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Agenda

- Fur
- EGLImage
- Thread synchronisation
- High Quality Text Rendering
- Simple Text Rendering
- Particle system
- Shadow mapping



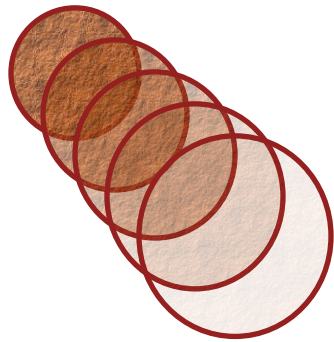
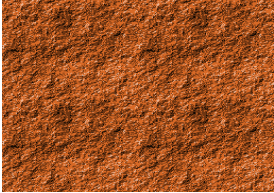
Fur
***Real-Time Rendering
Technique using
OpenGL[®] ES 2.0***

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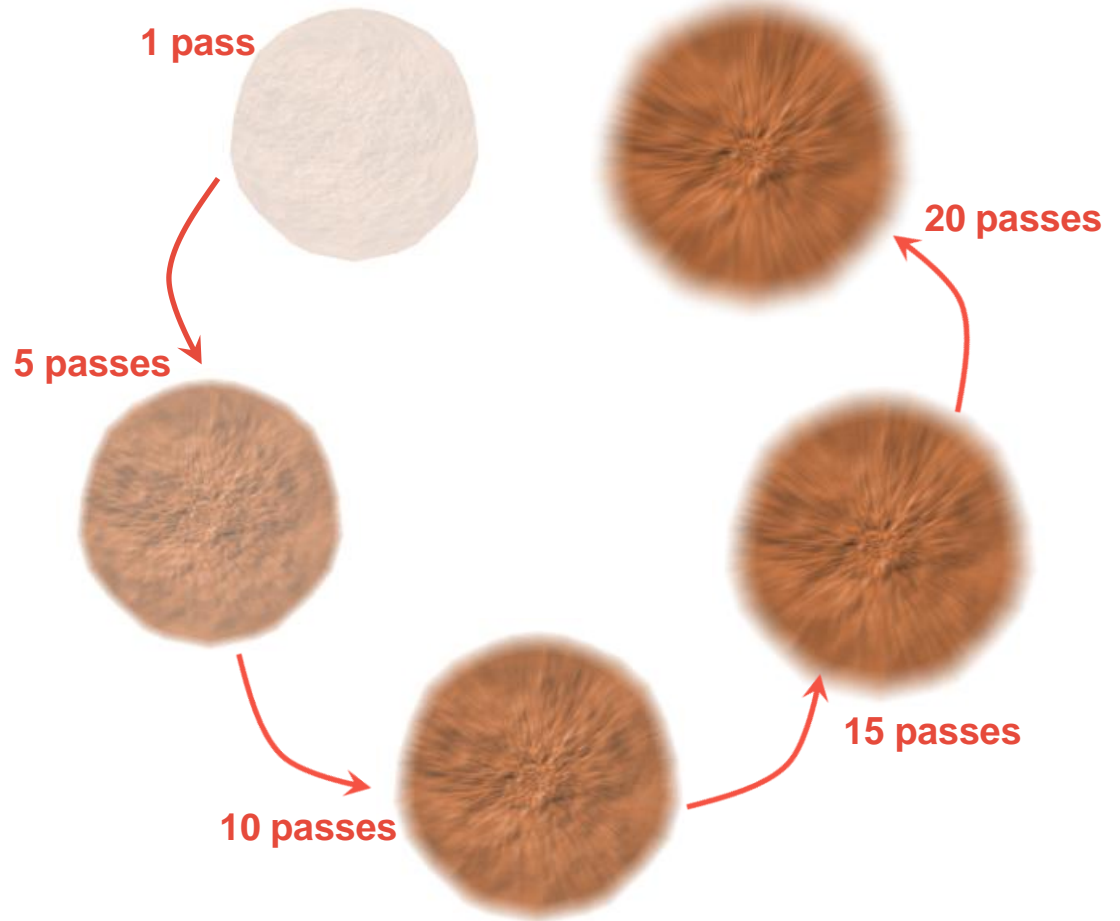
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Shell Rendering

Noise texture



Each rendering pass
scales the object and
uses less alpha





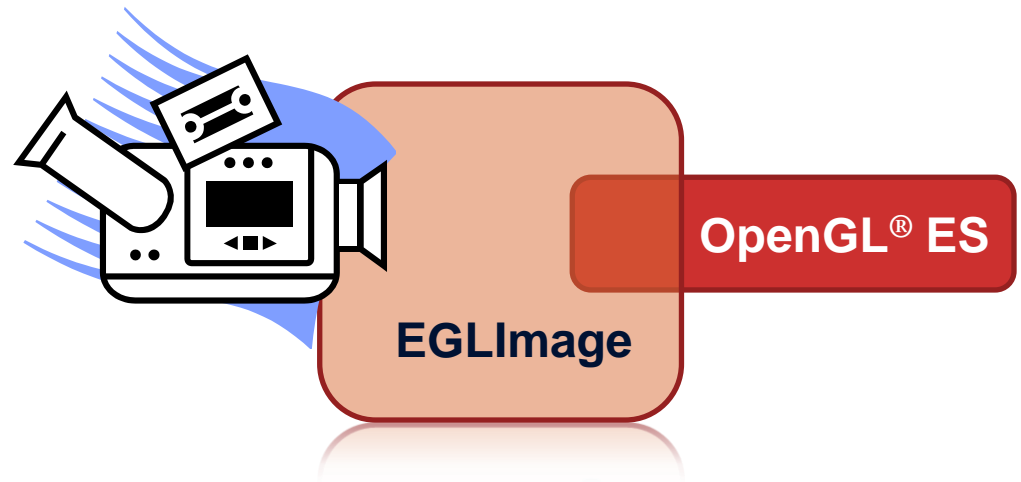
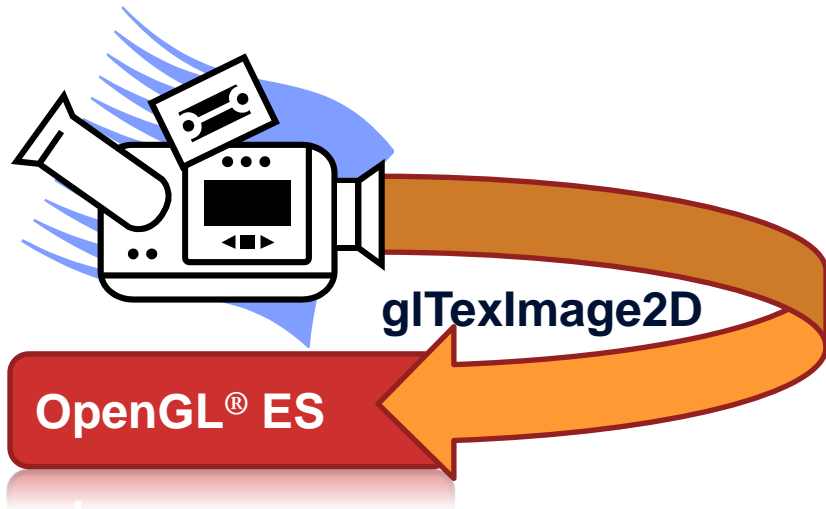
EGLImage

Updating a Texture without copying memory under Android

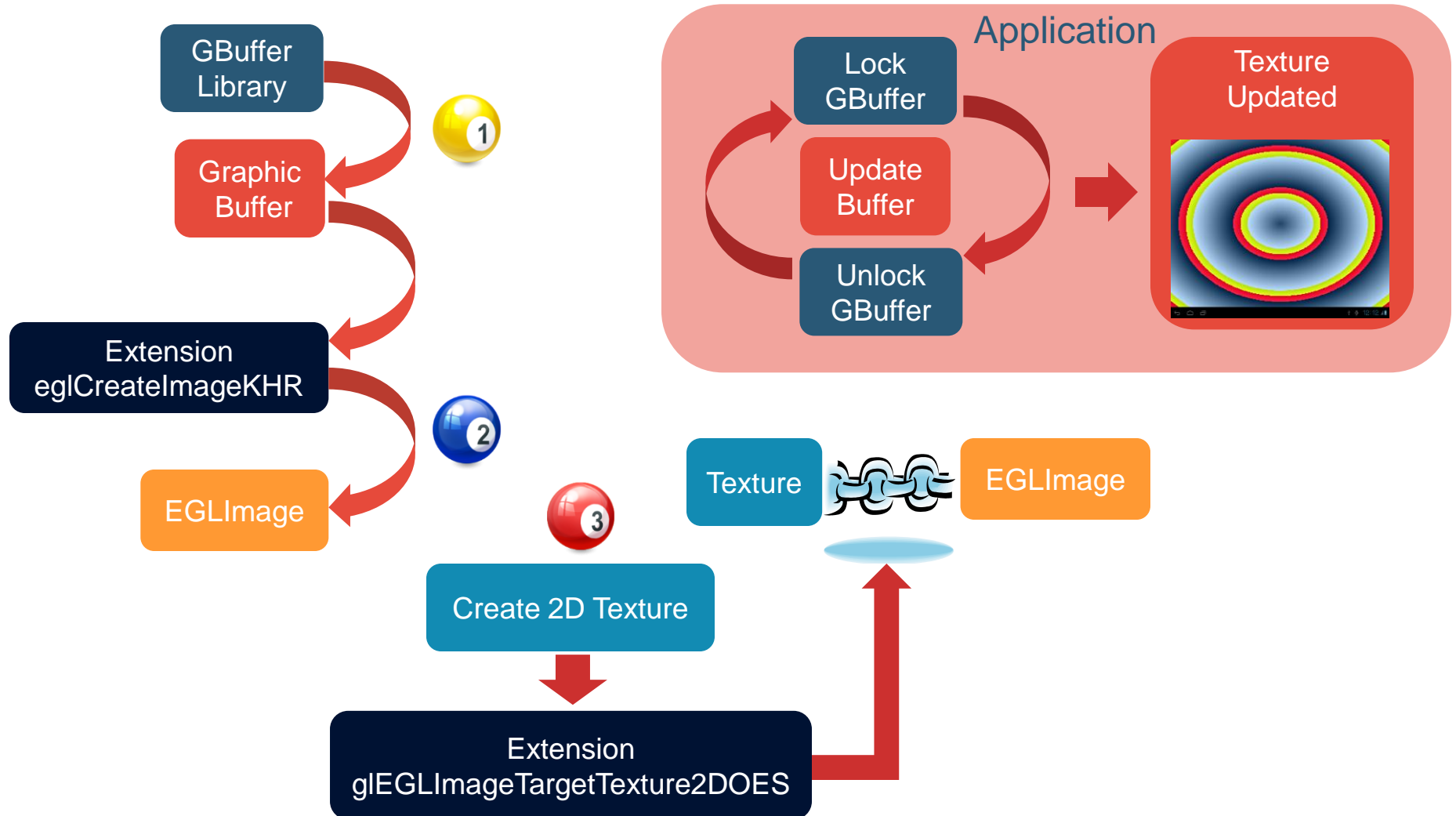
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EGLImage: Saving resources



EGLImage extension with NDK



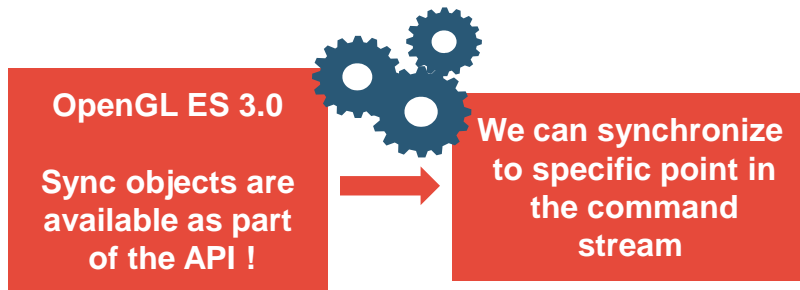


Thread Synchronization Using OpenGL[®] ES 3.0 Sync Objects in a Multithreading Environment

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Sync objects



Command queue

GL ES command 1
GL ES command 2
syncObj = glFenceSync
GL ES command 3

Execution

GL ES command 1
GL ES command 2
syncObj = glFenceSync
GL ES command 3

```
GLsync glFenceSync(GLenum condition, GLbitfield flags);
```

Create a sync object in unsigned state

```
GLenum glClientWaitSync(GLsync sync, GLbitfield flags, GLuint64 timeout);
```

Block CPU until sync object is signaled

```
void glWaitSync(GLsync sync, GLbitfield flags, GLuint64 timeout);
```

GPU will wait until sync object is signaled

Thread Synchronization

Application

Context 1

Main Thread

```
while (rendering)
{
    /* Wait for secondary thread's sync obj. */
    glWaitSync(syncObj2, 0, timeout);

    /* Draw scene. */
    glDrawElements(...);

    /* Create sync object 1. */
    syncObj1= glFenceSync(condition, flags);
}
```

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Context 2

Secondary Thread

```
while (updating texture)
{
    /* Change texture. */
    updateTextureFunc();

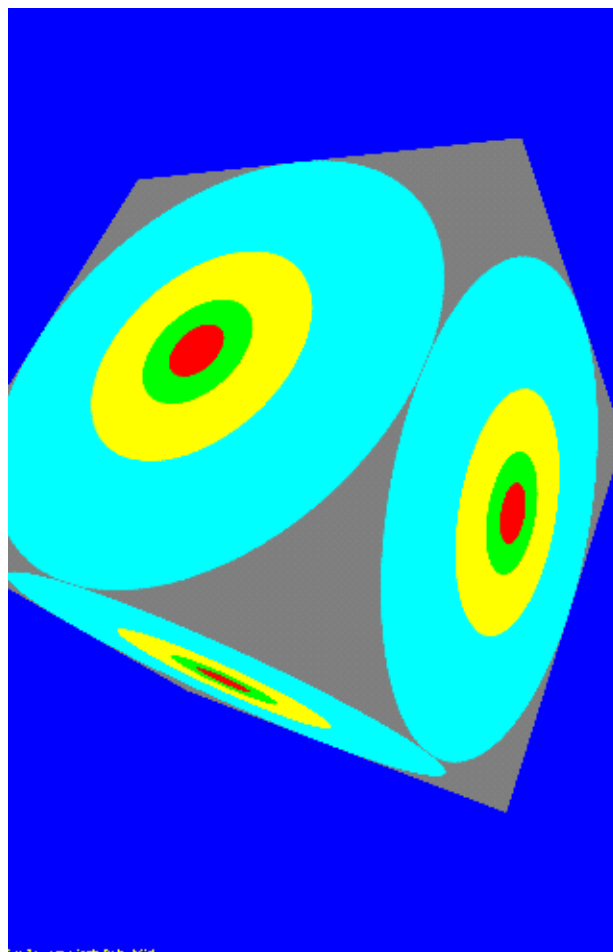
    /* Wait for main thread's sync object. */
    glWaitSync(syncObj1, 0, timeout);

    /* Upload texture. */
    glBindtexture(...);
    glTexImage2D(...);

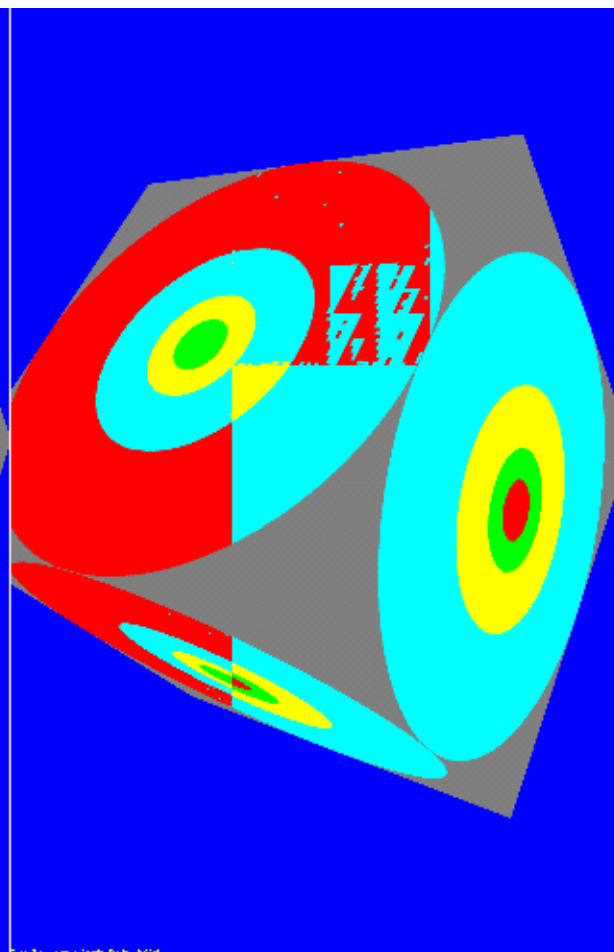
    /* Create sync object 2. */
    syncObj2= glFenceSync(condition, flags);
}
```

ThreadSync example running on Nexus 10. (Cortex-A15 dual core CPU and ARM Mali-T604 GPU)

Fencing on.



Fencing off.





High Quality Text Rendering

Improving Quality for textured Text under Android

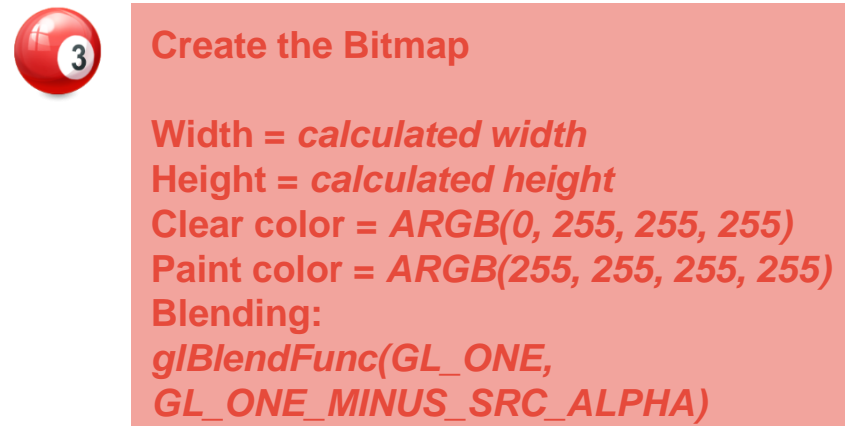
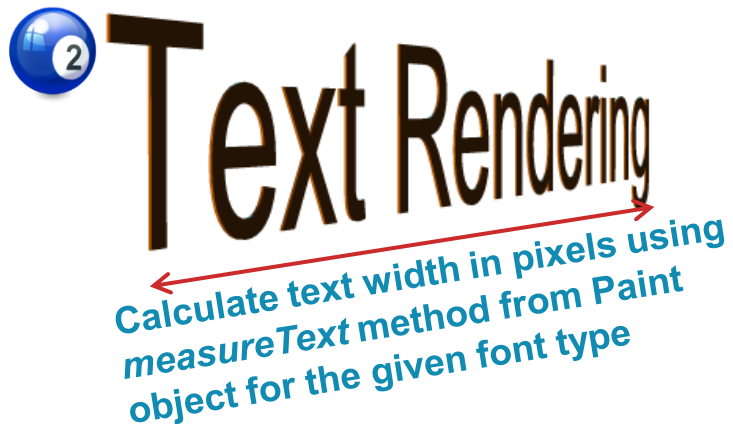
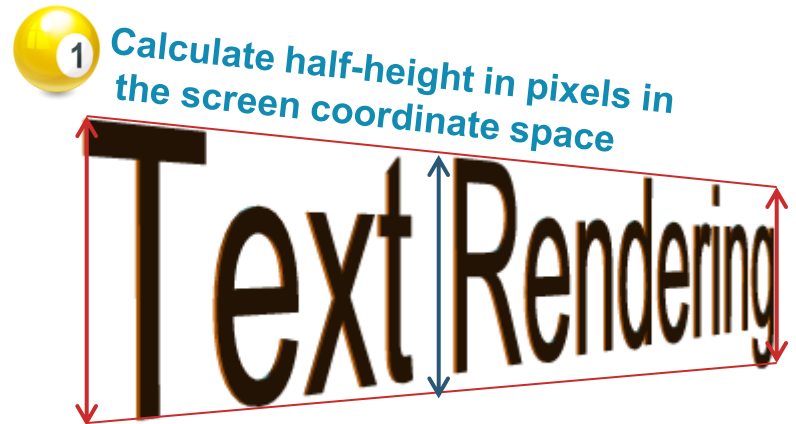
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Text Rendering



Find the font size that gives the closest matching of texels onto screen pixels





Simple Text Rendering *Improving Quality and Performance*

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Simple Text Rendering



text
text
text

Text transformations negatively affect text quality



Single atlas per font face approach as a simple and effective solution

Create an atlas for each font face



```
ABCDEFGHIJKLMN  
OPQRSTUVWXYZab  
cdefghijklmnopq  
rstuvwxyz  
0123456789.,<>!  
"£$%^&*()_+ -=
```

Define the mapping of each glyph



Merge glyphs into a single primitive to be drawn with one GL draw call

Text Rendering



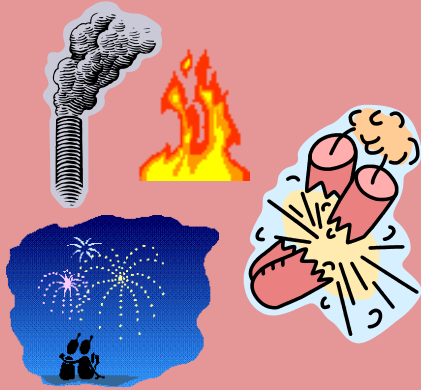
Particle System
*Realtime smoke rendering with
OpenGL[®] ES 2.0*

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Particle Systems

Particle Systems



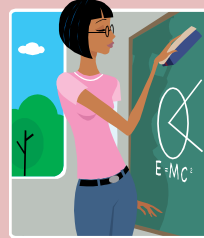
Particle Creation

The Emitter:
defines where
the particles
are created
and their
initial
properties



Simulation

x , v , a , etc.
are calculated



Rendering

Point sprites
are rendered
efficiently as
GL_POINT





Shadow Mapping
*Real-time Shadow Rendering
with OpenGL[®] ES 2.0*



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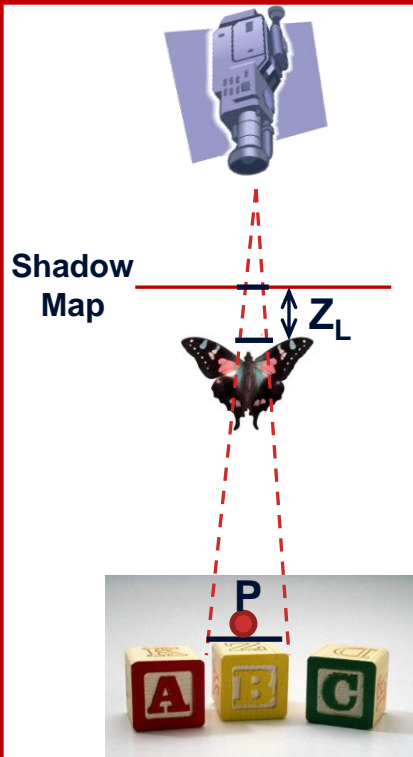


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Shadow mapping process.

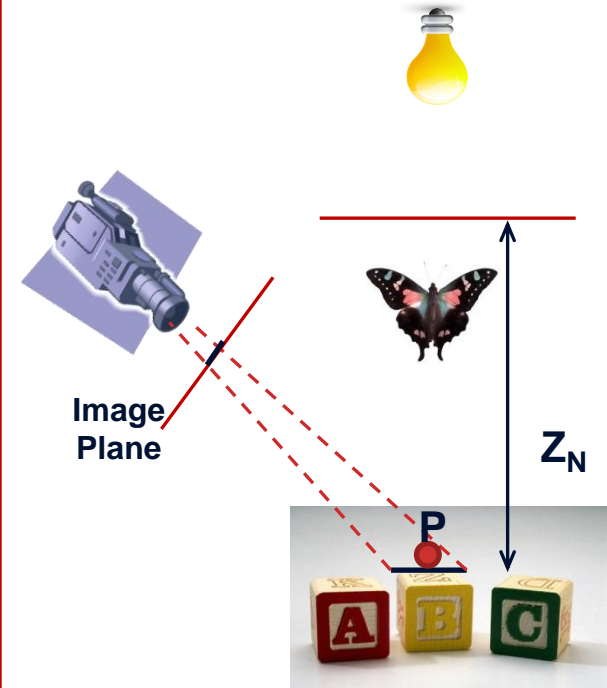


3D Scene



Light Pass

Render scene to texture from light's point of view to store fragments' depth.



Final Pass

Render scene from camera's point of view. Additionally calculate position of fragments' in light's space.

If $Z_N > Z_L$ the fragment is in shadow.

All these samples and more
are available on:

malideveloper.arm.com

Thank you 
Any questions?

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