CUSTOM GRAPHIC ELEMENTS

STRV

OVERVIEW

01

OVERVIEW

- High-level graphics frameworks
  - Abstracted from hardware
  - Handles complex tasks behind the scenes
  - Easier for developers to use
  - *Examples: UIKit, SwiftUI, RealityKit, ARKit, SpriteKit*
- Low-level graphics frameworks
  - Closer to hardware, with more control
  - Optimized for memory, performance, and resources
  - *Examples: Core Graphics, Metal*

SWIFTUI

02

SWIFTUI

- Mostly UIKit under the hood
- Interoperability UIKit <-> SwiftUI
  - SwiftUI to UIKit: UIHostingController
  - UIKit to SwiftUI: UIViewRepresentable
- Less code, more clarity
- Declarative approach for defining view behavior using view modifiers

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```
class CustomLabelView: UIView {
    private let label: UILabel = {
        let label = UILabel()
        label.text = "Hello world!!!"
        label.translatesAutoresizingMaskIntoConstraints = false
        return label
    }()

    override init(frame: CGRect) {
        super.init(frame: frame)
        setupView()
    }

    required init?(coder: NSCoder) {
        super.init(coder: coder)
        setupView()
    }

    private func setupView() {
        addSubview(label) // Přidání labelu jako subview

        NSLayoutConstraint.activate([  // Nastavení constraintů pomocí NSLayoutConstraint
            label.centerXAnchor.constraint(equalTo: centerXAnchor),
            label.centerYAnchor.constraint(equalTo: centerYAnchor),
            label.leadingAnchor.constraint(greaterThanOrEqualTo: leadingAnchor, constant: 16),
            label.trailingAnchor.constraint(lessThanOrEqualTo: trailingAnchor, constant: -16)
        ])
    }
}
```

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```
struct LoadingView: View {
    var body: some View {
        Text("Hello world!!!")
    }
}
```

SWIFTUI

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```
Rectangle()
    .foregroundStyle(Color.red)
    .opacity(0.5)
    .frame(width: 100, height: 100)
```

PROPERTY WRAPPERS

- Adds behavior to common properties
  - managing, observing, or validating data, without cluttering code
- Types
  - @State – Manages local view state. Change triggers redrawing view
  - @Binding – Shares state between parent and child views. Change triggers redrawing view
  - @Environment – Accesses shared environment data
  - @StateObject/@ObservedObject: – Tracks observable objects shared across views

VIEW MODIFIERS

- Ability to wrap in another view
  and override behaviour of given content
- Reduces code duplication by grouping frequently
  used modifiers together
- Ability to encapsulate property wrappers
  - @State, @Binding, etc…

```
struct Title: ViewModifier {
    func body(content: Content) -> some View {
        content
            .font(.largeTitle)
            .foregroundStyle(.white)
            .padding()
            .background(.blue)
            .clipShape(.rect(cornerRadius: 10))
    }
}
```

```
Text("hello world!!!")
    .modifier(Title())
```

VIEW MODIFIERS

- Ability to wrap in another view
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  - @State, @Binding, etc…

```
struct Title: ViewModifier {
    func body(content: Content) -> some View {
        content
            .font(.largeTitle)
            .foregroundStyle(.white)
            .padding()
            .background(.blue)
            .clipShape(.rect(cornerRadius: 10))
    }
}

extension View {
    func title() -> some View {
        self.modifier(Title())
    }
}


Text("hello world!!!")
    .title()
```

VIEW MODIFIERS

- Ability to wrap in another view
  and override behaviour of given content
- Reduces code duplication by grouping frequently used modifiers together
- Ability to encapsulate property wrappers
  - @State, @Binding, etc…

```
struct OnFirstAppear: ViewModifier {
    @State var viewDidAppear = false
    var action: () -> Void

    func body(content: Content) -> some View {
        content
            .onAppear {
                if !viewDidAppear {
                    viewDidAppear = true
                    action()
                }
            }
    }
}
```

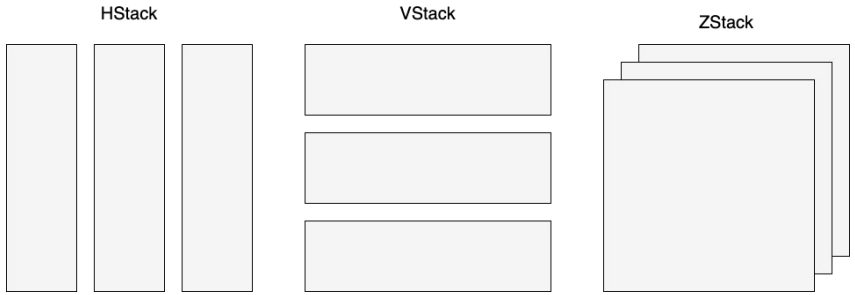
VIEW STYLES

- Modifier for overwriting default style of basic SwiftUI components
  - .buttonStyle, .labelStyle, .toggleStyle, .pickerStyle (not customizable)
- Reduces code duplication by reusing styles across views
- Enhances maintainability of large apps
- Creates a unified design for a consistent and improved UX

```
struct BlueButtonStyle: ButtonStyle {
    func makeBody(configuration: Configuration) -> some View {
        configuration.label
            .padding()
            .background(Color.blue)
    }
}
```

STACKS

- Basic layout containers
  - VStack, HStack, ZStack
- Identify primitive elements
  and then group into containers
- Before coding, consider
  - Potential new features
  - Development time
  - Separation of concerns
    (view models for UI components
    not for entire screens)
- Complex layouts with Layout protocol
  - FlowLayout etc…
- More about this at https://www.swiftuifieldguide.com



Primitive element

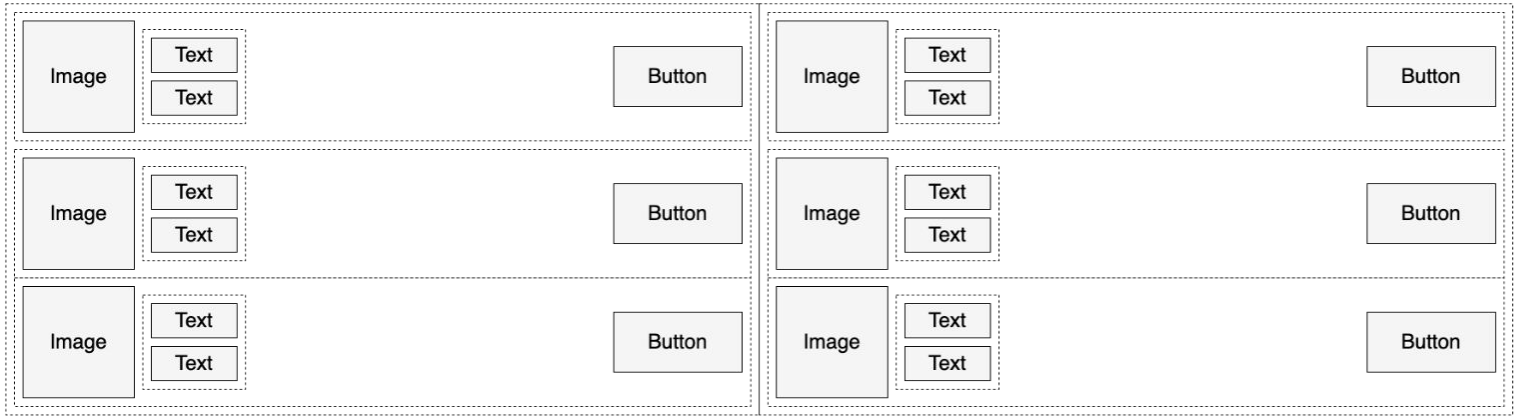

VStack
Text
Text


HStack
Image
Text
Text
Button

VStack


Image
Text
Text
Button
Image
Text
Text
Button
Image
Text
Text
Button

HStack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Text
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Button
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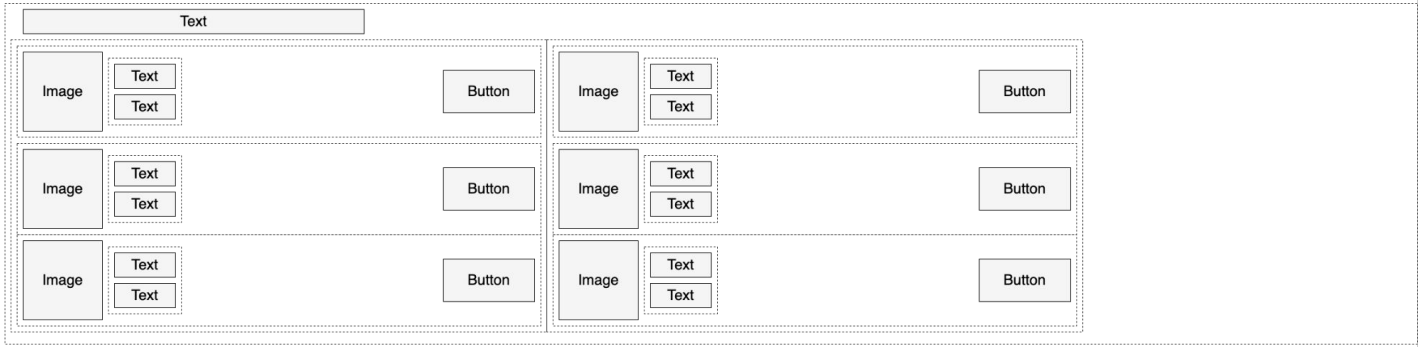
Text
Button

VStack


Text
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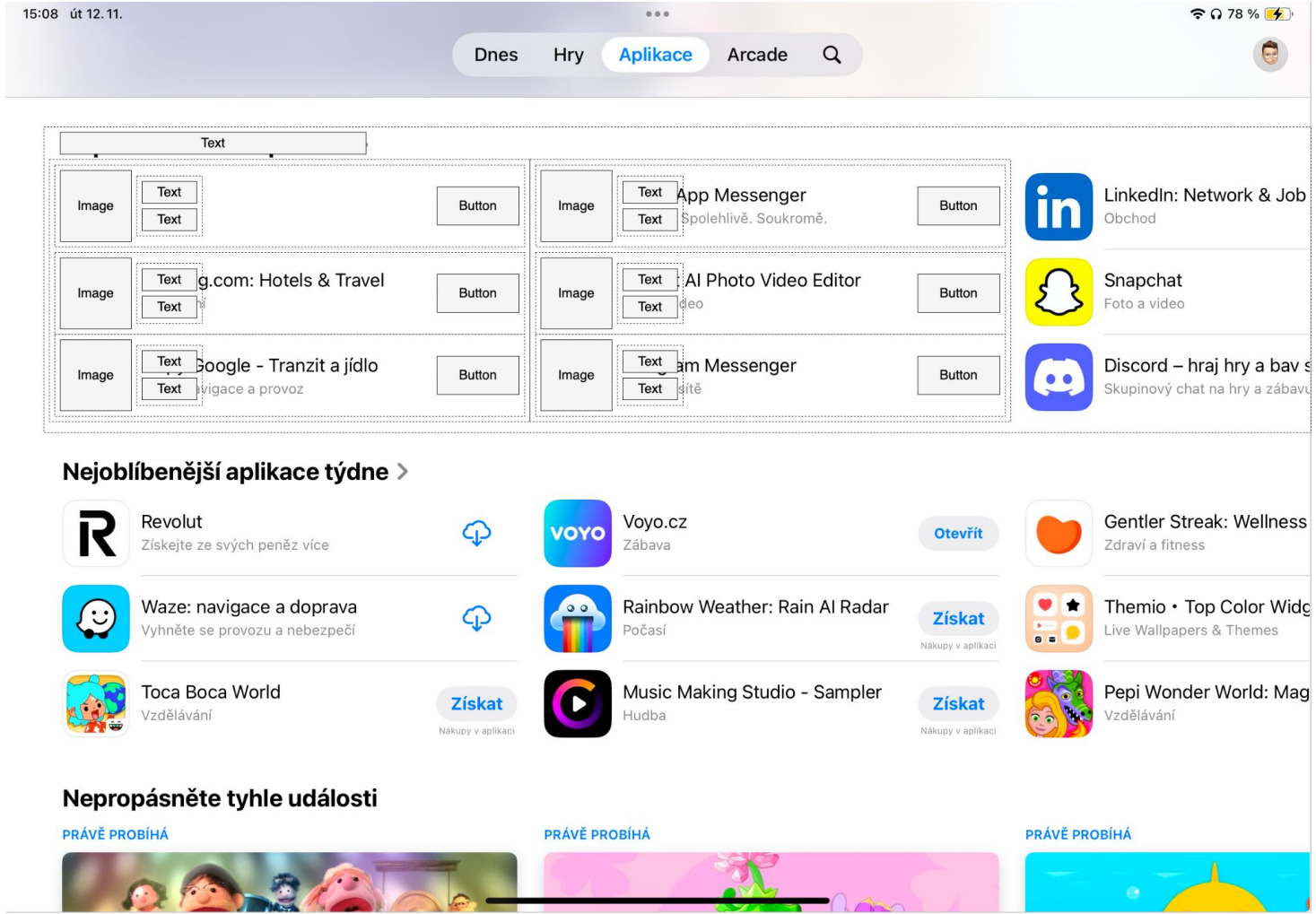
15:08 út 12. 11.
78 %
Dnes
Hry
Aplikace
Arcade
Text
Image
Text
Text
Button
App Messenger
Společně. Soukromě.
LinkedIn: Network & Job
Obchod
Snapchat
Foto a video
Discord – hraj hry a bav
Skupinový chat na hry a zábavu
Nejoblíbenější aplikace týdne
Revolut
Získejte ze svých peněz více
Waze: navigace a doprava
Vyhněte se provozu a nebezpečí
Toca Boca World
Vzdělávání
Získat
Nákupy v aplikaci
Voyo.cz
Zábava
Otevřít
Rainbow Weather: Rain AI Radar
Počasí
Music Making Studio - Sampler
Hudba
Gentler Streak: Wellness
Zdraví a fitness
Themio • Top Color Widg
Live Wallpapers & Themes
Pepi Wonder World: Mag
Vzdělávání
Nepropásněte tyhle události
PRÁVĚ PROBÍHÁ
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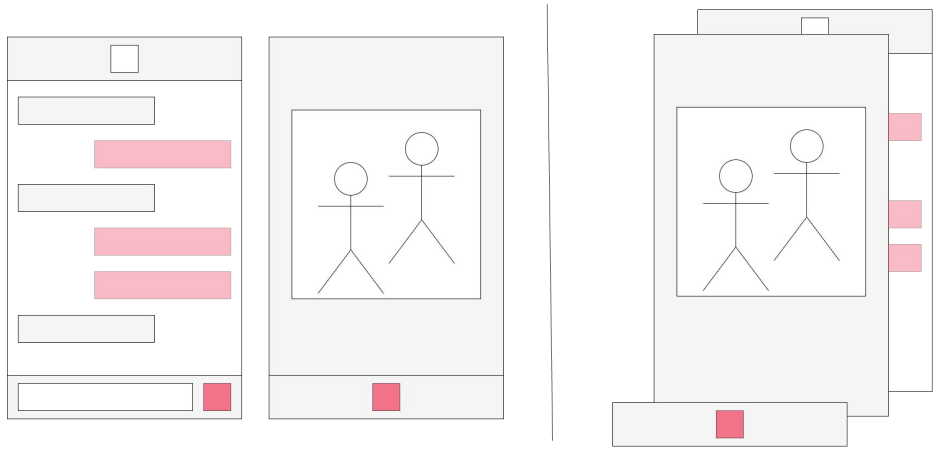

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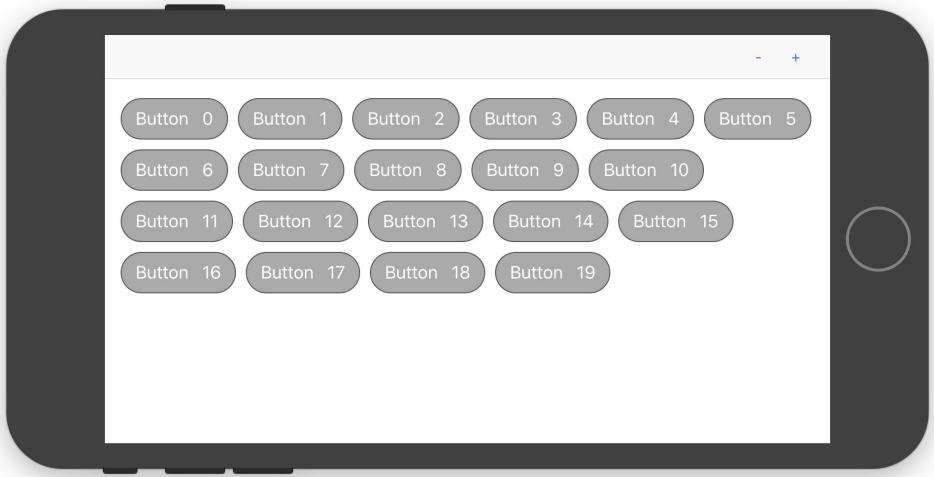
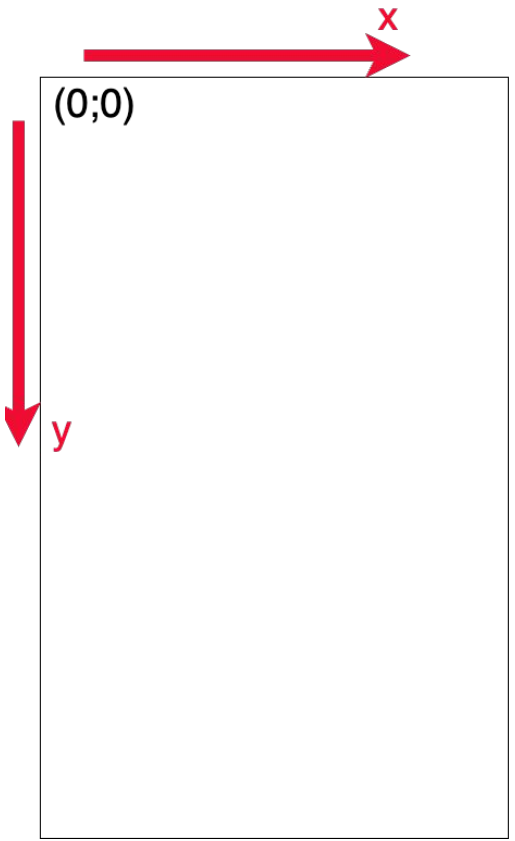


GEOMETRYREADER

- Use when basic containers aren’t enough
- Own coordinate system for precise layout control
- Reads proposed size by parent
    - e.g., setting text width to 1/4 of screen

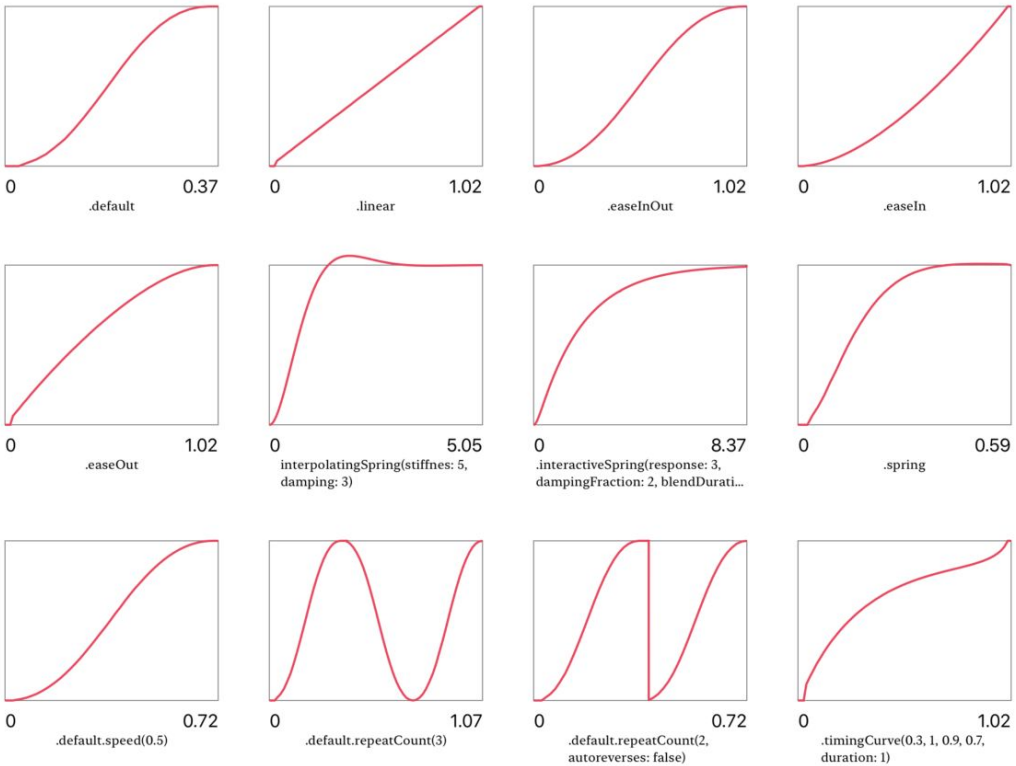


ANIMATIONS

- The change in value is continuous, not discrete.
  - Instead of shift 1 (true) to 0 (false),
    the value gradually decreases.
  - Example: Instead of moving from 1 → 0,
    the value transitions smoothly, e.g., 1 → 0.9 → 0.8 → … → 0
  - Timing curve of animation is adjustable

```
struct AnimateButton: View {
    @State var animatedColor: Color = .red
    var body: some View {
        Button("Start animation") {
            withAnimation(.bouncy.repeatForever(autoreverses: true)) {
                animatedColor = .green
            }
        }
        .padding()
        .background(animatedColor)
    }
}
```

ANIMATIONS


0
0.37
.default
0
1.02
.linear
0
1.02
.easeInOut
0
1.02
.easeIn
0
1.02
.easeOut
0
5.05
interpolatingSpring(stiffnes: 5, damping: 3)
0
8.37
.interactiveSpring(response: 3, dampingFraction: 2, blendDurati...
0
0.59
.spring
0
0.72
.default.speed(0.5)
0
1.07
.default.repeatCount(3)
0
0.72
.default.repeatCount(2, autoreverses: false)
0
1.02
.timingCurve(0.3, 1, 0.9, 0.7, duration: 1)

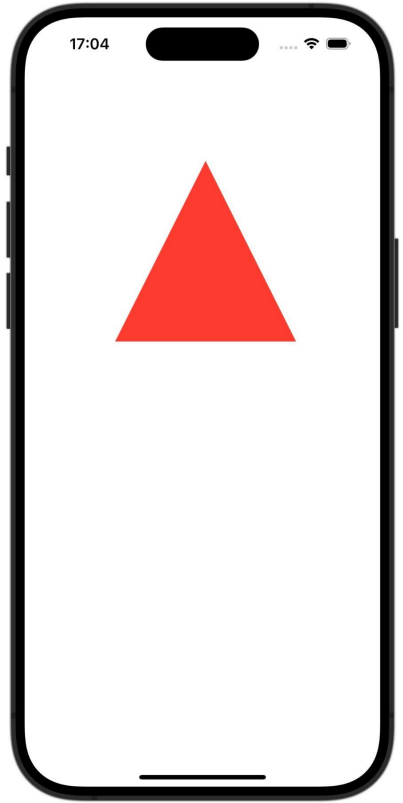
BEZIERPATH

03

PATH

- Custom shapes
  - Eg. Map regions

```
Path { path in
    path.move(to: CGPoint(x: 200, y: 100))
    path.addLine(to: CGPoint(x: 100, y: 300))
    path.addLine(to: CGPoint(x: 300, y: 300))
    path.addLine(to: CGPoint(x: 200, y: 100))
}
```



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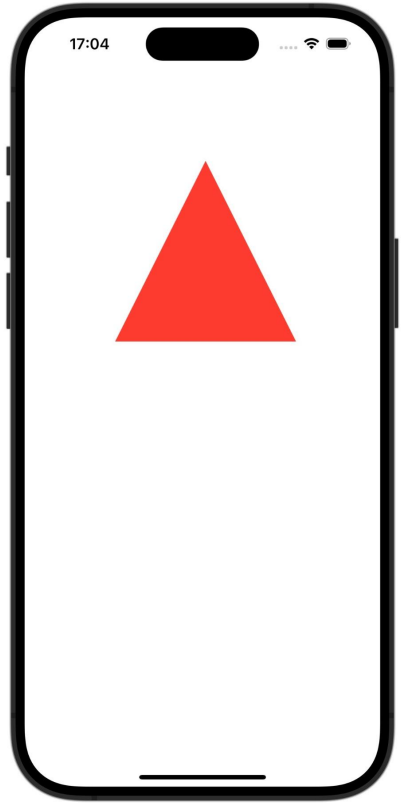
}
```

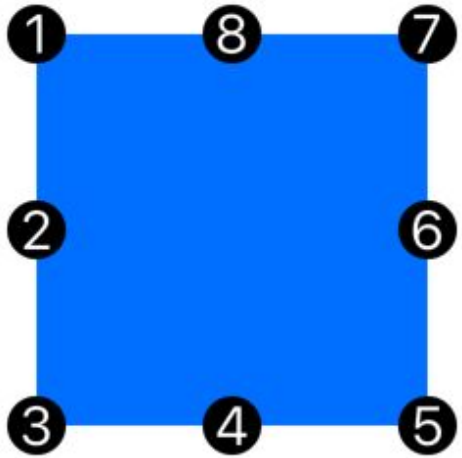


PATH

```
var firstPoint = CGPoint(x: 100, y: 100)
var secondPoint = CGPoint(x: 100, y: 200)
var thirdPoint = CGPoint(x: 100, y: 300)
var fourthPoint = CGPoint(x: 200, y: 300)
var fifthPoint = CGPoint(x: 300, y: 300)
var sixthPoint = CGPoint(x: 300, y: 200)
var seventhPoint = CGPoint(x: 300, y: 100)
var eighthPoint = CGPoint(x: 200, y: 100)
```

SQUARE

```
var square: Path {
    Path { path in
        path.move(to: firstPoint)
        path.addLine(to: secondPoint)
        path.addLine(to: thirdPoint)
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addLine(to: seventhPoint)
        path.addLine(to: eighthPoint)
        path.closeSubpath()
    }
}
```



TRIANGLE

```
var triangle: Path {
    Path { path in
        path.move(to: eighthPoint)
        path.addLine(to: thirdPoint)
        path.addLine(to: fifthPoint)
        path.closeSubpath() // back to eightPoint
    }
}
```

TRIANGLE

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var triangle: Path {
    Path { path in
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        path.addLine(to: thirdPoint)
        path.addLine(to: fifthPoint)
        path.closeSubpath() // back to eightPoint
    }
}
```

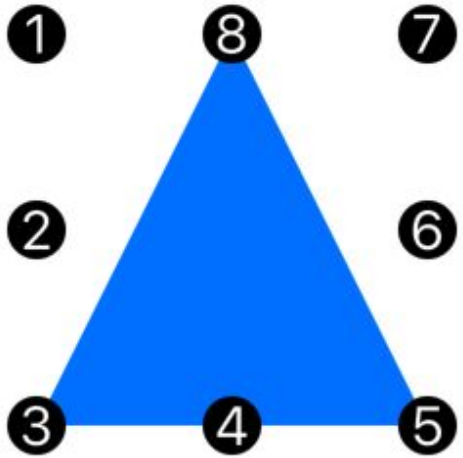

CURVE1

```
var curve1: Path {
    Path { path in
        path.move(to: eighthPoint)
        path.addQuadCurve(
            to: thirdPoint,
            control: firstPoint
        )
        path.addLine(to: fifthPoint)
        path.closeSubpath() // back to eightPoint
    }
}
```

CURVE1

```
var curve1: Path {
    Path { path in
        path.move(to: eighthPoint)
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        path.addLine(to: fifthPoint)
        path.closeSubpath() // back to eightPoint
    }
}
```

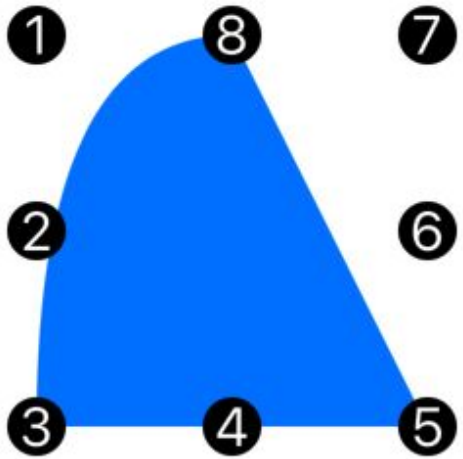

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            control: firstPoint
        )
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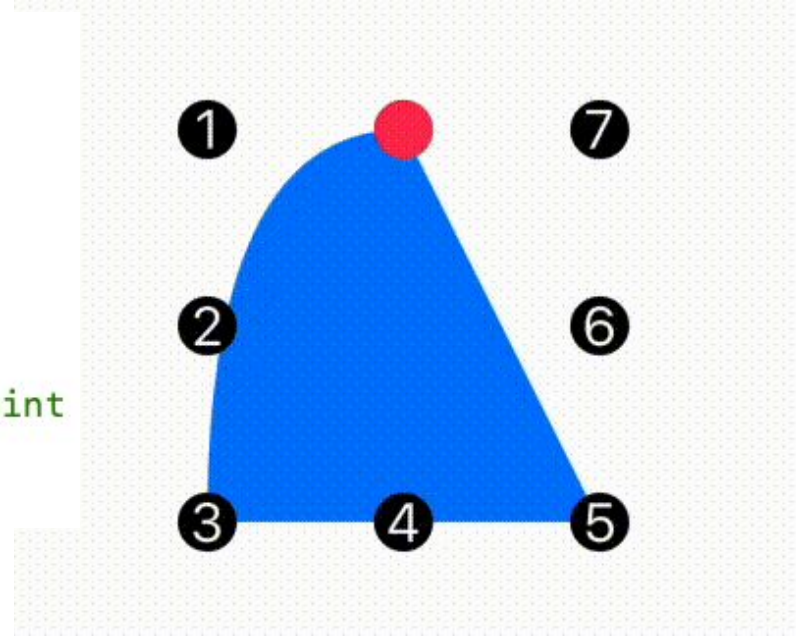
        path.closeSubpath() // back to eightPoint
    }
}
```

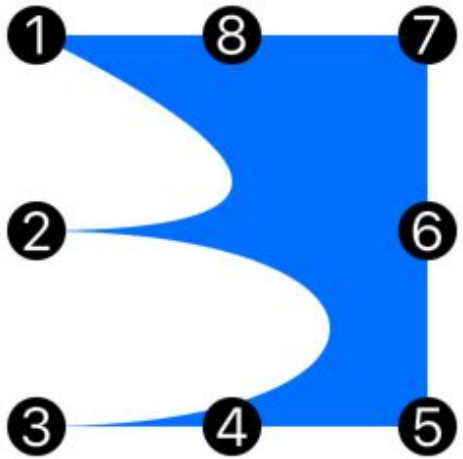


CURVE2

```
var curve2: Path {
    Path { path in
        path.move(to: firstPoint)
        path.addQuadCurve(
            to: secondPoint,
            control: sixthPoint
        )
        path.addCurve(
            to: thirdPoint,
            control1: sixthPoint,
            control2: fifthPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addLine(to: seventhPoint)
        path.addLine(to: eighthPoint)
        path.closeSubpath()
    }
}
```

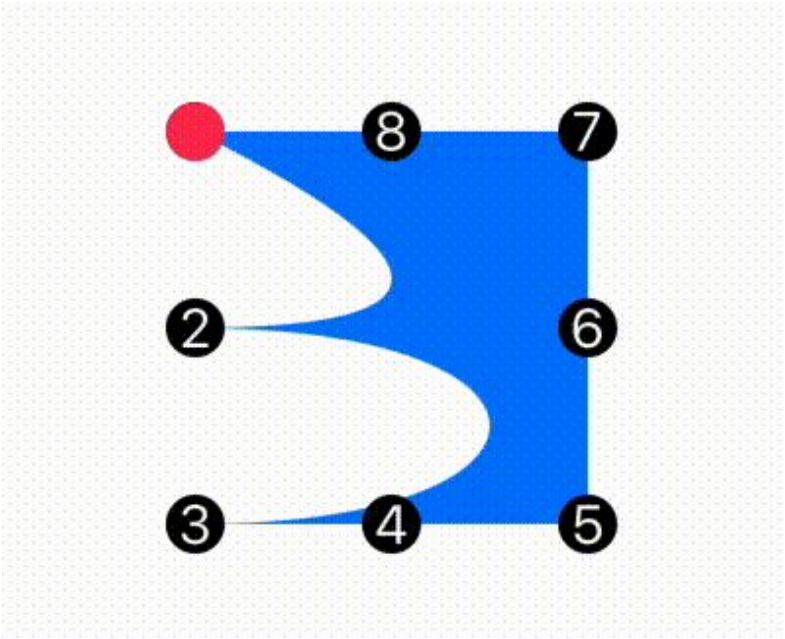
CURVE2

```
var curve2: Path {
    Path { path in
        path.move(to: firstPoint)
        path.addQuadCurve(
            to: secondPoint,
            control: sixthPoint
        )
        path.addCurve(
            to: thirdPoint,
            control1: sixthPoint,
            control2: fifthPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addLine(to: seventhPoint)
        path.addLine(to: eighthPoint)
        path.closeSubpath()
    }
}
```



CURVE2

```
var curve2: Path {
    Path { path in
        path.move(to: firstPoint)
        path.addQuadCurve(
            to: secondPoint,
            control: sixthPoint
        )
        path.addCurve(
            to: thirdPoint,
            control1: sixthPoint,
            control2: fifthPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addLine(to: seventhPoint)
        path.addLine(to: eighthPoint)
        path.closeSubpath()
    }
}
```



CURVE3

```
var curve3: Path {
    Path { path in
        path.move(to: firstPoint)
        path.addQuadCurve(
            to: secondPoint,
            control: sixthPoint
        )
        path.addQuadCurve(
            to: thirdPoint,
            control: seventhPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addCurve(
            to: seventhPoint,
            control1: firstPoint,
            control2: secondPoint
        )
        path.addLine(to: eighthPoint)
        path.addLine(to: firstPoint)
        path.closeSubpath()
    }
}
```

CURVE3

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var curve3: Path {
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        path.addQuadCurve(
            to: secondPoint,
            control: sixthPoint
        )
        path.addQuadCurve(
            to: thirdPoint,
            control: seventhPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addCurve(
            to: seventhPoint,
            control1: firstPoint,
            control2: secondPoint
        )
        path.addLine(to: eighthPoint)
        path.addLine(to: firstPoint)
        path.closeSubpath()
    }
}
```

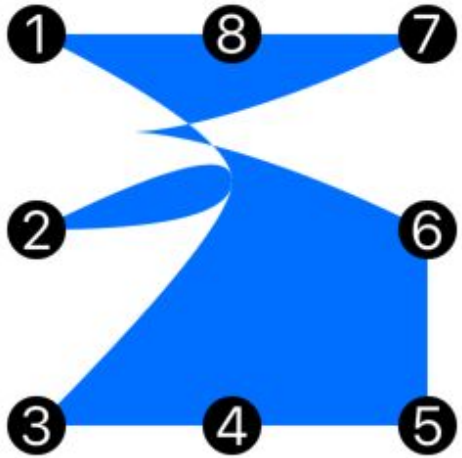

CURVE3

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            control: sixthPoint
        )
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            to: thirdPoint,
            control: seventhPoint
        )
        path.addLine(to: fourthPoint)
        path.addLine(to: fifthPoint)
        path.addLine(to: sixthPoint)
        path.addCurve(
            to: seventhPoint,
            control1: firstPoint,
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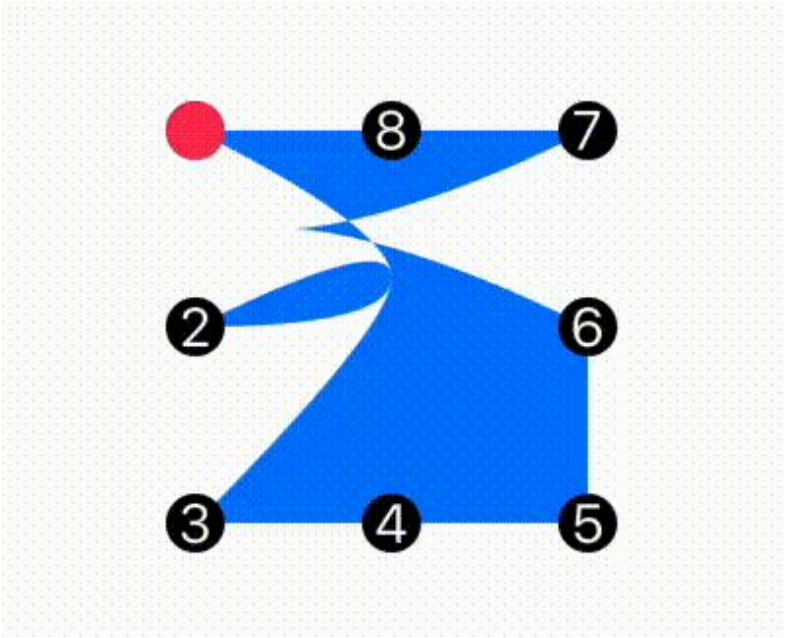

SPRITEKIT

03

SPRITEKIT

- Ideal for building both 2D games and animations
- Supports realistic object behavior

  for smooth animations
  - Physics (gravitation, object interaction)
  - Lighting / shadows
- Optimized for Apple devices

```
class LoadingScene: SKScene {
    override func didMove(to view: SKView) {
        let loadingSprite = SKSpriteNode(imageNamed: "loadingIcon")
        loadingSprite.position = CGPoint(x: size.width / 2, y: size.height / 2)

        addChild(loadingSprite)

        let rotateAction = SKAction.rotate(byAngle: .pi * 2, duration: 1.0)
        let repeatRotation = SKAction.repeatForever(rotateAction)

        loadingSprite.run(repeatRotation)
    }
}
```

SPRITEKIT

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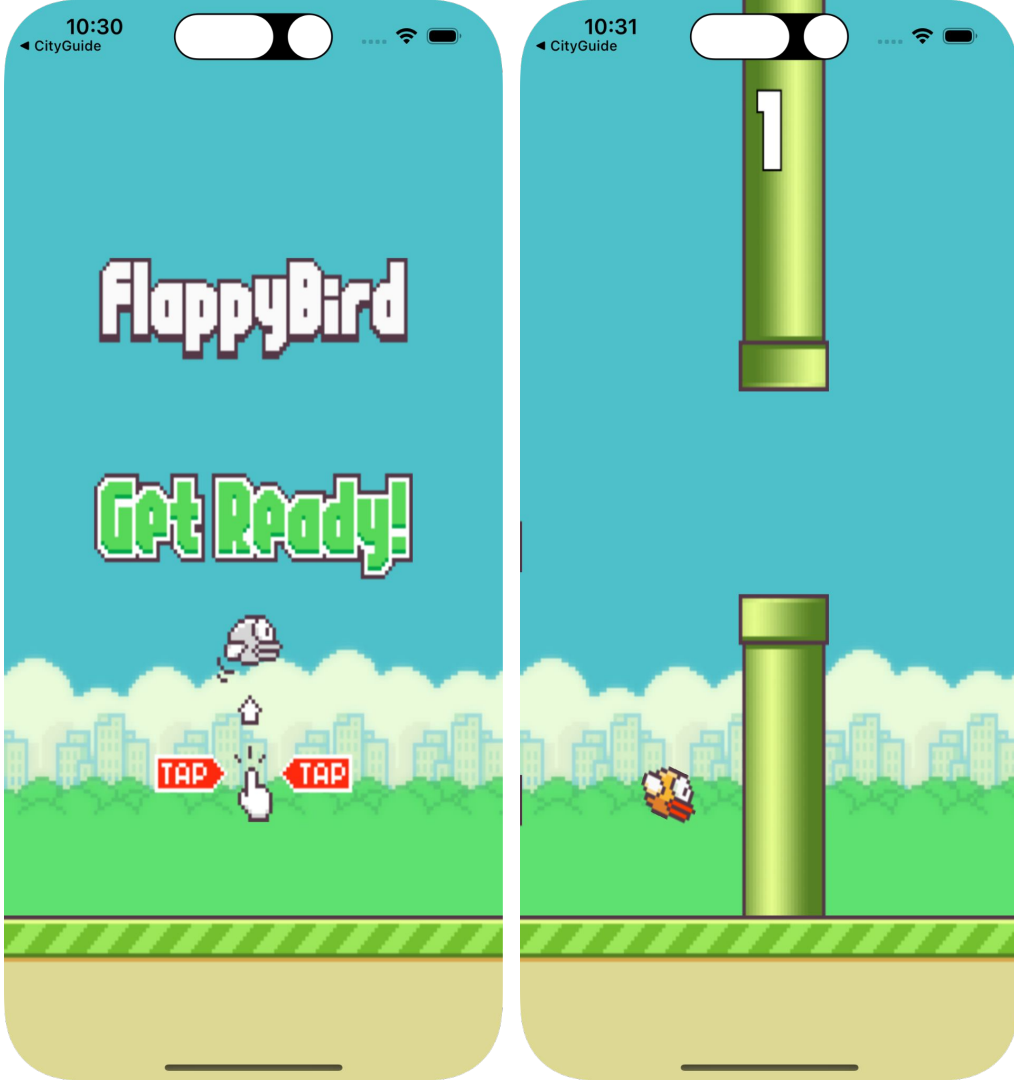


LOW-LEVEL

03

CORE GRAPHICS

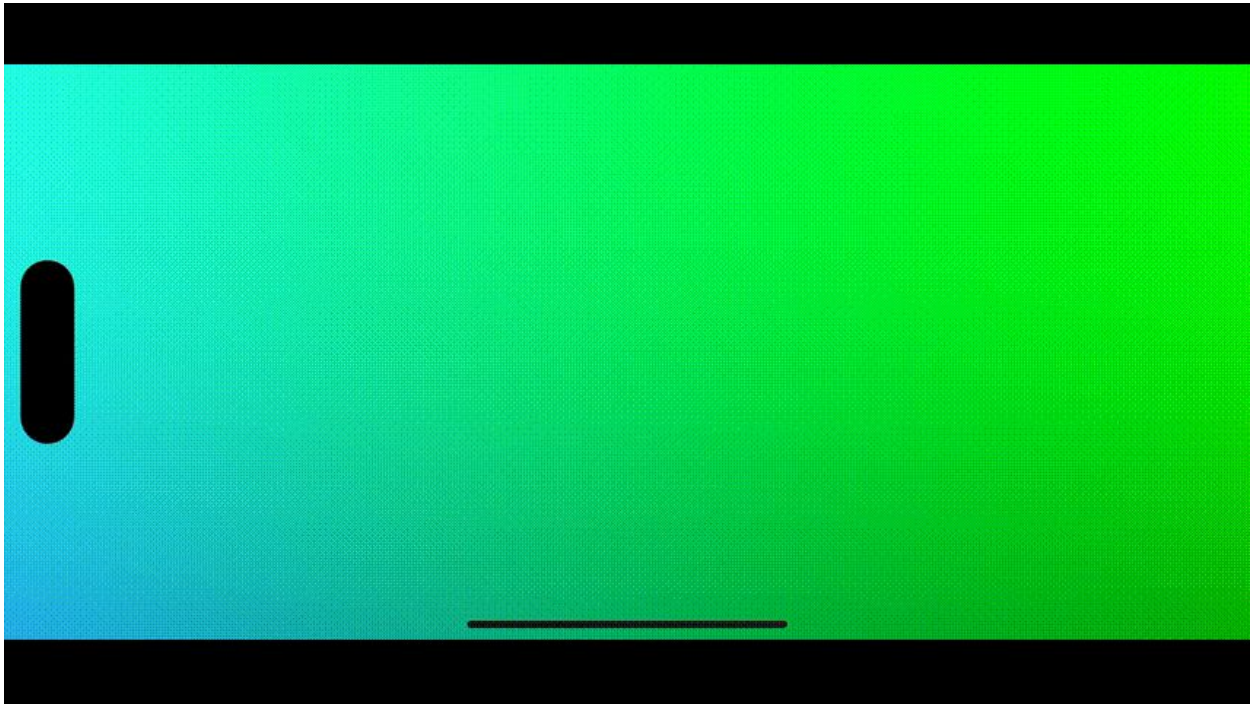
- Used for 2D vector graphics
- Working directly with paths, shapes, colors, and images
- Heavily integrated into higher-level frameworks
    - Essential data types like CGFloat, CGSize, CGColor (reduction of type conversions)

METAL

- Low-level graphics API
- Customization of elements is done by shaders
  - GPU programs for high-performance graphics and parallel data processing
- Provides direct access to the GPU
  - Designed for maximum graphics performance and optimized for Apple hardware
  - Unlike OpenGL, it is built to reduce CPU overhead
- Applications:
  - Game graphics
  - Machine learning

METAL EXAMPLES

Try handling individual pixels with swiftUI



THANK YOU!

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QUESTIONS

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