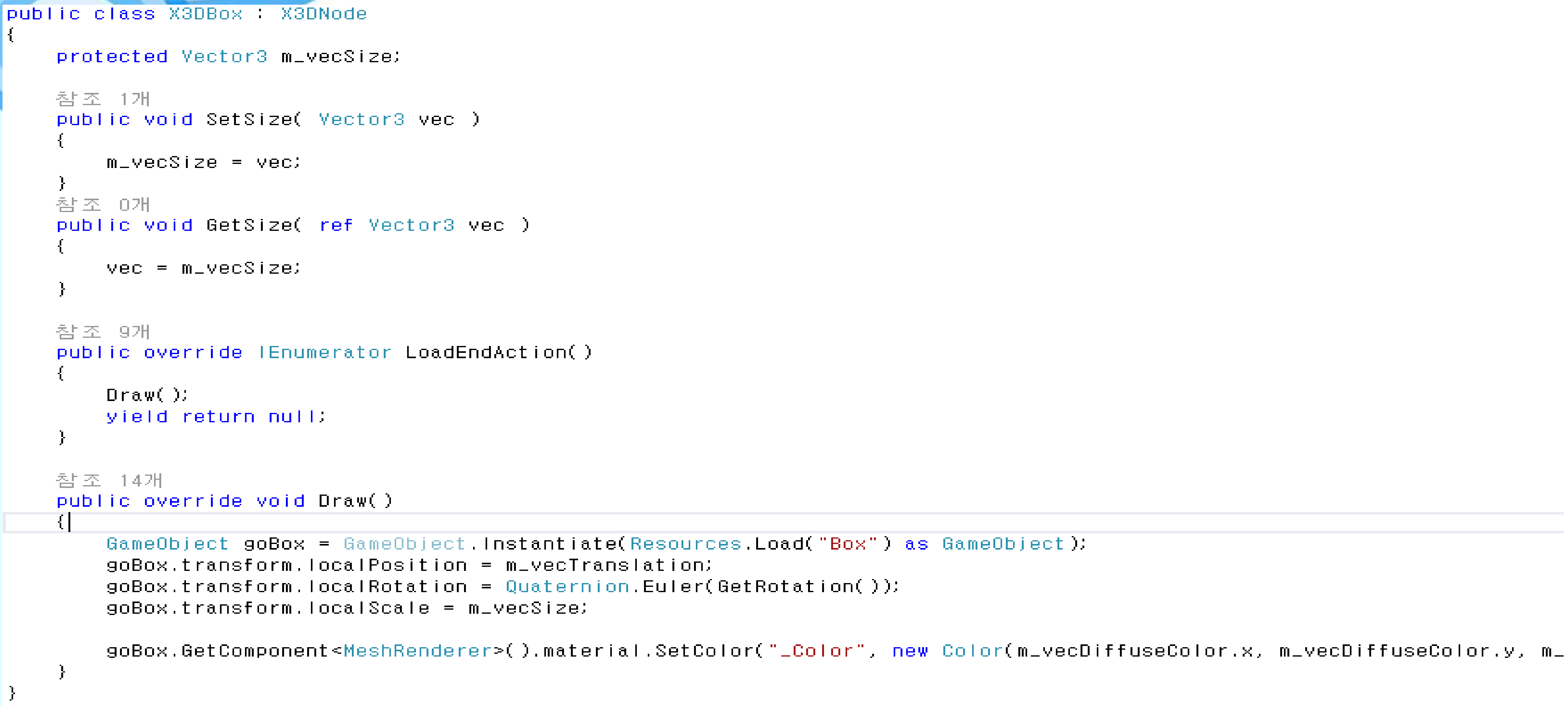
Url D:₩X3DViewer_Unity₩Assets₩StreamingAssets₩GeometryPrimitiveNodes.x3d - 8.205-9433:230-Jun.30.2014-64-dx9

Box Parsing



```
case "Box":
    X3DBox x3dBox = new X3DBox();
    x3dBox.SetSize(Parse_Vector3(Parse_AttributeValue(xnRoot, "size")));

    x3dBox.SetTranslation(m_vecParseTranslation);
    x3dBox.SetRotation(m_vecParseRotation);
    x3dBox.SetScale(m_vecParseScale);
    m_listX3DNode.Add(x3dBox);
    break;
```

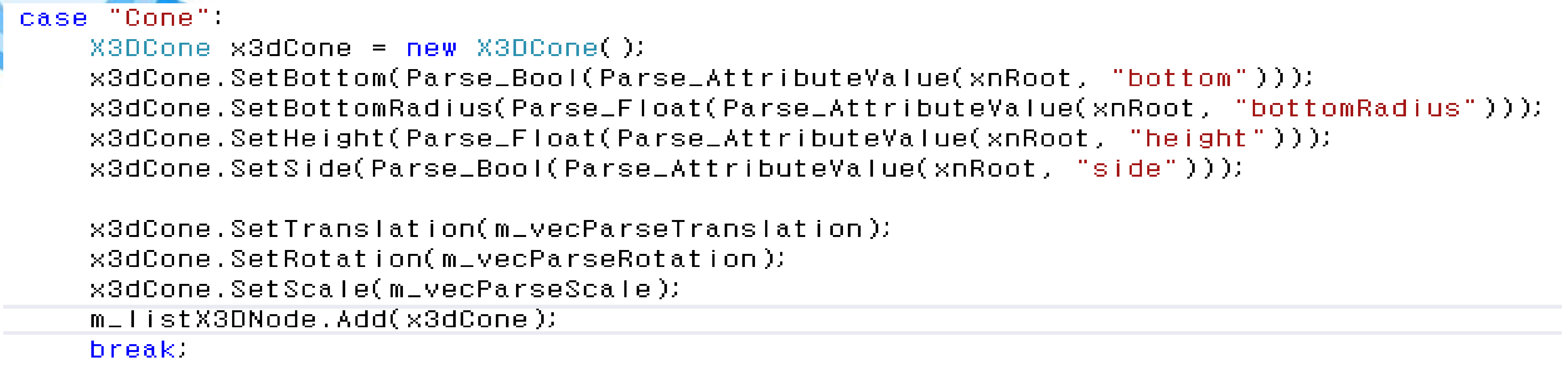
Box Class



```
public class X3DBox : X3DNode
{
    protected Vector3 m_vecSize;

    참조 1개
    public void SetSize( Vector3 vec )
    {
        m_vecSize = vec;
    }
    참조 0개
    public void GetSize( ref Vector3 vec )
    {
        vec = m_vecSize;
    }

    참조 9개
    public override IEnumerator LoadEndAction()
    {
        Draw();
        yield return null;
    }

    참조 14개
    public override void Draw()
    {
        GameObject goBox = GameObject.Instantiate(Resources.Load("Box") as GameObject);
        goBox.transform.localPosition = m_vecTranslation;
        goBox.transform.localRotation = Quaternion.Euler(GetRotation());
        goBox.transform.localScale = m_vecSize;

        goBox.GetComponent<MeshRenderer>().material.SetColor("_Color", new Color(m_vecDiffuseColor.x, m_vecDiffuseColor.y, m_
    }
}
```

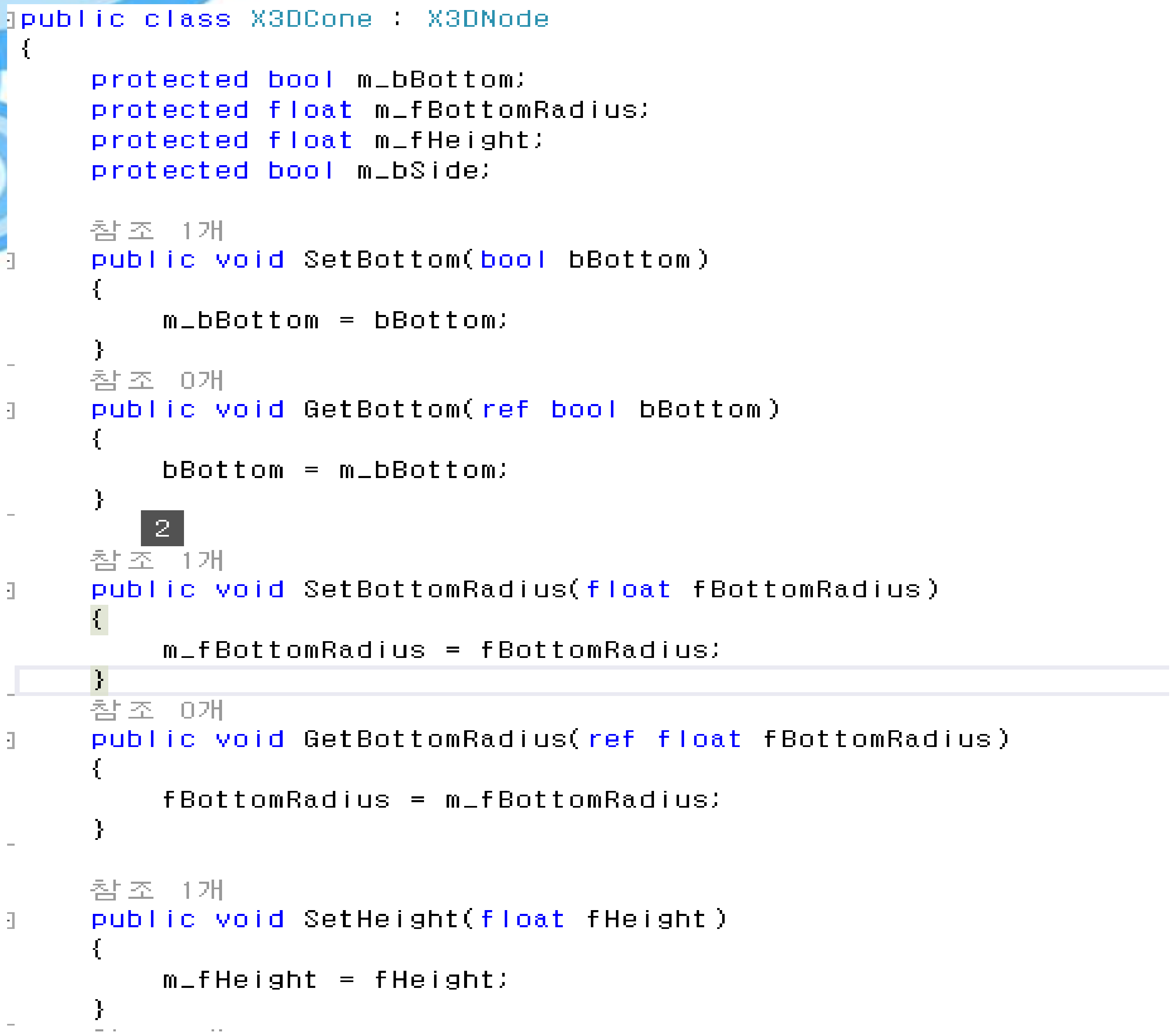
Box Unity

Cone Parsing



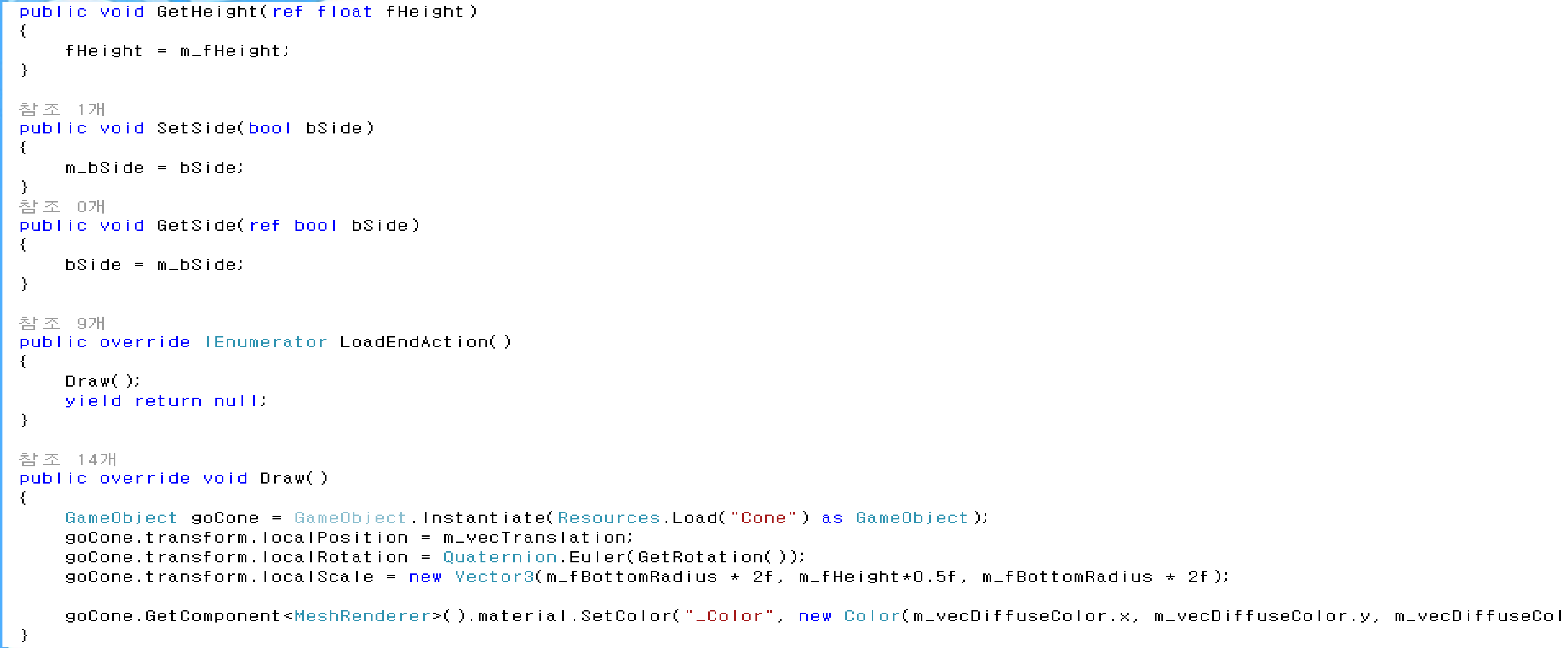
```
case "Cone":
    X3DCone x3dCone = new X3DCone();
    x3dCone.SetBottom(Parse_Bool(Parse_AttributeValue(xnRoot, "bottom")));
    x3dCone.SetBottomRadius(Parse_Float(Parse_AttributeValue(xnRoot, "bottomRadius")));
    x3dCone.SetHeight(Parse_Float(Parse_AttributeValue(xnRoot, "height")));
    x3dCone.SetSide(Parse_Bool(Parse_AttributeValue(xnRoot, "side")));

    x3dCone.SetTranslation(m_vecParseTranslation);
    x3dCone.SetRotation(m_vecParseRotation);
    x3dCone.SetScale(m_vecParseScale);
    m_listX3DNode.Add(x3dCone);
    break;
```

Cone Class



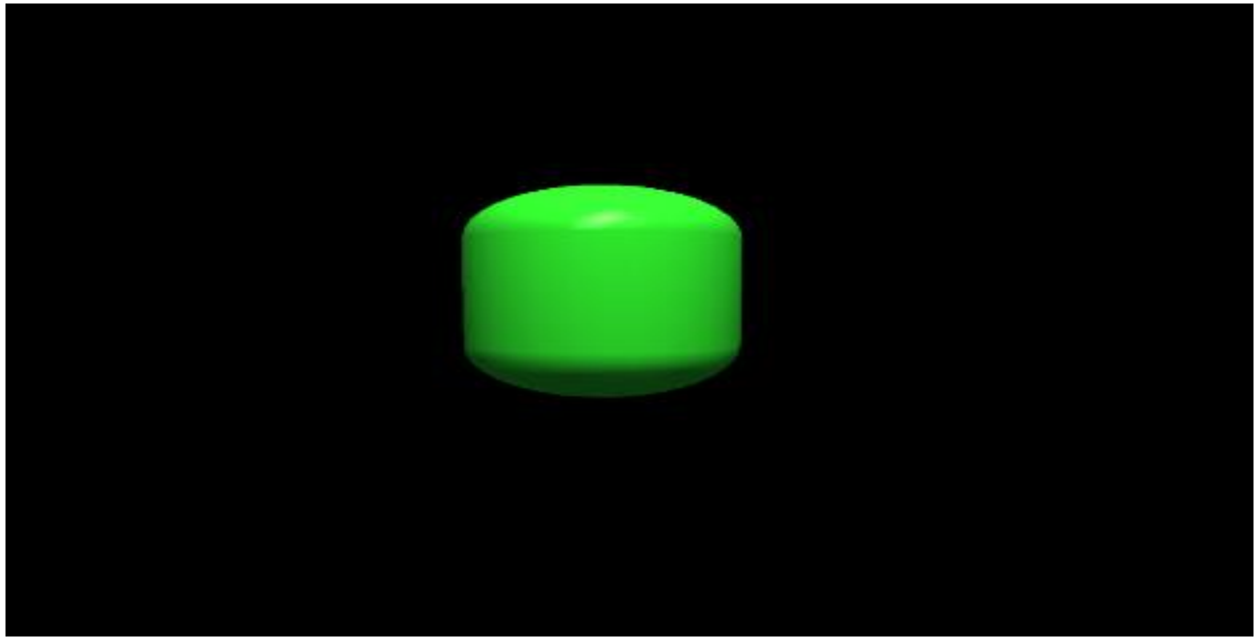
```
public class X3DCone : X3DNode
{
    protected bool m_bBottom;
    protected float m_fBottomRadius;
    protected float m_fHeight;
    protected bool m_bSide;

    참조 1개
    public void SetBottom(bool bBottom)
    {
        m_bBottom = bBottom;
    }
    참조 0개
    public void GetBottom(ref bool bBottom)
    {
        bBottom = m_bBottom;
    }
         2
    참조 1개
    public void SetBottomRadius(float fBottomRadius)
    {
        m_fBottomRadius = fBottomRadius;
    }
    참조 0개
    public void GetBottomRadius(ref float fBottomRadius)
    {
        fBottomRadius = m_fBottomRadius;
    }

    참조 1개
    public void SetHeight(float fHeight)
    {
        m_fHeight = fHeight;
    }
```

Cone Class

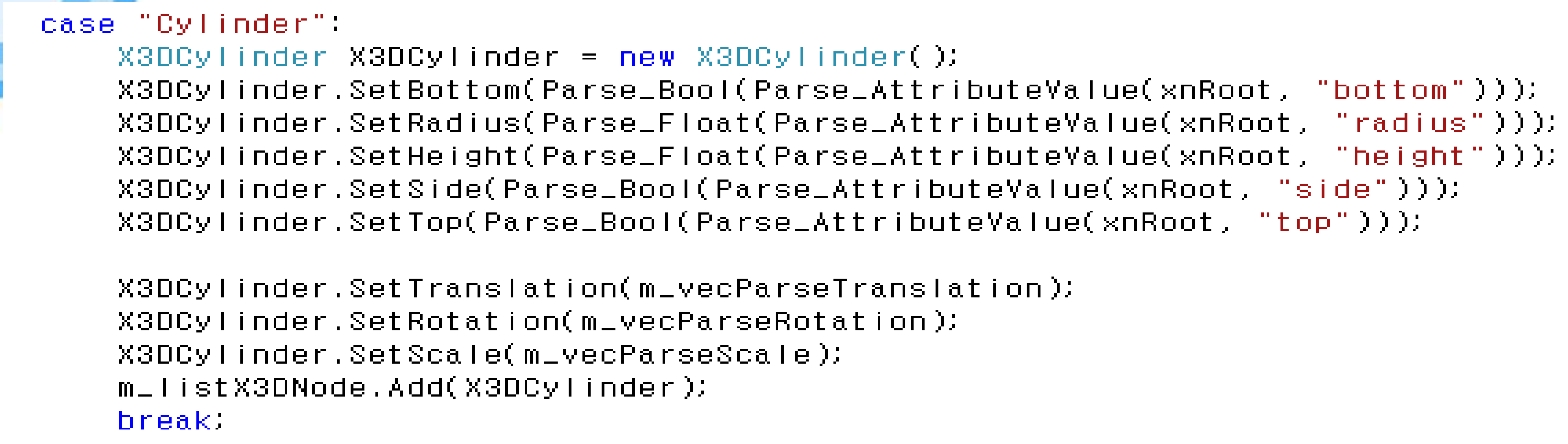


```
public void GetHeight(ref float fHeight)
{
    fHeight = m_fHeight;
}

참조 1개
public void SetSide(bool bSide)
{
    m_bSide = bSide;
}
참조 0개
public void GetSide(ref bool bSide)
{
    bSide = m_bSide;
}

참조 9개
public override IEnumerator LoadEndAction()
{
    Draw();
    yield return null;
}

참조 14개
public override void Draw()
{
    GameObject goCone = GameObject.Instantiate(Resources.Load("Cone") as GameObject);
    goCone.transform.localPosition = m_vecTranslation;
    goCone.transform.localRotation = Quaternion.Euler(GetRotation());
    goCone.transform.localScale = new Vector3(m_fBottomRadius * 2f, m_fHeight*0.5f, m_fBottomRadius * 2f);

    goCone.GetComponent<MeshRenderer>().material.SetColor("_Color", new Color(m_vecDiffuseColor.x, m_vecDiffuseColor.y, m_vecDiffuseCol
}
```

Cone Unity

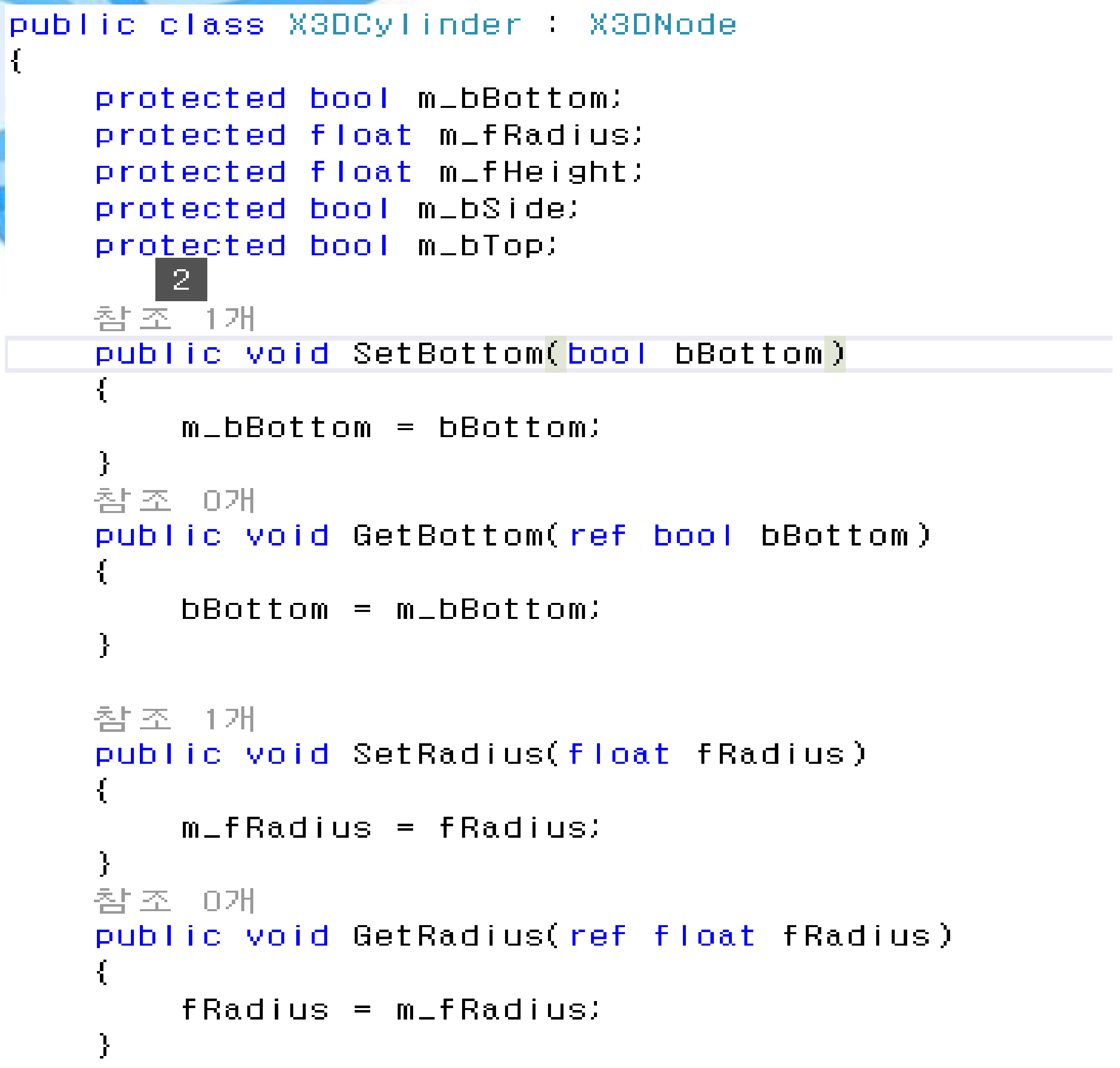


Cylinder Parsing



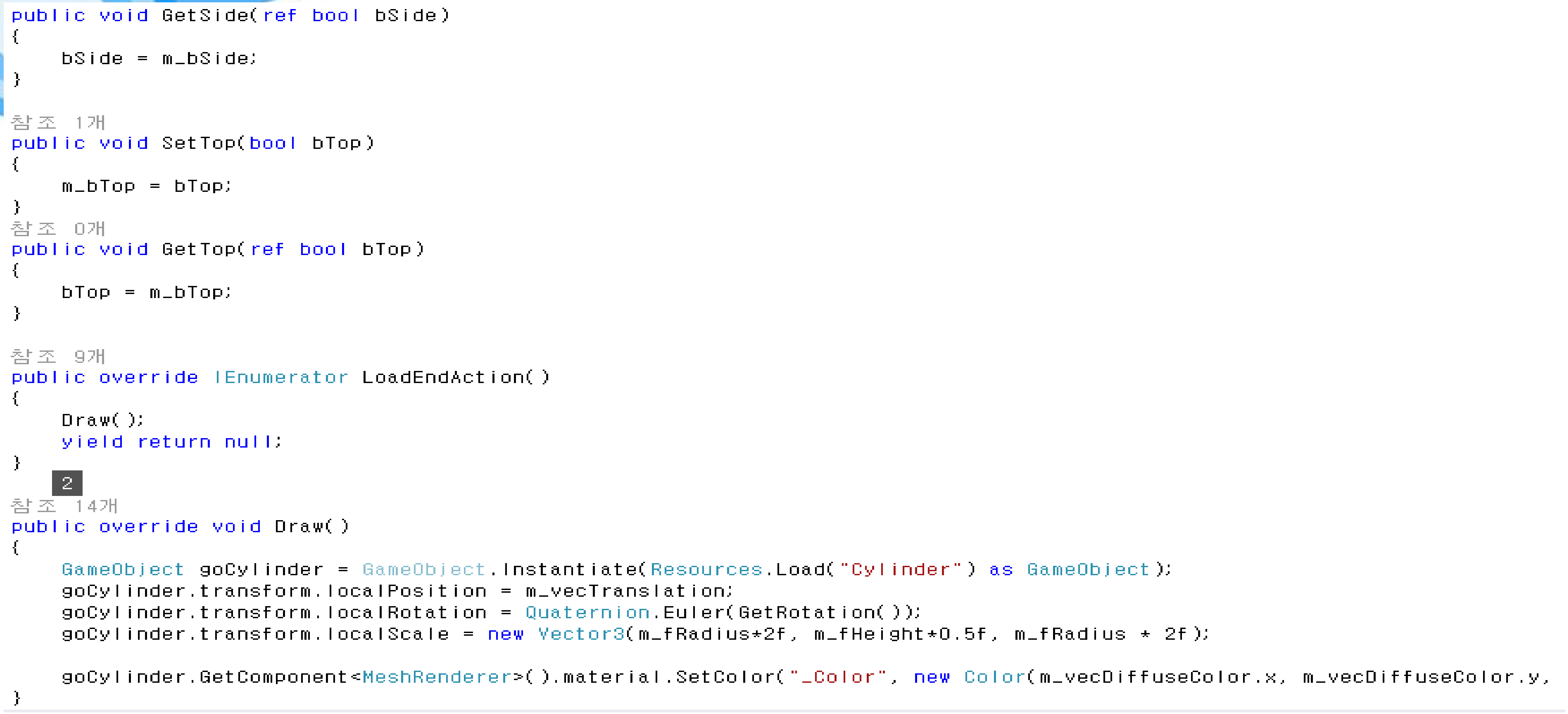
```
case "Cylinder":
    X3DCylinder X3DCylinder = new X3DCylinder();
    X3DCylinder.SetBottom(Parse_Bool(Parse_AttributeValue(xnRoot, "bottom")));
    X3DCylinder.SetRadius(Parse_Float(Parse_AttributeValue(xnRoot, "radius")));
    X3DCylinder.SetHeight(Parse_Float(Parse_AttributeValue(xnRoot, "height")));
    X3DCylinder.SetSide(Parse_Bool(Parse_AttributeValue(xnRoot, "side")));
    X3DCylinder.SetTop(Parse_Bool(Parse_AttributeValue(xnRoot, "top")));

    X3DCylinder.SetTranslation(m_vecParseTranslation);
    X3DCylinder.SetRotation(m_vecParseRotation);
    X3DCylinder.SetScale(m_vecParseScale);
    m_listX3DNode.Add(X3DCylinder);
    break;
```

Cylinder Class



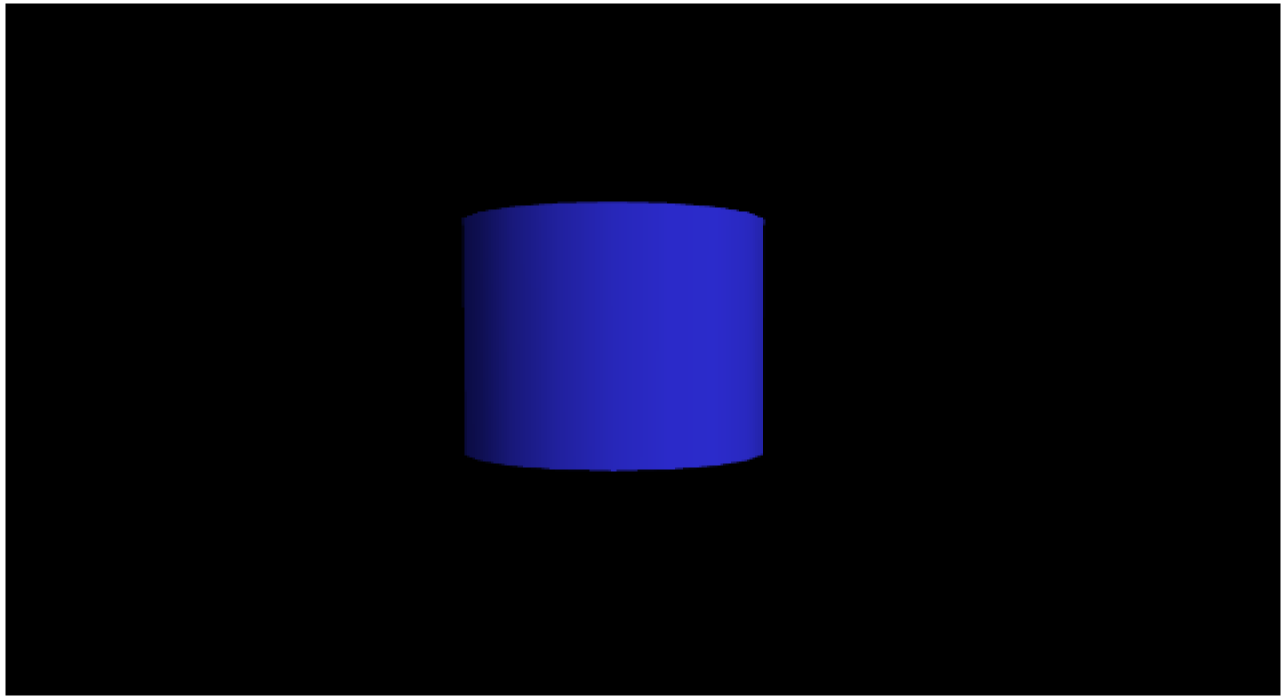
```
public class X3DCylinder : X3DNode
{
    protected bool m_bBottom;
    protected float m_fRadius;
    protected float m_fHeight;
    protected bool m_bSide;
    protected bool m_bTop;
        2
    참조 1개
    public void SetBottom(bool bBottom)
    {
        m_bBottom = bBottom;
    }
    참조 0개
    public void GetBottom(ref bool bBottom)
    {
        bBottom = m_bBottom;
    }

    참조 1개
    public void SetRadius(float fRadius)
    {
        m_fRadius = fRadius;
    }
    참조 0개
    public void GetRadius(ref float fRadius)
    {
        fRadius = m_fRadius;
    }
```

Cylinder Class

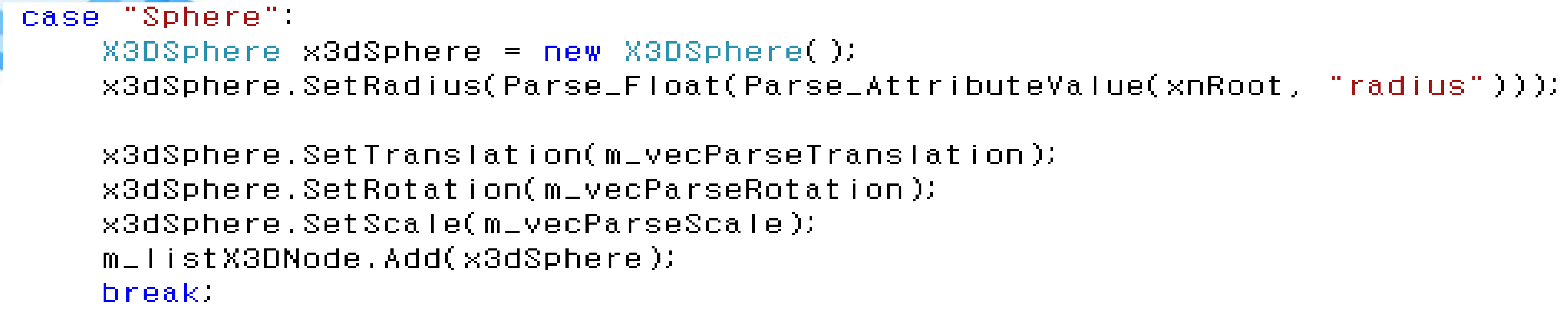


```
public void GetSide(ref bool bSide)
{
    bSide = m_bSide;
}

참조 1개
public void SetTop(bool bTop)
{
    m_bTop = bTop;
}
참조 0개
public void GetTop(ref bool bTop)
{
    bTop = m_bTop;
}

참조 9개
public override IEnumerator LoadEndAction()
{
    Draw();
    yield return null;
}
   2
참조 14개
public override void Draw()
{
    GameObject goCylinder = GameObject.Instantiate(Resources.Load("Cylinder") as GameObject);
    goCylinder.transform.localPosition = m_vecTranslation;
    goCylinder.transform.localRotation = Quaternion.Euler(GetRotation());
    goCylinder.transform.localScale = new Vector3(m_fRadius*2f, m_fHeight*0.5f, m_fRadius * 2f);

    goCylinder.GetComponent<MeshRenderer>().material.SetColor("_Color", new Color(m_vecDiffuseColor.x, m_vecDiffuseColor.y,
}
```

Cylinder Unity

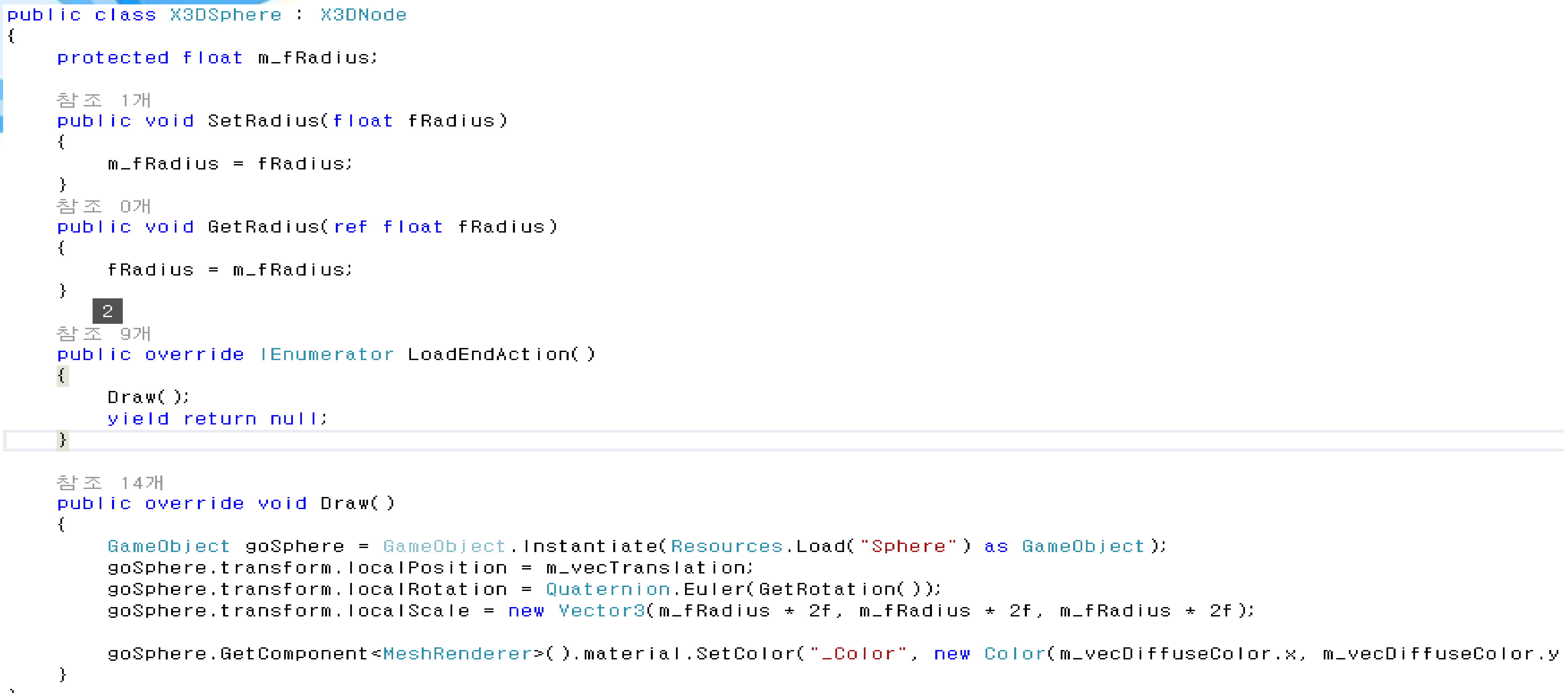


Sphere Parsing



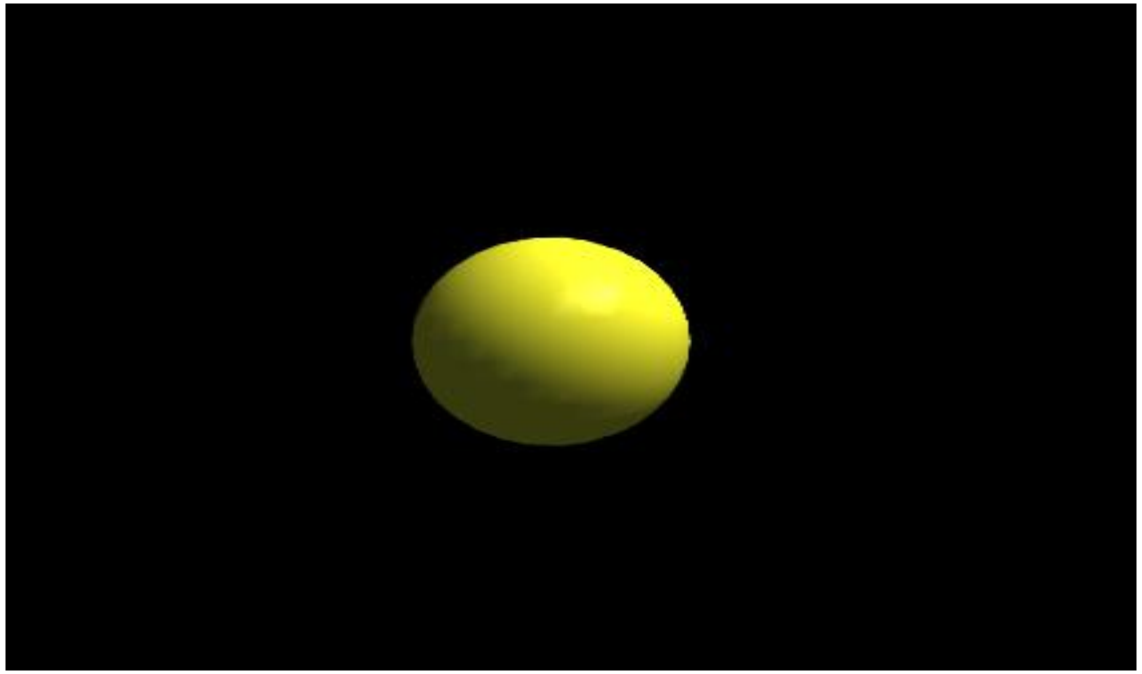
```
case "Sphere":
    X3DSphere x3dSphere = new X3DSphere();
    x3dSphere.SetRadius(Parse_Float(Parse_AttributeValue(xnRoot, "radius")));

    x3dSphere.SetTranslation(m_vecParseTranslation);
    x3dSphere.SetRotation(m_vecParseRotation);
    x3dSphere.SetScale(m_vecParseScale);
    m_listX3DNode.Add(x3dSphere);
    break;
```

Sphere Class

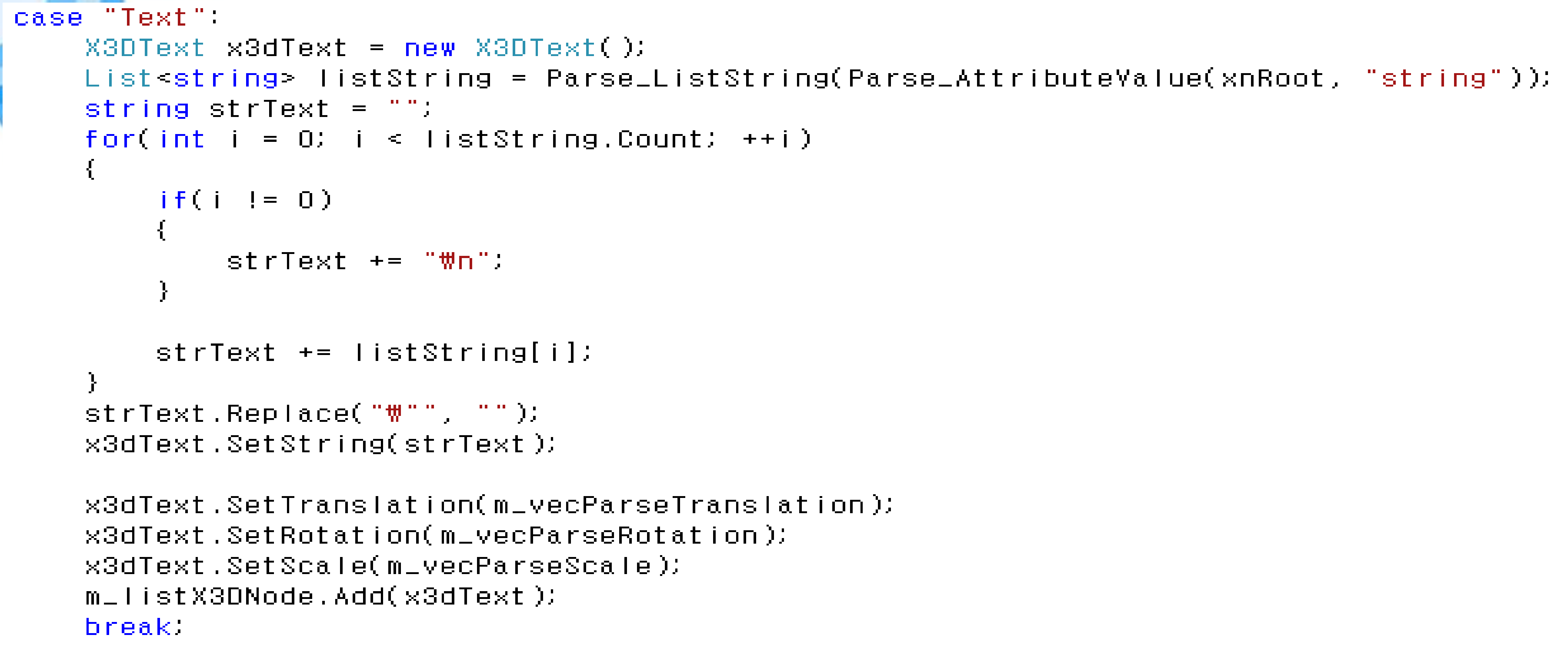


```
public class X3DSphere : X3DNode
{
    protected float m_fRadius;

    참조 1개
    public void SetRadius(float fRadius)
    {
        m_fRadius = fRadius;
    }
    참조 0개
    public void GetRadius(ref float fRadius)
    {
        fRadius = m_fRadius;
    }
       2
    참조 9개
    public override IEnumerator LoadEndAction()
    {
        Draw();
        yield return null;
    }

    참조 14개
    public override void Draw()
    {
        GameObject goSphere = GameObject.Instantiate(Resources.Load("Sphere") as GameObject);
        goSphere.transform.localPosition = m_vecTranslation;
        goSphere.transform.localRotation = Quaternion.Euler(GetRotation());
        goSphere.transform.localScale = new Vector3(m_fRadius * 2f, m_fRadius * 2f, m_fRadius * 2f);

        goSphere.GetComponent<MeshRenderer>().material.SetColor("_Color", new Color(m_vecDiffuseColor.x, m_vecDiffuseColor.y
    }
}
```

Sphere Unity

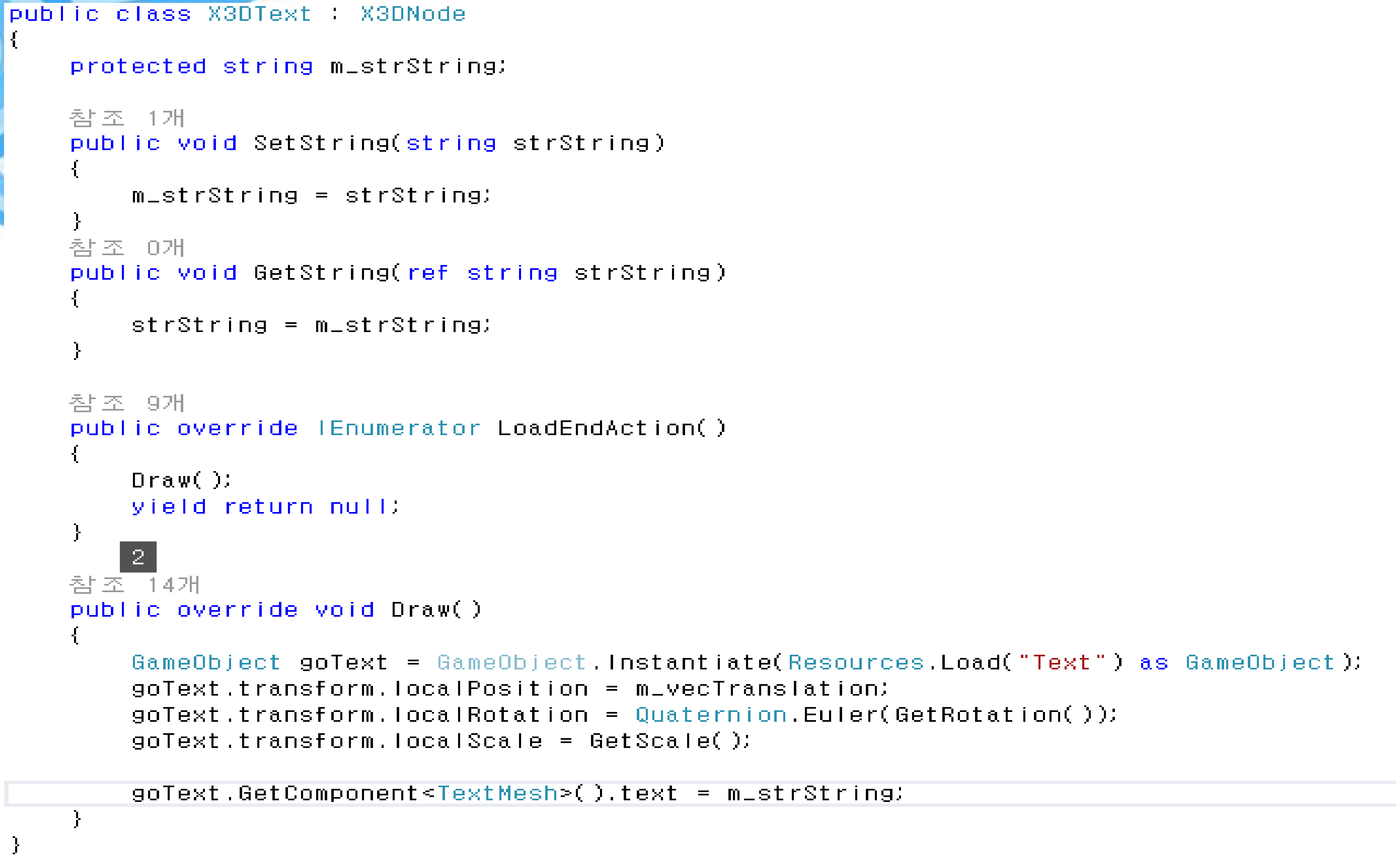


Text Parsing



```
case "Text":
    X3DText x3dText = new X3DText();
    List<string> listString = Parse_ListString(Parse_AttributeValue(xnRoot, "string"));
    string strText = "";
    for( int i = 0; i < listString.Count; ++i )
    {
        if(i != 0)
        {
            strText += "₩n";
        }

        strText += listString[i];
    }
    strText.Replace("₩"", "");
    x3dText.SetString(strText);

    x3dText.SetTranslation(m_vecParseTranslation);
    x3dText.SetRotation(m_vecParseRotation);
    x3dText.SetScale(m_vecParseScale);
    m_listX3DNode.Add(x3dText);
    break;
```

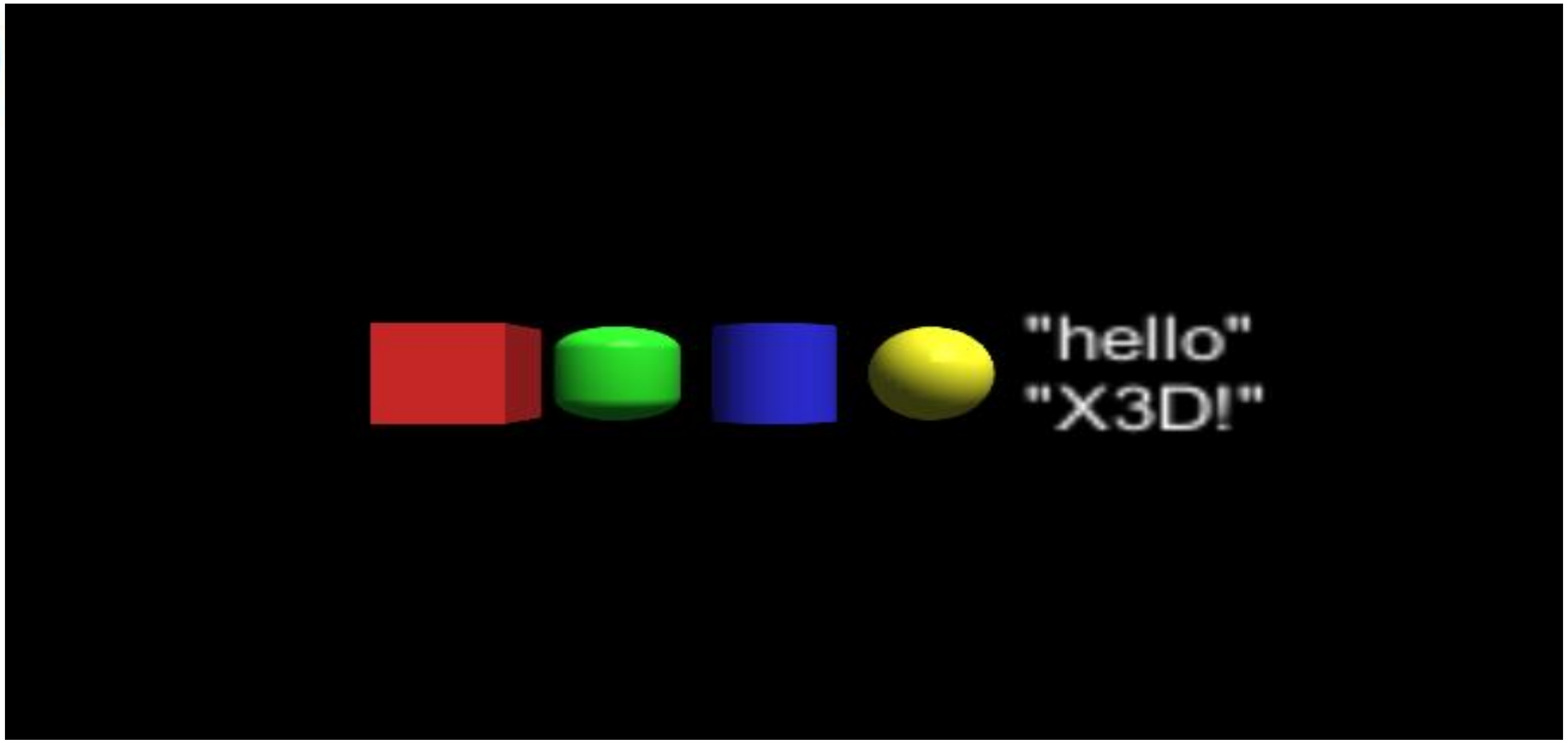
Text Class



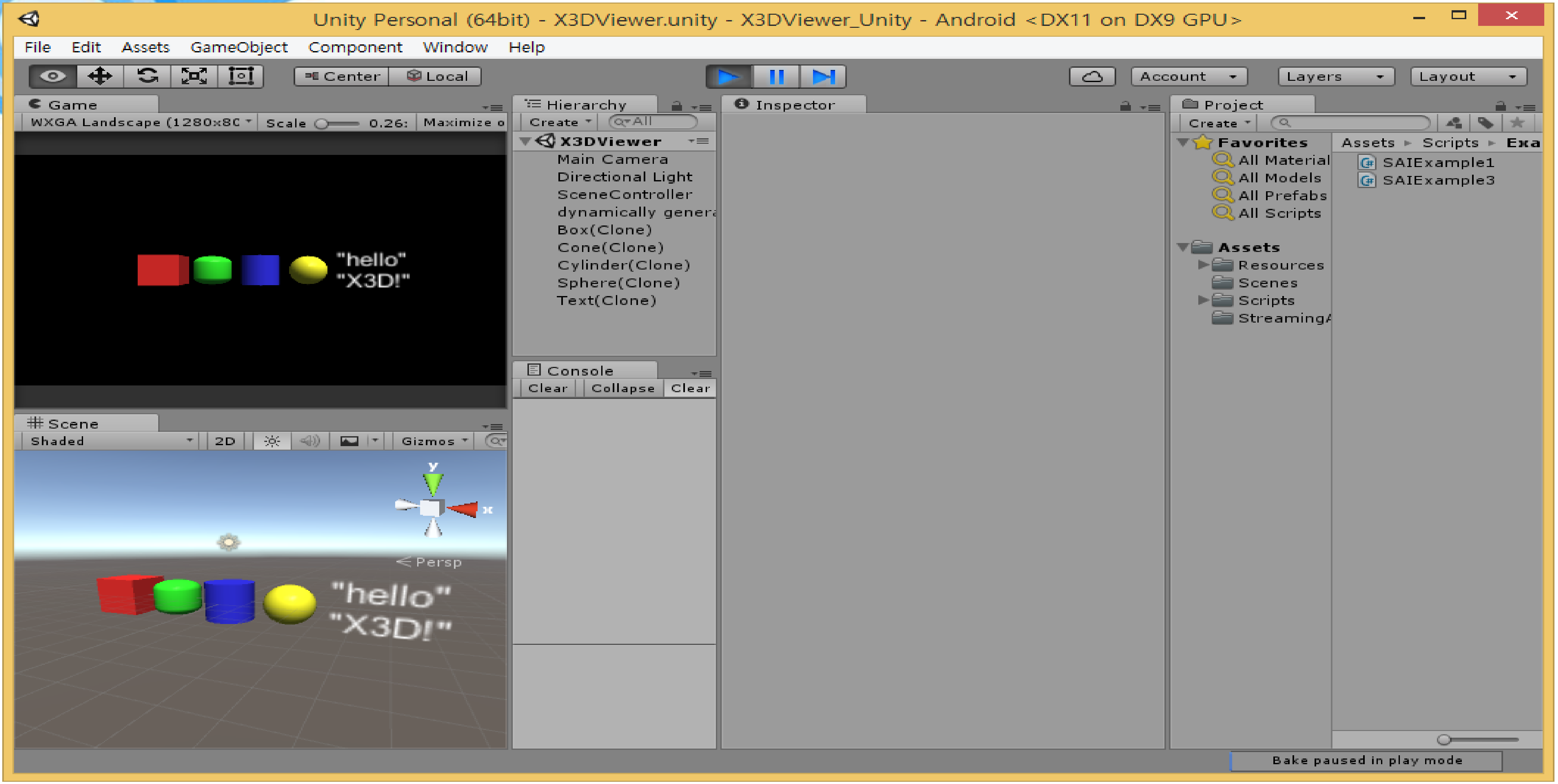
```
public class X3DText : X3DNode
{
    protected string m_strString;

    참조 1개
    public void SetString(string strString)
    {
        m_strString = strString;
    }
    참조 0개
    public void GetString(ref string strString)
    {
        strString = m_strString;
    }

    참조 9개
    public override IEnumerator LoadEndAction()
    {
        Draw();
        yield return null;
    }
        2
    참조 14개
    public override void Draw()
    {
        GameObject goText = GameObject.Instantiate(Resources.Load("Text") as GameObject);
        goText.transform.localPosition = m_vecTranslation;
        goText.transform.localRotation = Quaternion.Euler(GetRotation());
        goText.transform.localScale = GetScale();

        goText.GetComponent<TextMesh>().text = m_strString;
    }
}
```

Text Unity

GeometryPrimitiveNodes.x3d Unity



GeometryPrimitiveNodes.x3d Unity



Unity Personal (64bit) - X3DViewer.unity - X3DViewer_Unity - Android <DX11 on DX9 GPU>

File Edit Assets GameObject Component Window Help

X3DViewer
Main Camera
Directional Light
SceneController
dynamically genera
Box(Clone)
Cone(Clone)
Cylinder(Clone)
Sphere(Clone)
Text(Clone)

Bake paused in play mode

Work in Progress

- 19777-3 and 19777-4 NWIP submission to ISO (2018.7)
- 19777-5 NWIP submission (2018.1), did not pass due to insufficient participation initially; now satisfied the required number of national bodies, and will be registered on the ISO project portal
- Implementation of C, C++ and C# language bindings
  - 19777-3 X3D scene access interface definition using C
    - Visual C++ and OpenGL
  - 19777-4 X3D scene access interface definition using C++
    - Visual C++ and OpenGL
  - 19777-5 X3D scene access interface definition using C#
    - Unity and C#
- Developing X3D Binding viewer programs with C, C++ and C# binding capability