Learning jME

This will provide all you need to get started with jME. It assumes you have jME installed. If not, you can look to this installation guide. As a supplement to this guide, you can read the documentation at jME's documentation link, paying special attention to jME's wiki. Finally, never be afraid to ask questions (no matter how simple) at jME's forum.

Contents

1) Hello World

Here we'll learn the basics of creating a jME program by exploring SimpleGame, Box, and rootNode.

2) Hello Node

This program introduces Nodes, Bounding Volumes, Sphere, Colors, Translation, and Scaling.

3) Hello TriMesh

This program introduces the TriMesh class and how to make your own objects from scratch.

4) Hello States

This program introduces MaterialState, TextureState, LightState, and PointLight.

5) Hello KeyInput

This program introduces KeyBindingManager, texture wrapping, and how to change TriMesh data after it is assigned.

6) Hello Animation

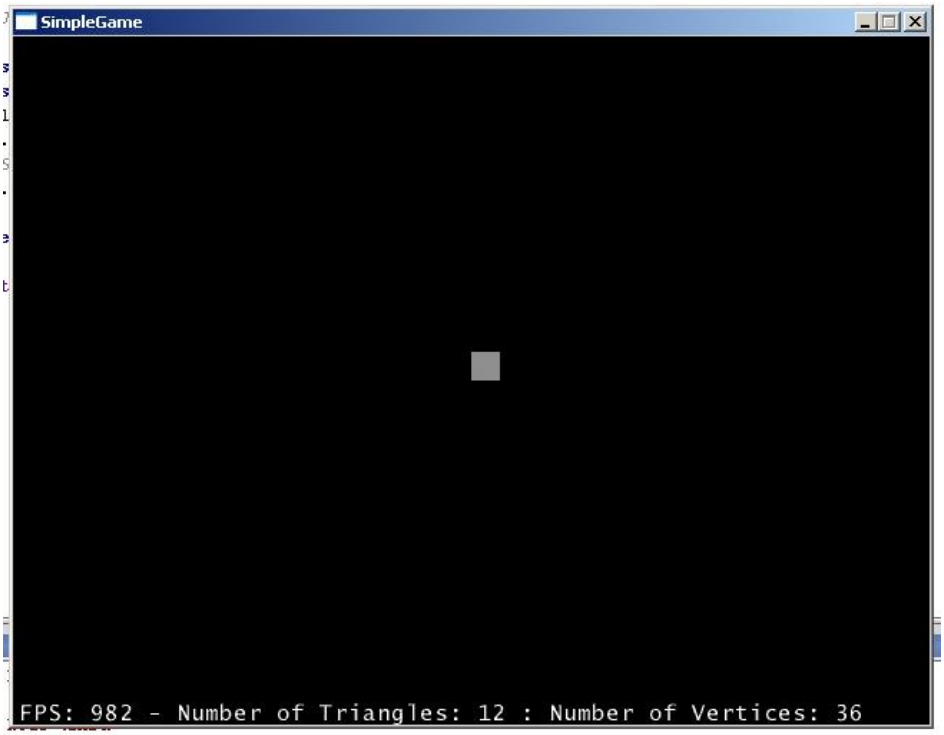
This program introduces LightNode and using Controllers. The controller we will use is called SpatialTransformer.

1. Hello World

Here we'll learn the basics of creating a jME program, by exploring SimpleGame, Box, and rootNode.

OK, let's just dive in. Here's as basic a program as you can get:

```
import com.jme.app.SimpleGame;
import com.jme.scene.shape.Box;
import com.jme.math.Vector3f;

/**
 * Started Date: Jul 20, 2004<br><br>
 * Simple HelloWorld program for jME
 *
 * @author Jack Lindamood
 */
public class HelloWorld extends SimpleGame{
    public static void main(String[] args) {
        HelloWorld app=new HelloWorld();    // Create Object
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        // Signal to show properties dialog
        app.start();    // Start the program
    }
    protected void simpleInitGame() {
        Box b=new Box("My box",new Vector3f(0,0,0),new Vector3f(1,1,1));    // Make a box
        rootNode.attachChild(b);    // Put it in the scene graph
    }
}
```



Pretty short, right? The real meat of our program begins with the following:

public class HelloWorld extends SimpleGame{

SimpleGame does a lot of initialization for us behind our back. If you really want to, you can look at its code, but for now just realize that it creates all the basics needed for rendering. You'll want to extend it on all your beginning programs.

app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);

You know that picture of a monkey you see when the program is first run – the one that lets you select what resolution you want to run at?

Well, this command makes it show. As the name suggests, it always shows the properties dialog on every run. You'll never see that dialog box if you change it to the following:

SimpleGame.NEVER_SHOW_PROPS_DIALOG

Not too difficult.

app.start();

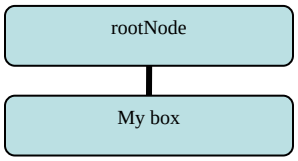
The function start() is basically an infinite while loop. First it initializes the jME system, and then the while loop does two things per iteration: first, it tells everything in your game that it needs to move, and secondly, it renders everything. Basically, it gets the game going.

```
protected void simpleInitGame() {
    Box b=new Box("My box",new Vector3f(0,0,0),new Vector3f(1,1,1));
    rootNode.attachChild(b);
}
```

The function simpleInitGame() is abstract in SimpleGame, so you're forced to implement it every time you extend SimpleGame. Just by looking at the code, it's obvious that two things happen. First I make

a box (it's the thing you saw on the screen). Second, I attach the box to the root of my scene graph. The object rootNode is of class Node which is created by SimpleGame for you. You'll attach everything to it or one of its children. Notice I gave *b* 3 parameters: a string and two Vector3f objects. Every Node or Box or Circle or Person or ***anything*** in your scene graph will have a name. Usually you want the name to be specific for each object. I called this one "My box", but really you could have called it anything. The next two parameters specify the corners of the Box. It has one corner at the origin, and another at x=1, y=1, z=1. Basically, it's a unit cube.

OK, I've created the Box, but I have to tell it I want it rendered, too. That's why I attach it to the rootNode object. Your scene graph basically looks like this:



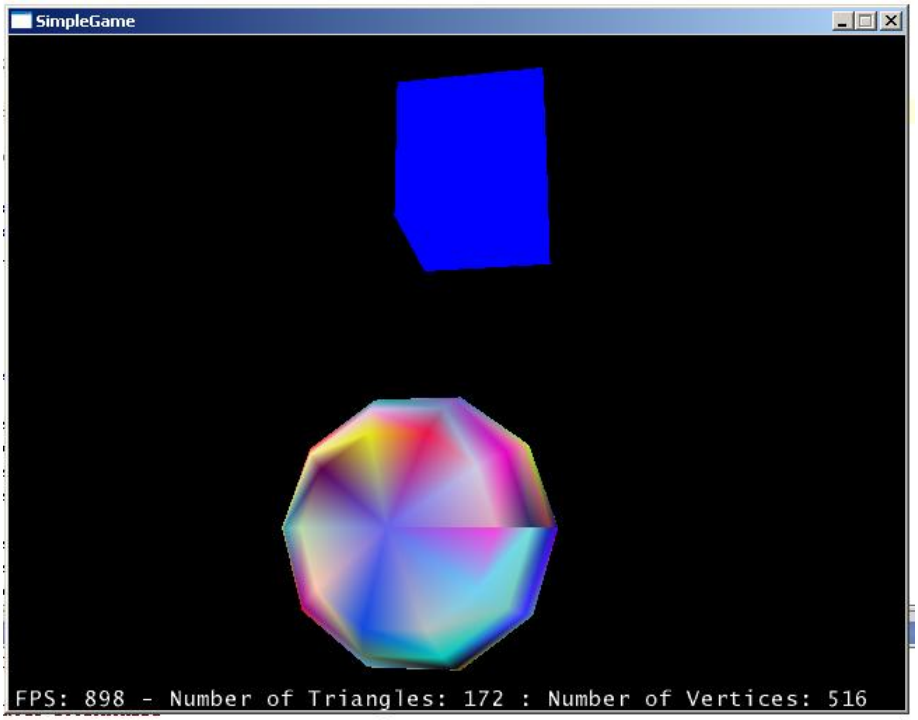
The object rootNode is at the top and "My box" is below it. So, when SimpleGame tries to draw rootNode it will try to draw "My box" as well. That's it! Now, on to something more complex.

2. Hello Node

This program introduces Nodes, Bounding Volumes, Sphere, Colors, Translation and Scaling.

```
import com.jme.app.SimpleGame;
import com.jme.scene.Node;
import com.jme.scene.shape.Box;
import com.jme.scene.shape.Sphere;
import com.jme.math.Vector3f;
import com.jme.bounding.BoundingSphere;
import com.jme.bounding.BoundingBox;
import com.jme.renderer.ColorRGBA;

/**
 * Started Date: Jul 20, 2004<br><br>
 *
 * Simple Node object with a few Geometry manipulators.
 *
 * @author Jack Lindamood
 */
public class HelloNode extends SimpleGame {
    public static void main(String[] args) {
        HelloNode app = new HelloNode();
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        app.start();
    }

    protected void simpleInitGame() {
        Box b=new Box("My Box",new Vector3f(0,0,0),new Vector3f(1,1,1));
        // Give the box a bounds object to allow it to be culled
        b.setModelBound(new BoundingSphere());
        // Calculate the best bounds for the object you gave it
        b.updateModelBound();
        // Move the box 2 in the y direction up
        b.setLocalTranslation(new Vector3f(0,2,0));
        // Give the box a solid color of blue.
        b.setSolidColor(ColorRGBA.blue);

        Sphere s=new Sphere("My sphere",10,10,1f);
        // Do bounds for the sphere, but we'll use a BoundingBox this time
        s.setModelBound(new BoundingBox());
        s.updateModelBound();
        // Give the sphere random colors
        s.setRandomColors();

        // Make a node and give it children
        Node n=new Node("My Node");
        n.attachChild(b);
        n.attachChild(s);
        // Make the node and all its children 5 times larger.
        n.setLocalScale(5);

        // Remove  lighting for rootNode so that it will use our basic colors.
        lightState.detachAll();
```

```
        rootNode.attachChild(n);
    }
}
```



The first new thing you see is:

```
// Give the box a bounds object to allow it to be culled
b.setModelBound(new BoundingSphere());
```

Bounding Volumes (such as BoundingSphere and BoundingBox) are the key to speed in jME. What happens is your object is surrounded by a bounds, and this bounds allows jME to do a quick, easy test to see if your object is even viewable. So in your game, you'll make this really complex person and surround him with a sphere, for instance. A sphere is a really easy object mathematically, so jME can tell very fast if the sphere around your object is visible. If the sphere surrounding your guy isn't visible (which is an easy test), then jME doesn't even bother trying to draw your really large, very complex person. In this example, I surround my box with a sphere, but it makes more sense to surround it with a BoundingBox. Why? Well trying to draw a sphere around a box isn't as tight a fit as a Box around a Box (obviously). I just use a sphere as an example:

```
// Calculate the best bounds for the object you gave it
b.updateModelBound();
```

When I start, I give my Box object bounds, but it's an empty bounds. I now have to "update" the bounds so that it surrounds the object correctly. Now we'll move it up:

```
// Move the box 2 in the y direction up
b.setLocalTranslation(new Vector3f(0,2,0));
```

Now we start moving our object. Vector3f has the format x, y, z, so this moves the object 2 units up. Remember how our Box looks above the Sphere? That's because I moved it up some. If I had used *Vector3f(0,-2,0)* then it would have moved down two. Moving objects in jME is extremely simple. Now color it:

```
// Give the box a solid color of blue.
b.setSolidColor(ColorRGBA.blue);
```

Just looking at the function, you can tell I give my box a solid color. As you can guess by the color type, the color is blue. ColorRGBA.red would make it…. red! You can also use new ColorRGBA(0,1,0,1). These four numbers are: Red/Green/Blue/Alpha and are percentages from 0 to 1. Alpha is lingo for how opaque it is. (The opposite of opaque is transparent. Opaque would be a wall; not opaque would be a window.) So, an alpha of 0 would mean we couldn't see it at all, while .5 would mean we see half way thru it. New ColorRGBA(0,1,1,1) would create a color that is green and blue. Now let's make a sphere:

```
Sphere s=new Sphere("My sphere",10,10,1f);
```

jME can't draw curves. It draws triangles. It's very hard to draw a circle with triangles, isn't it? Because of this, you have to get as close to a circle as you can. The first two numbers represent that closeness. If you change 10, 10 to 5,5 you'll see a pretty bad looking sphere. If you make them 30, 30 you'll see a very round looking sphere but the problem is that it's made of a lot of triangles. More triangles mean slower FPS. The last number, 1, is the radius of the sphere. Just like my Node and my Box, Sphere needs a name which I give "My sphere". For our sphere, let's be a bit prettier with colors:

```
// Give the sphere random colors
s.setRandomColors();
```

This gives each vertex of the sphere a random color, which creates that psychodelic effect you saw. Now on to the node:

```
// Make a node and give it children
Node n=new Node("My Node");
n.attachChild(b);
n.attachChild(s);
```

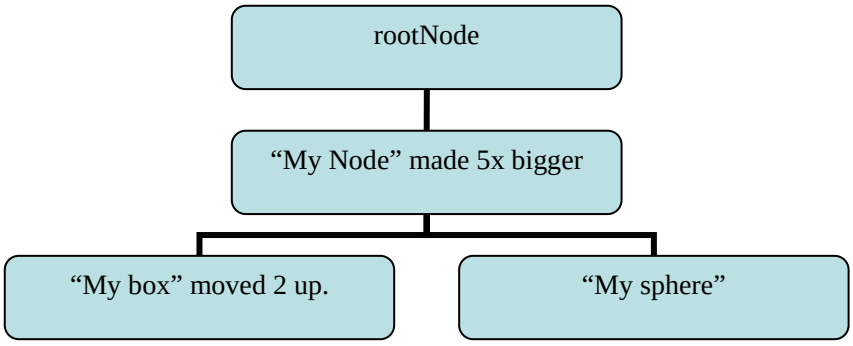
Instead of attaching our box and sphere to the rootNode, we create a new node *n* to attach them too. I also wanted *n* (and all its children) to be five times bigger, so I did this:

```
// Make the node and all its children 5 times larger.
n.setLocalScale(5)
;
```

You'll notice it's similar to the function call setLocalTranslation in name. There's also a setLocalRotation, which we'll get into later. As the name suggests, this makes everything five times larger. Finally, you'll notice a strange line at the end of my code:

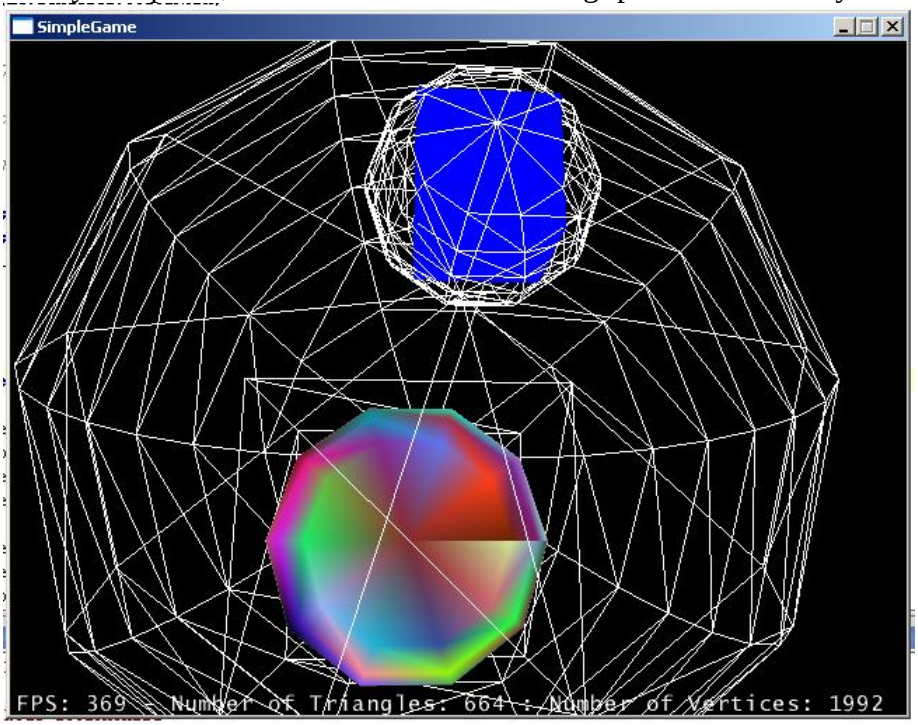
```
// Remove  lighting for rootNode so that it will use our basic colors.
lightState.detachAll();
```

You see, per vertex colors (which is what I'm doing here) isn't really lighting. It's a cheap, easy way to create colors. You'll notice there's no shading for these colors at all. If you don't use this line, jME won't try to use per vertex colors. The scene graph looks like this:



You'll notice that because "My box" and "My sphere" are children of "My Node", they are made five times bigger, as well. If I move "My Node" down 10, then "My Box" and "My sphere" would move down 10, as well. This is the ease of making a game with a scene graph.

While you're running the program, press "B" to see the bounding in action. It is a neat way to visualize the parent/child scene graph relationship. You can see the BoundingSphere around your box, the BoundingBox around your sphere, and the automatic BoundingSphere around "My node":

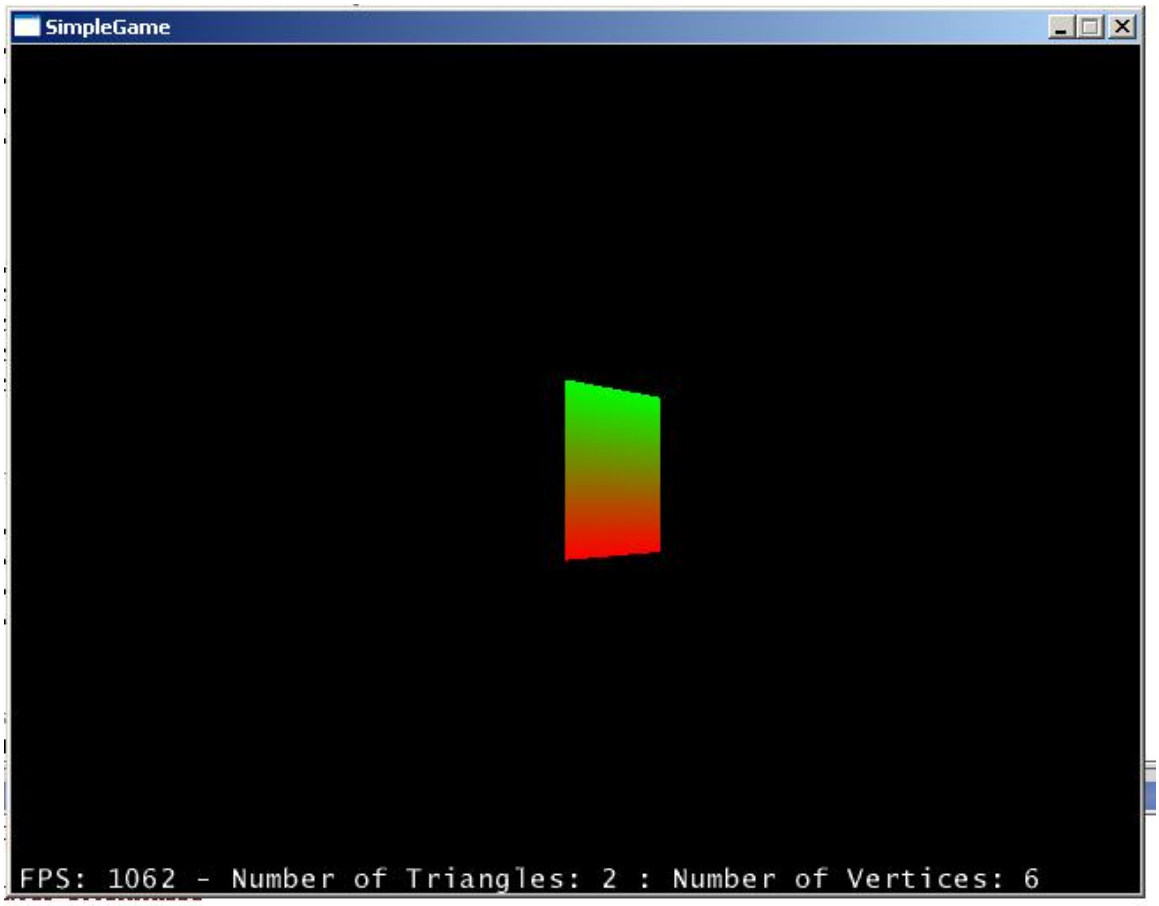


3) Hello TriMesh

This program introduces the TriMesh class and how to make your own objects from scratch. We will make a flat rectangle:

```
import com.jme.app.SimpleGame;
import com.jme.scene.TriMesh;
import com.jme.math.Vector3f;
import com.jme.math.Vector2f;
import com.jme.renderer.ColorRGBA;
import com.jme.bounding.BoundingBox;

/**
 * Started Date: Jul 20, 2004<br><br>
 *
 * Demonstrates making a new TriMesh object from scratch.
 *
 * @author Jack Lindamood
 */
public class HelloTriMesh extends SimpleGame {
    public static void main(String[] args) {
        HelloTriMesh app = new HelloTriMesh();
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        app.start();
    }

    protected void simpleInitGame() {
        // TriMesh is what most of what is drawn in jME actually is
        TriMesh m=new TriMesh("My Mesh");

        // Vertex positions for the mesh
        Vector3f[] vertexes={
            new Vector3f(0,0,0),
            new Vector3f(1,0,0),
            new Vector3f(0,1,0),
            new Vector3f(1,1,0)
        };

        // Normal directions for each vertex position
        Vector3f[] normals={
            new Vector3f(0,0,1),
            new Vector3f(0,0,1),
            new Vector3f(0,0,1),
            new Vector3f(0,0,1)
        };

        // Color for each vertex position
        ColorRGBA[] colors={
            new ColorRGBA(1,0,0,1),
            new ColorRGBA(1,0,0,1),
            new ColorRGBA(0,1,0,1),
            new ColorRGBA(0,1,0,1)
        };
```

```
        // Texture Coordinates for each position
        Vector2f[] texCoords={
            new Vector2f(0,0),
            new Vector2f(1,0),
            new Vector2f(0,1),
            new Vector2f(1,1)
        };

        // The indexes of Vertex/Normal/Color/TexCoord sets.  Every 3 makes a triangle.
        int[] indexes={
            0,1,2,1,2,3
        };

        // Feed the information to the TriMesh
        m.reconstruct(vertexes,normals,colors,texCoords,indexes);

        // Create a bounds
        m.setModelBound(new BoundingBox());
        m.updateModelBound();

        // Attach the mesh to my scene graph
        rootNode.attachChild(m);
    }
}
```



The first new thing here is:

```
// TriMesh is what most of what is drawn in jME actually is
TriMesh m=new TriMesh("My Mesh");
```

WARNING: *Do not ever use the constructor new TriMesh(). Always use new TriMesh("String name"). The empty constructor is for internal use only and will not render correctly. The same goes for Node, Box, Sphere, and anything else that extends com.jme.scene.Spatial;*

If you were to look at the class header for the Box and Sphere class we were using, you'd see
public class Box extends TriMesh
and
public class Sphere extends TriMesh

TriMesh is the parent class of both Box and Sphere. They are made from it. You'll notice that most things actually drawn are from TriMesh.

```
// Vertex positions for the mesh
Vector3f[] vertexes={
   new Vector3f(0,0,0),
   new Vector3f(1,0,0),
   new Vector3f(0,1,0),
   new Vector3f(1,1,0)
};
```

This creates positions for the corners of the rectangle we're about to make. Now let's give each vertex a normal:

```
// Normal directions for each vertex position
Vector3f[] normals={
   new Vector3f(0,0,1),
   new Vector3f(0,0,1),
   new Vector3f(0,0,1),
   new Vector3f(0,0,1)
};
```

The normal for vertex[0] is normal[0], just like the normal for vertex[i] is normal[i]. Normals are a very common 3D graphics concept. For more information on how normals work with triangles, please visit jME's math links. After normals, each vertex can have a color:

```
// Color for each vertex position
ColorRGBA[] colors={
   new ColorRGBA(1,0,0,1),
   new ColorRGBA(1,0,0,1),
   new ColorRGBA(0,1,0,1),
   new ColorRGBA(0,1,0,1)
};
```

In the last program, we assigned a solid blue color to every vertex of our box (ColorRGBA.blue which is the equivalent of new ColorRGBA(0,0,1,1)). In this program, we give the first two vertexes the color red, and the last two green. You'll notice the first two vertex positions are vertexes[0]=(0,0,0) and vertexes[1]=(1,0,0) which are the lower part of our rectangle and the last two are vertexes[2]=(0,1,0) and vertexes[3]=(1,1,0) which are the upper parts. Looking at the picture you can see how the rectangle does a smooth transition from red to green from bottom to top. Next, we assign texture coordinates:

```
// Texture Coordinates for each position
Vector2f[] texCoords={
   new Vector2f(0,0),
   new Vector2f(1,0),
   new Vector2f(0,1),
   new Vector2f(1,1)
};
```

If you've worked with any 3D graphics before, the concept of texture coordinates is the same in jME as it is anywhere. Vector2f is just like a Vector3f, but it has 2 floats (notice the 2f in Vector2f) instead of 3 floats (notice the 3f in Vector3f). These two floats are x, y. I'll go into texturing later, but for now I throw this in just so you can get the pattern of how constructing a TriMesh works. Finally, I have to make indexes for my TriMesh:

```
// The indexes of Vertex/Normal/Color/TexCoord sets.  Every 3 makes a triangle.
int[] indexes={
   0,1,2,1,2,3
};
```

TriMesh means Triangle mesh. It is a collection of triangles. Your indexes array must always be a length of modulus 3 (3,6,9,12,15,ect). That's because triangles always have 3 coordinates. Notice this is made up of two triangles. If I had {0,1,2,1,2,3,2,3,0}, that would be 3 triangles. Lets look at the first set of 0,1,2. This means that my TriMesh object's first triangle is drawn by connecting vertexes [0] -> vertexes [1] -> vertexes [2]. Vertex [0] has a normal of normals [0], a color of colors [0], a texture coordinate of texCoords [0]. The next triangle is drawn from vertexes [1] -> vertexes [2] -> vertexes [3]. Note that it would be illegal to have the following:

```
int[] indexes={
   0,1,2,1,2,4
};
```

This is illegal because there are no vertexes[4]. After making all our data, we finally feed it into the TriMesh, then attach it after creating a bounds

```
// Feed the information to the TriMesh
m.reconstruct(vertexes,normals,colors,texCoords,indexes);

// Create a bounds
m.setModelBound(new BoundingBox());
m.updateModelBound();

// Attach the mesh to my scene graph
rootNode.attachChild(m);
```

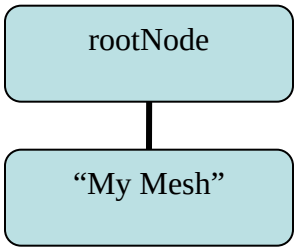
Note that because I don’t use the texCoords really in this example, I could have used the following:

m.reconstruct(vertexes,normals,colors,null,indexes);

I could even have done the following:

m.reconstruct(vertexes,null,null,null,indexes);

Then I could have drawn a grey, boring TriMesh. Here is a picture of the scene graph:

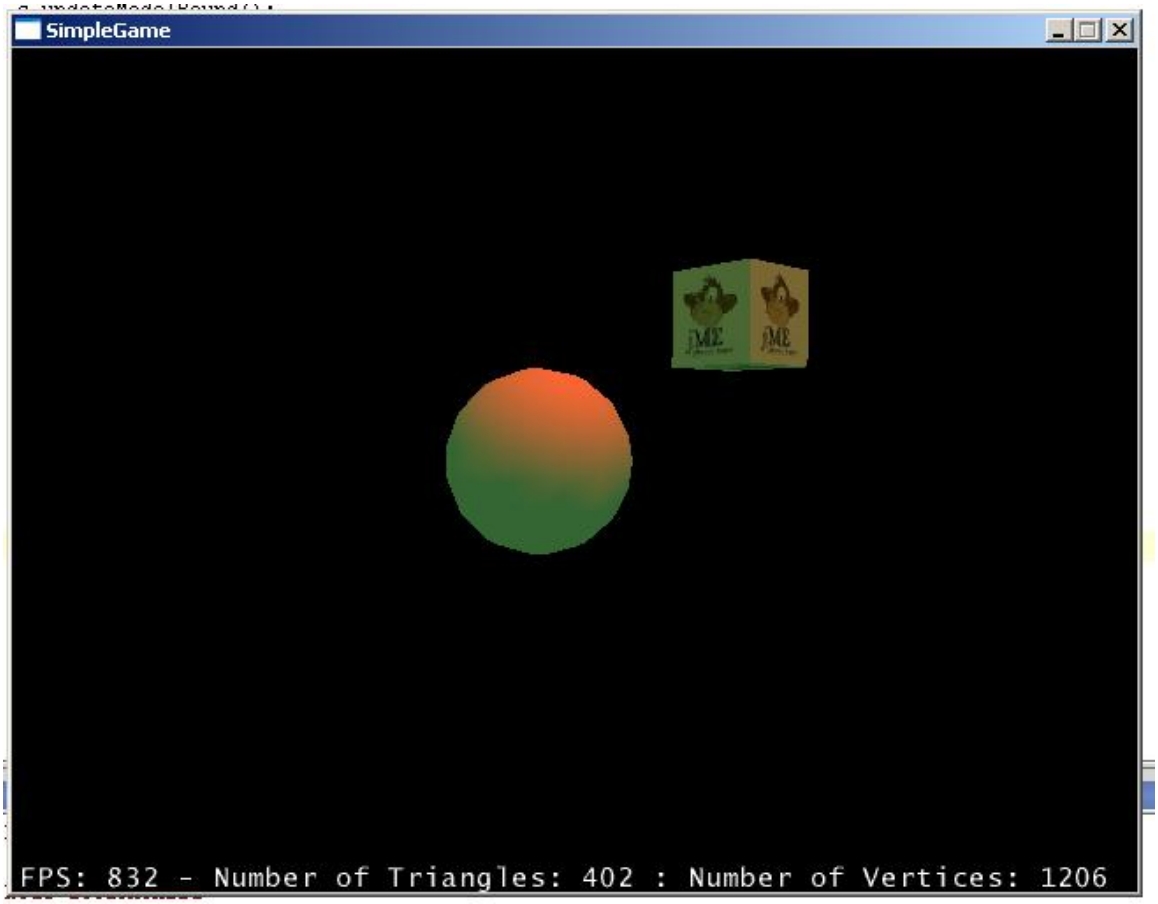


4) Hello States

This program introduces MaterialState, TextureState, LightState, and PointLight.

```
import com.jme.app.SimpleGame;
import com.jme.scene.shape.Box;
import com.jme.scene.shape.Sphere;
import com.jme.scene.Node;
import com.jme.scene.state.TextureState;
import com.jme.scene.state.MaterialState;
import com.jme.scene.state.LightState;
import com.jme.math.Vector3f;
import com.jme.util.TextureManager;
import com.jme.image.Texture;
import com.jme.renderer.ColorRGBA;
import com.jme.light.PointLight;
import com.jme.bounding.BoundingBox;
import com.jme.bounding.BoundingSphere;

import java.net.URL;


/**
 * Started Date: Jul 20, 2004<br><br>
 *
 * Demonstrates using RenderStates with jME.
 *
 * @author Jack Lindamood
 */
public class HelloStates extends SimpleGame {
    public static void main(String[] args) {
        HelloStates app = new HelloStates();
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        app.start();
    }

    protected void simpleInitGame() {

        // Create our objects.  Nothing new here.
        Box b=new Box("my box",new Vector3f(1,1,1),new Vector3f(2,2,2));
        b.setModelBound(new BoundingBox());
        b.updateModelBound();
        Sphere s=new Sphere("My sphere",15,15,1);
        s.setModelBound(new BoundingSphere());
        s.updateModelBound();
        Node n=new Node("My root node");

        // Get a URL that points to the texture we're going to load
        URL monkeyLoc;
        monkeyLoc=HelloStates.class.getClassLoader().getResource("jmetest/data/images/Monkey.tga");

        // Get a TextureState
        TextureState ts=display.getRenderer().getTextureState();
        // Use the TextureManager to load a texture
        Texture t=TextureManager.loadTexture(monkeyLoc,Texture.MM_LINEAR,Texture.FM_LINEAR,true);
        // Assign the texture to the TextureState
```

```
        ts.setTexture(t);
        // Enable the TextureState
        ts.setEnabled(true);

        // Get a MaterialState
        MaterialState ms=display.getRenderer().getMaterialState();
        // Give the MaterialState an emissive tint
        ms.setEmissive(new ColorRGBA(0f,.2f,0f,1));
        // Enable the material state
        ms.setEnabled(true);

        // Create a point light
        PointLight l=new PointLight();
        // Give it a location
        l.setLocation(new Vector3f(0,10,5));
        // Make it a red light
        l.setDiffuse(ColorRGBA.red);
        // Enable it
        l.setEnabled(true);

        // Create a LightState to put my light in
        LightState ls=display.getRenderer().getLightState();
        // Attach the light
        ls.attach(l);
        // Enable the lightstate
        ls.setEnabled(true);


        // Signal that b should use renderstate ts
        b.setRenderState(ts);
        // Signal that n should use renderstate ms
        n.setRenderState(ms);
        // Detach all the default lights made by SimpleGame
        lightState.detachAll();
        // Make my light effect everything below node n
        n.setRenderState(ls);

        // Attach b and s to n, and n to rootNode.
        n.attachChild(b);
        n.attachChild(s);
        rootNode.attachChild(n);
    }
}
```



Here, the first new line of code is where we locate our Monkey image

```
// Get a URL that points to the texture we're going to load
URL monkeyLoc;
monkeyLoc=HelloStates.class.getClassLoader().getResource("jmetest/data/images/Monkey.tga");
```

What we are doing is locating the Monkey.tga image that we'll use to put on our cube. After the image, we need the TextureState

```
// Get a TextureState
TextureState ts=display.getRenderer().getTextureState();
```

There's a new one! "display" is an object defined in SimpleGame. It "gets" whatever renderer I'm using (In my example I was using LWJGL) and from that renderer gets a texturestate. So this would give me a TextureState that works with LWJGL. This is jME's abstraction. If I was using JOGL, it would give me a TextureState that works with JOGL. The code is independent of the rendering environment. Another way to write this line would be

```
// Get a TextureState
TextureState ts=DisplaySystem.getDisplaySystem()..getRenderer().getTextureState();
```

This is because display is equal to DisplaySystem.getDisplaySystem() in SimpleGame. Now we have our texture state, so lets attach a texture to it.

```
// Use the TextureManager to load a texture
Texture t=TextureManager.loadTexture(monkeyLoc,Texture.MM_LINEAR,Texture.FM_LINEAR,true);
```

We use a class called TextureManager to do this. It manages loading of textures so that all we need to do is supply the URL and it will load correctly. The weird things about MM_LINEAR and FM_LINEAR just let us know how to filter the texture. For now, just use these. The "true" at the end is a mipmap flag. I won't get into any of those here, use the wiki for a more in depth explanation. For now, just use these 3 all the time. After I've created a Texture with my URL, I need to feed it to my TextureState.

```
// Assign the texture to the TextureState
ts.setTexture(t);
// Enable the TextureState
ts.setEnabled(true);
```

Notice I have to enable the TextureState. All states (TextureState, MaterialState, CullState, ect)are false by default, so I have to enable it to make it work. Next lets make a MaterialState. While a TextureState gives things pictures, MaterialStates give things tints or colors. The difference between MaterialStates and per-vertex coloring is this uses lighting so it looks much better.

```
// Get a MaterialState
MaterialState ms=display.getRenderer().getMaterialState();
```

Notice I get a MaterialState very similarly to how I get a TextureState. After I get the MaterialState, I decided to give it an emissive color

```
// Give the MaterialState an emissive tint
ms.setEmissive(new ColorRGBA(0f,.2f,0f,1));
```

This makes it look a tiny bit green, which is why you see a green tint at the bottom. There's setEmissive, setSpecular, setDiffuse, and setAmbient as well as shininess and alpha characteristics. These work just like any other modeling environment. For more detail, see the wiki. My MaterialState has to be enabled after I make it

```
// Enable the material state
ms.setEnabled(true);
```

Again, all *State objects must be enabled first or they don't operate. After my two states, I'll make a light to make them show up.

```
// Create a point light
PointLight l=new PointLight();
// Give it a location
l.setLocation(new Vector3f(0,10,5));
```

This creates a point light. Think of a PointLight as a lightbulb. It's a light, at a point. Which point you say? Well, that's why I use setLocation. It moves my light to (x=0,y=10,z=5). Lights can have colors of course, so I give my light a red color

```
// Make it a red light
l.setDiffuse(ColorRGBA.red);
```

Just like *States, I have to enable the light

```
// Enable it
l.setEnabled(true);
```

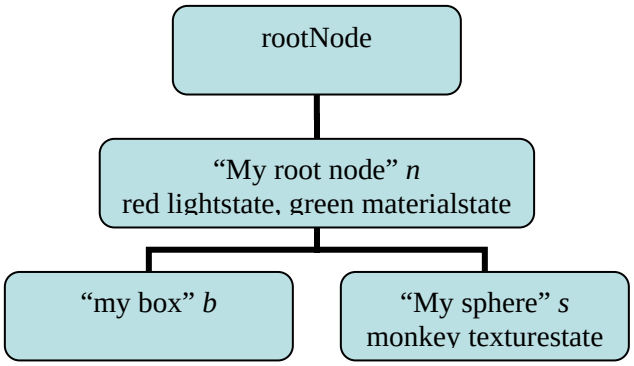
After creating the PointLight, I have to make a LightState to attach it too.

```
// Create a LightState to put my light in
LightState ls=display.getRenderer().getLightState();
// Attach the light
ls.attach(l);
// Enable the lightstate
ls.setEnabled(true);
```

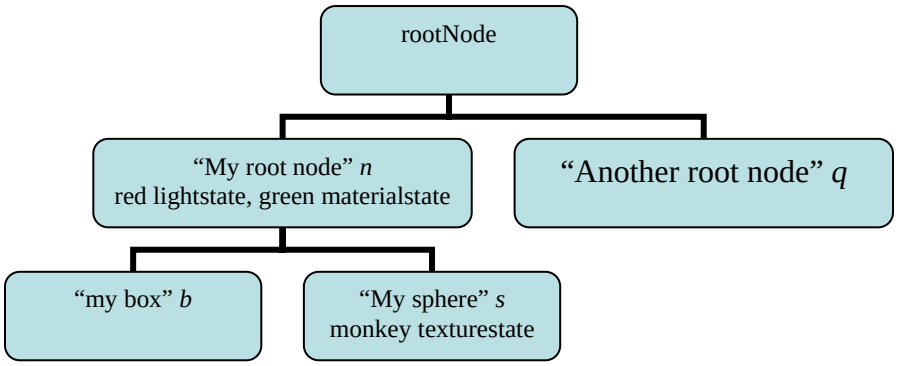
Notice I make a LightState the same way I make the other states, and I still have to enable the LightState. After I make my states, I have to assign them to the places I want them to effect

```
// Signal that b should use renderstate ts
b.setRenderState(ts);
// Signal that n should use renderstate ms
n.setRenderState(ms);
// Detach all the default lights made by SimpleGame
lightState.detachAll();
// Make my light effect everything below node n
n.setRenderState(ls);
```

Notice I have to call detachAll() on lightState. That is because SimpleGame makes a light for us and puts it in lightState. I only want to use my lights so I detach all of lightState's lights. Finally, I build my scene graph.



Again, the scene graph inheritance comes into play. The box "my box" is affected by a red lightstate (The red light) and green materialstate(The green tint) because it is a child of n. The same with s. Notice the next scene graph.



If my scene graph looked like this, q would not be affected by n's light at all, no matter how close it was to the lights location. That's because it isn't a child of n. This allows you to control what your lights are lighting.

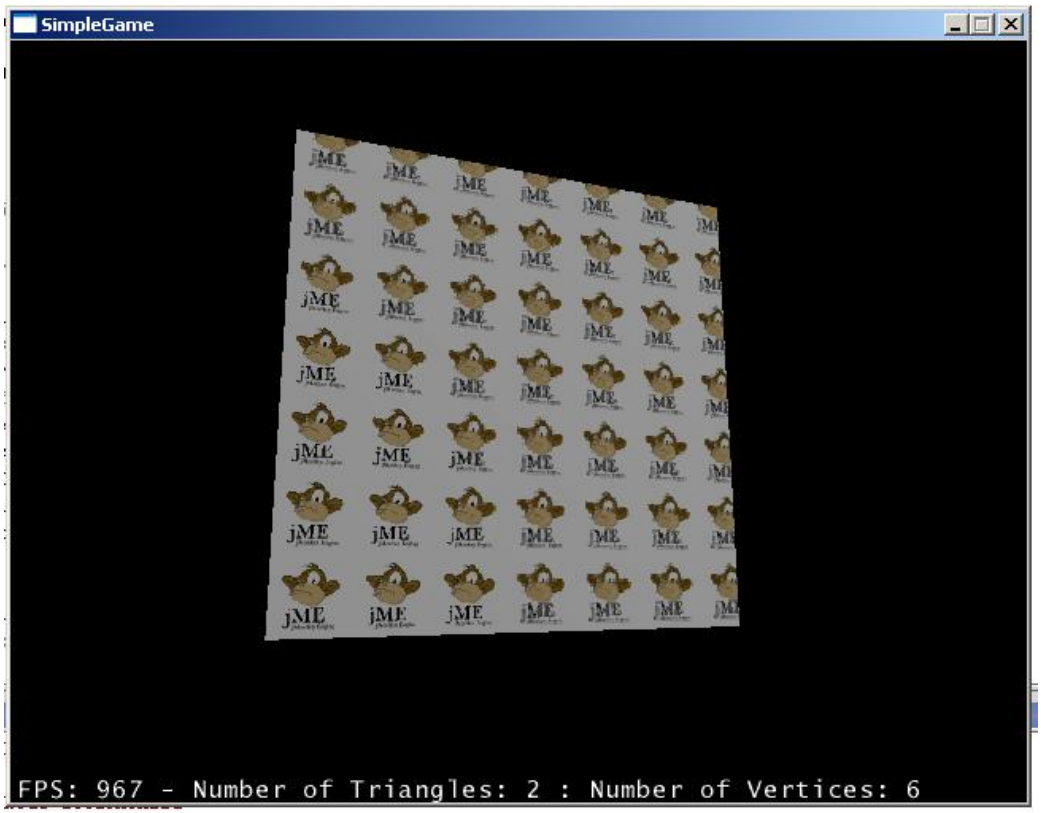
5) Hello KeyInput

This program introduces KeyBindingManager, texture wrapping, and how to change TriMesh data after it is assigned.

```
import com.jme.app.SimpleGame;
import com.jme.scene.TriMesh;
import com.jme.scene.state.TextureState;
import com.jme.math.Vector3f;
import com.jme.math.Vector2f;
import com.jme.util.TextureManager;
import com.jme.image.Texture;
import com.jme.input.KeyBindingManager;
import com.jme.input.KeyInput;

import java.net.URL;

/**
 * Started Date: Jul 21, 2004<br><br>
 *
 * This program demonstrates using key inputs to change things.
 *
 * @author Jack Lindamood
 */
public class HelloKeyInput extends SimpleGame {
    // The TriMesh that I will change
    TriMesh square;
    // A scale of my current texture values
    float coordDelta;
    public static void main(String[] args) {
        HelloKeyInput app = new HelloKeyInput();
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        app.start();
    }

    protected void simpleInitGame() {
        // Vertex positions for the mesh
        Vector3f[] vertexes={
            new Vector3f(0,0,0),
            new Vector3f(1,0,0),
            new Vector3f(0,1,0),
            new Vector3f(1,1,0)
        };

        // Texture Coordinates for each position
        coordDelta=1;
        Vector2f[] texCoords={
            new Vector2f(0,0),
            new Vector2f(coordDelta,0),
            new Vector2f(0,coordDelta),
            new Vector2f(coordDelta,coordDelta)
        };
```

```
        // The indexes of Vertex/Normal/Color/TexCoord sets.  Every 3 makes a triangle.
        int[] indexes={
            0,1,2,1,2,3
        };
        // Create the square
        square=new TriMesh("My Mesh",vertexes,null, null, texCoords, indexes);
        // Point to the monkey image
        URL
monkeyLoc=HelloKeyInput.class.getClassLoader().getResource("jmetest/data/images/Monkey.tga");
        // Get my TextureState
        TextureState ts=display.getRenderer().getTextureState();
        // Get my Texture
        Texture t=TextureManager.loadTexture(monkeyLoc,Texture.MM_LINEAR,
Texture.FM_LINEAR,true);
        // Set a wrap for my texture so it repeats
        t.setWrap(Texture.WM_WRAP_S_WRAP_T);
        // Set the texture to the TextureState
        ts.setTexture(t);
        // Enable the TextureState
        ts.setEnabled(true);

        // Assign the TextureState to the square
        square.setRenderState(ts);
        // Scale my square 10x larger
        square.setLocalScale(10);
        // Attach my square to my rootNode
        rootNode.attachChild(square);

        // Assign the "+" key on the keypad to the command "coordsUp"
        KeyBindingManager.getKeyBindingManager().set(
            "coordsUp",
            KeyInput.KEY_ADD);

        // Adds the "u" key to the command "coordsUp"
        KeyBindingManager.getKeyBindingManager().add(
            "coordsUp",
            KeyInput.KEY_U);

        // Assign the "-" key on the keypad to the command "coordsDown"
        KeyBindingManager.getKeyBindingManager().set(
            "coordsDown",
            KeyInput.KEY_SUBTRACT);
    }

    // Called every frame update
    protected void simpleUpdate(){

        // If the coordsDown command was activated
        if (KeyBindingManager.getKeyBindingManager().isValidCommand("coordsDown",true)){
            // Scale my texture down
            coordDelta-=.01f;
            // Get my square's texture array
            Vector2f[] texes=square.getTextures();
            // Change the values of the texture array
            texes[1].set(coordDelta,0);
            texes[2].set(0,coordDelta);
```

```
            texes[3].set(coordDelta,coordDelta);
            // Tell the square TriMesh that I have changed values in it's array
            square.updateTextureBuffer();
        }
        // if the coordsUp command was activated
        if (KeyBindingManager.getKeyBindingManager().isValidCommand("coordsUp",true)){
            // Scale my texture up
            coordDelta+=.01f;
            // Assign each texture value manually.
            square.setTexture(1,new Vector2f(coordDelta,0));
            square.setTexture(2,new Vector2f(0,coordDelta));
            square.setTexture(3,new Vector2f(coordDelta,coordDelta));
        }
    }
}
```



The first new thing you see here is how I create my square.

```
// Create the square
square=new TriMesh("My Mesh",vertexes,null, null, texCoords, indexes);
```

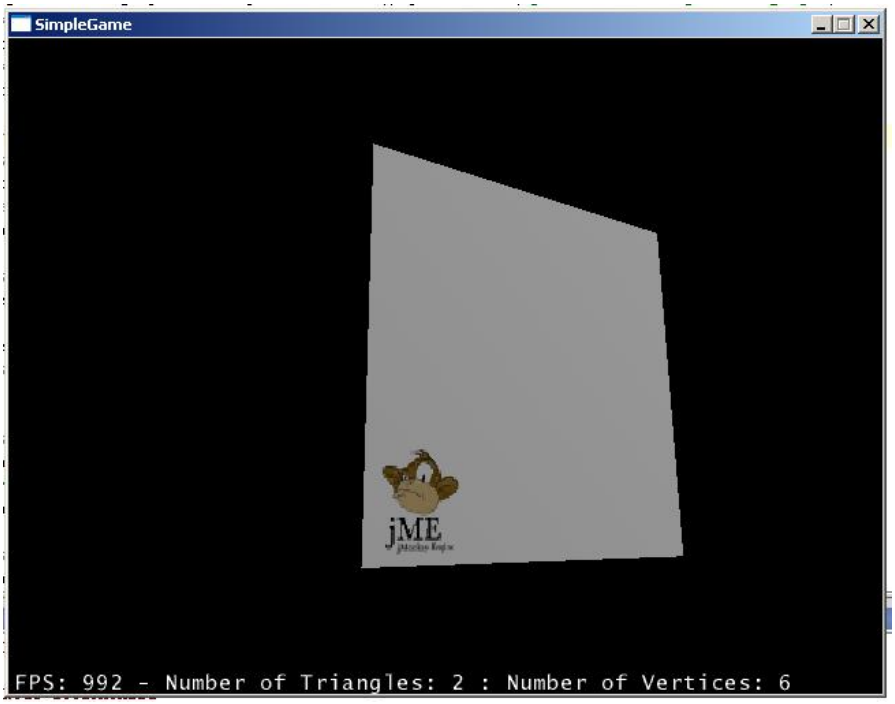
This is equivalent to:

```
square=new TriMesh("My Mesh");
square.reconstruct(vertexes,null, null, texCoords, indexes)
```

So it's just like example 3, but I put the reconstruct into the constructor. Nothing too difficult, right? The next new thing is my setting a wrap attribute.

```
// Set a wrap for my texture so it repeats
t.setWrap(Texture.WM_WRAP_S_WRAP_T);
```

Without this, my picture would just get smaller. It wouldn't show up 20 million times like it does in the picture. As an example, comment this line out and run the program. You'll see something like the following.



After attaching the TextureState and nodes correctly, I begin to bind commands to keys.

```
// Assign the "+" key on the keypad to the command "coordsUp"
KeyBindingManager.getKeyBindingManager().set(
    "coordsUp",
    KeyInput.KEY_ADD);
```

Key input is abstracted away just like the rendering, so just like I have to use display.getRenderer() I have to also use KeyBindingManager.getKeyBindingManager() . This function sets the command "coordsUp" to the key KEY_ADD (which is the + key). Later, we won't check "Did they press the + key". Instead we will check "did the coordsUp action happen". This lets me assign multiple keys to the same command, and lets users customize their keys very easily. Speaking of this, next I assign the U key to coordsUp as well.

```
// Adds the "u" key to the command "coordsUp"
KeyBindingManager.getKeyBindingManager().add(
    "coordsUp",
    KeyInput.KEY_U);
```

Notice the “add” function call, not the “set” function call. This “adds” key U to the “coordsUp” command. So either key U or + will trigger “coordsUp”. Next I add a key for coordsDown

```
// Assign the "-" key on the keypad to the command "coordsDown"
KeyBindingManager.getKeyBindingManager().set(
    "coordsDown",
    KeyInput.KEY_SUBTRACT);
```

It’s just like I assigned for “coordsUp”. Next you see a new function we haven’t used before.

```
// Called every frame update
protected void simpleUpdate(){
```

I am overriding the simpleUpdate()unction in SimpleGame. This function is called every frame. By putting queries here, I can poll for a key every frame. Which is exactly what I do right off the bat.

```
// If the coordsDown command was activated
if (KeyBindingManager.getKeyBindingManager().isValidCommand("coordsDown",true)){
```

Notice I don’t ask “Did they press the + key or the U key”. I don’t need to know which key is “coordsDown”. I just ask “did a coordsDown key get pressed”. The Boolean at the end signals if I allow users to hold the button down and execute the command multiple times. Change the true to false, and you’ll notice you only get once change per button press. On a down command, I shrink my texture cords for each point of my square.

```
// Scale my texture down
coordDelta-=.01f;
```

Next I get my texture array for the square and change the values in the array.

```
// Get my square's texture array
Vector2f[] texes=square.getTextures();
// Change the values of the texture array
texes[1].set(coordDelta,0);
texes[2].set(0,coordDelta);
texes[3].set(coordDelta,coordDelta);
```

Texture coordinate numbers are a value between 0 and 1 that signals which part of my picture is put in the rectangle. If they go from 0 to .5 then the lower half is shown. If they go from .5 to 1 then the upper half is shown. Because I set the command *wrap* the texture will wrap so that a value of 1.5 would look like all of my picture plus the first half. That is why as coordDelta gets large, you see many monkeys. The *set* command of Vector2f just changes the vector’s values. So for example

```
texes[1].set(coordDelta,0)
```

Changes texes[1] to an x of coordDelta and a y of 0. After I change my texture values, I must tell my square that the values of its textures array have changed. This lets the square recreate its texture buffer.

```
// Tell the square TriMesh that I have changed values in it's array
square.updateTextureBuffer();
```

If I don't call this function, the square won't know its texture buffer needs to be updated. Next, I check for the "coordsUp" command

```
// if the coordsUp command was activated
if (KeyBindingManager.getKeyBindingManager().isValidCommand("coordsUp",true)){
```

If this command is activated, then I shrink my texture cords. I setup this function a little bit different than the last one just as an example.

```
// Scale my texture up
coordDelta+=.01f;
// Assign each texture value manually.
square.setTexture(1,new Vector2f(coordDelta,0));
square.setTexture(2,new Vector2f(0,coordDelta));
square.setTexture(3,new Vector2f(coordDelta,coordDelta));
```

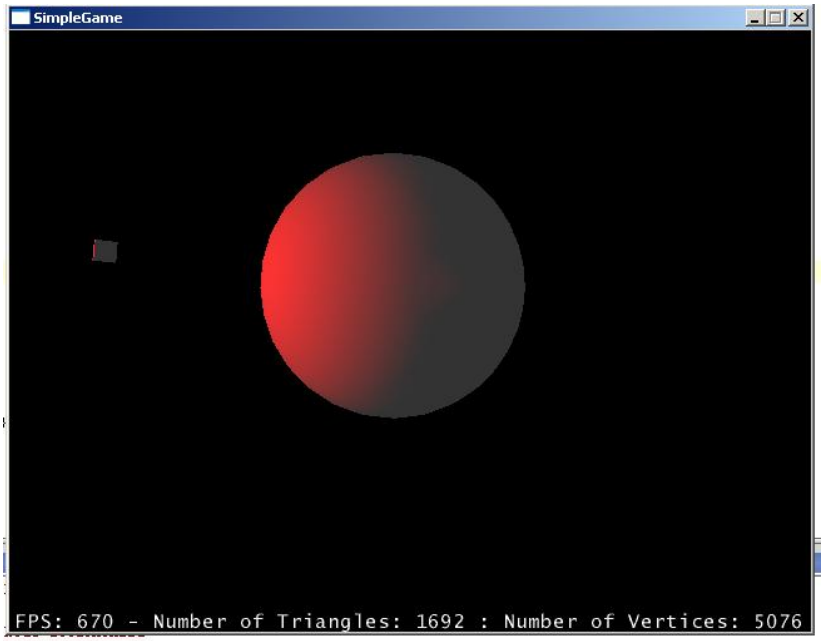
First, notice I never ask for the texture array. I also don't have to tell square that the texture array has changed. The reason is that each function call of setTexture updates my texture buffer as it is called. Each are two ways to do the same thing. In general, you want to use the first if most values in your array are going to change, and you would want to use the second if only a few values are going to change. That's it. Simple!

6) Hello Animation

This program introduces LightNode and using Controllers. The controller we will use is called SpatialTransformer.

```
import com.jme.app.SimpleGame;
import com.jme.scene.shape.Box;
import com.jme.scene.shape.Sphere;
import com.jme.scene.Node;
import com.jme.math.Vector3f;
import com.jme.math.Quaternion;
import com.jme.math.FastMath;
import com.jme.animation.SpatialTransformer;
import com.jme.light.PointLight;
import com.jme.light.SimpleLightNode;
import com.jme.renderer.ColorRGBA;

/**
 * Started Date: Jul 21, 2004<br><br>
 *
 * This class demonstrates animation via a controller, as well as LightNode.
 *
 * @author Jack Lindamood
 */
public class HelloAnimation extends SimpleGame {
    public static void main(String[] args) {
        HelloAnimation app = new HelloAnimation();
        app.setDialogBehaviour(SimpleGame.ALWAYS_SHOW_PROPS_DIALOG);
        app.start();
    }

    protected void simpleInitGame() {
        Sphere s=new Sphere("My sphere",30,30,5);
        // I will rotate this pivot to move my light
        Node pivot=new Node("Pivot node");

        // This light will rotate around my sphere.  Notice I don't give it a position
        PointLight pl=new PointLight();
        // Color the light red
        pl.setDiffuse(ColorRGBA.red);
        // Enable the light
        pl.setEnabled(true);
        // Remove the default light and attach this one
        lightState.detachAll();
        lightState.attach(pl);

        // This node will hold my light
        SimpleLightNode ln=new SimpleLightNode("A node for my pointLight",pl);
        // I set the light's position thru the node
        ln.setLocalTranslation(new Vector3f(0,10,0));
        // I attach the light's node to my pivot
        pivot.attachChild(ln);

        // I create a box and attach it too my lightnode.  This lets me see where my light is
```

```
        Box b=new Box("Blarg",new Vector3f(-.3f,-.3f,-.3f),new Vector3f(.3f,.3f,.3f));
        ln.attachChild(b);

        // I create a controller to rotate my pivot
        SpatialTransformer st=new SpatialTransformer(1);
        // I tell my spatial controller to change pivot
        st.setObject(pivot,0,-1);

        // Assign a rotation for object 0 at time 0 to rotate 0 degrees around the z axis
        Quaternion x0=new Quaternion();
        x0.fromAngleAxis(0,new Vector3f(0,0,1));
        st.setRotation(0,0,x0);

        // Assign a rotation for object 0 at time 2 to rotate 180 degrees around the z axis
        Quaternion x180=new Quaternion();
        x180.fromAngleAxis(FastMath.DEG_TO_RAD*180,new Vector3f(0,0,1));
        st.setRotation(0,2,x180);

        // Assign a rotation for object 0 at time 4 to rotate 360 degrees around the z axis
        Quaternion x360=new Quaternion();
        x360.fromAngleAxis(FastMath.DEG_TO_RAD*360,new Vector3f(0,0,1));
        st.setRotation(0,4,x360);

        // Prepare my controller to start moving around
        st.interpolateMissing();
        // Tell my pivot it is controlled by st
        pivot.addController(st);

        // Attach pivot and sphere to graph
        rootNode.attachChild(pivot);
        rootNode.attachChild(s);
    }
}
```



The first new thing in this program is LightNode

```
// This node will hold my light
SimpleLightNode ln=new SimpleLightNode("A node for my pointLight",pl);
// I set the light's position thru the node
ln.setLocalTranslation(new Vector3f(0,10,0));
// I attach the light's node to my pivot
pivot.attachChild(ln);
```

Only objects that extend Spatial can be attached to a scene graph. Node extends Spatial. Box extends TriMesh which extends Geometry which extends Spatial. PointLight extends Light, but is not a spatial. LightNode is a bridge between Light and Spatial. When I set the LightNode's local translation, I am actually setting my lights position. The difference is that this light's position is relative to the LightNode. For example, if light node's parent is translated up 10 and the lightnode is translated up 10, then the light is at 20 y. But, if I light.setLocation() to 10, then the light's exact position is 10 no matter what parent it's attached too. Usually, you'll want to use LightNode to position your lights just like I did. The next new thing is when I create my controller to rotate my pivot.

```
// I create a controller to rotate my pivot
SpatialTransformer st=new SpatialTransformer(1);
// I tell my spatial controller to change pivot
st.setObject(pivot,0,-1);
```

SpatialTransformer extends Controller. Controllers 'control' things. They are the java3d equivalent of Behaviors. Every frame, any Spatial that is rendered has its Controllers updated first. SpatialTransformer changes a set of Spatial's rotations, translations, and scales over time. The first part creates a SpatialTransformer that will change one object. I set the object pivot to index 0 on the second part. The -1 at the end of setObject is a parent index. Don't confuse this with an object's parent in the scene graph. It's a little different. For now, always use -1. Now that SpatialTransformer knows *what* to update, lets tell it *how* to update it.

```
// Assign a rotation for object 0 at time 0 to rotate 0 degrees around the z axis
Quaternion x0=new Quaternion();
x0.fromAngleAxis(0,new Vector3f(0,0,1));
st.setRotation(0,0,x0);
```

The fromAngleAxis command means that Quaternion x0 is equivalent to rotating 0 degrees about a vector drawn to x=0,y=0,z=1. After calculating the correct rotation, I say that index 0 (which is pivot) should at time=0 rotate by x0. Next I assign a rotation of 180 degrees at time=2. Because the fromAngleAxis function takes rotations in radians not degrees I have to convert 180 to radians. I use FastMath to do that. FastMath is an equivalent of the Math library, but uses all floats instead of doubles. This is because everything in jME uses floats, not doubles.

```
// Assign a rotation for object 0 at time 2 to rotate 180 degrees around the z axis
Quaternion x180=new Quaternion();
x180.fromAngleAxis(FastMath.DEG_TO_RAD*180,new Vector3f(0,0,1));
st.setRotation(0,2,x180);
```

After setting a rotation for time=4 to rotate the object back, I wrap up using my Controller.

```
// Prepare my controller to start moving around
st.interpolateMissing();
// Tell my pivot it is controlled by st
pivot.addController(st);
```

In order to correctly interpolate rotations/scales/translations for times I didn't specify to SpatialTransformer, I call interpolateMissing(). This is just a requirement for SpatialTransformer to work correctly. After interpolating, I add it as a controller (not as a child) to pivot. This means that whenever pivot is viewable, the controller will be updated and the object rotated. My scene graph looks like the following