# Going Beyond 2D with SpriteKit

Session 609

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# SpriteKit

## What is SpriteKit?

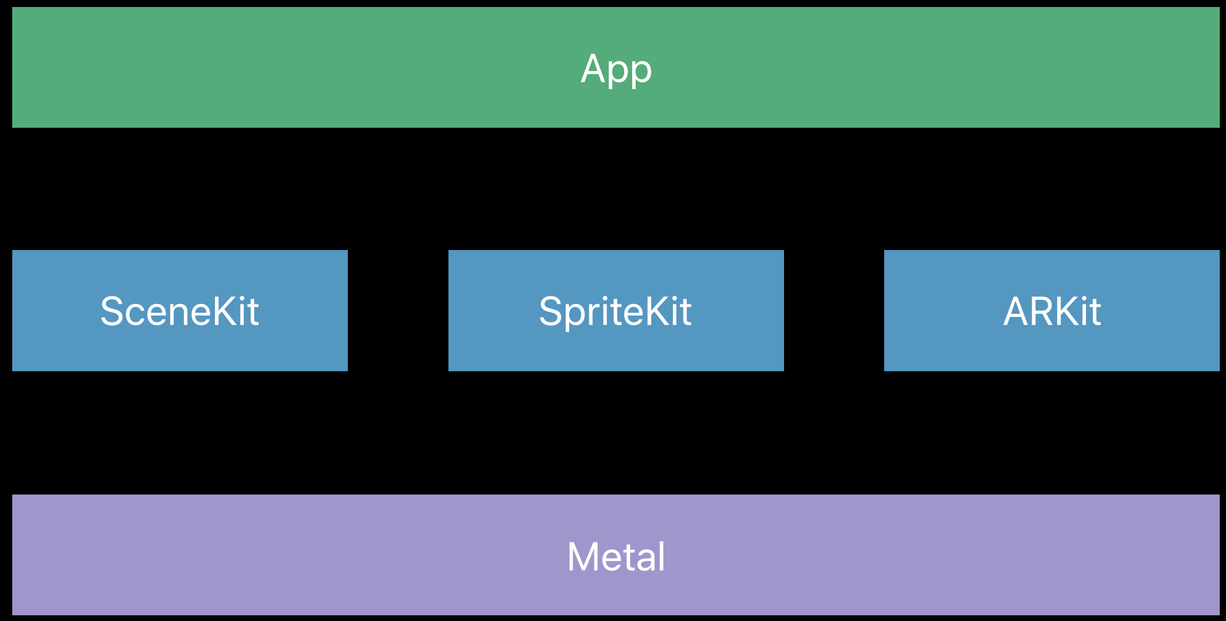
2D graphics framework for games

Flexible, fast, easy to use

Supported on iOS, macOS, tvOS, and watchOS

Xcode integrated live editor

# Apple Graphics Frameworks



# Going Beyond 2D with SpriteKit

Rendering content in ARKit with SpriteKit

Using SpriteKit and SceneKit in ARKit

Introduction to SKRenderer

# Working with ARKit

# What is Augmented Reality?

# Working with ARKit

## What is ARKit?

ARKit does all the hard work for you

Tracks your device’s pose

Provide it content you want to appear in AR

Updates the relative position of your content

See Introducing ARKit for more info

# Working with ARKit

## Content anchors

Anchors are what makes AR work

3D points tied to real-world features

ARKit uses device hardware to detect them

Easy to create

# Working with ARKit

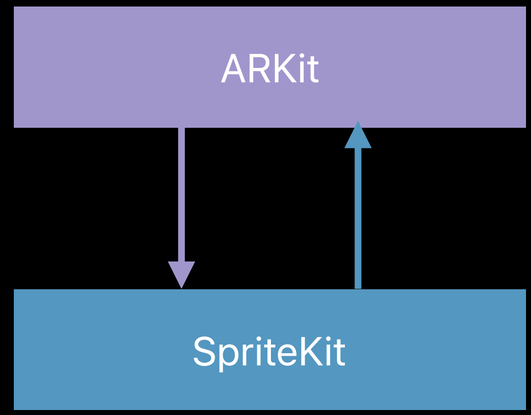
## How ARKit works with SpriteKit

ARKit directly interacts with SpriteKit

Asks for nodes it will associate with anchors

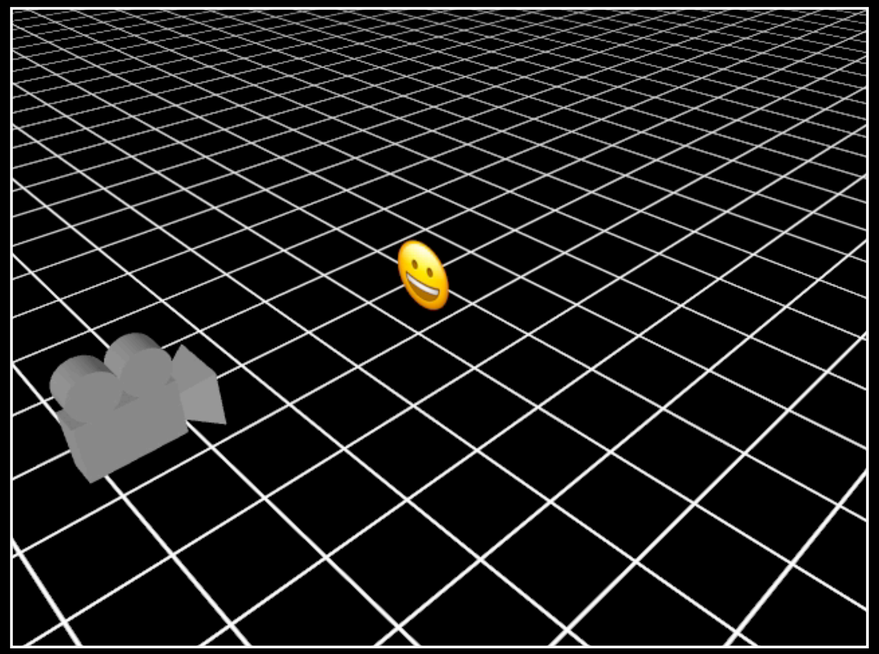
Nodes are updated as the device moves

Sprites always face the camera



# Working with ARKit

## How sprites work in 3D



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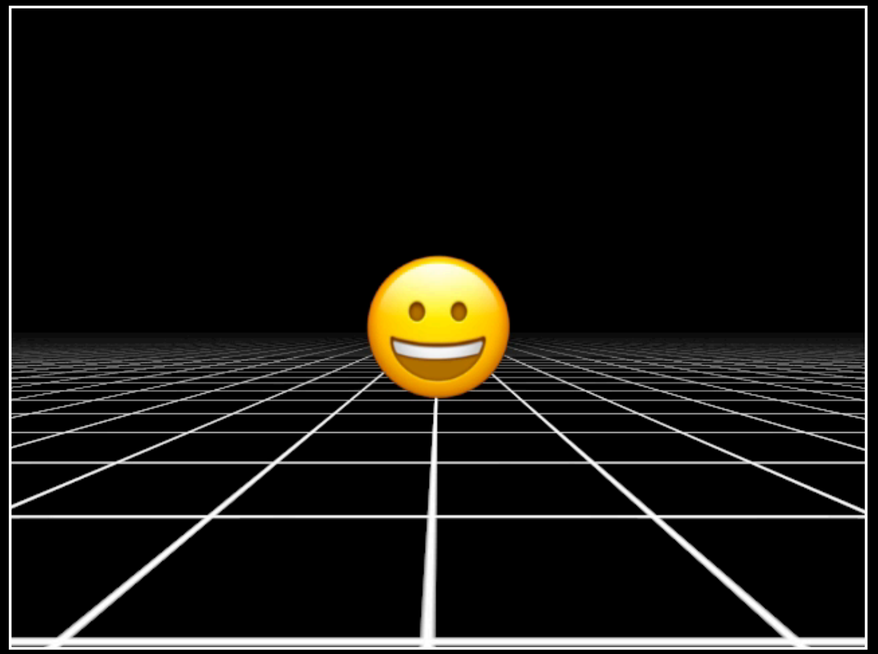

Camera View

# Working with ARKit

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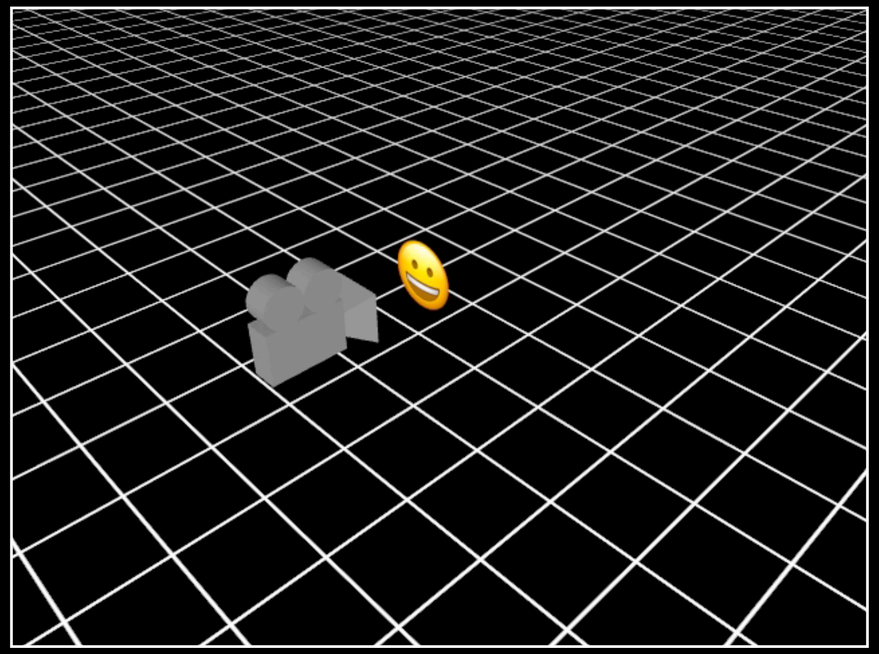

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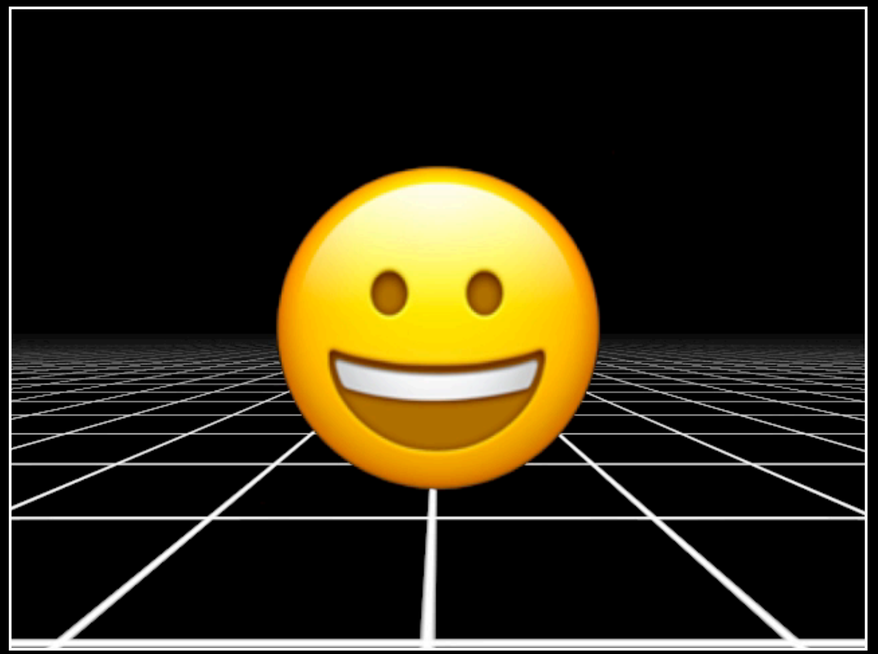

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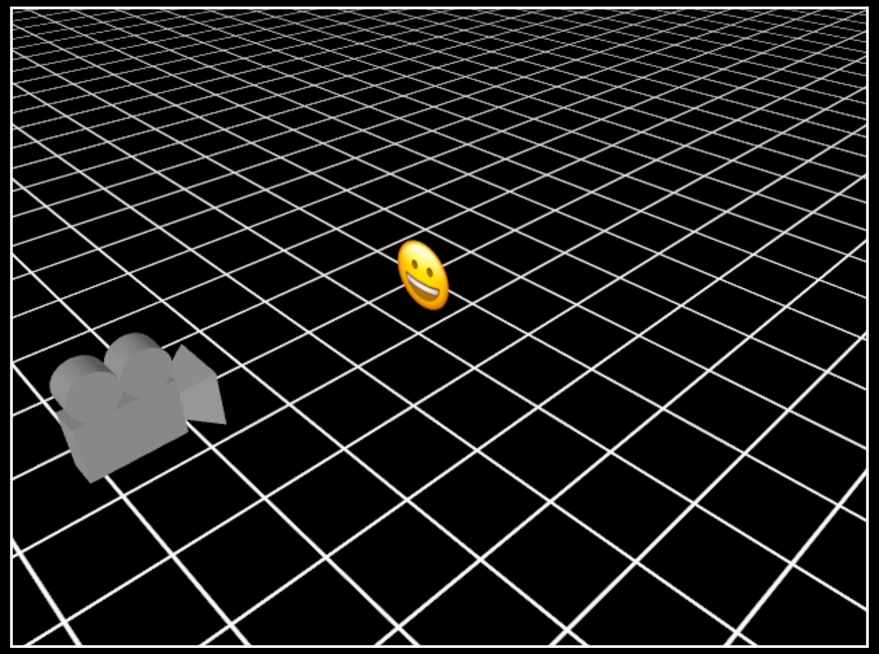

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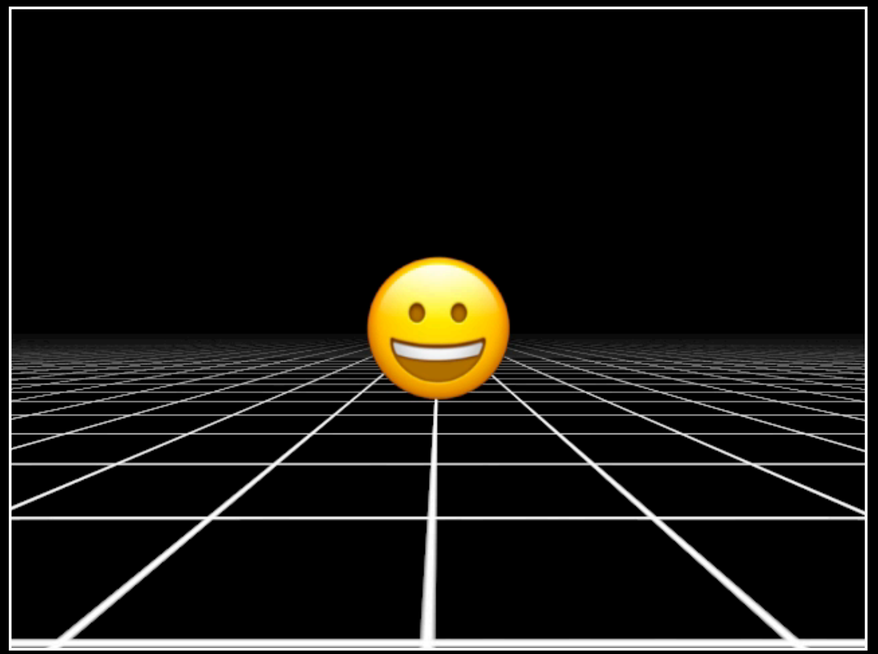

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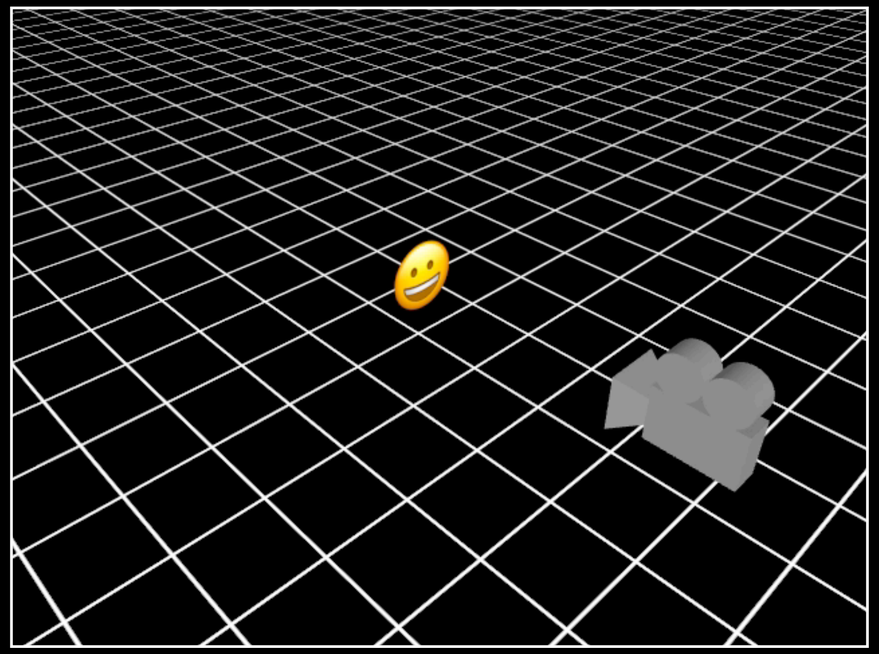

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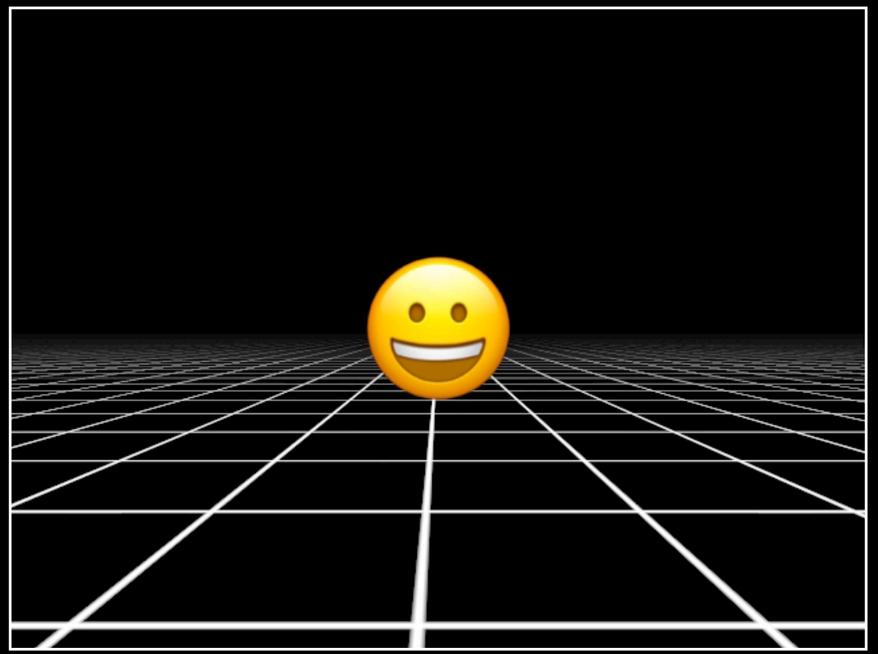

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# Working with ARKit

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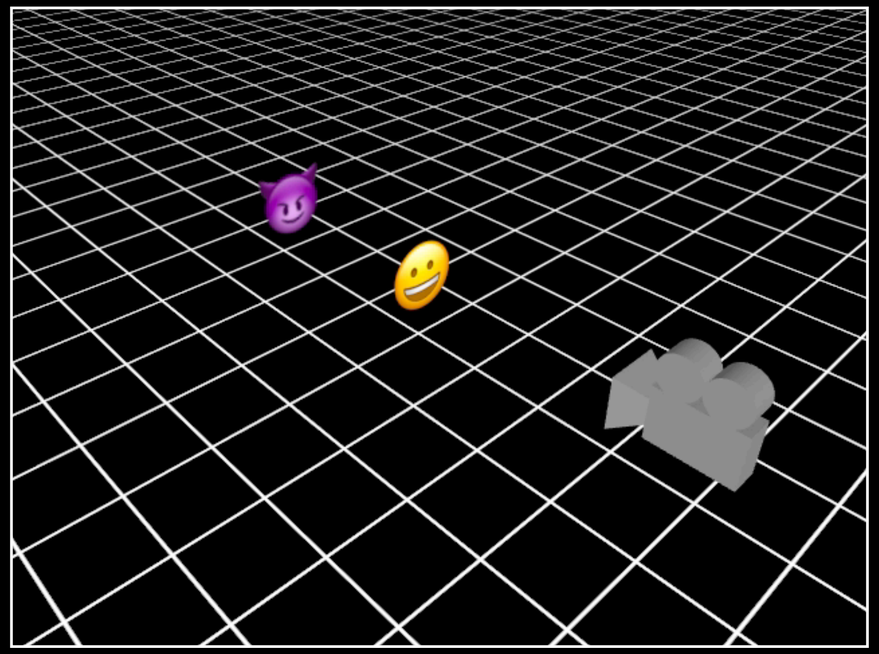

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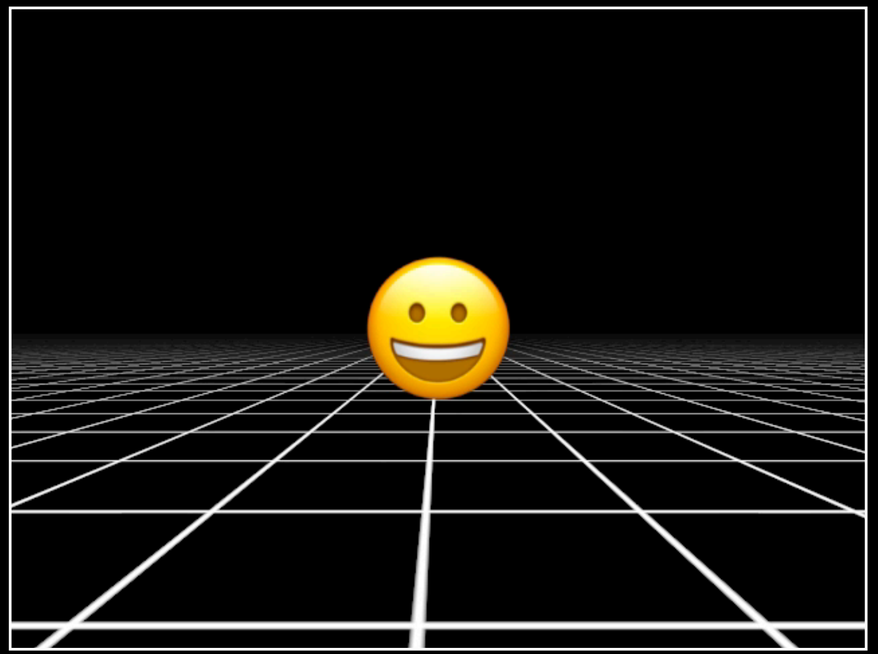

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# Working with ARKit

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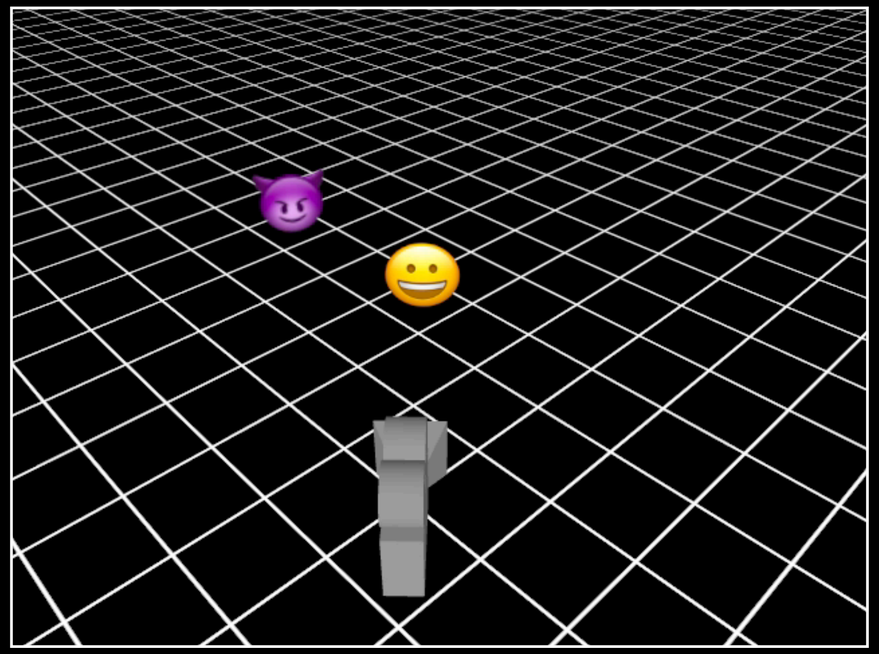

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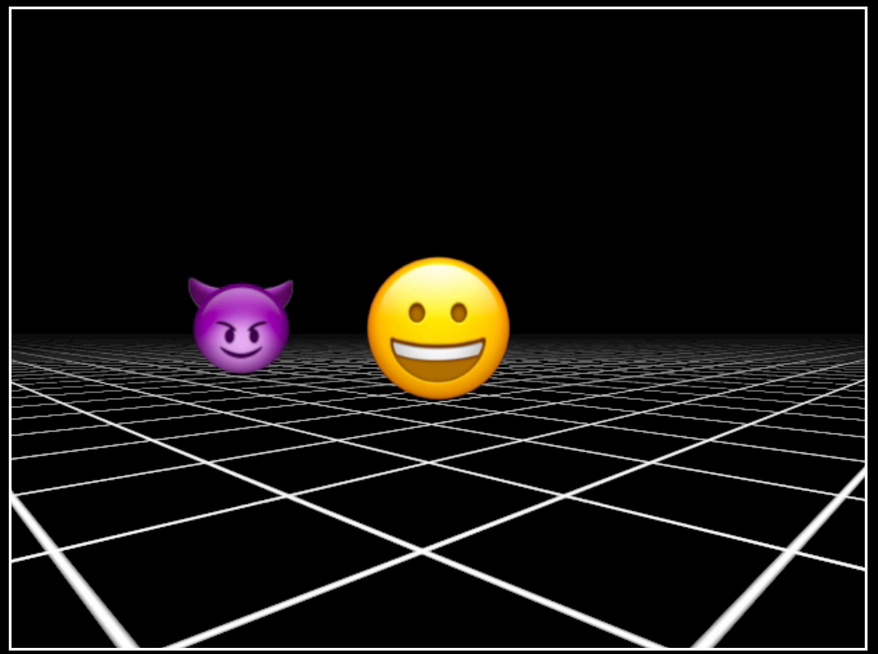

Camera View

# Working with ARKit

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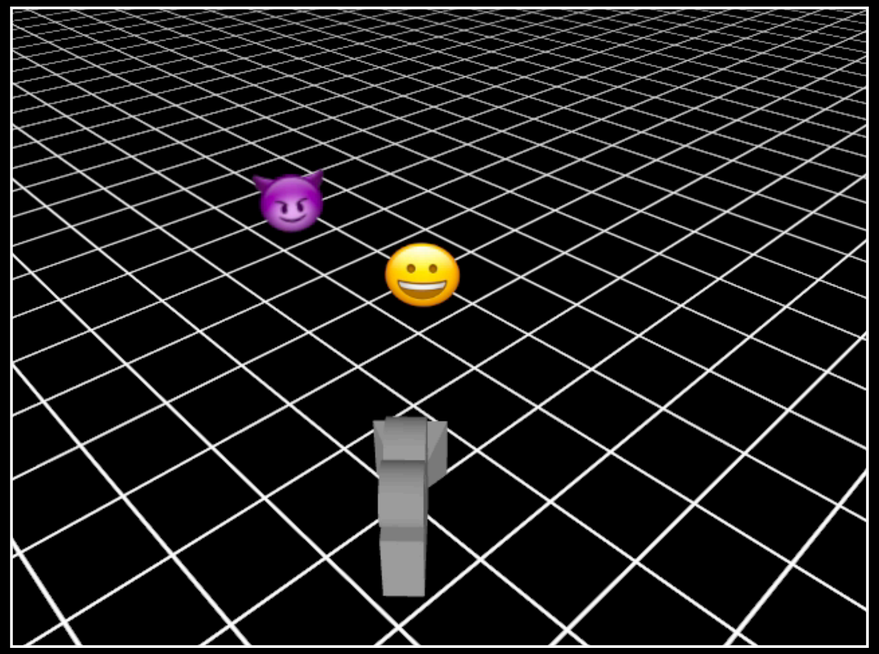

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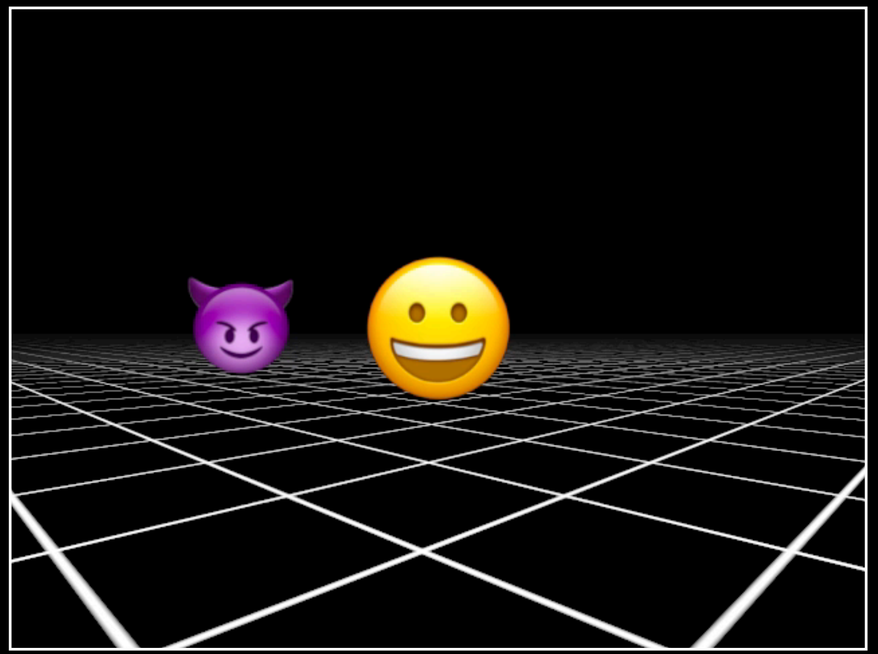

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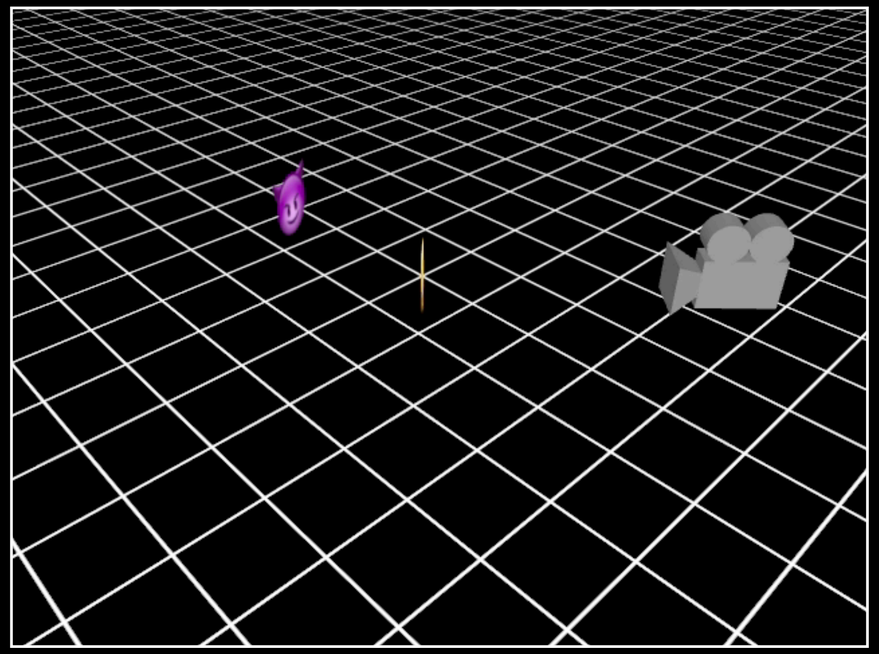

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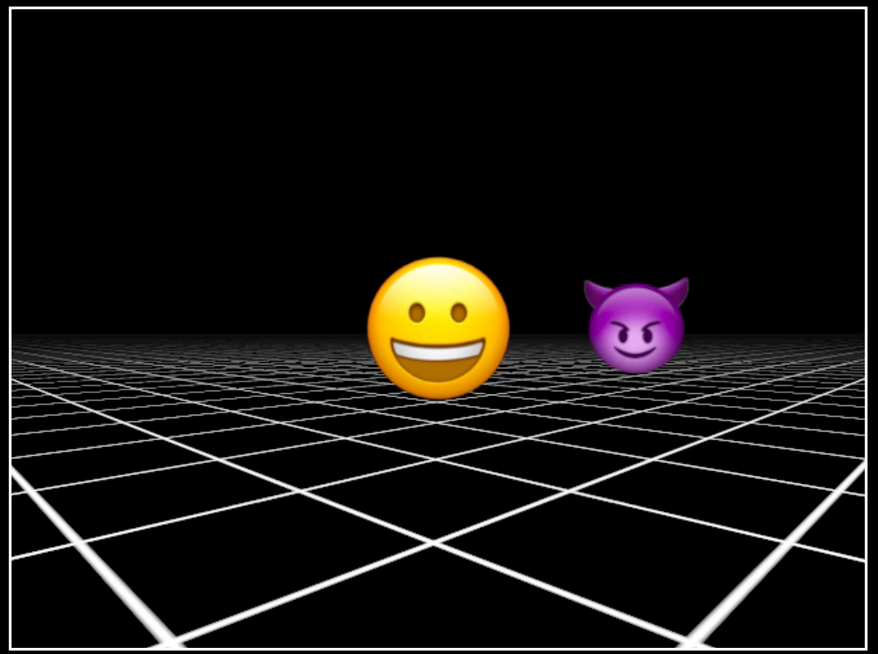


Camera View

# Working with ARKit

## ARKit Objects

ARSession

ARAnchor

ARSKView

ARSKViewDelegate

# Working with ARKit

## ARKit Objects

ARSession

ARAnchor

ARSKView

ARSKViewDelegate

# ARSession

The heart of ARKit

Handles device tracking

Orchestrates interactions with SpriteKit

Methods for adding and removing anchors

Call run method to start

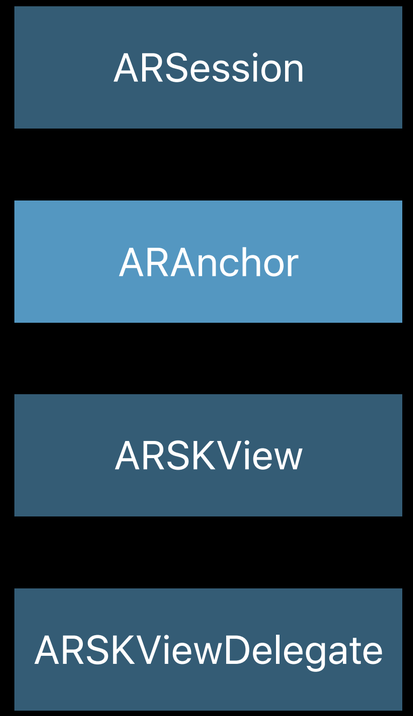
- Requires an ARSessionConfiguration
- Use ARWorldTrackingSessionConfiguration

# ARAnchor

Defines real-world feature points

Contains transform data, unique identifier

ARAnchors are mapped to SKNodes



# ARSKView

Bridge between SpriteKit and ARKit

Derived from SKView

Creates and contains ARSession

Methods for getting related anchors/nodes

hitTest method for creating anchors

# ARSKViewDelegate

Callbacks for anchor updates

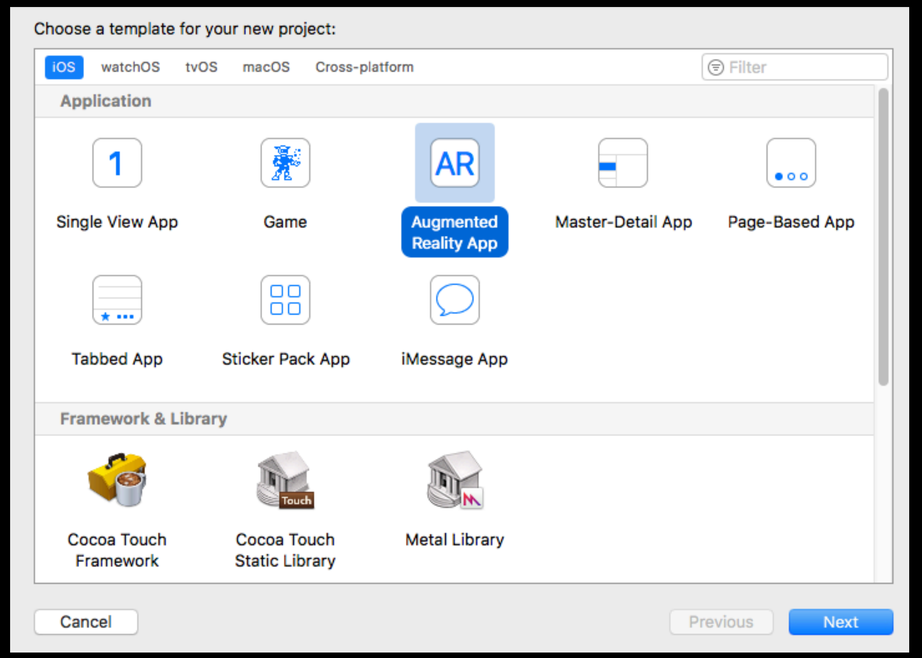
Protocol derived from SKViewDelegate

All methods are optional

# Working with ARKit

## Creating a project

New AR app template in Xcode 9

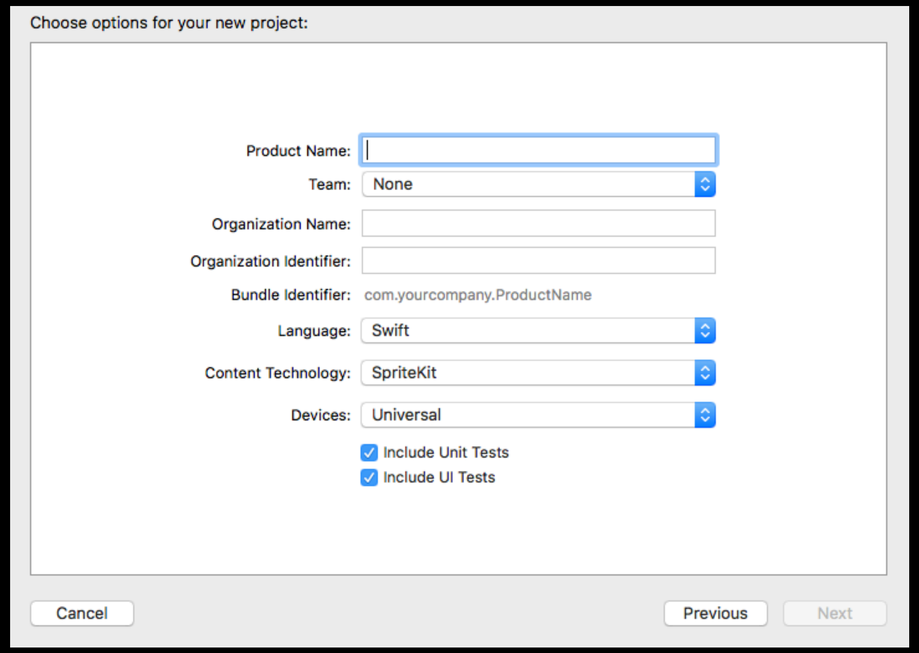


# Working with ARKit

## Creating a project

New AR app template in Xcode 9

Select SpriteKit as the content technology



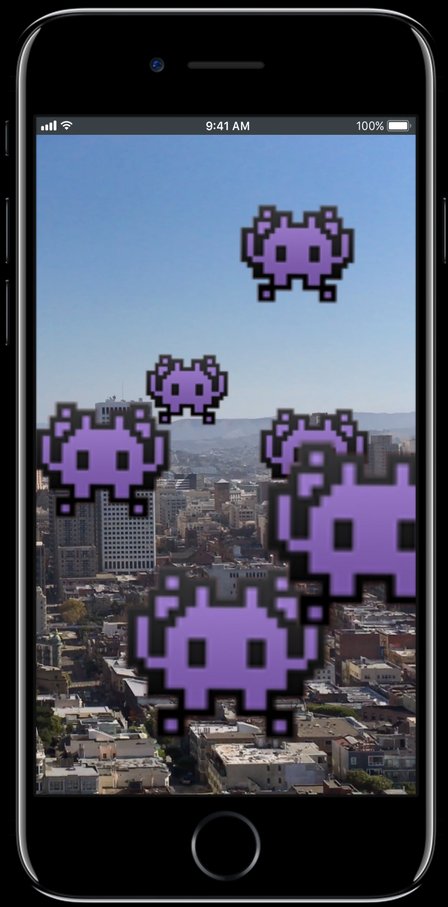
# Working with ARKit

## Creating a project

New AR app template in Xcode 9

Select SpriteKit as the content technology

Ready to enter augmented reality!



# Working with ARKit

## Scene.sks

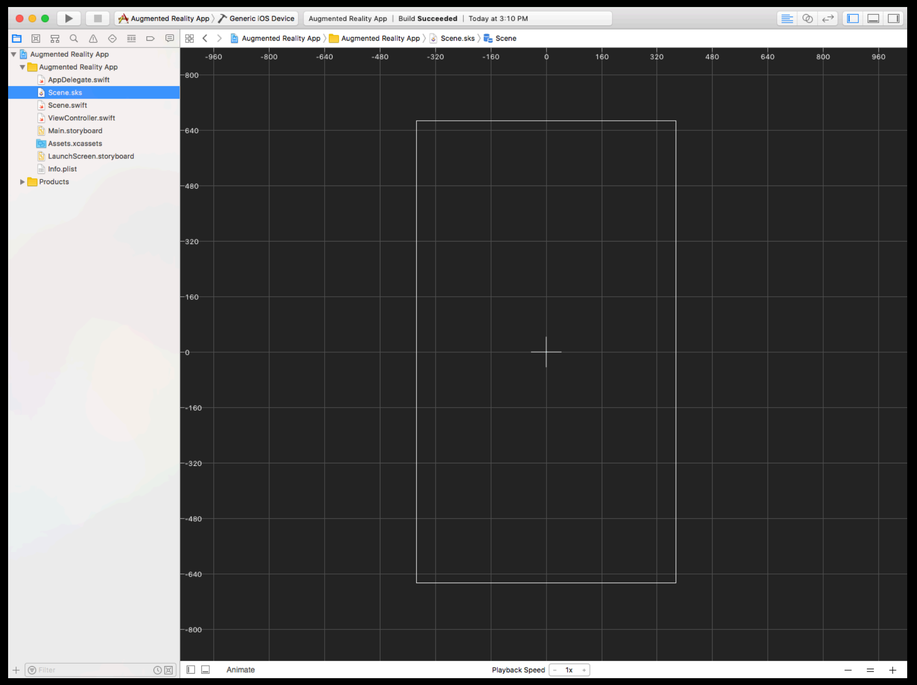
The SpriteKit scene

Add non-AR content here

- Good for HUD, help text, etc.
- Z ≥ 0 will draw over AR content

AR content is managed by ARKit

- AR content z positions are < 0



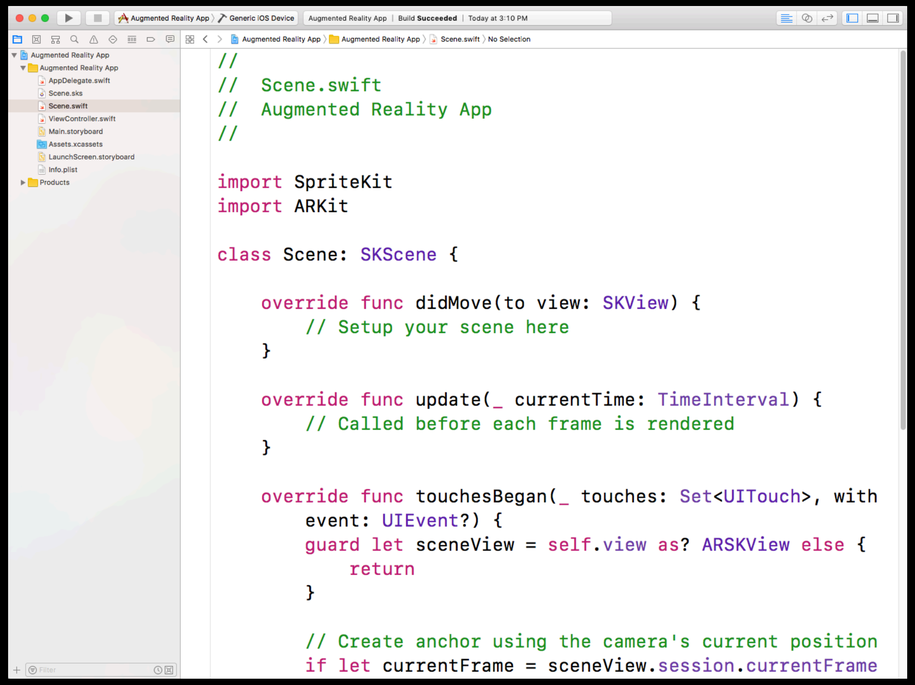
# Working with ARKit

## Scene.swift

The SpriteKit scene’s corresponding source file

Put code to manage your scene in here

- Gameplay, logic, etc.



# Working with ARKit

## ViewController.swift

App’s view controller

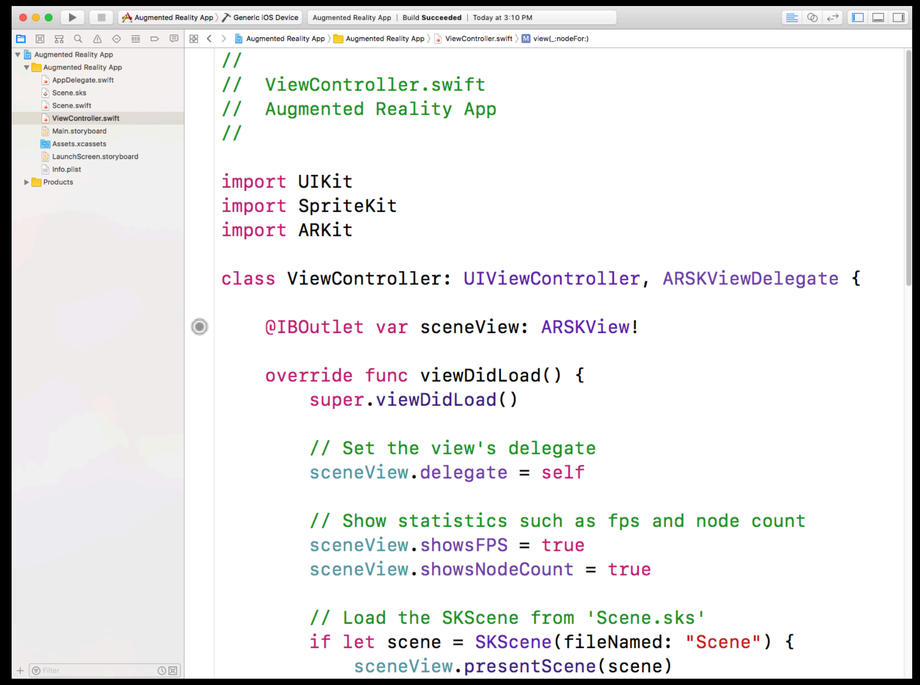
Conforms to ARSKViewDelegate

ARSKView sceneView property

Primary means of ARKit interaction

Calls run on ARSession

Implement delegate methods here



# Working with ARKit

## Anchor events

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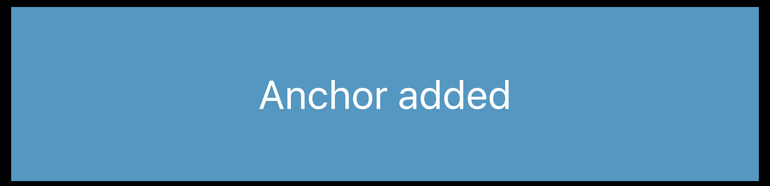

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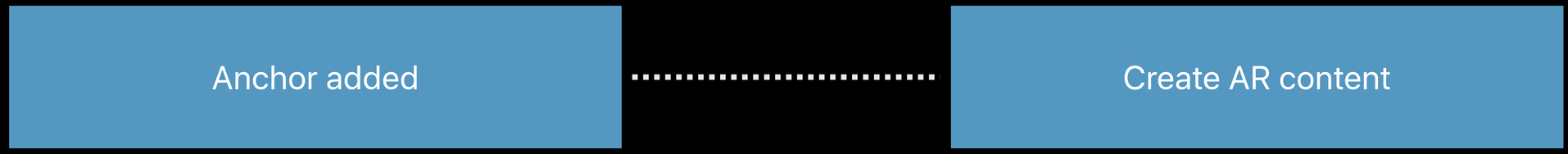

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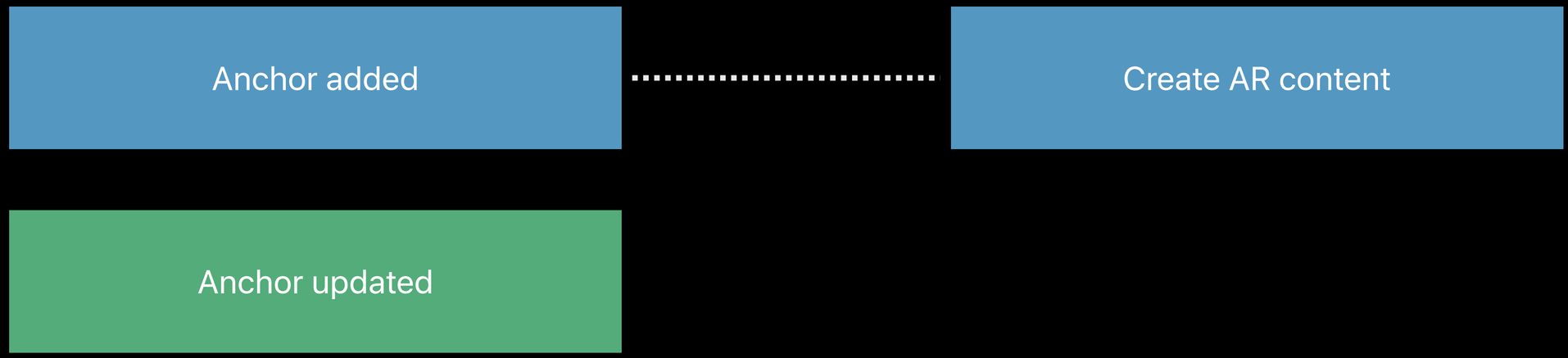

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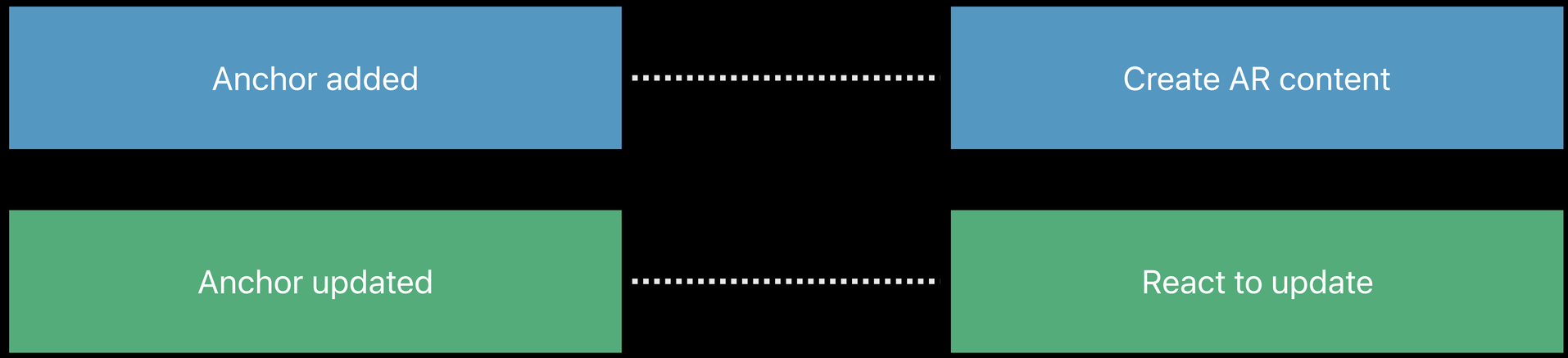

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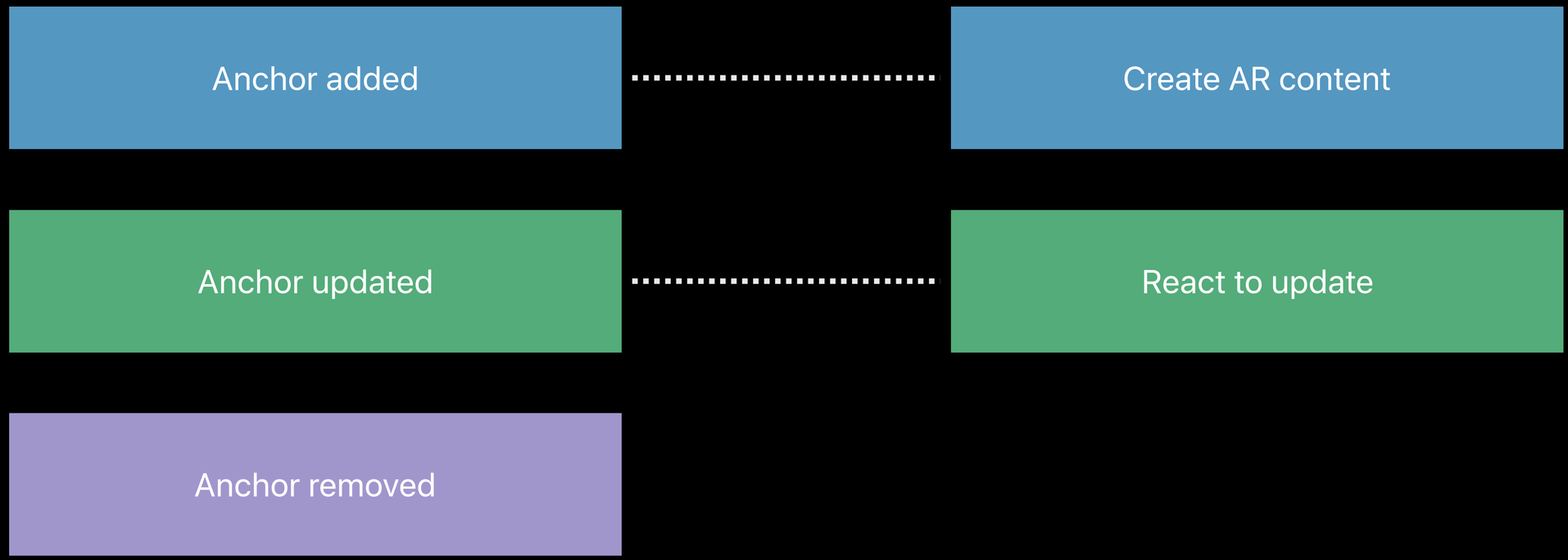

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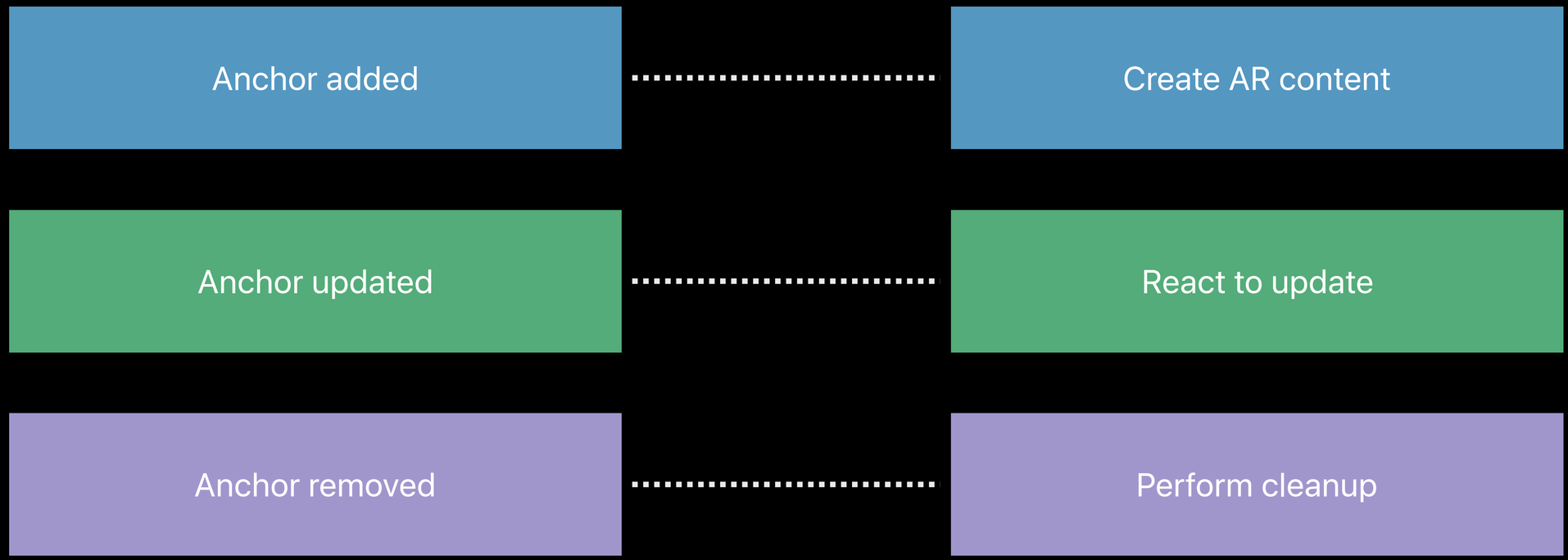

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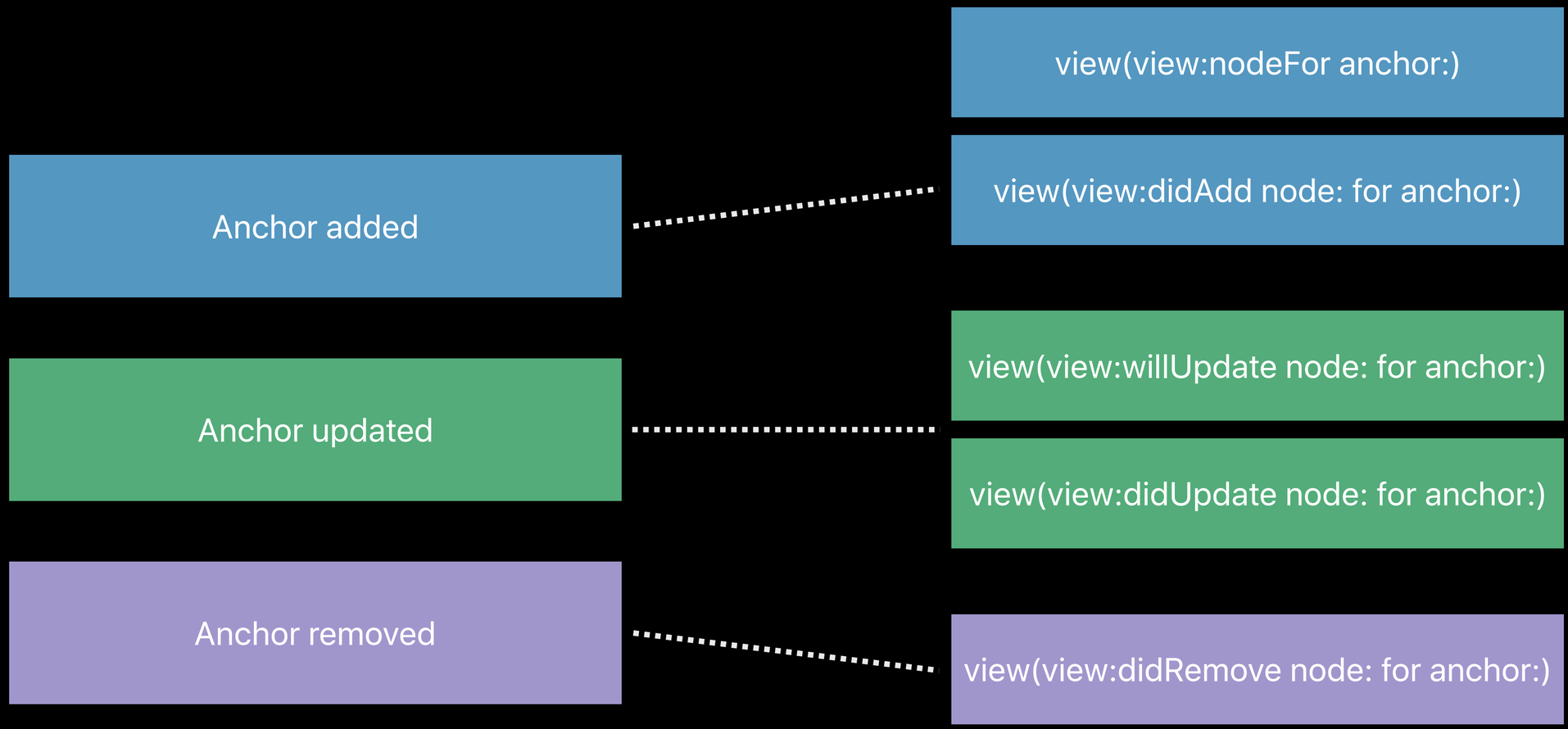

# ARSKViewDelegate Methods

## Anchor added

Create a custom node for an anchor

If not implemented, SKNode created for you

Node will be modified by ARKit

Automatically added to the scene graph

view(view:nodeFor anchor:)

view(view:didAdd node: for anchor:)

view(view:willUpdate node: for anchor:)

view(view:didUpdate node: for anchor:)

view(view:didRemove node: for anchor:)

# ARSKViewDelegate Methods

## Anchor added

Called after an SKNode is mapped to an anchor

If view(view:nodeFor anchor:) implemented

- Node is the result of that method
- Otherwise a default empty node

Add content as children of node

Children won’t be modified by ARKit

view(view:nodeFor anchor:)

view(view:didAdd node: for anchor:)

view(view:willUpdate node: for anchor:)

view(view:didUpdate node: for anchor:)

view(view:didRemove node: for anchor:)

# ARSKViewDelegate Methods

## Anchor updated

Called when node is updated with anchor’s data

- willUpdate called before update
- didUpdate called after update

Occurs when device moves & view changes

Node’s transform may change

view(view:nodeFor anchor:)

view(view:didAdd node: for anchor:)

view(view:willUpdate node: for anchor:)

view(view:didUpdate node: for anchor:)

view(view:didRemove node: for anchor:)

# ARSKViewDelegate Methods

## Anchor removed

Called when node removed from scene graph

Occurs on anchor removed from ARSession

view(view:nodeFor anchor:)

view(view:didAdd node: for anchor:)

view(view:willUpdate node: for anchor:)

view(view:didUpdate node: for anchor:)

view(view:didRemove node: for anchor:)

```swift
// Creating anchors - Scene.swift

override func touchesBegan(_ touches: Set<UITouch>, with event: UIEvent?) {
    guard let sceneView = self.view as? ARSKView else {
        return
    }

    if let touchLocation = touches.first?.location(in: sceneView) {

        // Create anchor with ARSKView's hitTest method
        if let hit = sceneView.hitTest(touchLocation, types: .featurePoint).first {
            sceneView.session.add(anchor: ARAnchor(transform: hit.worldTransform))
        }
    }}
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```swift
// Providing SpriteKit content - ViewController.swift

// Implementation of delegate method
func view(_ view: ARSKView, didAdd node: SKNode, for anchor: ARAnchor) {
    let labelNode = SKLabelNode(text: "👾")

    labelNode.horizontalAlignmentMode = .center
    labelNode.verticalAlignmentMode = .center

    node.addChild(labelNode)
}
```

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# *Demo*

SpriteKit and ARKit

# Attributed Strings

NEW

SKLabelNode now supports attributed strings

Allows you to mix colors, fonts in the same label

Uses NSAttributedString

Set it on the new attributedText property

Attributed ***Text***

# Attributed Strings

NEW

SKLabelNode now supports attributed strings

Allows you to mix colors, fonts in the same label

Uses NSAttributedString

Set it on the new attributedText property

Attributed ***Text***

# SKTransformNode

NEW

SKNode already has z rotation

SKTransformNode adds x, y rotation

Rotations apply to all children

Uses orthographic projection

Getters and setters for

- Euler angles, rotation matrices, quaternions

# View Debugger Support

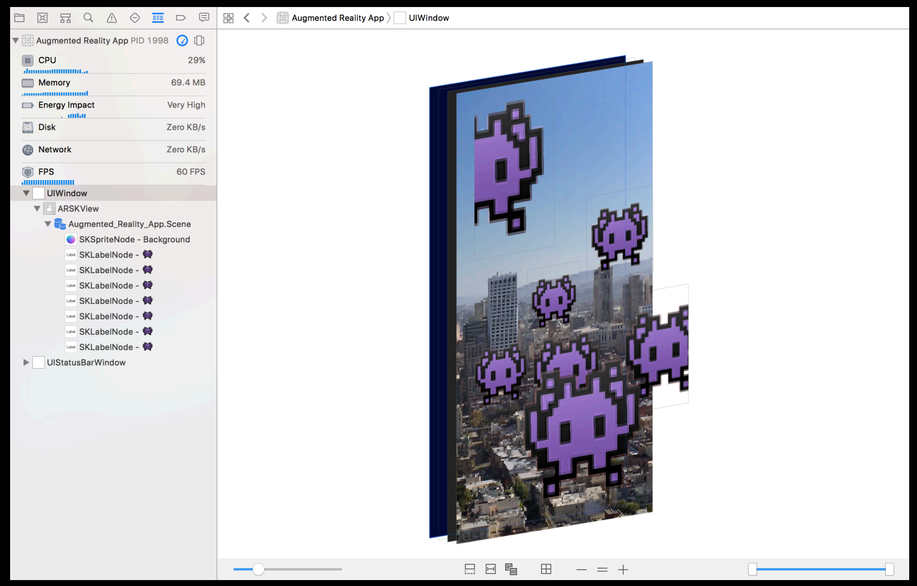
NEW

View debugging now supports SpriteKit content

Displays full scene graph

Inspect node properties

For more info, see Debugging with Xcode 9



# Working with ARKit

## Takeaways

Quick and easy to get started

ARKit does all the hard work for you

SpriteKit makes rendering AR content a snap

New SpriteKit features give greater flexibility

# Working with ARKit

## Open questions

What if we don’t want billboarded sprites?

What if we want perspective?

What if we want to mix 2D and 3D content in augmented reality?

What if we want to take SpriteKit further into 3D?

# SceneKit, SpriteKit, and ARKit

# SceneKit, SpriteKit, and ARKit

## SceneKit and SpriteKit

SceneKit is SpriteKit's 3D counterpart

Use SpriteKit scenes as material on objects

Allows for 3D transforms and perspective

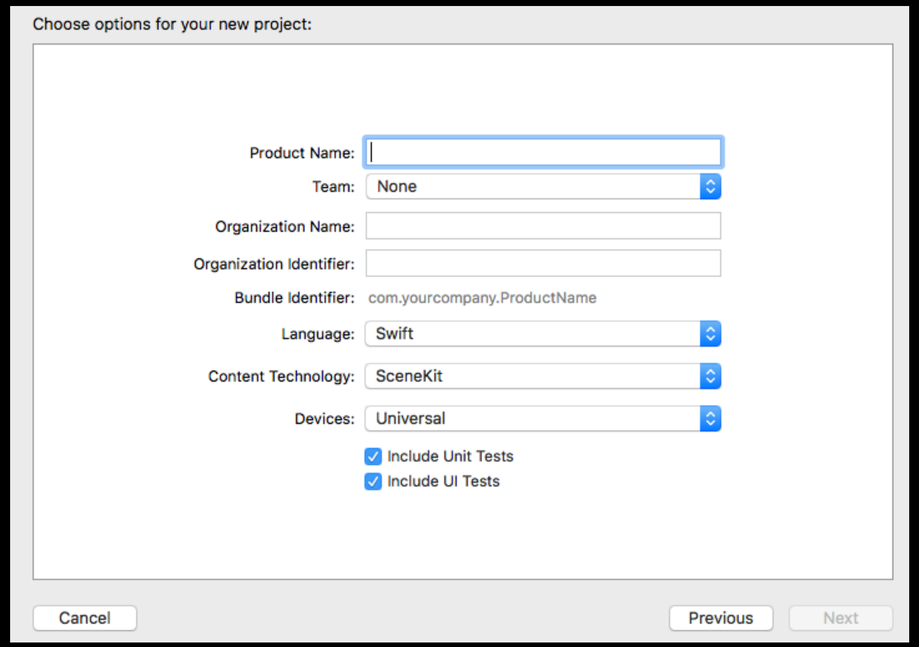
Mix 2D and 3D content

# SceneKit, SpriteKit, and ARKit

## ARKit and SceneKit

SceneKit is also integrated with ARKit

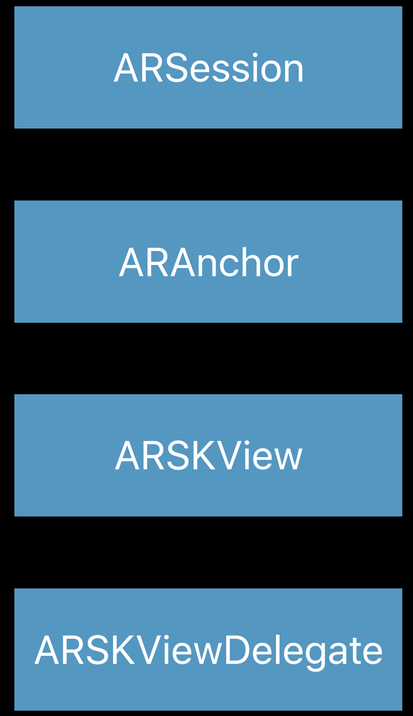
Use SceneKit as the content technology



# Working with ARKit

## ARKit API and SceneKit

API is similar by design



# Working with ARKit

## ARKit API and SceneKit

API is similar by design

Template creates ARSCNView for you

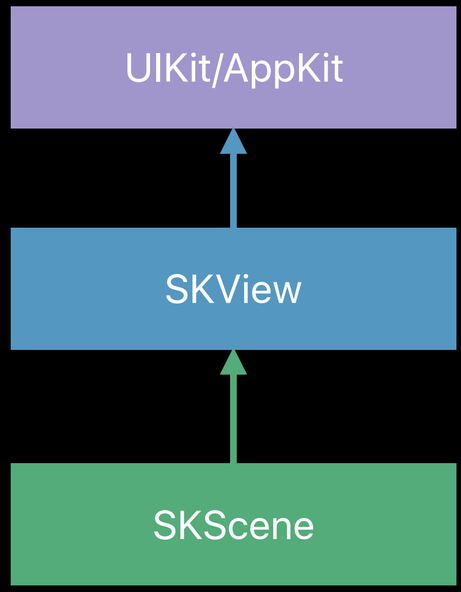
ViewController is ARSCNViewDelegate

# SceneKit, SpriteKit, and ARKit

## SpriteKit content in SceneKit

Normal SpriteKit rendering

- Set scene on SKView
- Works with UIKit/AppKit to render and display

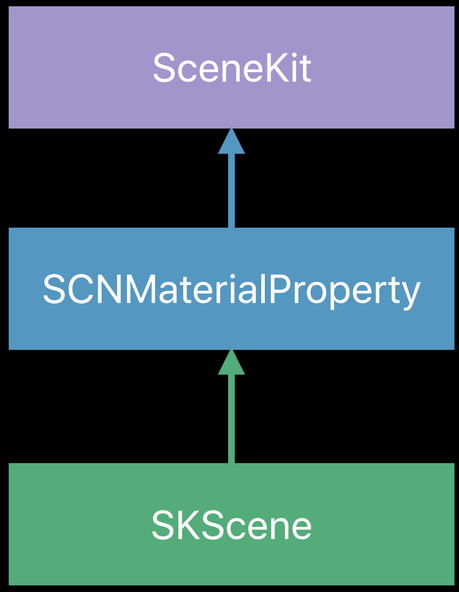


# SceneKit, SpriteKit, and ARKit

## SpriteKit content in SceneKit

Rendering SpriteKit content in SceneKit

- Set scene on SCNMaterialProperty
- The material works with SceneKit to render
  - Uses SceneKit's Metal command queue
- SpriteKit texture mapped onto geometry



# SceneKit, SpriteKit, and ARKit

## SpriteKit content in SceneKit

# SceneKit, SpriteKit, and ARKit

## SpriteKit content in SceneKit

# SceneKit, SpriteKit, and ARKit

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```
// Using SpriteKit in SceneKit

// Get SpriteKit scene
let spriteKitScene = SKScene(fileNamed: "SpriteKitScene")

// Create plane geometry
let plane = SCNPlane(width: 10.0, height: 10.0)

// Set SpriteKit scene on the plane's material
plane.firstMaterial?.diffuse.contents = spriteKitScene

// If material double-sided, SpriteKit scene will show up on both sides of the plane
plane.firstMaterial?.isDoubleSided = true

// Create a SceneKit node for the plane
let sceneKitNode = SCNNode(geometry: plane)

// Add the SceneKit node to the SceneKit scene
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# *Demo*

ARKit with SceneKit and SpriteKit

# SceneKit, SpriteKit, and ARKit

## Takeaways

Allows for full 3D transforms, perspective

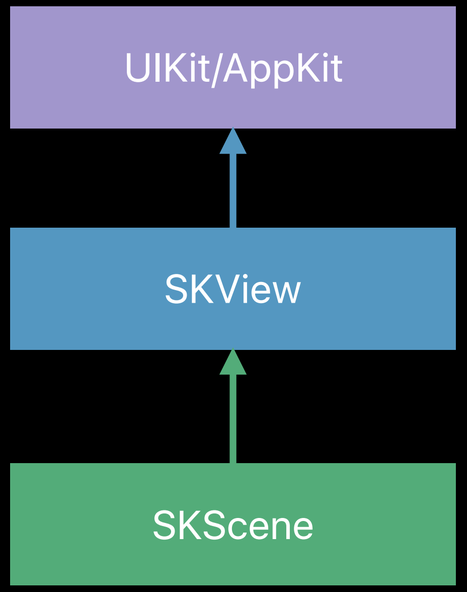
Can mix 2D and 3D content

Works with ARKit, or in general 3D apps

# Introduction to SKRenderer

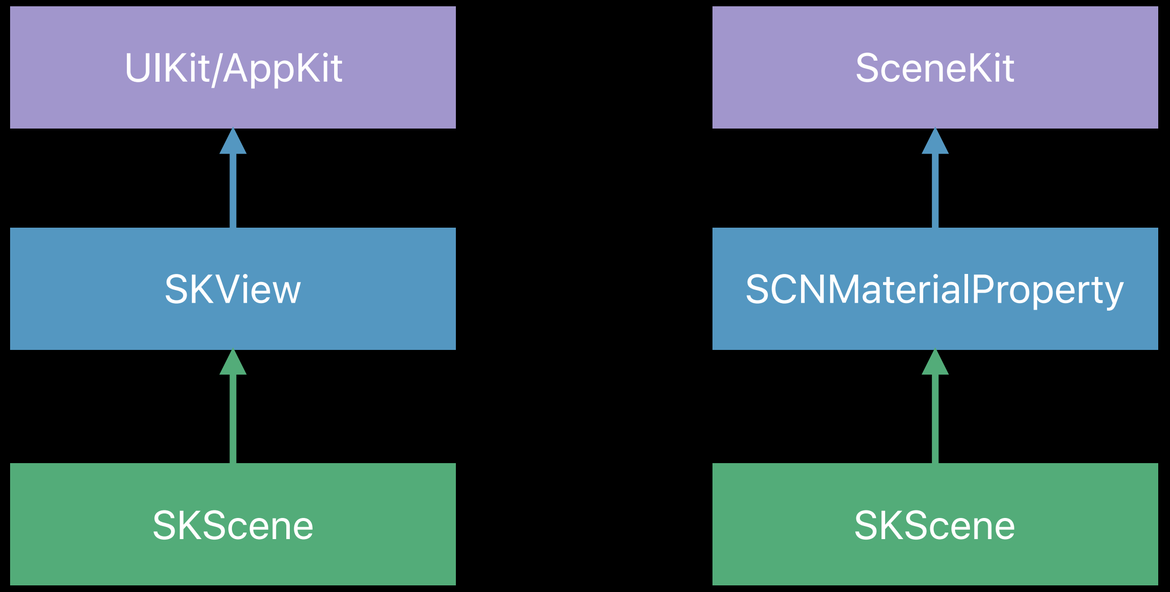
# How SpriteKit Works

## Normal usage



# How SpriteKit Works

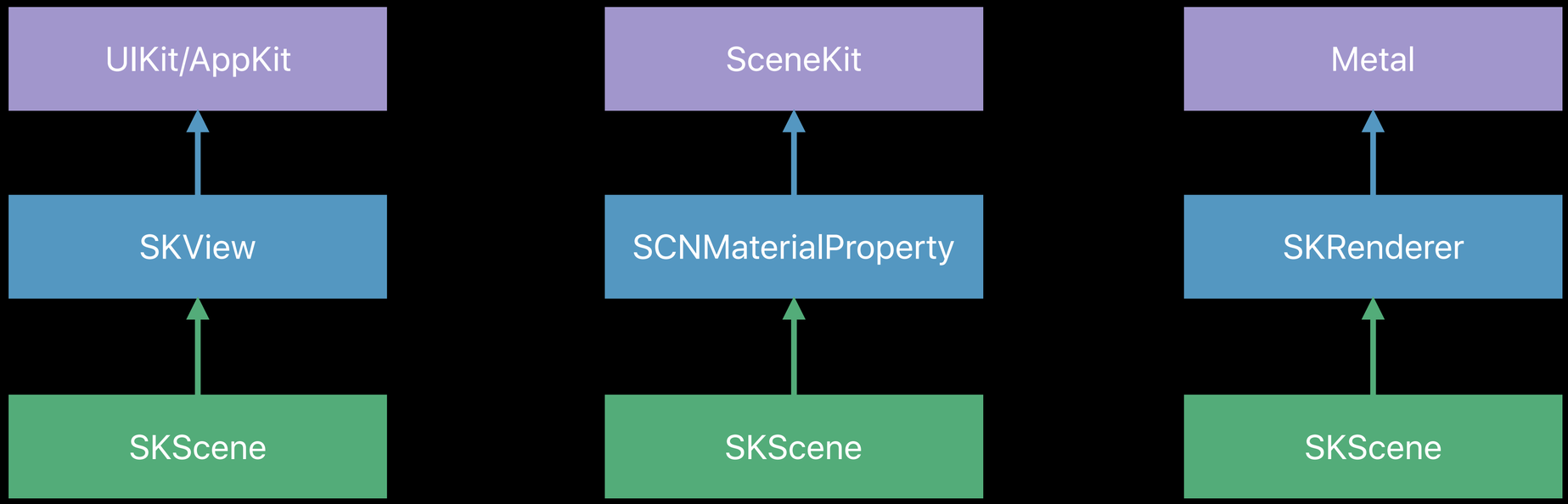
## SpriteKit with SceneKit



# How SpriteKit Works

## SKRenderer

NEW



# Introduction to SKRenderer

## Control update and render

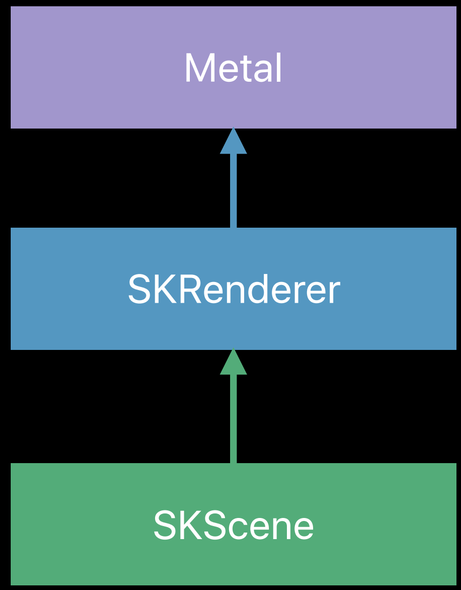
NEW

Use instead of SKView

Control update and render

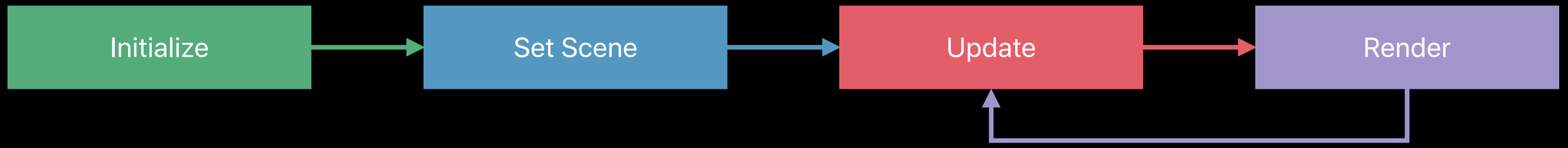
Works directly with Metal

SceneKit uses to render SpriteKit content



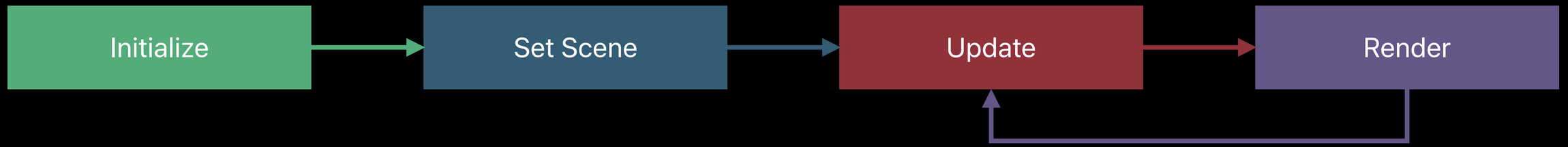
# Introduction to SKRenderer

## Using SKRenderer



# Introduction to SKRenderer

## Initialization



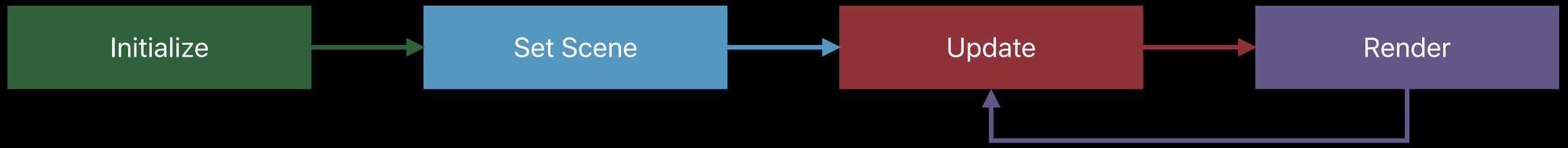

```
var device: MTLDevice! = nil
var renderer: SKRenderer! = nil
var skScene: SKScene! = nil
var commandQueue: MTLCommandQueue! = nil

…

device = MTLCreateSystemDefaultDevice()
commandQueue = device.makeCommandQueue()
renderer = SKRenderer(device: device)
```

# Introduction to SKRenderer

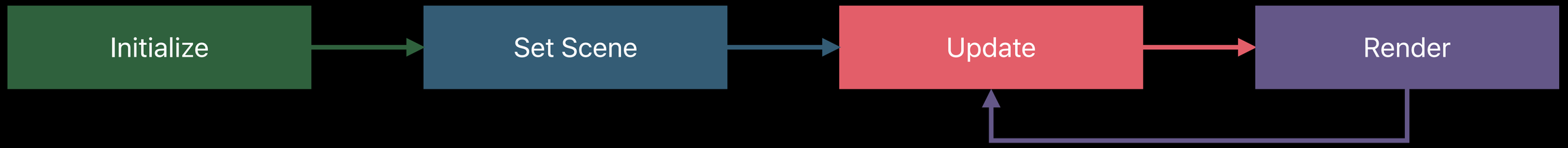
## Setting the scene




```
if let scene = SKScene(fileNamed: "GameScene") {
    skScene = scene
    renderer.scene = skScene
}
```

# Introduction to SKRenderer

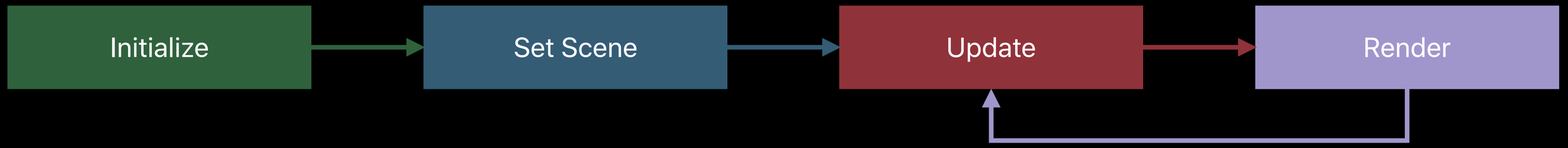
## Updating




```
let currentTime = CACurrentMediaTime()
renderer.update(atTime: currentTime)
```

# Introduction to SKRenderer

## Rendering




```
// Render for command buffer
renderer.render(withViewport: viewport, commandBuffer: commandBuffer, renderPassDescriptor:
renderPassDesc)

// Render for command encoder
renderer.render(withViewport: viewport, renderCommandEncoder: renderCommandEncoder,
renderPassDescriptor: renderPassDesc, commandQueue: commandQueue)
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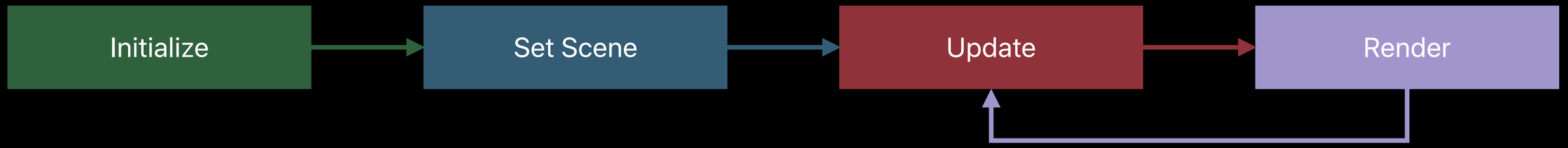
# Introduction to SKRenderer

## Rendering

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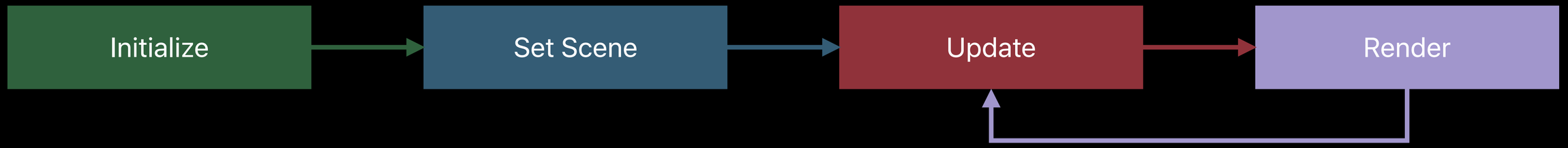
# Introduction to SKRenderer

## Rendering

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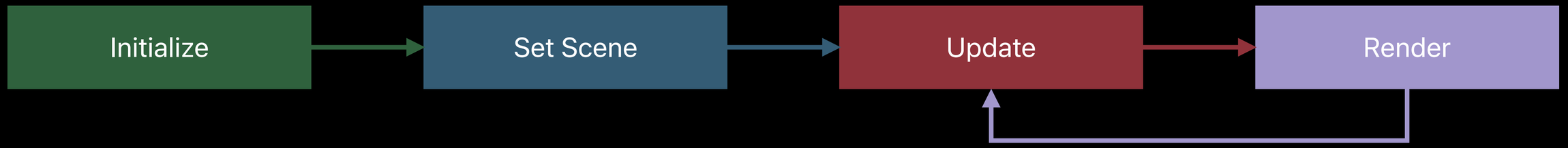
# Introduction to SKRenderer

## Rendering

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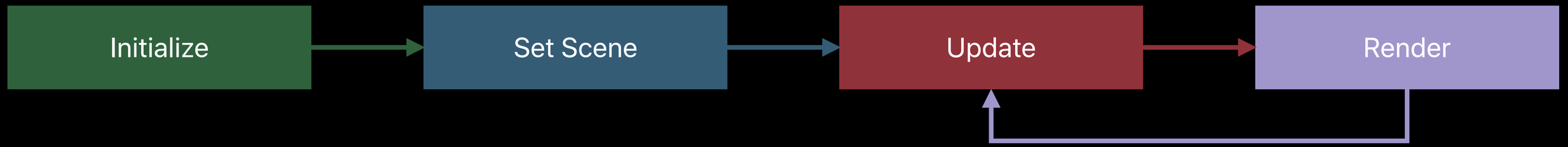
# Introduction to SKRenderer

## Rendering

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# *Demo*

Drawing SpriteKit content in 3D with Metal

# Introduction to SKRenderer

## Takeaways

SKRenderer gives more control over SpriteKit

Update and render exactly when you want

Use with Metal however you see fit

# Summary

SpriteKit is useful in both 2D and 3D

Plays nice with SceneKit, Metal, and ARKit

New features give you more control than ever

# More Information

https://developer.apple.com/wwdc17/609

# Related Sessions

| | | |
|---|---|---|
| Introducing Metal 2 | Executive Ballroom | Tuesday 1:50PM |
| Introducing ARKit: Augmented Reality for iOS | Hall 3 | Tuesday 5:10PM |
| SceneKit: What’s New | Grand Ballroom A | Wednesday 11:00AM |
| Debugging with Xcode 9 | Hall 2 | Wednesday 10:00AM |

# Labs

| | | |
|---|---|---|
| GameplayKit Lab | Technology Lab G | Fri 9:00AM–12:00PM |
| SpriteKit Lab | Technology Lab G | Fri 12:00PM–2:30PM |


WWDC17