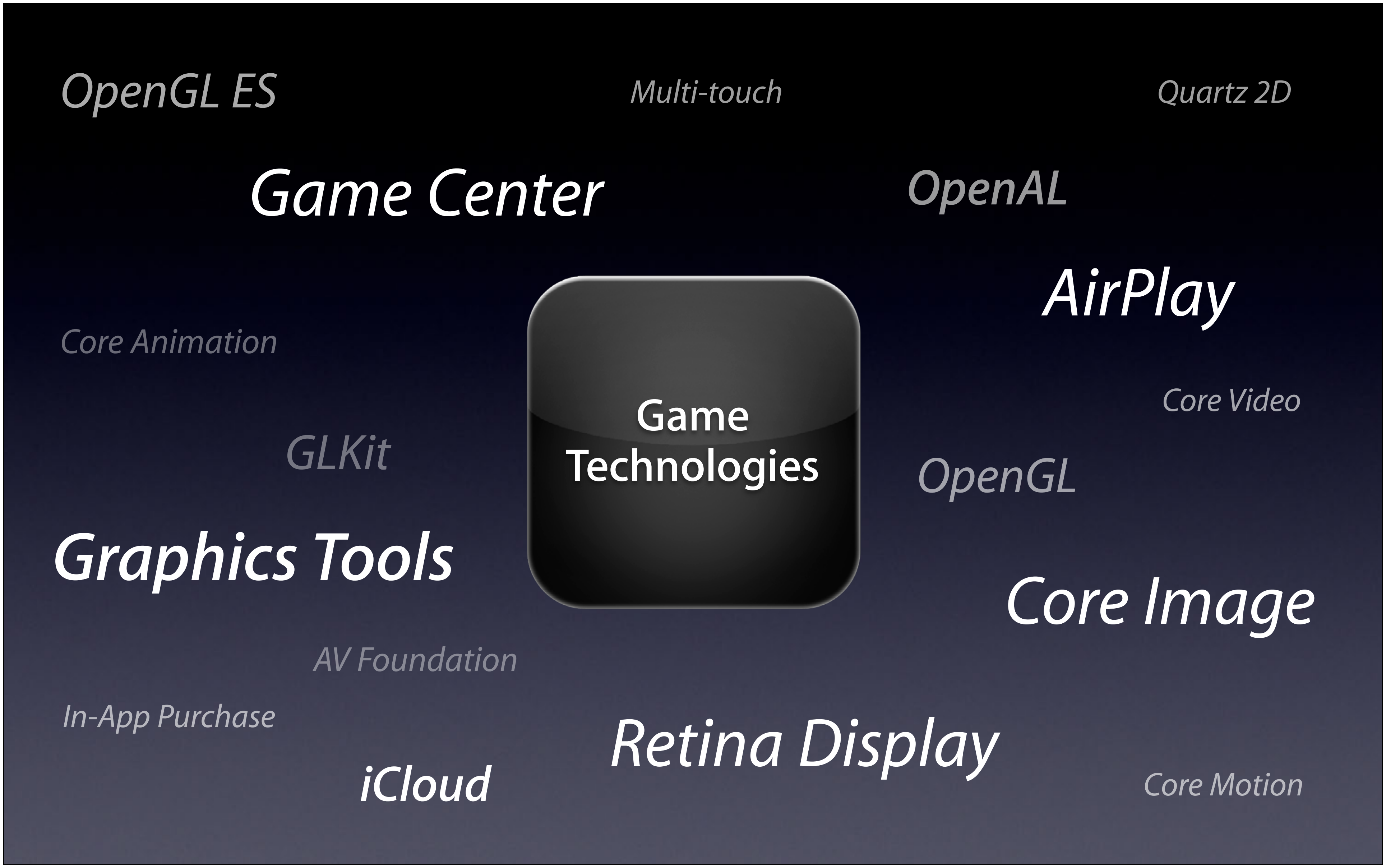
Game Technologies Kickoff

The Weather Channel
COMICS
HD
VALENTINS

iOS X



OpenGL ES

Multi-touch

Quartz 2D

Game Center

OpenAL

AirPlay

Core Animation

Core Video

GLKit

Game Technologies

OpenGL

Graphics Tools

Core Image

AV Foundation

In-App Purchase

Retina Display

iCloud

Core Motion

OpenGL ES

Multi-touch

Quartz 2D

Game Center

OpenAL

AirPlay

Core Animation

Game Technologies

Core Video

GLKit

OpenGL

Graphics Tools

Core Image

AV Foundation

In-App Purchase

Retina Display

iCloud

Core Motion

Game Center

130 Million

Players

5 Billion

Scores per week

iOS

X

Game Center
App

GameKit
Framework

Game Center
Services

Friends

Leaderboards

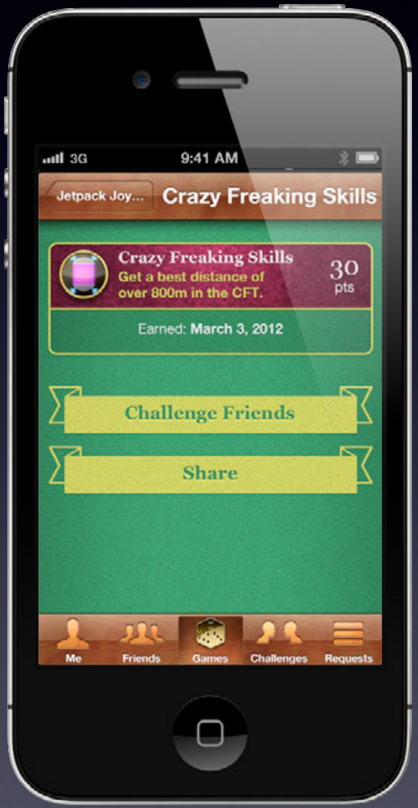
Achievements

Multiplayer

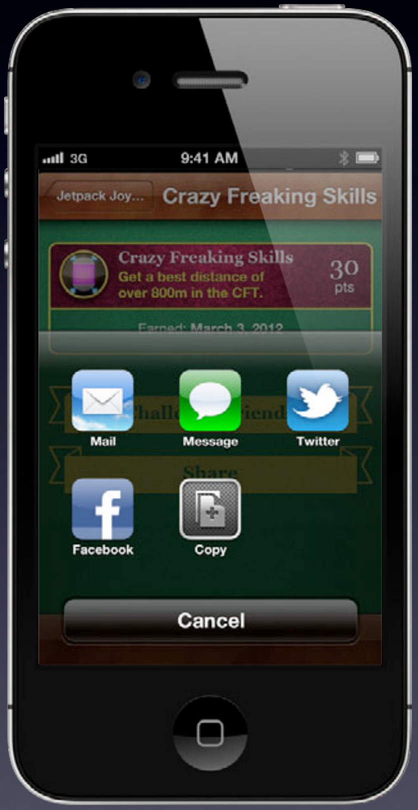
Voice Chat

Discovery

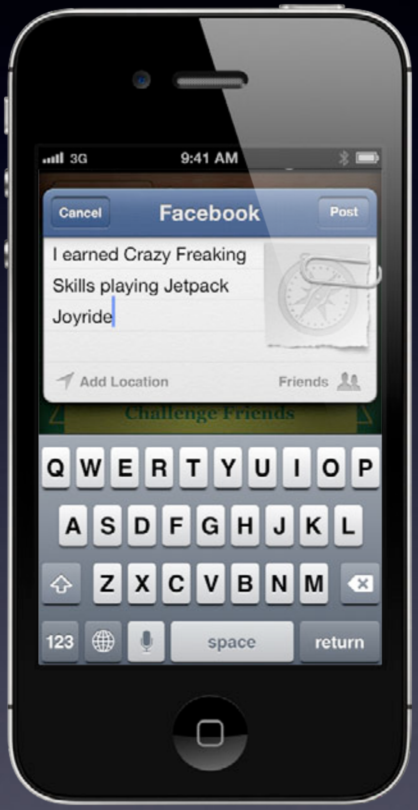
Sharing Scores and Achievements



Sharing Scores and Achievements

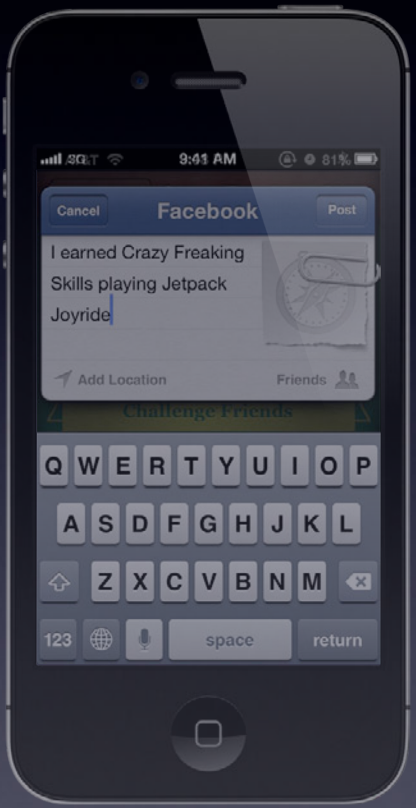


Sharing Scores and Achievements



I earned Crazy Freaking Skills playing Jetpack Joyride

Sharing Scores and Achievements



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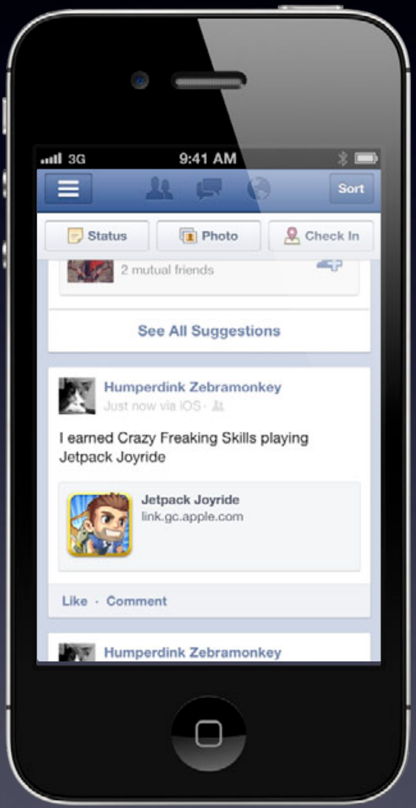
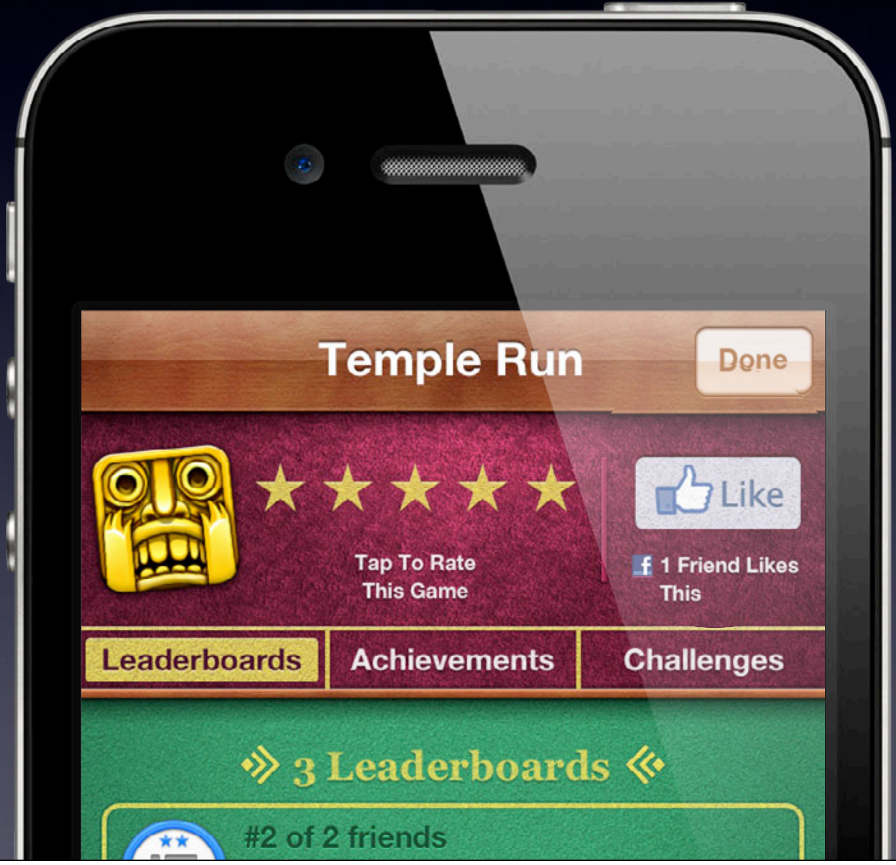
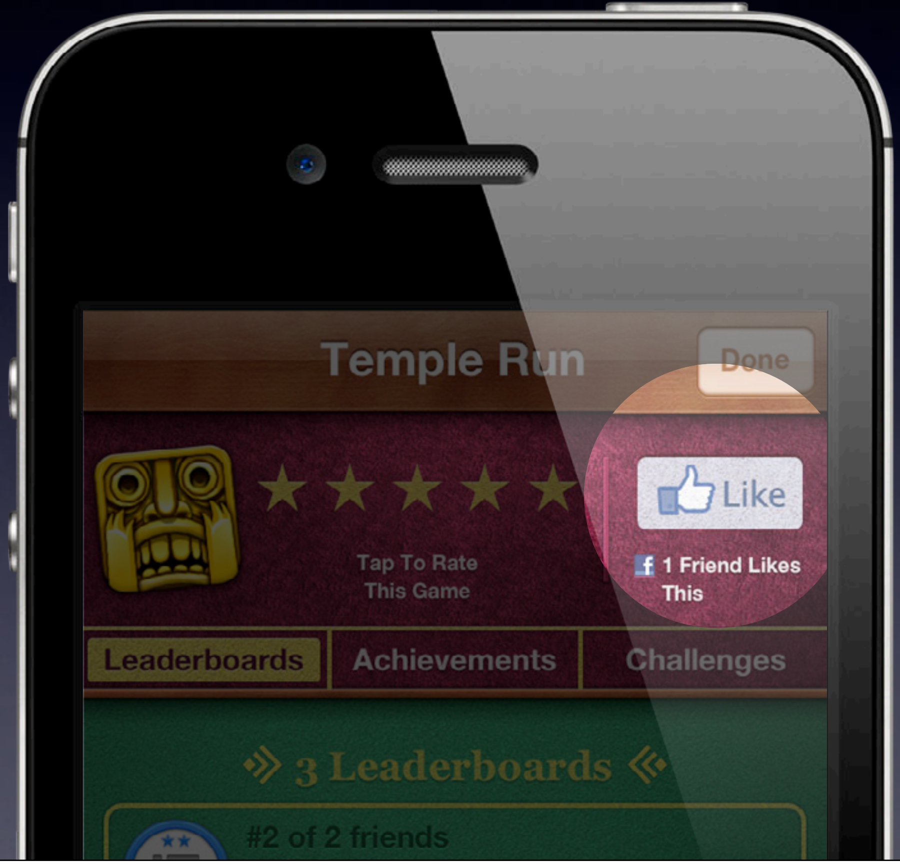


I earned Crazy Freaking Skills playing Jetpack Joyride

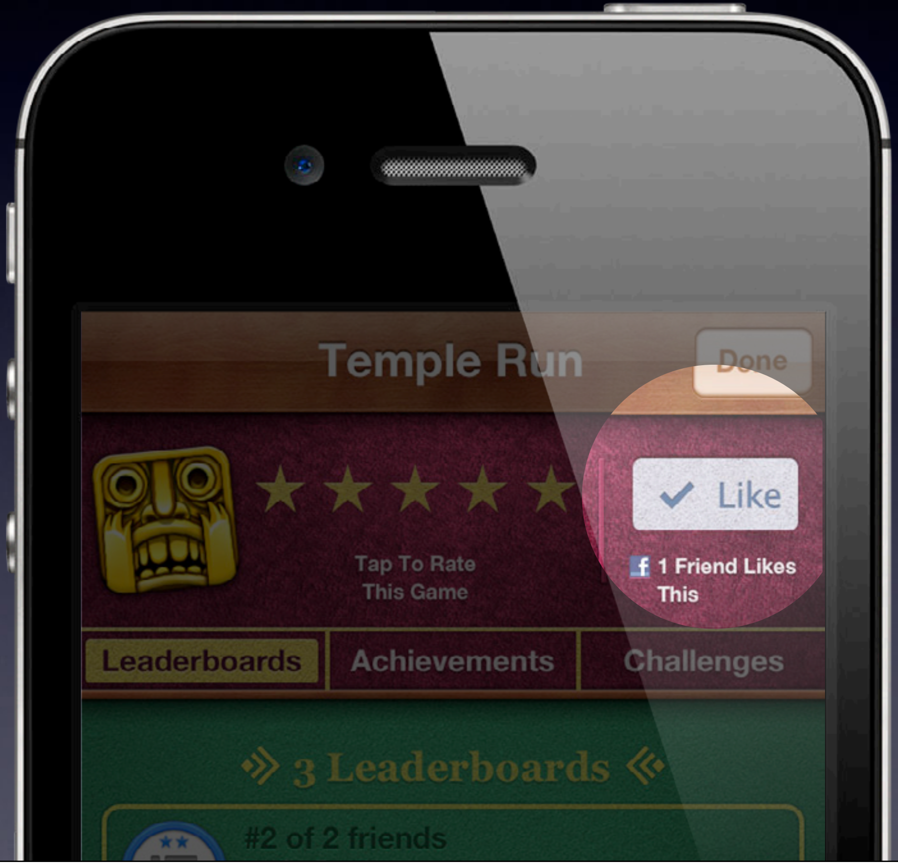
“Like” Games


Temple Run
Done
Like
Tap To Rate This Game
1 Friend Likes This
Leaderboards
Achievements
Challenges
3 Leaderboards
#2 of 2 friends

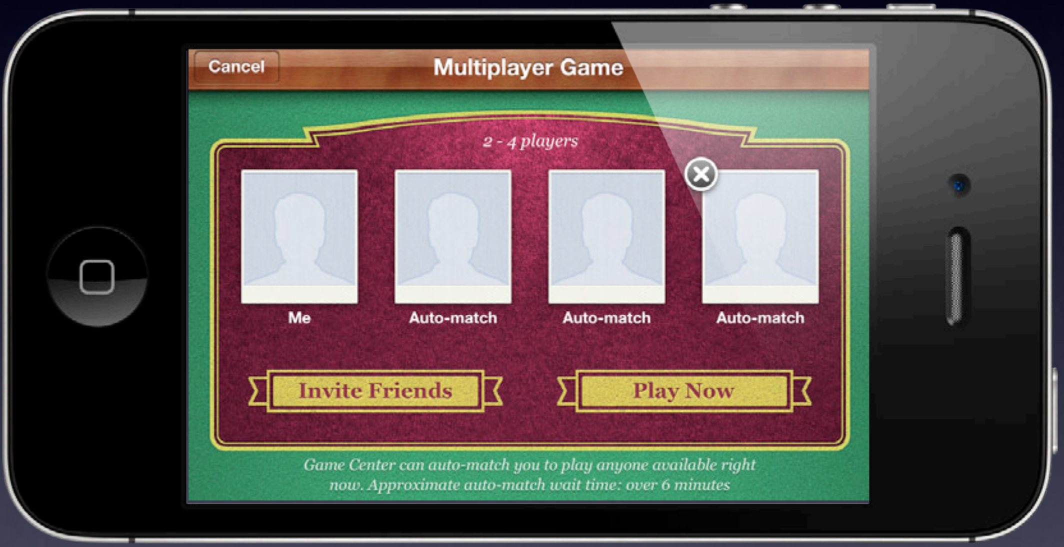
“Like” Games


Temple Run
Done
Like
Tap To Rate
This Game
1 Friend Likes This
Leaderboards
Achievements
Challenges
3 Leaderboards
#2 of 2 friends

“Like” Games

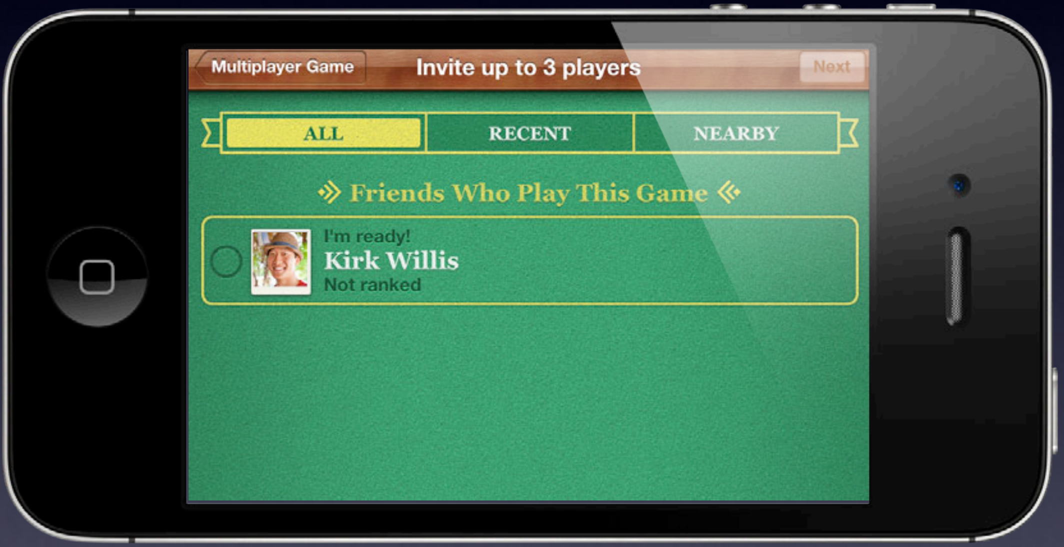

Temple Run
Done
Like
1 Friend Likes This
Tap To Rate This Game
Leaderboards
Achievements
Challenges
3 Leaderboards
#2 of 2 friends

Local Multiplayer

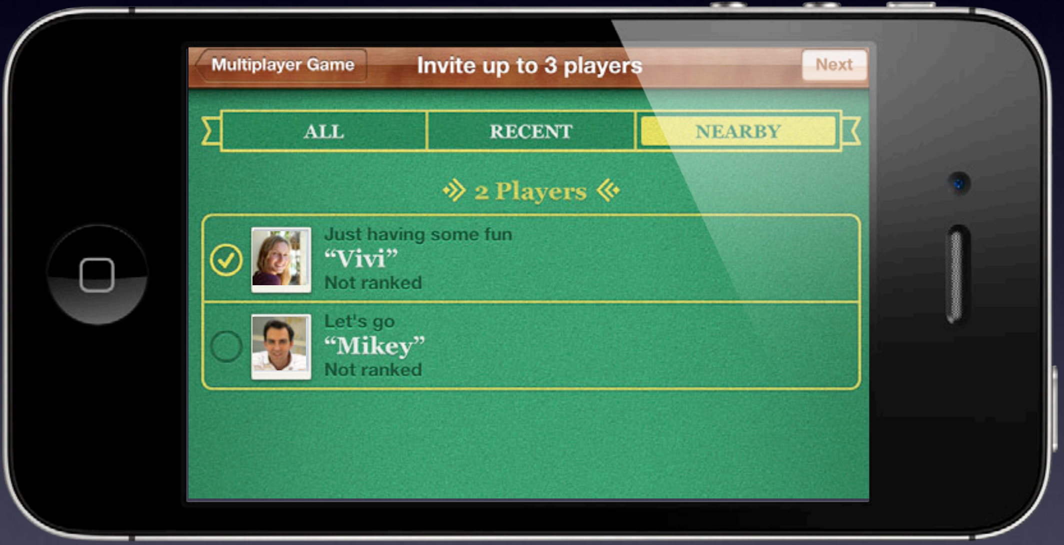


Game Center can auto-match you to play anyone available right now. Approximate auto-match wait time: over 6 minutes

Local Multiplayer



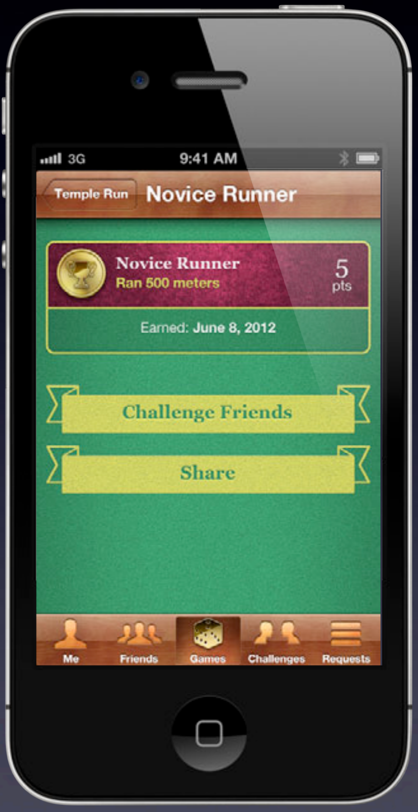
Local Multiplayer



Just having some fun
"Vivi"
Not ranked

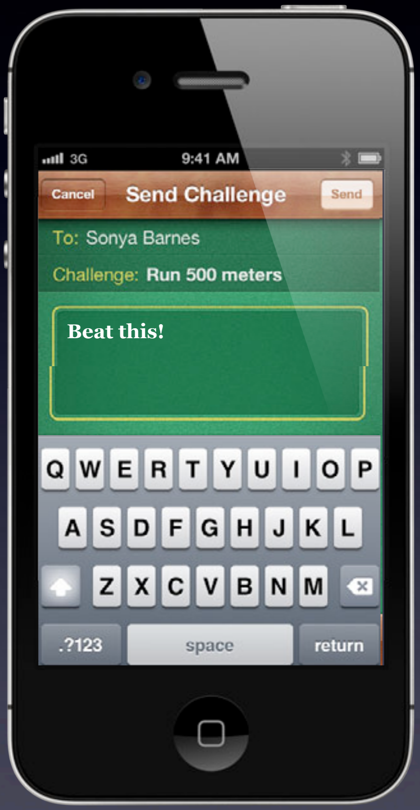
Let's go
"Mikey"
Not ranked

Challenges


9:41 AM
Temple Run
Novice Runner
Novice Runner
Ran 500 meters
5 pts
Earned: June 8, 2012
Challenge Friends
Share
Me
Friends
Games
Challenges
Requests

9:41 AM
Messages
Calendar
Photos
Camera
Videos
Maps
Weather
Passbook
Notes
Reminders
Clock
Game Center
Newsstand
iTunes
App Store
Settings
Phone
Mail
Safari
Music

Challenges

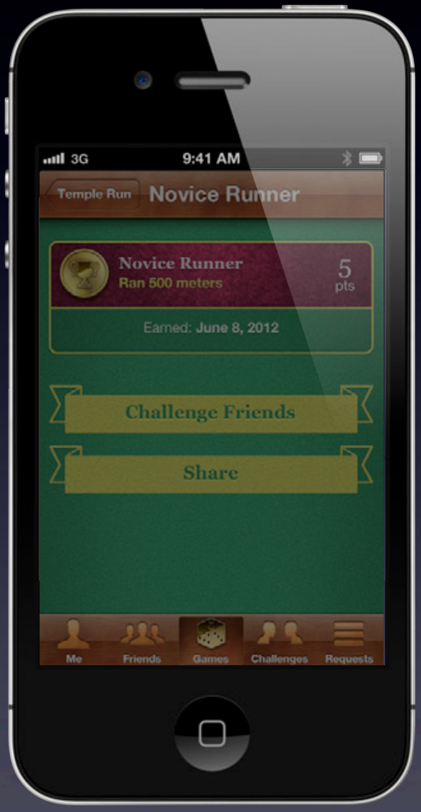


To: Sonya Barnes

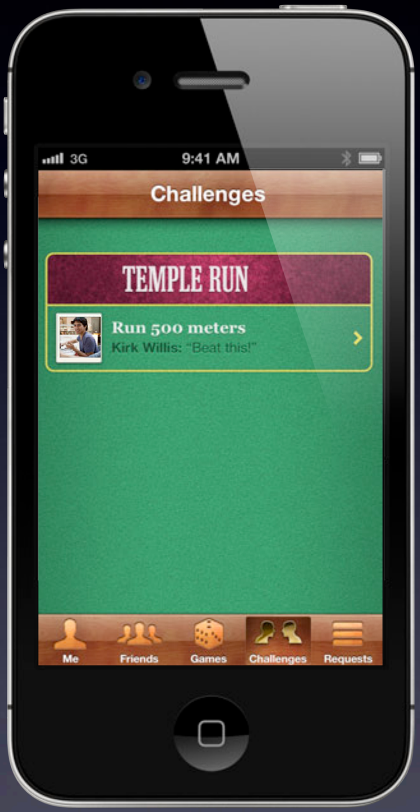
Challenge: Run 500 meters

Beat this!

Challenges

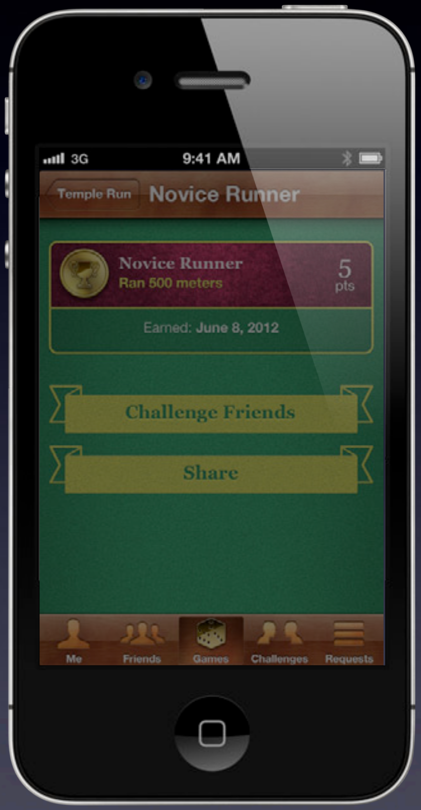


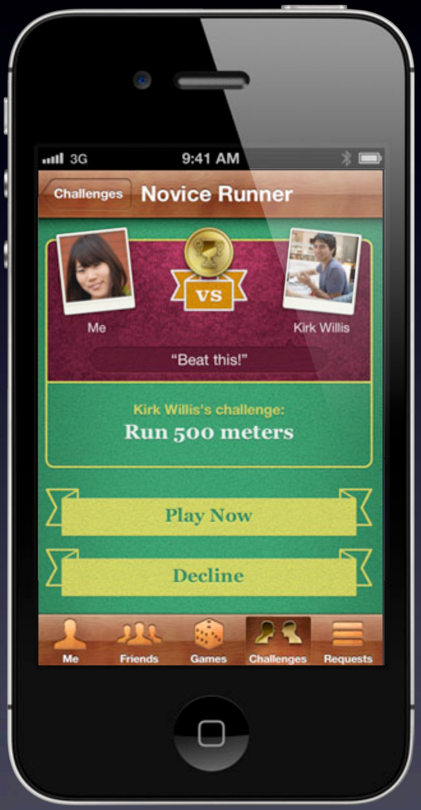
3G
9:41 AM
Temple Run
Novice Runner
Novice Runner
Ran 500 meters
5 pts
Earned: June 8, 2012
Challenge Friends
Share
Me
Friends
Games
Challenges
Requests



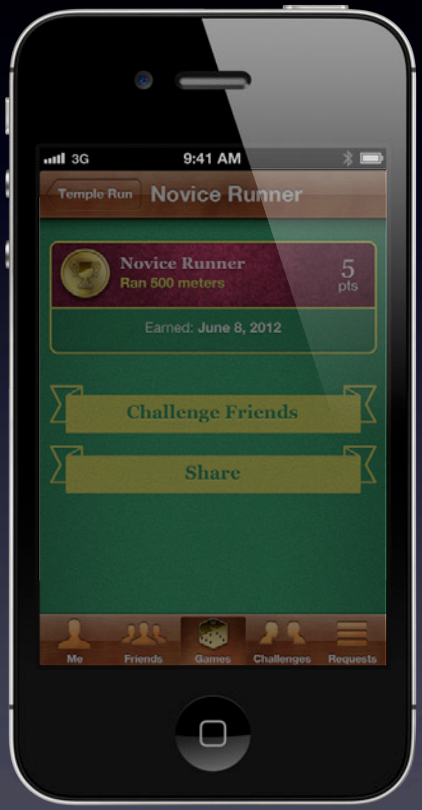
3G
9:41 AM
Challenges
TEMPLE RUN
Run 500 meters
Kirk Willis: "Beat this!"
Me
Friends
Games
Challenges
Requests

Challenges

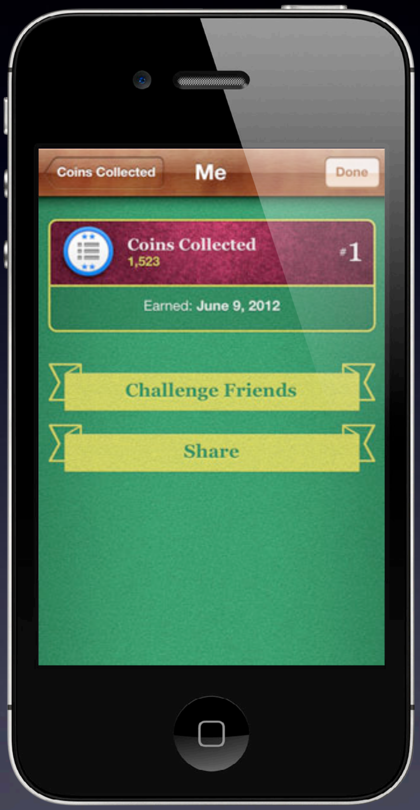

9:41 AM
Temple Run
Novice Runner
Novice Runner
Ran 500 meters
5 pts
Earned: June 8, 2012
Challenge Friends
Share
Me
Friends
Games
Challenges
Requests


9:41 AM
Challenges
Novice Runner
VS
Me
Kirk Willis
"Beat this!"
Kirk Willis's challenge:
Run 500 meters
Play Now
Decline
Me
Friends
Games
Challenges
Requests

Challenges

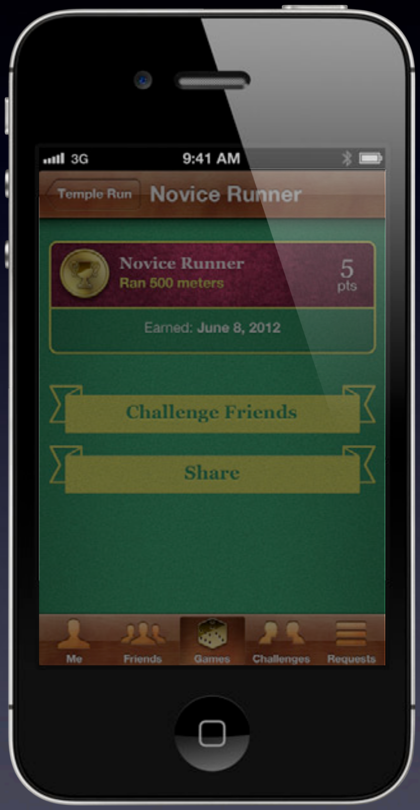


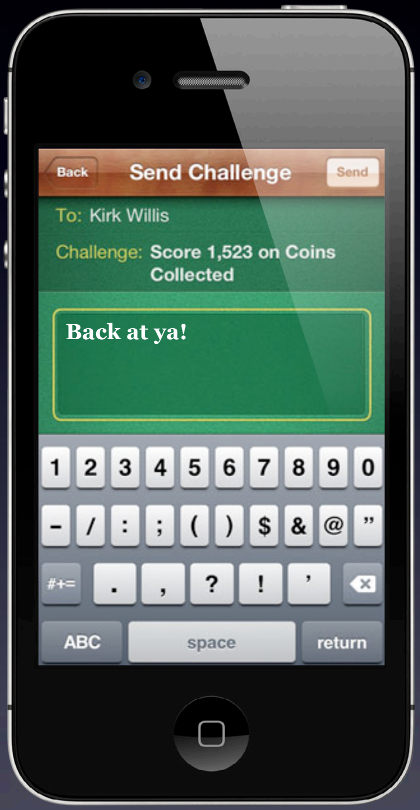
3G
9:41 AM
Temple Run
Novice Runner
Novice Runner
Ran 500 meters
5
pts
Earned: June 8, 2012
Challenge Friends
Share
Me
Friends
Games
Challenges
Requests



Coins Collected
Me
Done
Coins Collected
1,523
#1
Earned: June 9, 2012
Challenge Friends
Share

Challenges



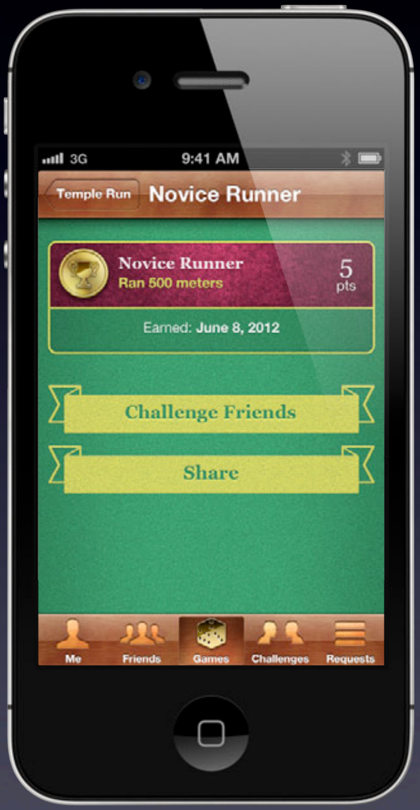


To: Kirk Willis

Challenge: Score 1,523 on Coins Collected

Back at ya!

Challenges


3G
9:41 AM
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Novice Runner
Ran 500 meters
5
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Challenge Friends
Share
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Games
Challenges
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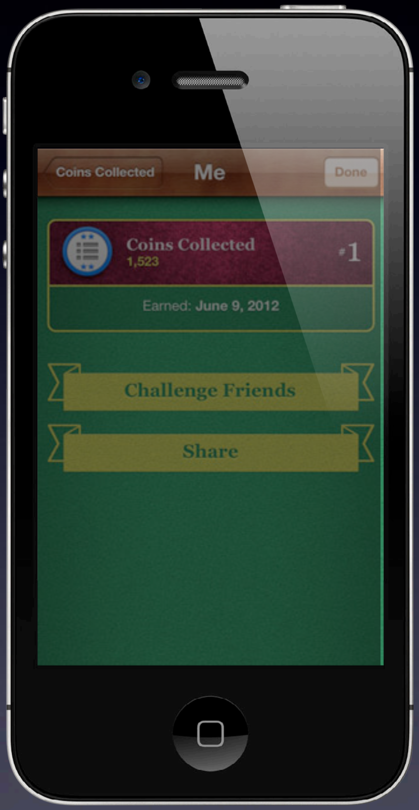

Coins Collected
Me
Done
Coins Collected
1,523
#1
Earned: June 9, 2012
Challenge Friends
Share

Demo

Game Groups

Game Groups

Space

Game Groups

Space

Space OS X

Game Groups

Space HD

Space

Space OS X

Game Groups

Space HD

Space

Space HD Lite

Space OS X

Game Groups

Space HD

Space

Alliance

Space HD Lite

Space OS X

Game Groups

Space HD

Space

Alliance

Space HD Lite

Space OS X

Alliance OS X

Game Groups

Unify audiences

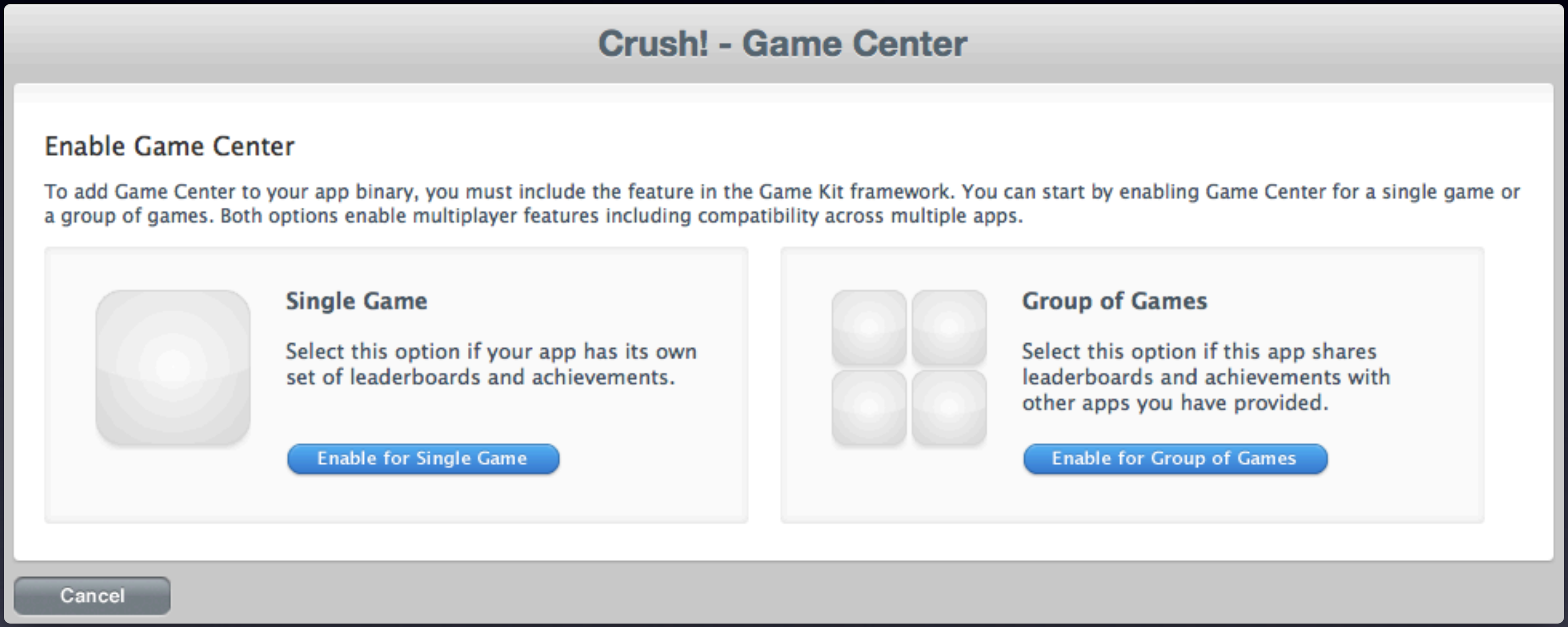
Combine leaderboards

Combine achievements

Game to game multiplayer

iOS and OS X

iTunes Connect



Enable Game Center

To add Game Center to your app binary, you must include the feature in the Game Kit framework. You can start by enabling Game Center for a single game or a group of games. Both options enable multiplayer features including compatibility across multiple apps.

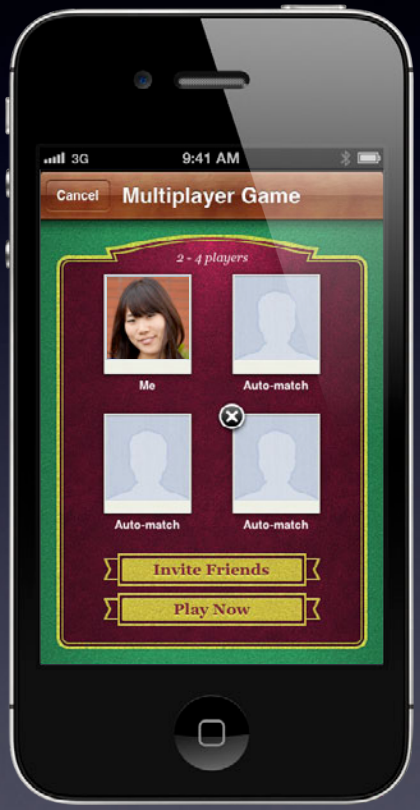
Single Game

Select this option if your app has its own set of leaderboards and achievements.

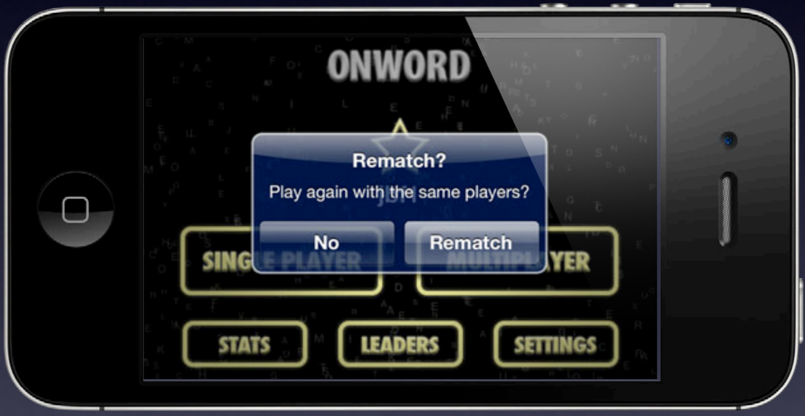
Group of Games

Select this option if this app shares leaderboards and achievements with other apps you have provided.

Streamlined Multiplayer UI



Multiplayer Rematch


Rematch?

Play again with the same players?

Improved Authentication

Unified Interface

Turn Timeouts

Programmatic Invites

Host election

Turn match data saving

Game Center

AirPlay

Mirror to a TV

Mirror to a TV

AirPlay Mirroring from OS X

AirPlay Mirroring from OS X

Second Display

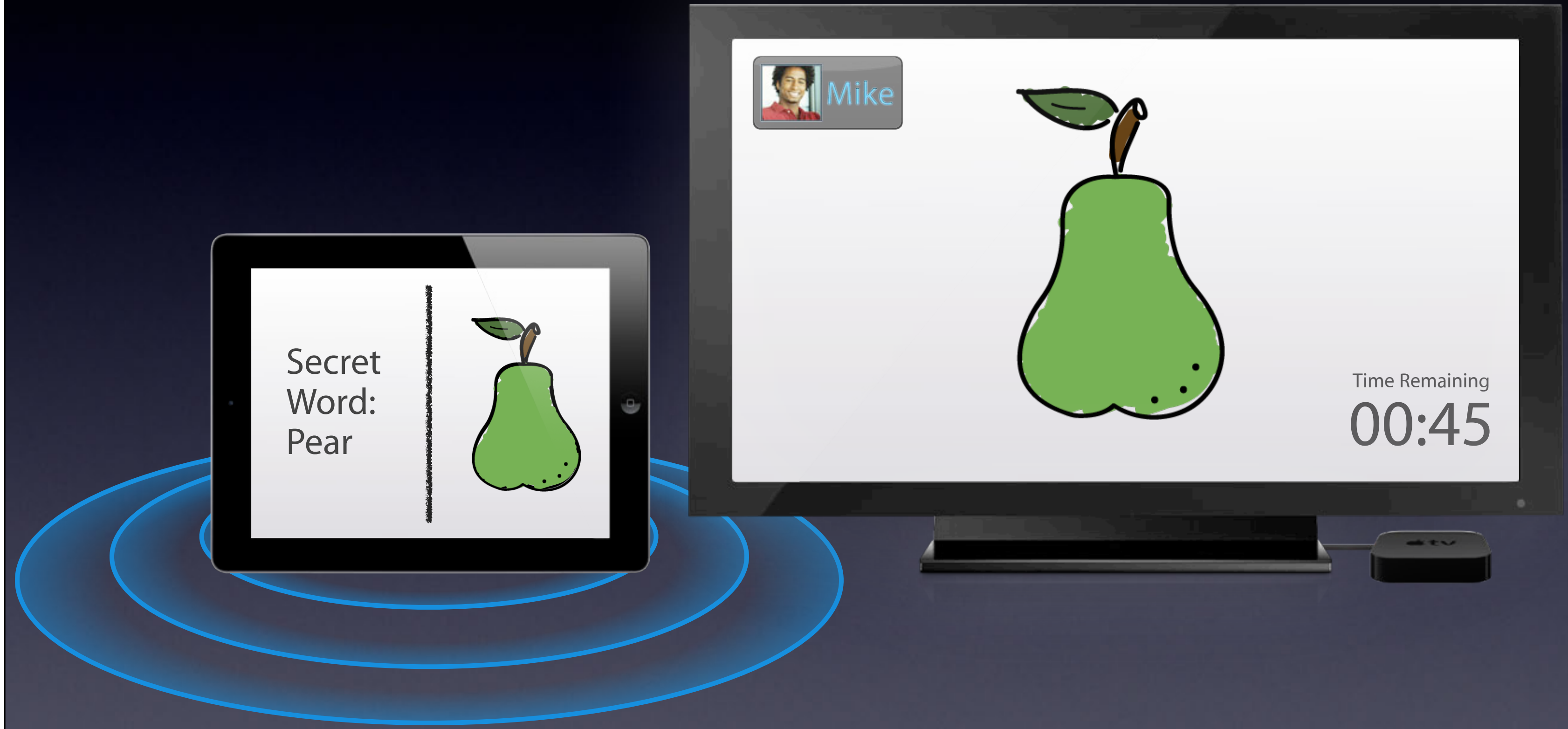
Second Display

Action Game

Shared Experience

Secret
Word:
Pear

Shared Experience



Family Game Night

Family Game Night

BEECHERTON
STELLONA BAY
POSITION 1/4
LAP 1/2
SPEED 76MPH
TIME 00:14.932

Supporting Second Display

- Set up at Launch
- Configure the Second Display
- Handle Rotation
- Design for Second Display

Setup at Launch

```
- (void)applicationDidFinishLaunching:(UIApplication *)application
{
    NSNotificationCenter* center = [NSNotificationCenter defaultCenter];

    // Handle screens that are present when the app is launched
    [ self setupScreens:nil ];

    // Watch for screen connect notifications
    [ center addObserver:self selector:@selector(setupScreens:)
                    name:UIScreenDidConnectNotification object:nil];

    // Watch for screen disconnect notifications
    [ center addObserver:self selector:@selector(setupScreens:)
                    name:UIScreenDidDisconnectNotification object:nil];
}
```

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}
```

Configure the Second Display

```
- (void)setupScreens:(NSNotification *)notification
{
    // Determine if a second screen is connected
    if ([[UIScreen screens] count] > 1) {

      // Get second screen and create a new window
      UIScreen* secondScreen = [[UIScreen screens] objectAtIndex:1];
      self.secondWindow = [[UIWindow alloc]initWithFrame:secondScreen.bounds];
      self.secondWindow.screen = secondScreen;

      // Create view controller for second screen
      self.secondViewController =
          [[GLKViewController alloc] initWithFrame:secondScreen.bounds];
      self.secondWindow.rootViewController = self.secondViewController;

      // Make second screen visible
        self.secondWindow.hidden = NO;
    }
}
```

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      // Make second screen visible
        self.secondWindow.hidden = NO;
    }
}
```

Handle Rotation

```
-(BOOL)shouldAutorotateToInterfaceOrientation:(UIInterfaceOrientation)orient
{
    if (UI_USER_INTERFACE_IDIOM() == UIUserInterfaceIdiomPhone &&
        orient == UIInterfaceOrientationPortraitUpsideDown)
    {
        return NO;
    }
    return YES;
}
```

Handle Rotation

```
-(BOOL)shouldAutorotateToInterfaceOrientation:(UIInterfaceOrientation)orient
{
    if (UI_USER_INTERFACE_IDIOM() == UIUserInterfaceIdiomPhone &&
        orient == UIInterfaceOrientationPortraitUpsideDown)
    {
        return NO;
    }
    return YES;
}
```

Design for Second Display

- Where is the user looking?
- How does the user control the game?
- What should be displayed on the device?
- What should be displayed on the TV?
- What frame rate can my application support?

Design for Second Display

Game Type	Looking At	Primary Controls	On the Device	On the Television
Action	Second screen	Device motion	Secondary information and controls	Primary game screen

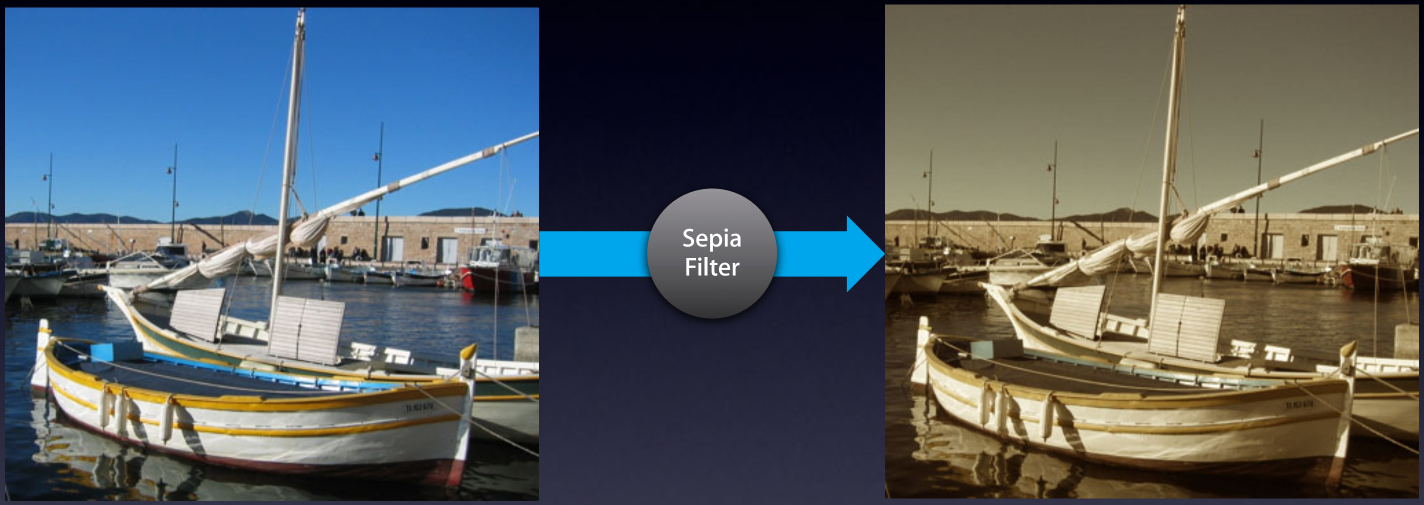
Design for Second Display

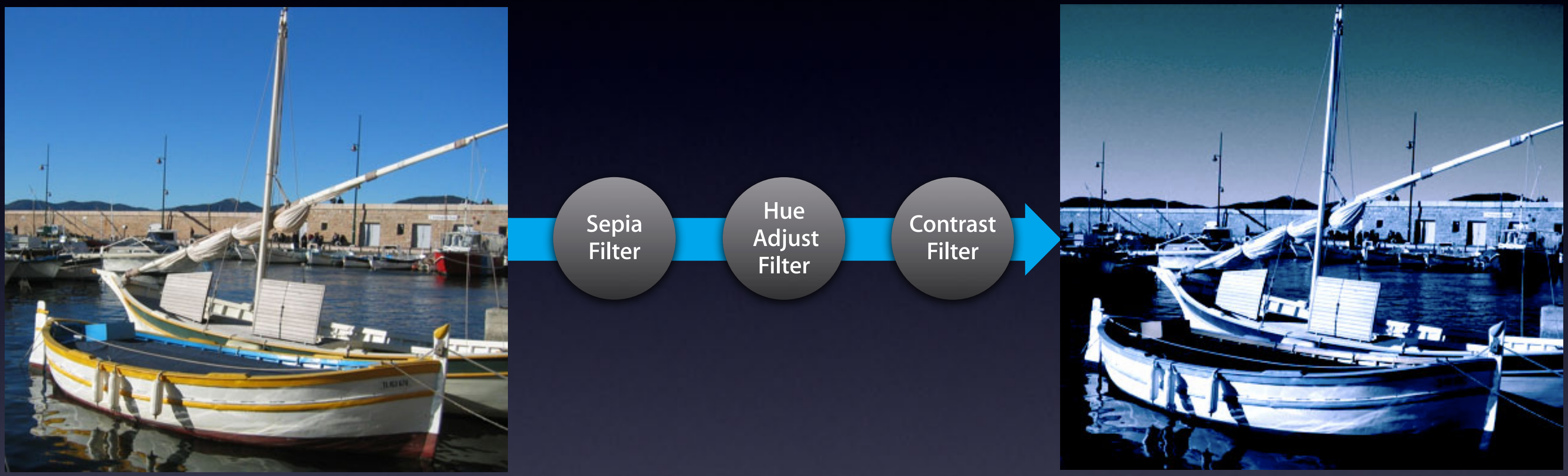
Game Type	Looking At	Primary Controls	On the Device	On the Television
Action	Second screen	Device motion	Secondary information and controls	Primary game screen
Shared Experience / Family Game Night	Device screen	Multitouch Input	Primary screen and controls	Shared game screen

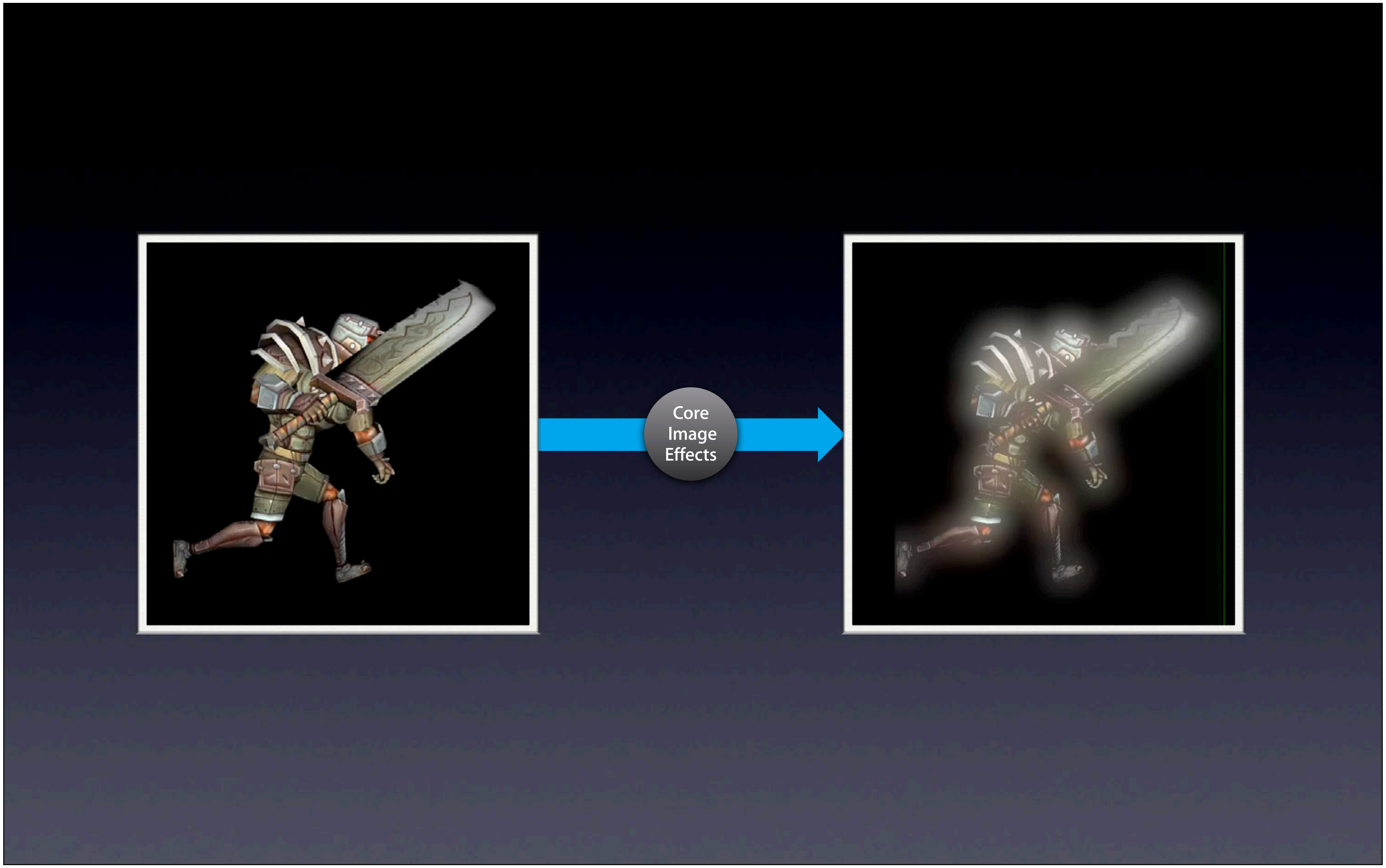
AirPlay

Core Image

iOS X


Sepia
Filter

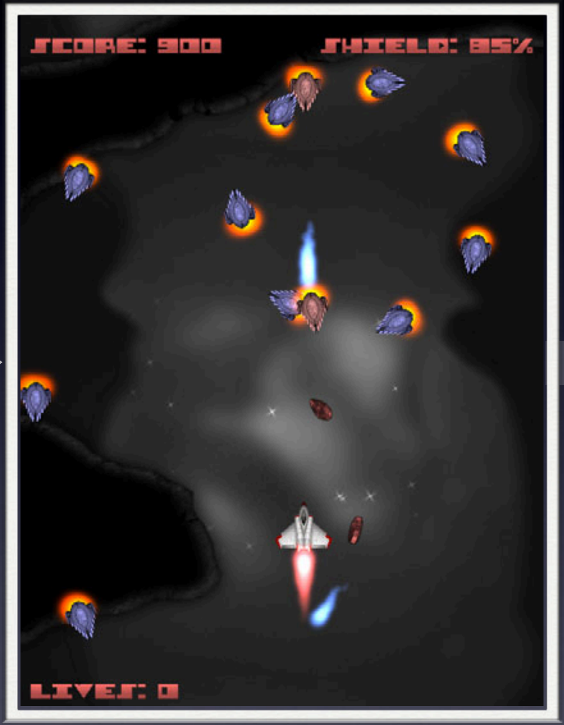

Sepia Filter
Hue Adjust Filter
Contrast Filter


Core
Image
Effects

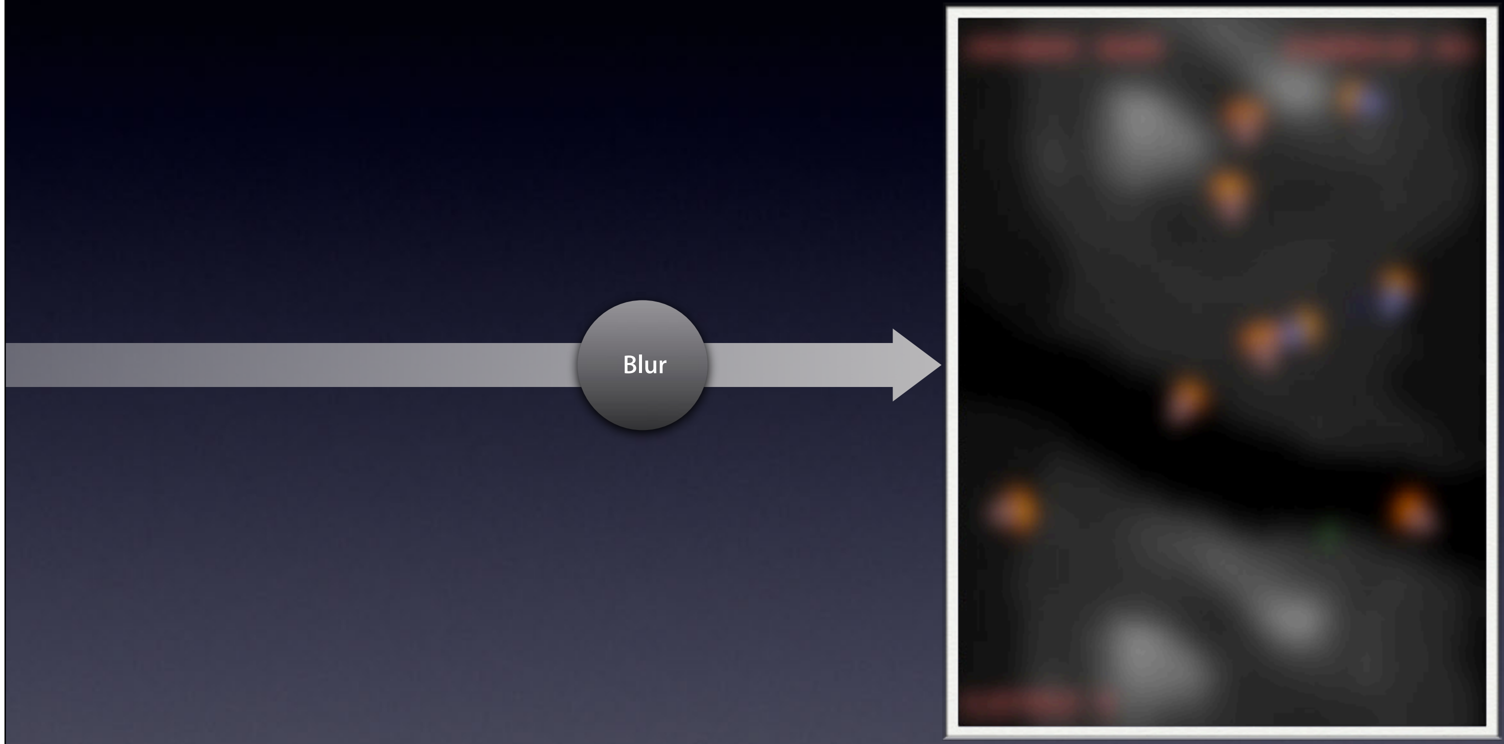
OpenGL

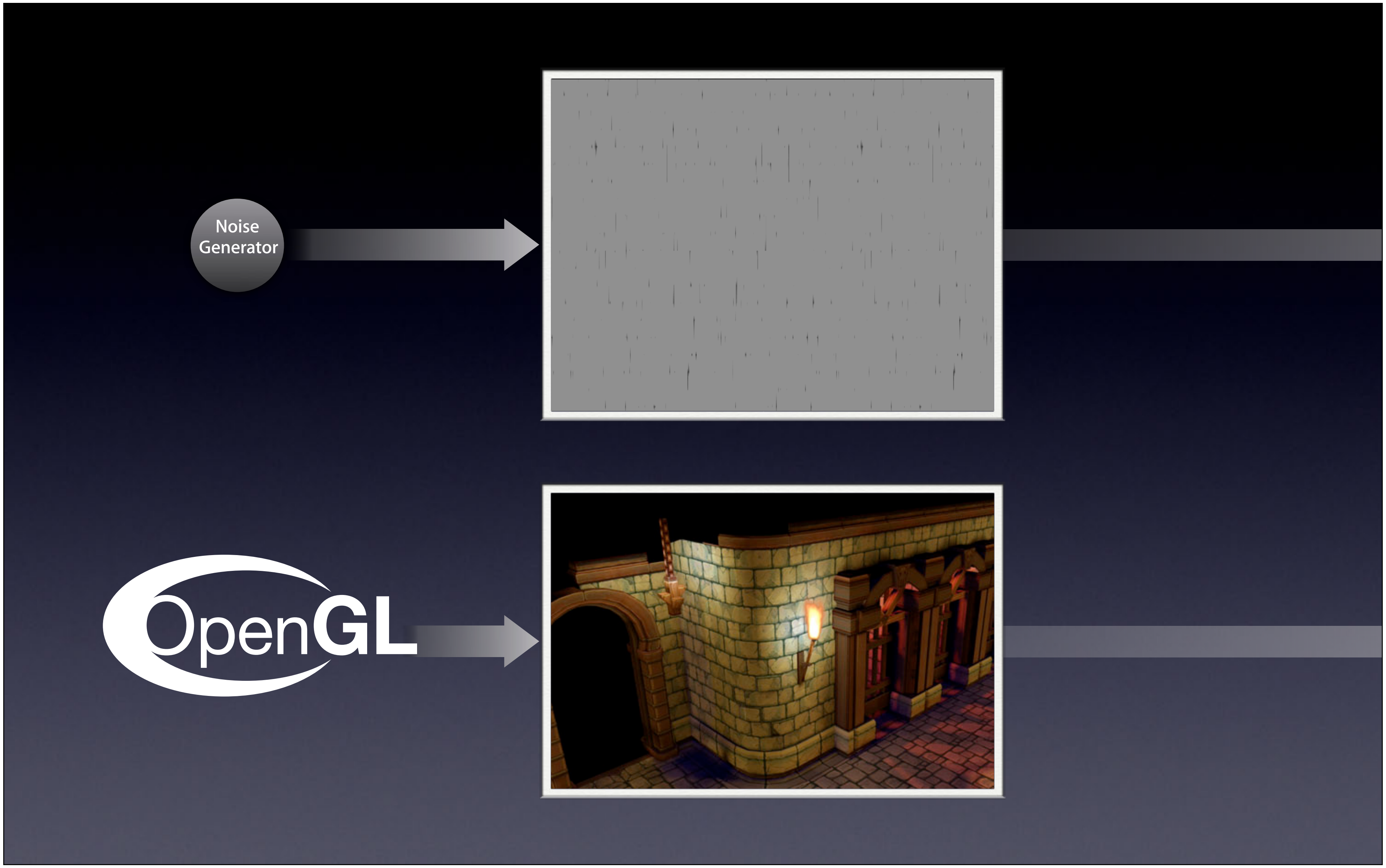
Vignette

OpenGL

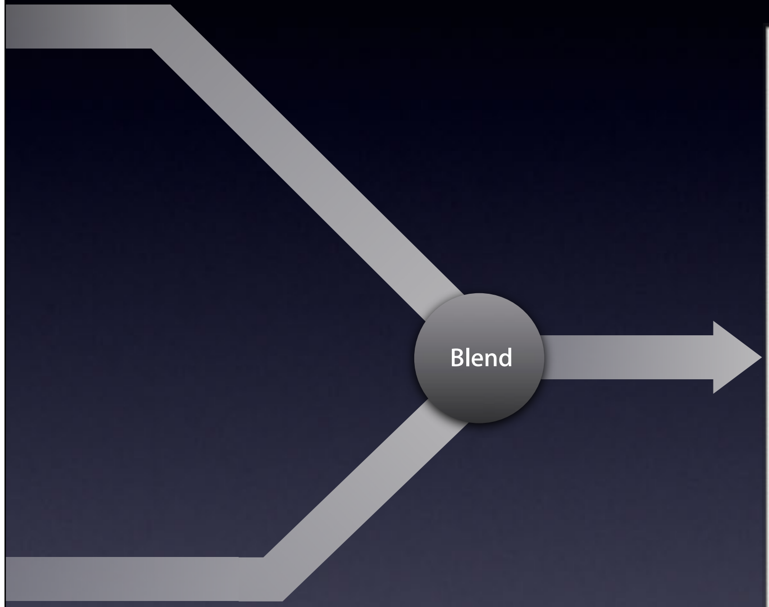


Full-Screen Blur

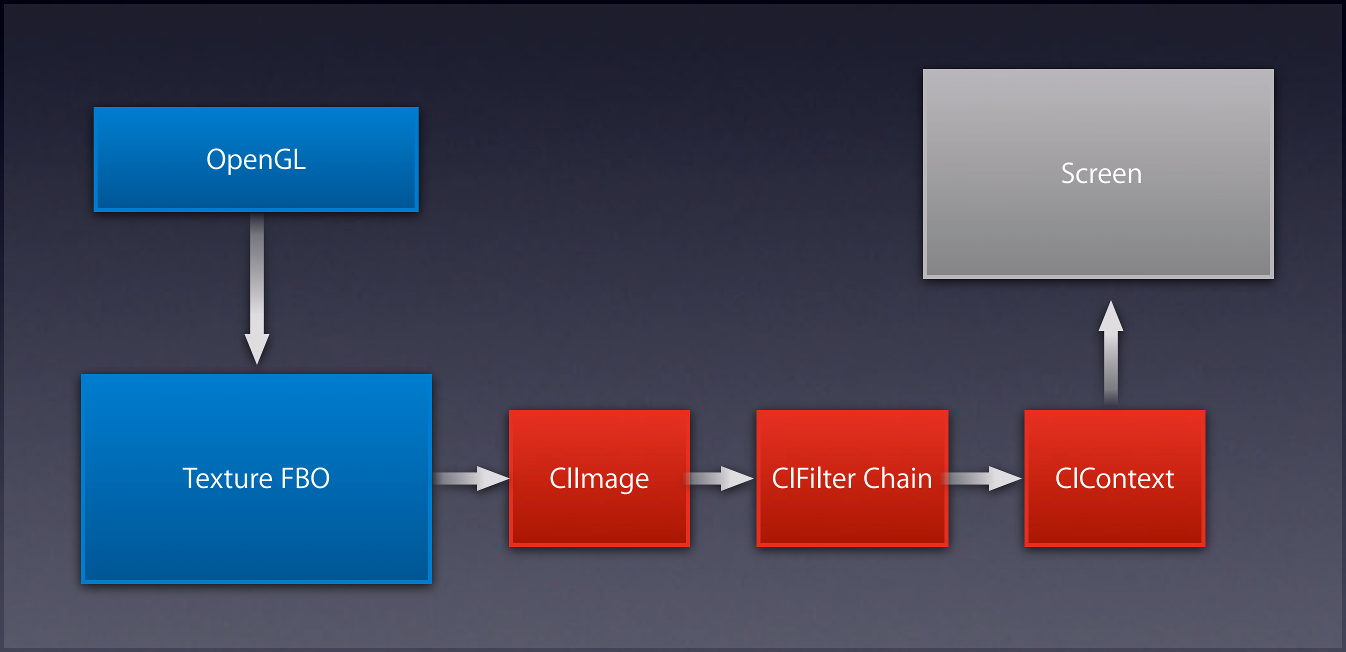



Noise Generator
OpenGL

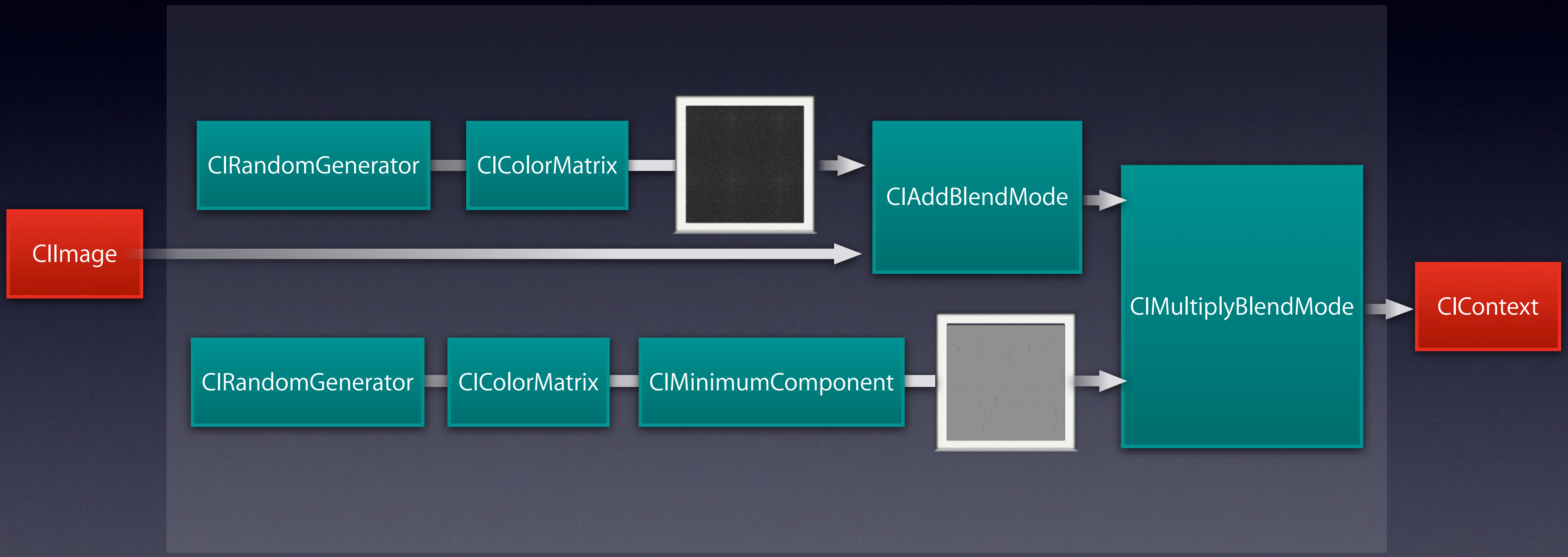
Film Grain



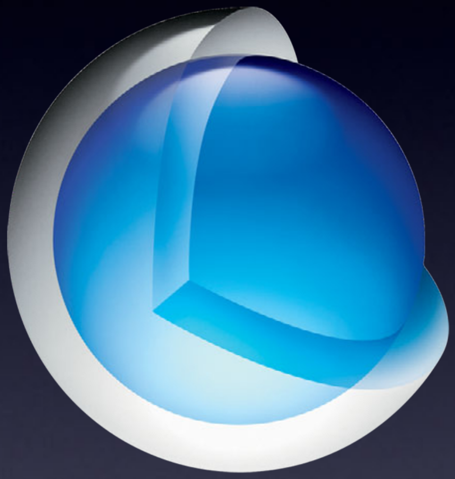
OpenGL to Core Image



Film Grain Example

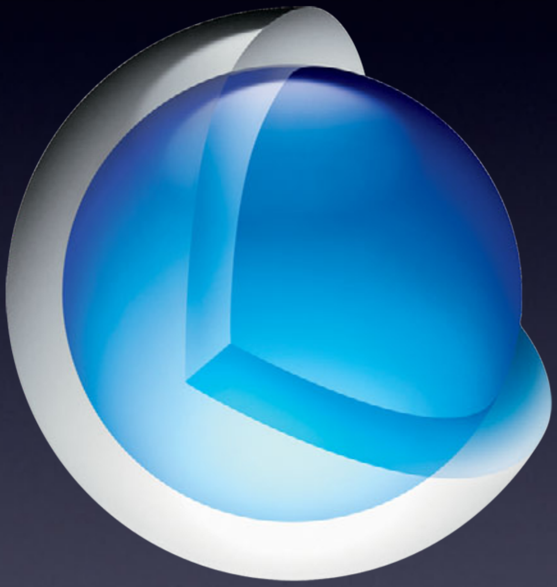


Demo



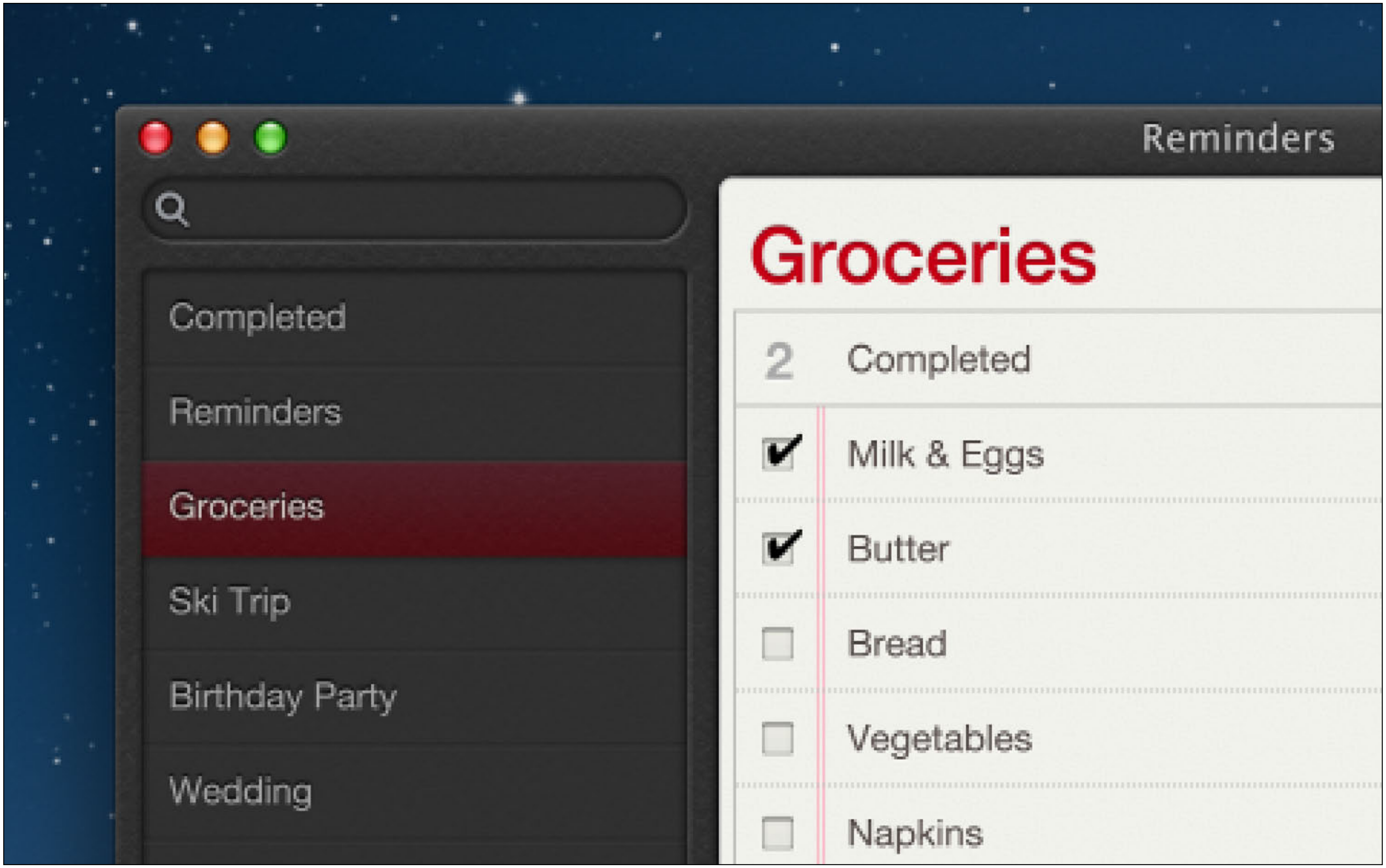
CIFalseColor CIHighlightShadowAdjust CIAffineTile CIColorBurnBlendMode
CIRandomGenerator
CIDifferenceBlendMode CICrop CIMaskToAlpha CIToneCurve
CIAffineClamp CIAdditionCompositing CIDotScreen
CIFlashTransition CIHueBlendMode CIFourfoldTranslatedTile
CIGloom CIColorMap CIPixellate CIDarkenBlendMode
CICopyMachineTransition CIVignette
CIGlideReflectedTile CIExclusionBlendMode CIStripesGenerator
CIDisintegrateWithMask
CISwipeTransition
CIGaussianGradient
CIDissolveTransition CIMinimumCompositing
CIColorMonochrome
CIGaussianBlur
CIRadialGradient
CIColorPosterize
CIHoleDistortion
CIConstantColorGenerator CIColorMonochrome CIPinchDistortion
CIColorControls
CISepiaTone CIBarsSwipeTransition CIToneCurve
CIBloom CIVibrance
CICheckerboardGenerator
CIVortexDistortion CIHardLightBlendMode
CIMultiplyCompositing
CIColorCube CIEightfoldReflectedTile CIBlendWithMask CIColorMatrix
CIExposureAdjust CISwipeTransition
CIPerspectiveTile
CIFourfoldReflectedTile CISharpenLuminance
CIHueAdjust CISourceOverCompositing CITwirlDistortion
CILinearGradient CICircularScreen CIAffineTransform
CIColorDodgeBlendMode
CIColorInvert CIMaximumCompositing CIFourfoldRotatedTile CIColorBlendMode

Core Image



Retina Display

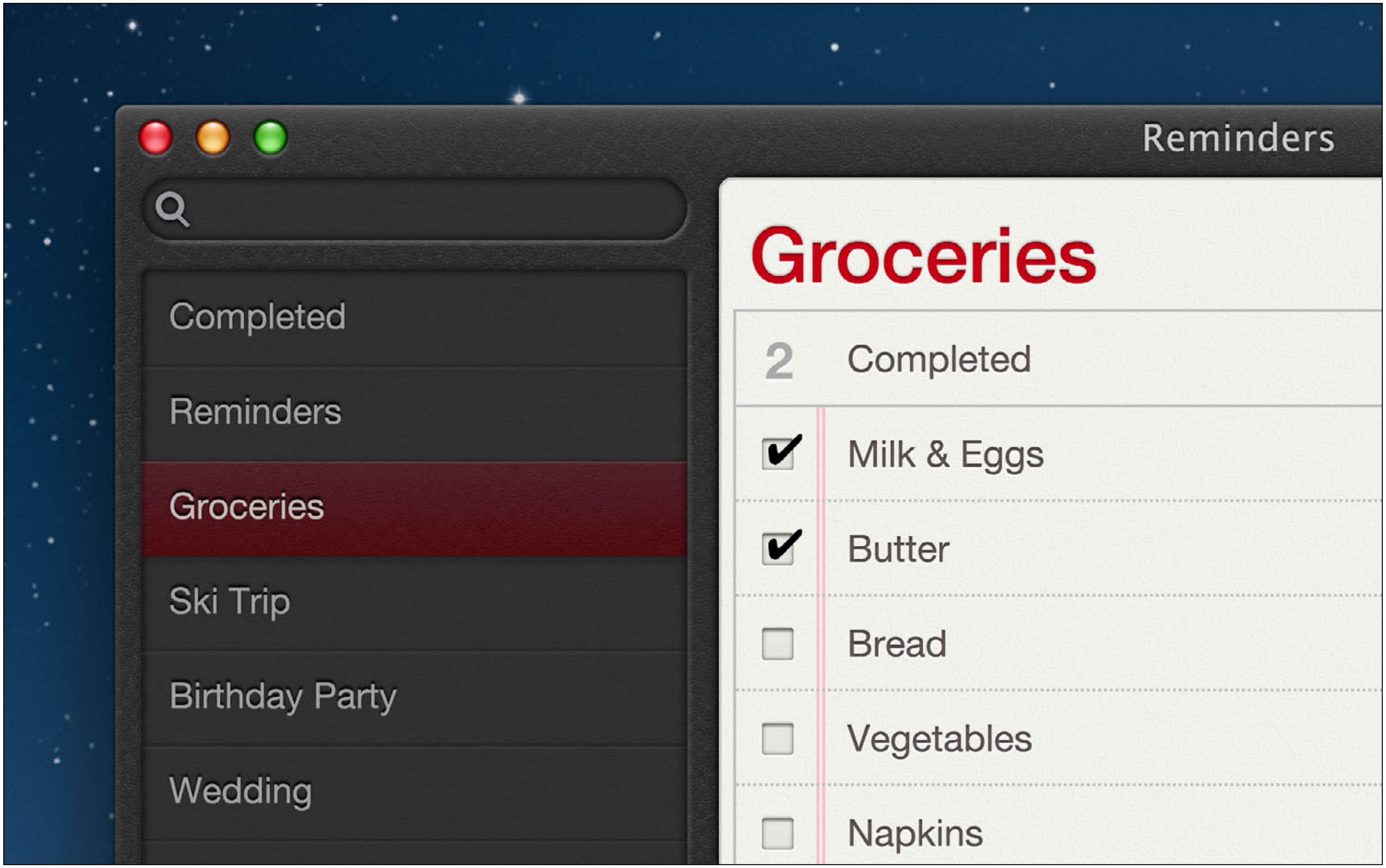
Templar
Leah
17
Writhing Deceiver
Demon
City of Caldeum
1:40 PM
Objectives
A Royal Audience
Escape the Imperial Palace
13
17
7
Templar: The world is a safer place.
1
2
3
4
Q
0



Groceries

2 Completed

- [x] Milk & Eggs
- [x] Butter
- [ ] Bread
- [ ] Vegetables
- [ ] Napkins



- [x] Milk & Eggs
- [x] Butter
- [ ] Bread
- [ ] Vegetables
- [ ] Napkins

Opt Into High Resolution OpenGL

Request high resolution on a per view basis

```
[self setWantsBestResolutionOpenGLSurface:YES];
```

Adjust glViewPort code to use correct pixel bounds

```
NSRect pixelBounds = [self convertRectToBacking:[self bounds]];
glViewPort( 0, 0, pixelBounds.size.width, pixelBounds.size.height );
```

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```

Eliminate Use of Deprecated APIs

```
NSMovieView
NSQuickDrawView
NSUnscaledWindowMask
[NSView convert...Base:]
[NSScreen userSpaceScaleFactor]
[NSWindow userSpaceScaleFactor]
[NSWindow convertBaseToScreen:]
[NSWindow convertScreenToBase:]
[NSImage lockFocus]
[NSImage compositeToPoint:]
[NSImage dissolveToPoint:]
[NSScreen userSpaceScaleFactor]
```

Eliminate Use of Deprecated APIs

```
NSMovieView
NSQuickDrawView
NSUnscaledWindowMask
[NSView convert...Base:]
[NSScreen userSpaceScaleFactor]
[NSWindow userSpaceScaleFactor]
[NSWindow convertBaseToScreen:]
[NSWindow convertScreenToBase:]
[NSImage lockFocus]
[NSImage compositeToPoint:]
[NSImage dissolveToPoint:]
[NSScreen userSpaceScaleFactor]
```

[DEPRECATED]

Correct Code Using Points and Pixels

```
NSSize sizeInPixels = NSMakeSize(CGImageGetWidth(cgImage),
    CGImageGetHeight(cgImage));


NSSize sizeInPoints = [screen convertSizeFromBacking:sizeInPixels;
NSImage *screenImage = [[NSImage alloc] initWithCGImage:cgImage
    size:sizeInPoints];
```

Correct Code Using Points and Pixels

```
NSSize sizeInPixels = NSMakeSize(CGImageGetWidth(cgImage),
    CGImageGetHeight(cgImage));
```

```
NSSize sizeInPoints = [screen convertSizeFromBacking:sizeInPixels;
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Correct Code Using Points and Pixels

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NSSize sizeInPixels = NSMakeSize(CGImageGetWidth(cgImage),
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```

```
NSSize sizeInPoints = [screen convertSizeFromBacking:sizeInPixels;
NSImage *screenImage = [[NSImage alloc] initWithCGImage:cgImage
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```

Supporting Retina Display

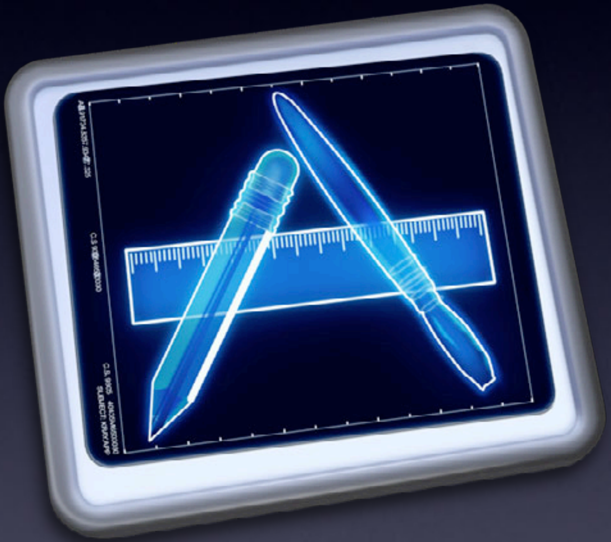
- Strategies
  - Retina resolution
  - Scaled
  - Render to texture
- Optimize app for the best user experience
  - Move beyond display resolution paradigm

Retina Display

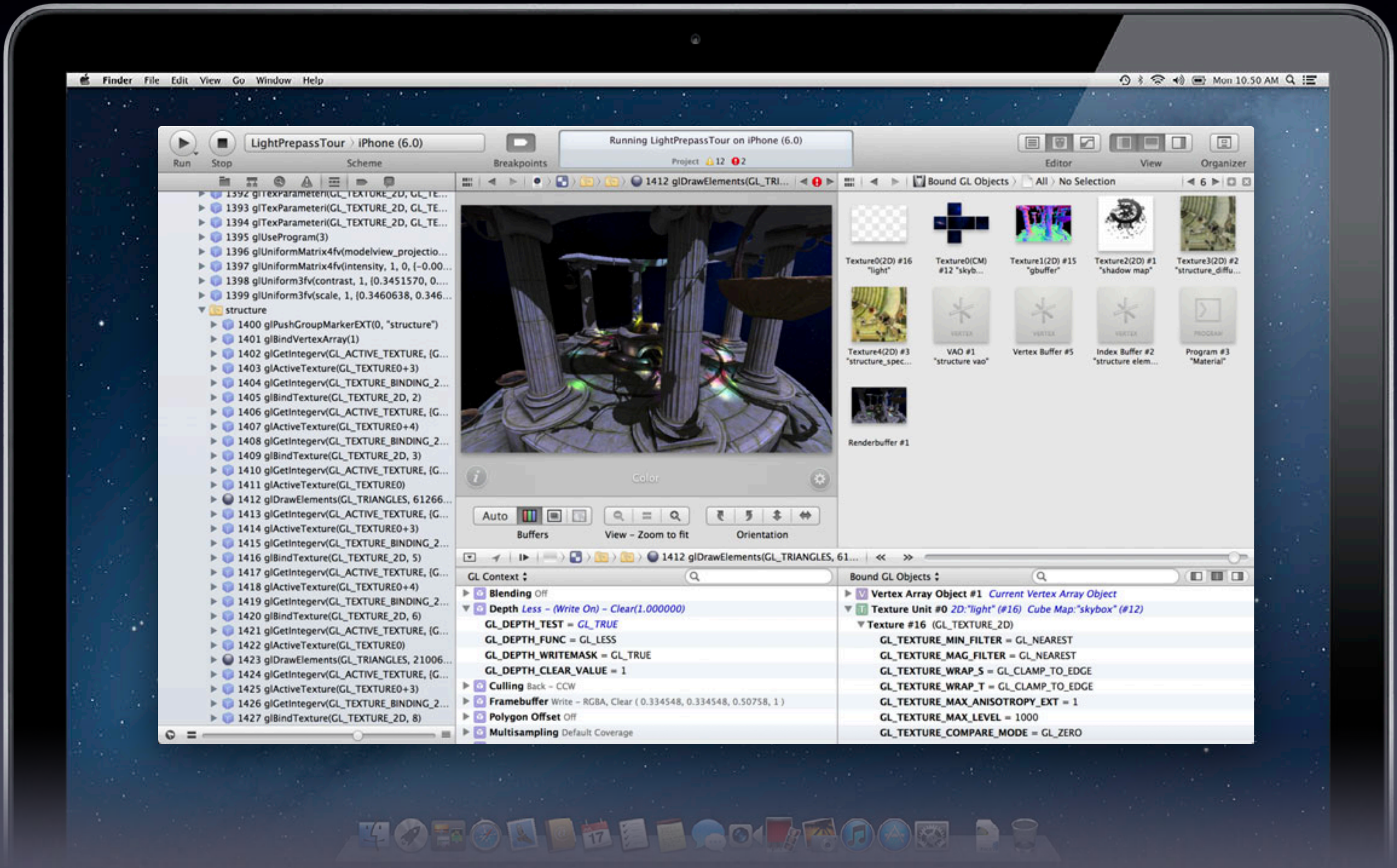
Graphics Tools

OpenGL ES Performance Detective

OpenGL ES Analyzer Instrument



OpenGL ES Debugger


Finder File Edit View Go Window Help
Mon 10.50 AM
Run
Stop
LightPrepassTour › iPhone (6.0)
Scheme
Breakpoints
Running LightPrepassTour on iPhone (6.0)
Project ⚠12 ❗2
Editor
View
Organizer
1412 glDrawElements(GL_TRI...
Bound GL Objects › All › No Selection
Texture0(2D) #16 "light"
Texture0(CM) #12 "skyb...
Texture1(2D) #15 "gbuffer"
Texture2(2D) #1 "shadow map"
Texture3(2D) #2 "structure_diffu...
Texture4(2D) #3 "structure_spec...
VAO #1 "structure vao"
Vertex Buffer #5
Index Buffer #2 "structure elem...
Program #3 "Material"
Renderbuffer #1
Color
Auto
Buffers
View – Zoom to fit
Orientation
1412 glDrawElements(GL_TRIANGLES, 61...
GL Context
Bound GL Objects

```
1392 glTexParameteri(GL_TEXTURE_2D, GL_TE...
1393 glTexParameteri(GL_TEXTURE_2D, GL_TE...
1394 glTexParameteri(GL_TEXTURE_2D, GL_TE...
1395 glUseProgram(3)
1396 glUniformMatrix4fv(modelview_projectio...
1397 glUniformMatrix4fv(intensity, 1, 0, {-0.00...
1398 glUniform3fv(contrast, 1, {0.3451570, 0....
1399 glUniform3fv(scale, 1, {0.3460638, 0.346...
structure
  1400 glPushGroupMarkerEXT(0, "structure")
  1401 glBindVertexArray(1)
  1402 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1403 glActiveTexture(GL_TEXTURE0+3)
  1404 glGetIntegerv(GL_TEXTURE_BINDING_2...
  1405 glBindTexture(GL_TEXTURE_2D, 2)
  1406 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1407 glActiveTexture(GL_TEXTURE0+4)
  1408 glGetIntegerv(GL_TEXTURE_BINDING_2...
  1409 glBindTexture(GL_TEXTURE_2D, 3)
  1410 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1411 glActiveTexture(GL_TEXTURE0)
  1412 glDrawElements(GL_TRIANGLES, 61266...
  1413 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1414 glActiveTexture(GL_TEXTURE0+3)
  1415 glGetIntegerv(GL_TEXTURE_BINDING_2...
  1416 glBindTexture(GL_TEXTURE_2D, 5)
  1417 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1418 glActiveTexture(GL_TEXTURE0+4)
  1419 glGetIntegerv(GL_TEXTURE_BINDING_2...
  1420 glBindTexture(GL_TEXTURE_2D, 6)
  1421 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1422 glActiveTexture(GL_TEXTURE0)
  1423 glDrawElements(GL_TRIANGLES, 21006...
  1424 glGetIntegerv(GL_ACTIVE_TEXTURE, {G...
  1425 glActiveTexture(GL_TEXTURE0+3)
  1426 glGetIntegerv(GL_TEXTURE_BINDING_2...
  1427 glBindTexture(GL_TEXTURE_2D, 8)
```

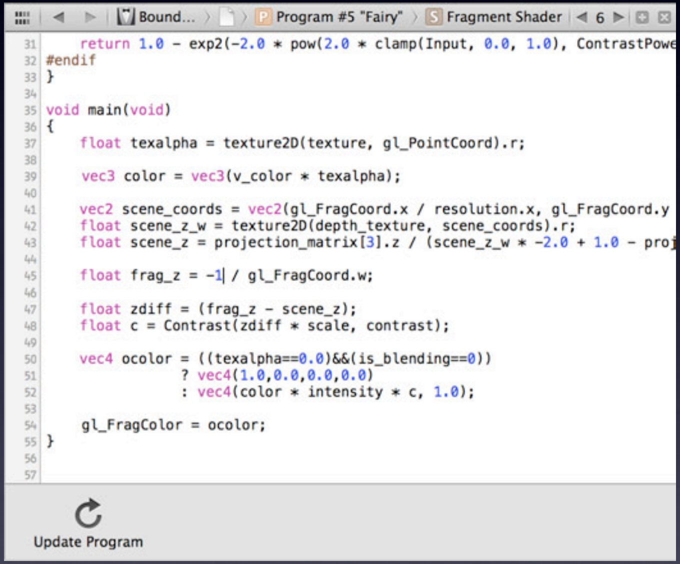
```
Blending Off
Depth Less - (Write On) - Clear(1.000000)
    GL_DEPTH_TEST = GL_TRUE
    GL_DEPTH_FUNC = GL_LESS
    GL_DEPTH_WRITEMASK = GL_TRUE
    GL_DEPTH_CLEAR_VALUE = 1
Culling Back - CCW
Framebuffer Write - RGBA, Clear ( 0.334548, 0.334548, 0.50758, 1 )
Polygon Offset Off
Multisampling Default Coverage
```

```
Vertex Array Object #1  Current Vertex Array Object
Texture Unit #0 2D:"light" (#16)  Cube Map:"skybox" (#12)
  Texture #16  (GL_TEXTURE_2D)
      GL_TEXTURE_MIN_FILTER = GL_NEAREST
      GL_TEXTURE_MAG_FILTER = GL_NEAREST
      GL_TEXTURE_WRAP_S = GL_CLAMP_TO_EDGE
      GL_TEXTURE_WRAP_T = GL_CLAMP_TO_EDGE
      GL_TEXTURE_MAX_ANISOTROPY_EXT = 1
      GL_TEXTURE_MAX_LEVEL = 1000
      GL_TEXTURE_COMPARE_MODE = GL_ZERO
```

Built into Xcode

Xcode’s OpenGL ES Tools

Xcode’s OpenGL ES Tools



```
    return 1.0 - exp2(-2.0 * pow(2.0 * clamp(Input, 0.0, 1.0), ContrastPowe
#endif
}

void main(void)
{
    float texalpha = texture2D(texture, gl_PointCoord).r;

    vec3 color = vec3(v_color * texalpha);

    vec2 scene_coords = vec2(gl_FragCoord.x / resolution.x, gl_FragCoord.y
    float scene_z_w = texture2D(depth_texture, scene_coords).r;
    float scene_z = projection_matrix[3].z / (scene_z_w * -2.0 + 1.0 - proj

    float frag_z = -1 / gl_FragCoord.w;

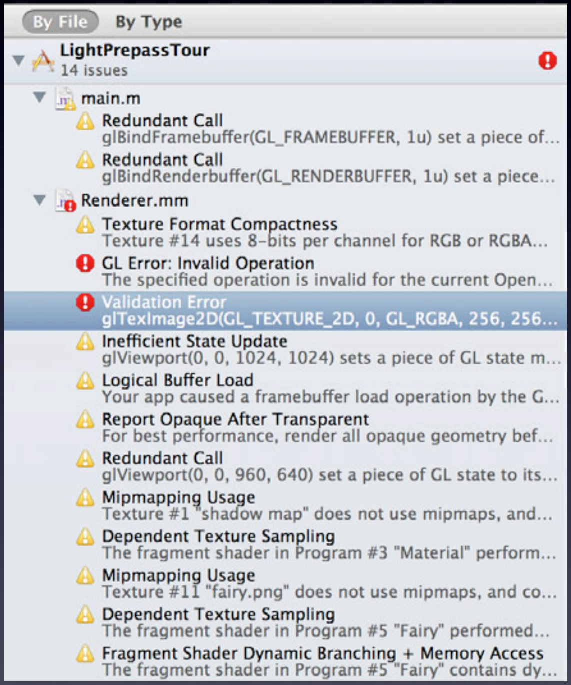
    float zdiff = (frag_z - scene_z);
    float c = Contrast(zdiff * scale, contrast);

    vec4 ocolor = ((texalpha==0.0)&&(is_blending==0))
                ? vec4(1.0,0.0,0.0,0.0)
                : vec4(color * intensity * c, 1.0);

    gl_FragColor = ocolor;
}
```

Shader edit and continue

Xcode's OpenGL ES Tools



By File By Type

LightPrepassTour
14 issues

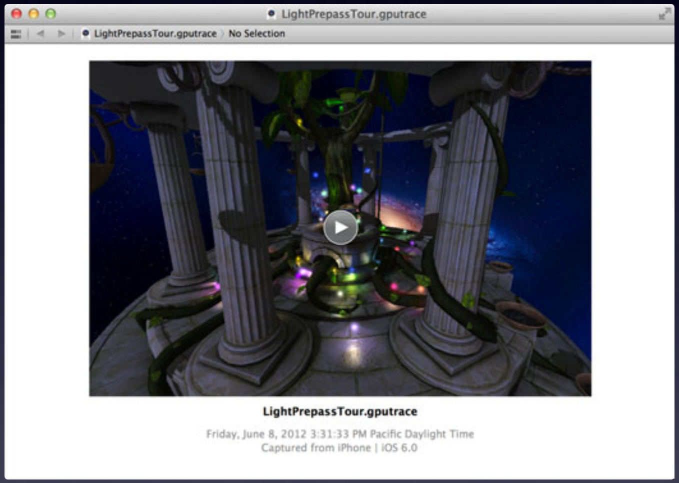
main.m
Redundant Call
glBindFramebuffer(GL_FRAMEBUFFER, 1u) set a piece of...
Redundant Call
glBindRenderbuffer(GL_RENDERBUFFER, 1u) set a piece...

Renderer.mm
Texture Format Compactness
Texture #14 uses 8-bits per channel for RGB or RGBA...
GL Error: Invalid Operation
The specified operation is invalid for the current Open...
Validation Error
glTexImage2D(GL_TEXTURE_2D, 0, GL_RGBA, 256, 256...
Inefficient State Update
glViewport(0, 0, 1024, 1024) sets a piece of GL state m...
Logical Buffer Load
Your app caused a framebuffer load operation by the G...
Report Opaque After Transparent
For best performance, render all opaque geometry bef...
Redundant Call
glViewport(0, 0, 960, 640) set a piece of GL state to its...
Mipmapping Usage
Texture #1 "shadow map" does not use mipmaps, and...
Dependent Texture Sampling
The fragment shader in Program #3 "Material" perform...
Mipmapping Usage
Texture #11 "fairy.png" does not use mipmaps, and co...
Dependent Texture Sampling
The fragment shader in Program #5 "Fairy" performed...
Fragment Shader Dynamic Branching + Memory Access
The fragment shader in Program #5 "Fairy" contains dy...

Shader edit and continue

Integrated OpenGL ES expert

Xcode's OpenGL ES Tools



LightPrepassTour.gputrace

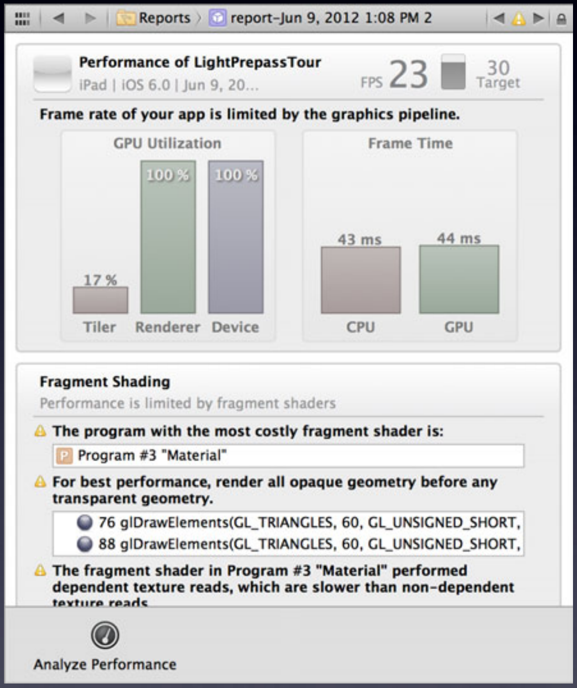
Friday, June 8, 2012 3:31:33 PM Pacific Daylight Time
Captured from iPhone | iOS 6.0

Shader edit and continue

Integrated OpenGL ES expert

Save and load captured frames

Xcode's OpenGL ES Tools



Performance of LightPrepassTour
iPad | iOS 6.0 | Jun 9, 20...
FPS 23 30 Target

Frame rate of your app is limited by the graphics pipeline.

Fragment Shading
Performance is limited by fragment shaders

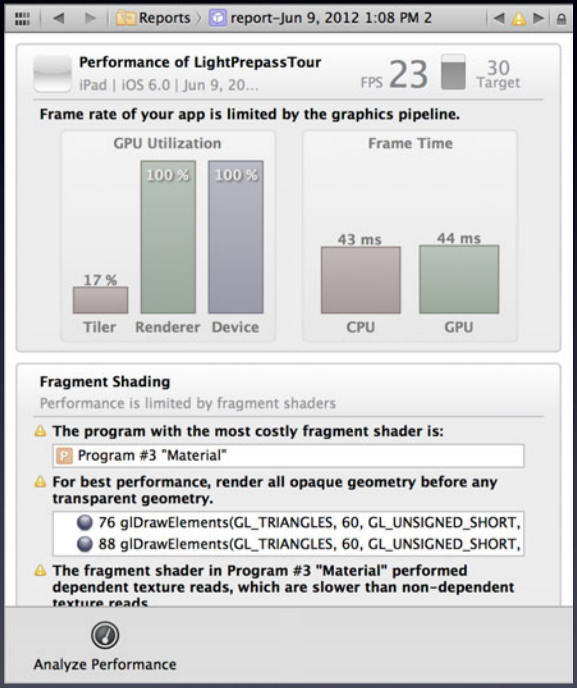
The program with the most costly fragment shader is:
Program #3 "Material"

For best performance, render all opaque geometry before any transparent geometry.
76 glDrawElements(GL_TRIANGLES, 60, GL_UNSIGNED_SHORT,
88 glDrawElements(GL_TRIANGLES, 60, GL_UNSIGNED_SHORT,

The fragment shader in Program #3 "Material" performed dependent texture reads, which are slower than non-dependent texture reads.

- Shader edit and continue
- Integrated OpenGL ES expert
- Save and load captured frames
- Integrated performance detective

Xcode's OpenGL ES Tools



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- Shader edit and continue
- Integrated OpenGL ES expert
- Save and load captured frames
- Integrated performance detective
- Faster
- More accurate
- More detailed

Demo

Graphics Tools

OpenGL ES

Multi-touch

Quartz 2D

Game Center

OpenAL

AirPlay

Core Animation

Game Technologies

Core Video

GLKit

OpenGL

Graphics Tools

Core Image

AV Foundation

In-App Purchase

Retina Display

iCloud

Core Motion

WWDC2012