Creating Games on the Java™ Platform with the jMonkeyEngine

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TS-5711

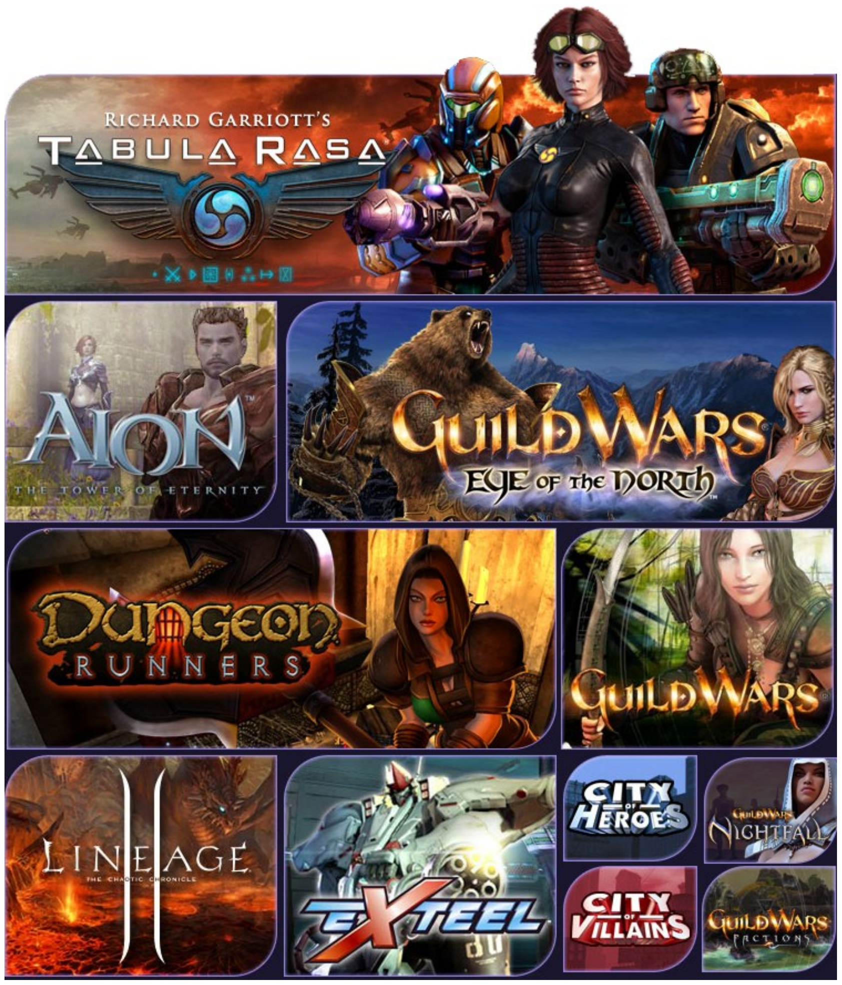
Our Goal:

To get you started on the path to creating professional quality 3D games and applications in Java™ technology **today**!

Our other jobs…

NCsoft Corp

- Makers of popular online games such as Guild Wars, Lineage, City of Heroes, and Tabula Rasa
- Started hiring jMonkeyEngine developers in 2006
- Demonstrated a strong commitment to the Java gaming community by actively contributing back to the jMonkeyEngine


Richard Garriott's Tabula Rasa
Aion The Tower of Eternity
Guild Wars Eye of the North
Dungeon Runners
Guild Wars
Lineage II The Chaotic Chronicle
Exteel
City of Heroes
Guild Wars Nightfall
City of Villains
Guild Wars Factions

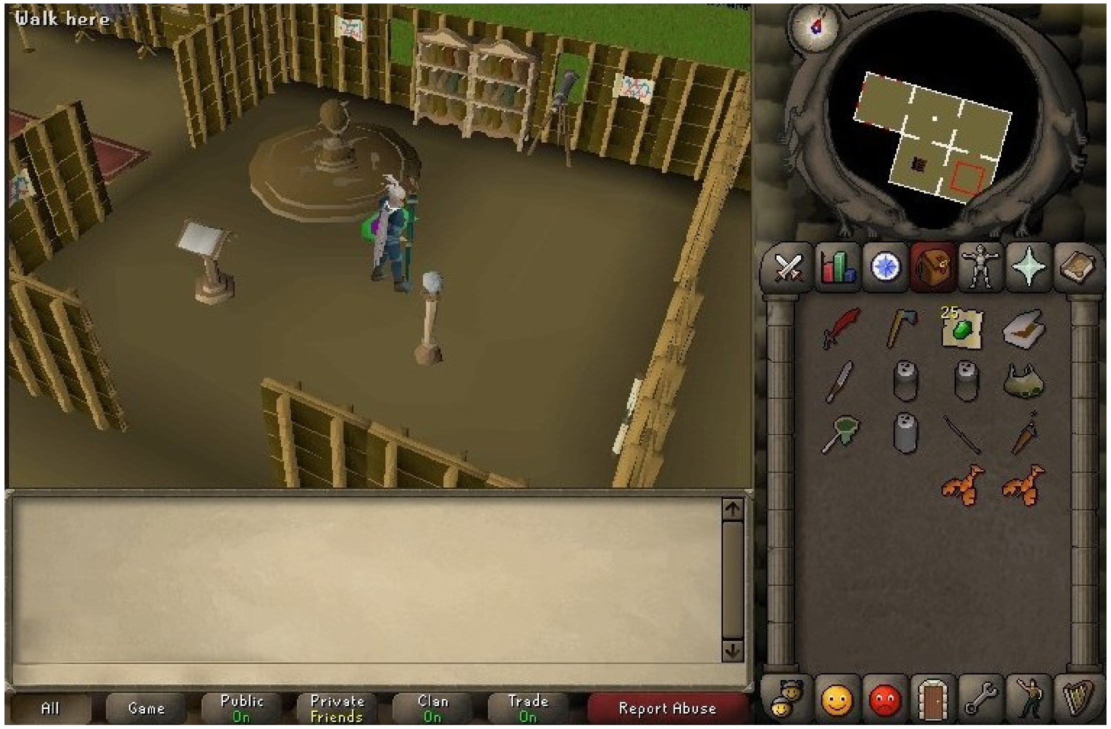
Agenda:

- **Myths and Realities**
- **Getting Your Feet Wet**
- **Taking it to the Next Level**
- **Trail Blazers**
- **Q&A**

Myths and Realities

- #1 - Speed
  - Myth: Java technology is too slow for games
  - Reality: Since 1.4.2, Java technology has closed the speed gap. Besides, much of the heavy lifting in games can be left to the hardware.
- #2 - Visual Quality
  - Myth: Java technology-based games are ugly. Just look at [*game X*]
  - Reality: With jMonkeyEngine, quality is limited by the art assets you have available and your skill as a graphics programmer –not the language.

Myths and Realities



Is this what Java based games have to look like?

Myths and Realities

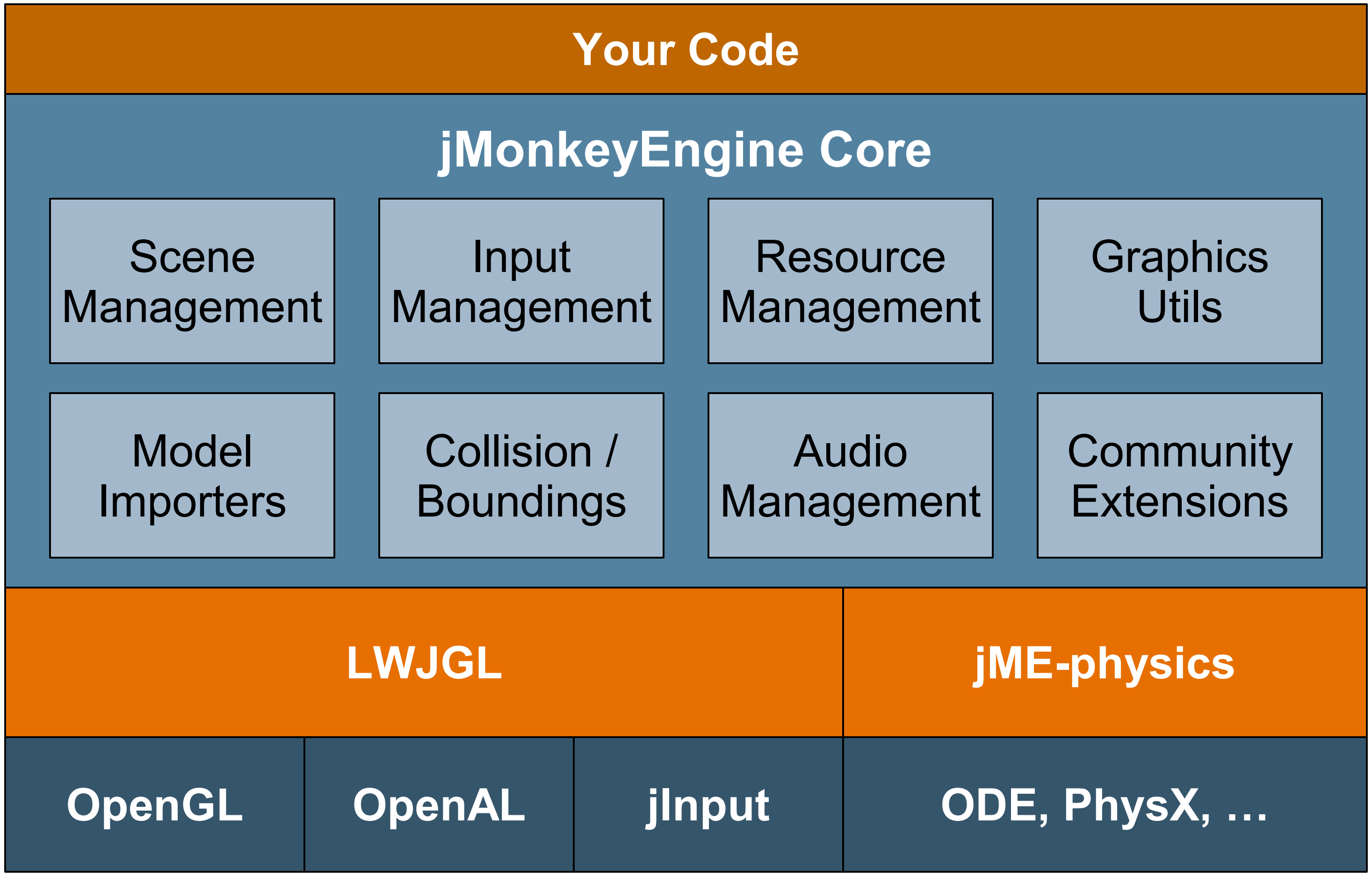
Here's an example of what can be done!

Let's get our feet wet!

What is the jMonkeyEngine?

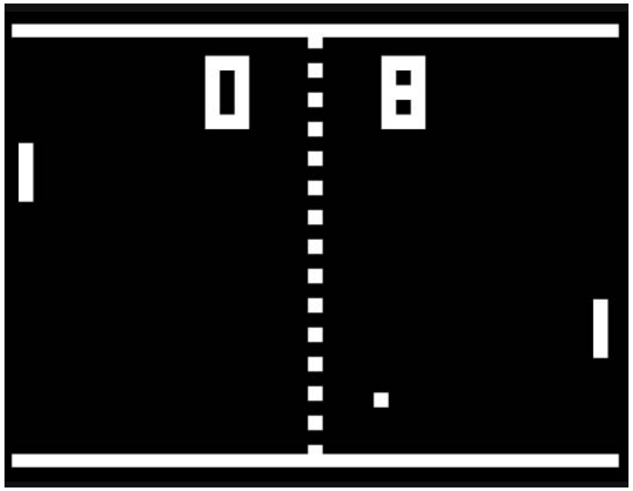
- jMonkeyEngine is a 3D scene graph that empowers **you** to create high quality games and applications with engaging graphics and sound.
- The engine is written 100% in Java programming language and uses a thin JNI layer to communicate directly with your audio, video and input device hardware.

The 10,000 Foot View



Making a Simple Game

- “MonkeyPong”
- Why?
  - We aren’t artists
  - Everyone knows the mechanics of the game
  - Everything we need is right there in the engine API



First Step – the framework

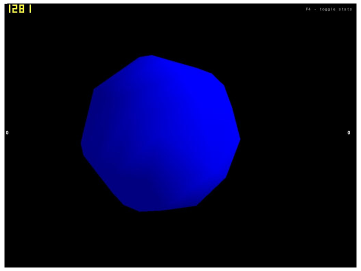
- We can get up and running very quickly by using one of jME's application classes:
    - AbstractGame, SimpleGame, SimplePassGame, StandardGame
- We'll use SimpleGame for this game.

```
public class MonkeyPong extends SimpleGame {
        protected void simpleInitGame() {
      }
}
```

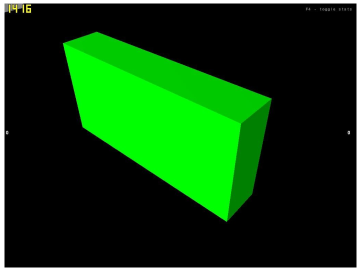
Next – the game elements

- We use jME's primitives for our ball, walls and paddles

```
ball = new Sphere("Ball", 8, 8, 2);
ball.setModelBound(new BoundingSphere());
ball.updateModelBound();
```



```
player1 = new Box("Player1", new Vector3f(), 2, 5, 10);
player1.setModelBound(new BoundingBox());
player1.updateModelBound();
player1.getLocalTranslation().set(-100, 0, 0);
```



Now – input control

- The simplest way of getting keyboard input is through the KeyBindingManager

```
simpleInitGame() {
   KeyBindingManager.getKeyBindingManager().set("MOVE_UP", KeyInput.KEY_W);
}

simpleUpdate() {
   if (KeyBindingManager.getKeyBindingManager()
                  .isValidCommand("MOVE_UP", true)) {
         player1.getLocalTranslation().z -=
                  player1Speed * timer.getTimePerFrame();
   }
}
```

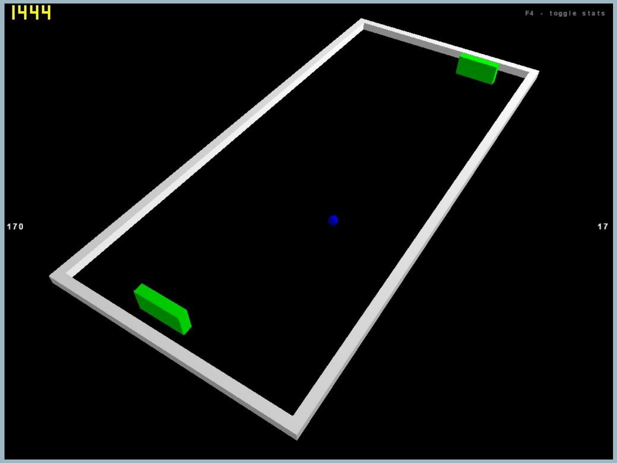
Mix in some collision…

- Bounding box collision is more than enough for us

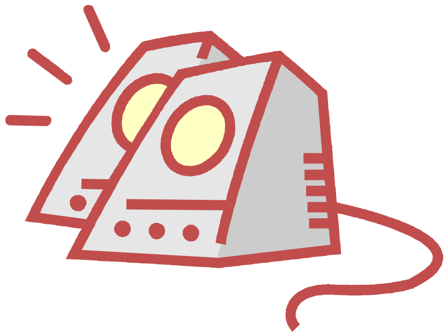
```
simpleUpdate() {
   if (player1.hasCollision(ball, false)) {
         ballVelocity.x *= -1f;
   }

   if (sideWalls.hasCollision(ball, false)) {
         ballVelocity.z *= -1f;
   }

   if (player1GoalWall.hasCollision(ball, false)) {
         player2Score++;
   }
}
```

Monkey Pong Live Demo #1

DEMO



That was too easy, let's add sound!



- First we setup a track in our init section:

```
...
AudioTrack collideSound =
   audio.createAudioTrack("/jmetest/data/sound/laser.ogg", false);
collideSound.setRelative(true);
```

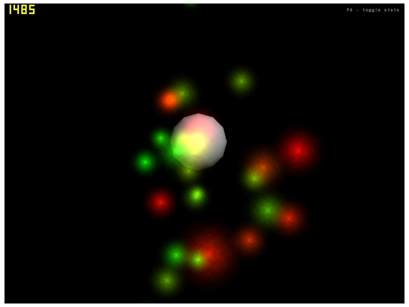
- Then we'll simply play the track when we detect a collision:

```
...
collideSound.play();
```

- Finally, make sure we update the AudioSystem in our game loop:

```
...
AudioSystem.getSystem().update();
```

More spice…



- Creating a particle system is easy through the factory

```
ParticleMesh particles =
   ParticleFactory.buildParticles("particles", 30);
```

- Setup particle system lifetime, sizes, colors, etc.

```
particles.setInitialVelocity(.05f);
particles.setStartSize(3f);
...
```

- Add an optional influence like gravity, wind or swarming

```
SwarmInfluence swarm = new SwarmInfluence(new
   Vector3f(particles.getWorldTranslation()), .001f);
particles.addInfluence(swarm);
```

Adding water…

- Realistic water with reflections and refraction is just a few lines of code

```
waterEffectRenderPass = new WaterRenderPass(cam, 4, false, true);
waterQuad = new Quad("waterQuad", 1, 1);
waterEffectRenderPass.setWaterEffectOnSpatial(waterQuad);
```

69

F4 - toggle stats

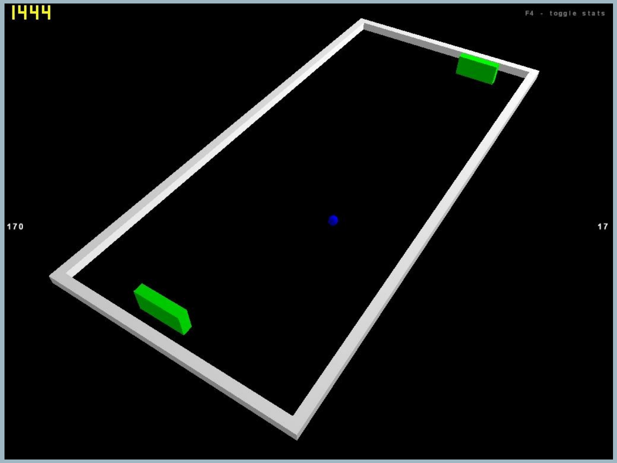
E: debug show/hide reflection and refraction textures
F: switch freeze/unfreeze projected grid

Terrain…

- Generate a terrain from image data or through our heightmap generators

```
RawHeightMap heightMap = new RawHeightMap(MonkeyPong.class
                .getClassLoader().getResource(
             "jmetest/data/texture/terrain/heights.raw").getFile(),
                129, RawHeightMap.FORMAT_16BITLE, false)
TerrainPage page = new TerrainPage("Terrain", 33, heightMap.getSize(),
                terrainScale, heightMap.getHeightMap(), false);
```

Monkey Pong Live Demo #2



Let’s recap…

- jMonkeyEngine provides a lot of foundational classes and examples to get you started
- You can use jME’s supplied special effects to add extra punch to your game
- Even with a programmer’s eye for art, you can build a fun game

- Get a closer look at the source for this example from the jME project svn

Taking it to the Next Level

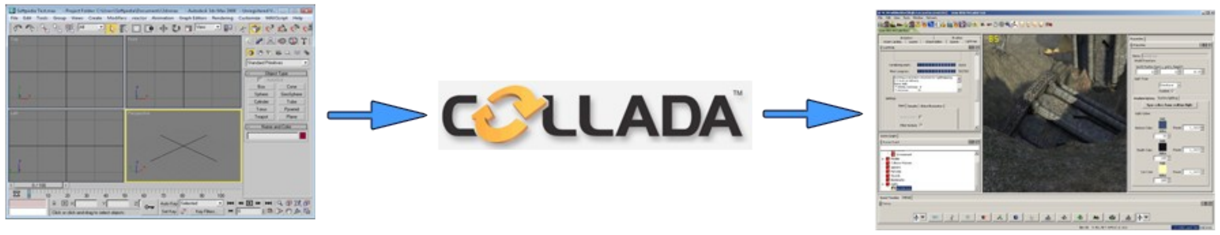
- Production quality games require a whole new level of effort
- To make such a game we need to work together with other creative types:
  - Artists
  - Level builders
  - Game designers
- Collaboration is achieved through good pipeline and tools
- Tool installation and start-up needs to be fast and hassle-free

Pipeline

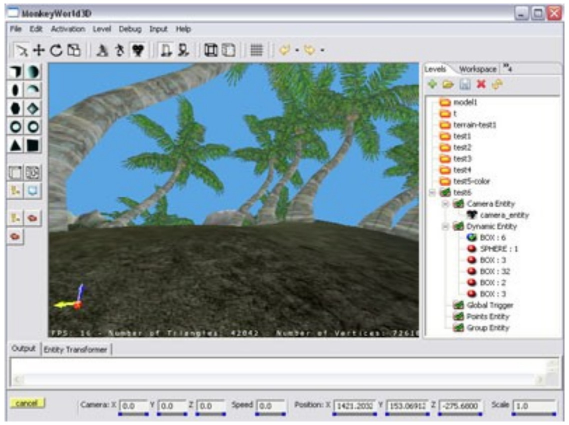
- Your game's pipeline is the path that artist generated content takes to get from their mind into the game
- jME has support for most popular image formats and some standard audio formats:
  - tga, png, jpg, gif, bmp, dds.
  - wav, ogg
- We also have support for several standard model formats:
  - Ase, Obj, 3ds, Md2-Md5, X3d, Milkshape and Collada

Pipeline (continued)

- But jME needs to improve in this area:
  - Improved Collada support
  - Community is working on better md5 support.
  - Create an XML equivalent to our binary import/export process and let the community create their own exporters (or tools.)

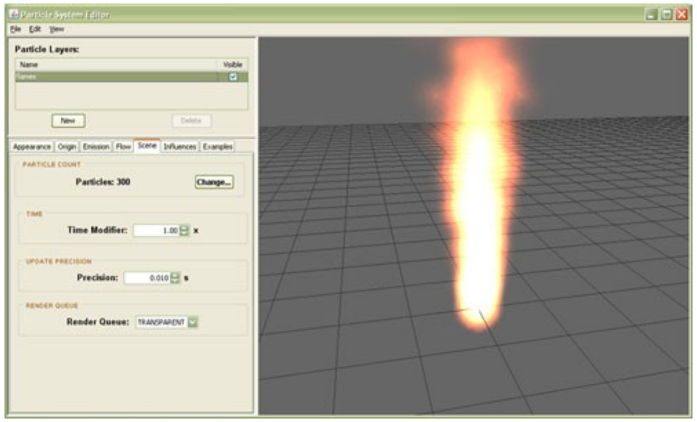


Tools



FPS: 16 - Number of Triangles: 42042 - Number of Vertices: 7261

Camera: X 0.0 Y 0.0 Z 0.0 Speed 0.0 Position: X 1421.2032 Y 153.06912 Z -275.6800 Scale 1.0



PARTICLE COUNT
Particles: 300

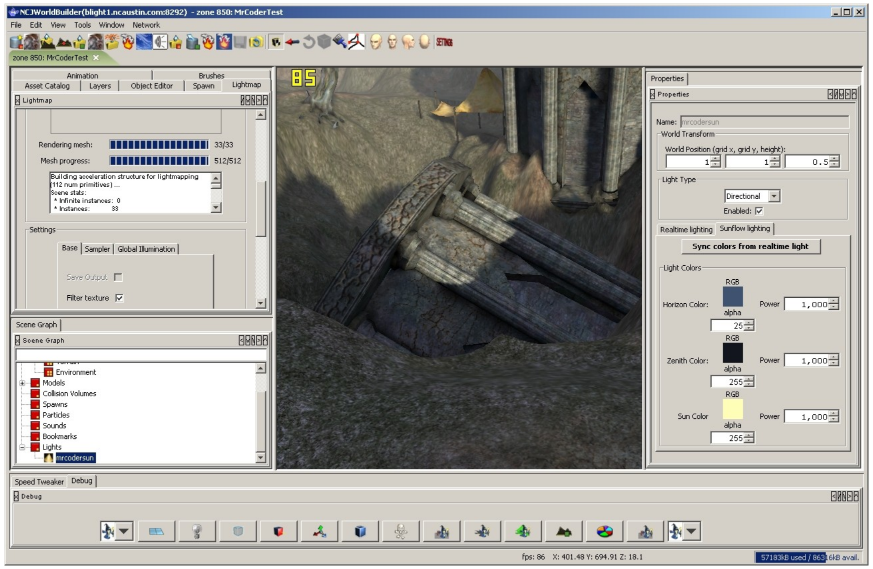
TIME
Time Modifier: 1.00 x

UPDATE PRECISION
Precision: 0.010 s

RENDER QUEUE
Render Queue: TRANSPARENT

- Tools turn your pipeline assets into a game environment
- Options Include:
  - MonkeyWorld 3D – Built using SWT and Eclipse RCP
  - Various small utilities in jME – Particle Editor, Control Editor, etc.
  - Rolling your own tool

Tools



Rendering mesh: 33/33

Mesh progress: 512/512

```
Building acceleration structure for lightmapping
(112 num primitives) ...
Scene stats:
 * Infinite instances:  0
 * Instances:          33
```

Settings: Base | Sampler | Global Illumination

Save Output ☐

Filter texture ☑

Scene Graph: Environment, Models, Collision Volumes, Spawns, Particles, Sounds, Bookmarks, Lights, mrcodersun

Name: mrcodersun

World Transform — World Position (grid x, grid y, height): 1, 1, 0.5

Light Type: Directional — Enabled: ☑

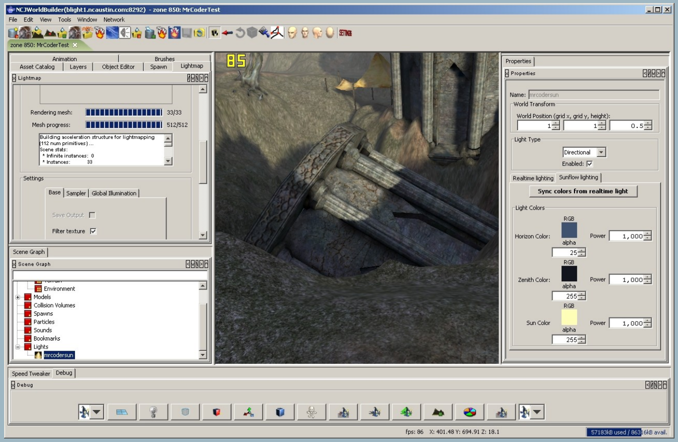
Light Colors

Horizon Color:	alpha 25	Power	1,000
Zenith Color:	alpha 255	Power	1,000
Sun Color	alpha 255	Power	1,000

fps: 86 X: 401.48 Y: 694.91 Z: 18.1

- Roll Your Own - An Example: NCsoft's World Builder
  - Swing + jME Canvas
  - Created by a small team in short time
  - Some features include:
    - Asset integration with Perforce, terrain generation/painting, lighting, lightmap generation, LOD setup, etc.

NCsoft's Java technology-based World Builder



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Scene stats:
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 * Instances:           33
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Save Output ☐
Filter texture ✓

Name: mrcodersun
World Position (grid x, grid y, height): 1 1 0.5
Light Type: Directional
Enabled: ✓

Horizon Color:	alpha 25	Power	1,000
Zenith Color:	alpha 255	Power	1,000
Sun Color	alpha 255	Power	1,000

fps: 86 X: 401.48 Y: 694.91 Z: 18.1
57183kB used / 86316kB avail.

Tools continued…

- Not many cons
  - Direct memory handling
  - Native buffer performance
- But lots of pros
  - Your tool runs anywhere (many artists prefer Macs)
  - Swing GUI development
  - Exception handling (not many hard crashes)
  - Logging (console, file, mail)
  - Scripting (Lua or JavaScript™ programming language, etc.)

Client

- Things to consider on your game client:
  - Aim for min spec, next-gen, or use fallbacks to handle both?
  - Give users controls – give as many configuration options as you can to allow the user to tweak things for their platform. (But use smart default settings.)
  - User Interface – several options: BUI, FengGUI, jMEDesktop or your own
  - Deploying your game:
    - Format: Applet or application
    - Java technology installation and min version
    - Delivery: Webstart, GetDown, etc.
    - Crash reporting and bootstrapping
  - Future options: Java Consumer JRE

To recap…

- You can make use of existing model and asset formats
- To make a professional game, you need artists and you need to provide them with tools
- There are some existing tools
- It’s easy to make your own tools with jME embedded

Evaluating Java as a Game Platform: Selling Points

- Versatile deployment options
  - Applet or application; fullscreen or windowed
- Error handling is more elegant
  - Easier than in traditional C/C++ frameworks
- Cross Platform:
  - OpenGL + Java platform means never having to say you’re sorry
- The Power of Java technology:
  - Easy to use, familiar, powerful
  - Lots of open source code out there to make use of
  - Easy integration into web-services, etc.

Evaluating Java as a Game Platform: Issues

- Major Problem Area – Infrastructure
  - Lack of source materials (books, articles, code samples)
  - Lack of existing games
  - Lack of developer support (disbelief, inexperience)
  - Lack of middleware support
- ALL of these points can be turned around rather quickly
  - This is still a fairly new area for Java technology
  - Releasing one or two high quality games would change attitudes and give inspiration (and create experienced developers)
  - Use by companies or universities with money to spend will encourage existing middleware to add Java technology support
  - Will this happen?

It's Already Happening – Commercial Games

Bang! Howdy

Three Rings

Fast-paced wild west tactical strategy

Hockey Heroes

Jadestone

Ice hockey with an attitude.

It's Already Happening - Commercial Games

Call of the k

Gamalocus

Online fantasy strategy-roleplaying

1 units of Orc Azan Kha arrived in Okhanz
Zrat gal the Soldier has arrived in Okhanz
3 units of Orc Azan Kha arrived in Okhanz
4 units of Orc Azan Kha arrived in Okhanz

Nord

SLX Games

Your personal online social experience.

It's Already Happening - Commercial Games

JCRPG – Classic RPG

Project X

NCsoft Corporation

Unannounced game under development…

It's Already Happening – Casual Gaming

BigFun Motorcycle Trials

OurAwesomeGames

Mad Skills Motorcross

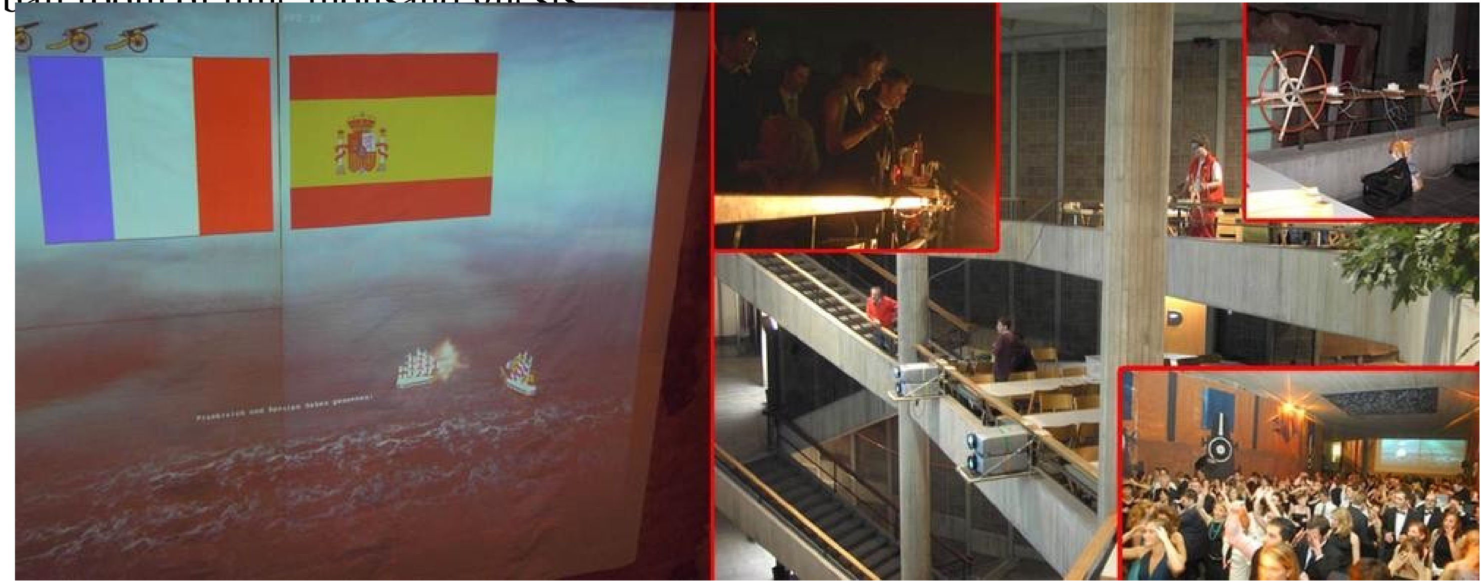
Turborilla

Race against the neural network trained riders to prove you're the best.

It's Already Happening – Event Based Entertainment

Polyball 2007

Sail the high seas and do ship combat in front of a ball room of nine thousand guests

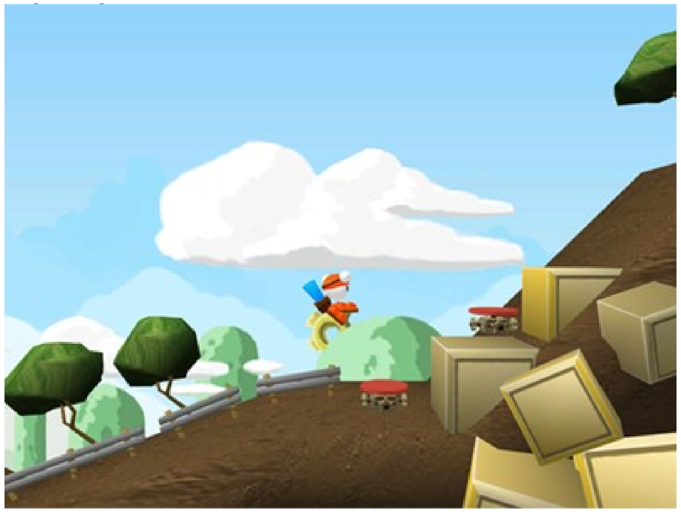


It's Already Happening – Student Projects

Matics

Georgia Tech

Puzzle based platformer with real



Lord of the Fjord

Georgia Tech

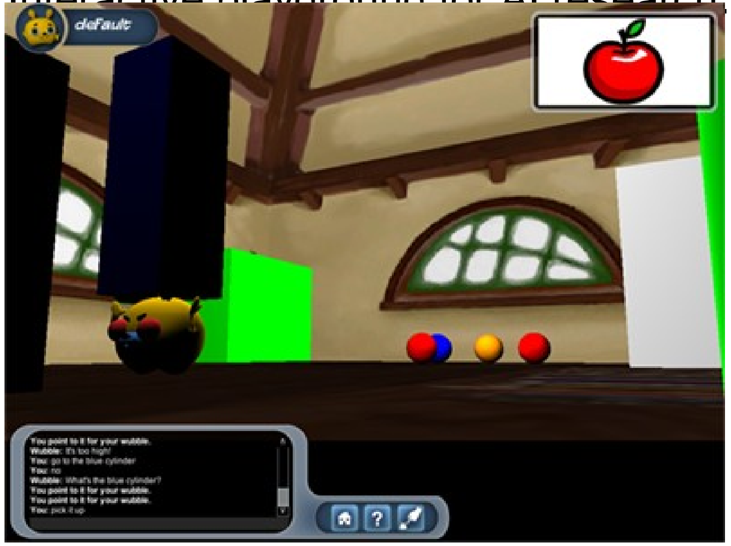
Viking boat bongo battle!

It's Already Happening – Research Applications

Wubble Wor

USC

Interactive playground for AI research.



You point to it for your wubble.
Wubble: It's too high!
You: go to the blue cylinder
You: no
Wubble: What's the blue cylinder?
You point to it for your wubble.
You point to it for your wubble.
You: pick it up

Multitouch Environment

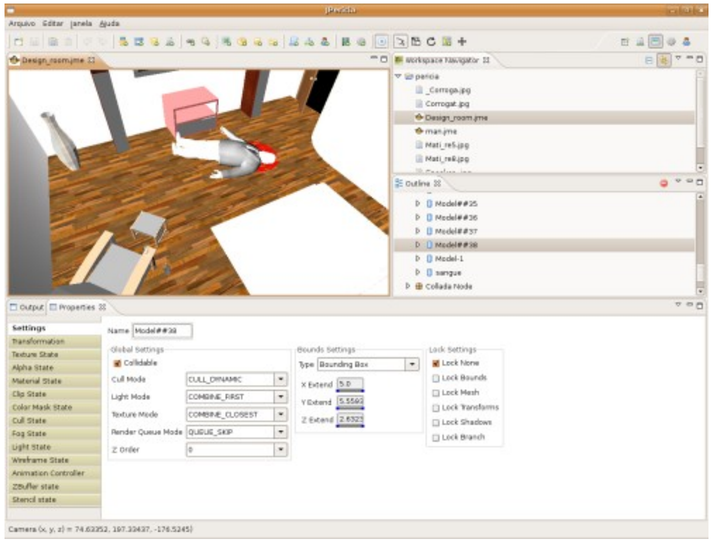
Durham University

Research into interactive learning interfaces

It's Already Happening – Commercial

Project Wonderland

JPericia
Team Cadanus
Scene visualizer for crime scene investigation in Brazil.



Settings: Transformation, Texture State, Alpha State, Material State, Clip State, Color Mask State, Cull State, Fog State, Light State, Wireframe State, Animation Controller, ZBuffer state, Stencil state

Name: Model##38

Global Settings
- [✓] Collidable
- Cull Mode: CULL_DYNAMIC
- Light Mode: COMBINE_FIRST
- Texture Mode: COMBINE_CLOSEST
- Render Queue Mode: QUEUE_SKIP
- Z Order: 0

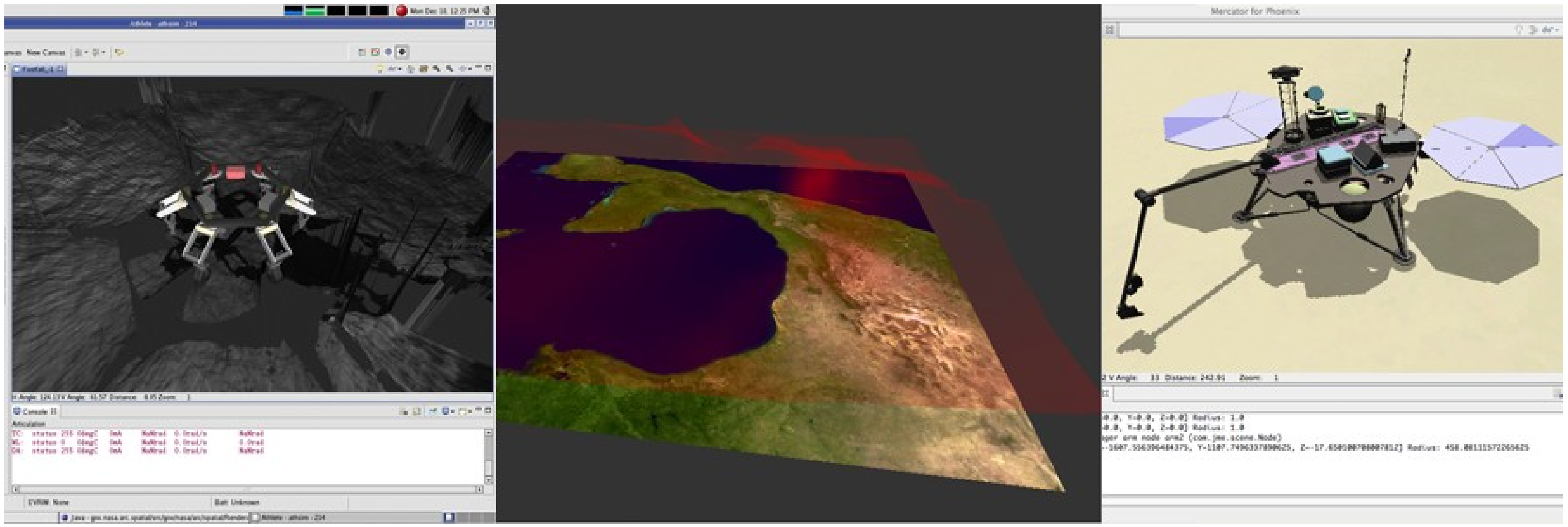
Bounds Settings
- Type: Bounding Box
- X Extend: 5.0
- Y Extend: 5.5593
- Z Extend: 2.6323

Lock Settings
- [✓] Lock None
- [ ] Lock Bounds
- [ ] Lock Mesh
- [ ] Lock Transforms
- [ ] Lock Shadows
- [ ] Lock Branch

Camera (x, y, z) = 74.63352, 197.33437, -176.5245)

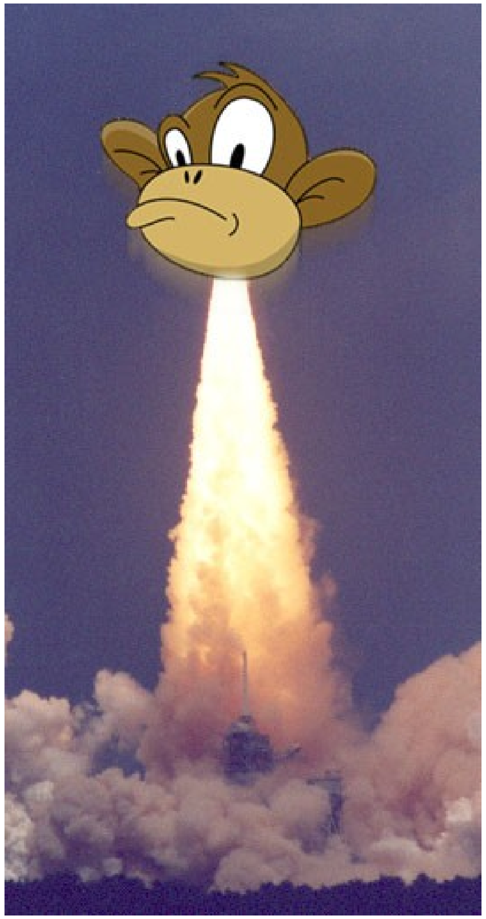
It's Already Happening - Science

Intelligent Robotics Group - NASA Ames

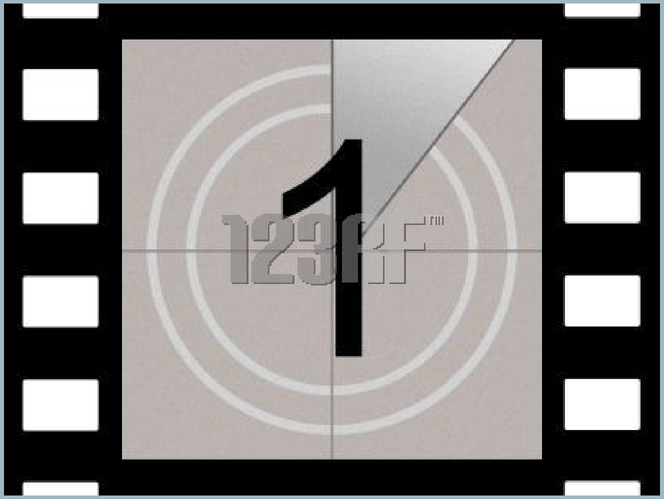


jME 2.0 – The future

- Planned features include:
  - Easy/safe threading
  - Separate game and render loop
  - Visibility/space partitioning handling in core
  - More Enumerations
  - Latest in OpenGL features
  - Refactoring / documentation
  - Pipeline Improvements
  - Community code process
- The jME 2.0 Architecture group



jMonkeyEngine in action!



For More Information

- Check us out on line:
  - Home: www.jMonkeyEngine.com
  - Wiki: www.jMonkeyEngine.com/wiki
- Talk to the community!
  - Forums: www.jMonkeyEngine.com/jmeforum
- Check out the “MonkeyPong” source:
  - jME’s SVN repository:
    - http://code.google.com/p/jmonkeyengine/source/checkout

THANK YOU

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