Evolution of Metal, ARKit, and RealityKit

2014	2015	2016	2017	2018	2019	2020	2021	2022
iOS 8 iPhone 6 A8	iOS 9 iPhone 6s A9	iOS 10 iPhone 7 A10 Fusion	iOS 11 iPhone 8/X A11 Bionic	iOS 12 iPhone XS/XR A12 Bionic	iOS / iPadOS 13 iPhone 11 A13 Bionic	iOS / iPadOS 14 iPhone 12 A14 Bionic iPhone 12 Pro LiDAR	iOS / iPadOS 15 iPhone 13 A15 Bionic iPhone 13 Pro LiDAR	iOS / iPadOS 16 iPhone SE (3rd) A15 Bionic
iPad Air 2 A8X iPad mini 3 A7	iPad Pro 12.9 (1st) A9X iPad mini 4 A8	iPad Pro 9.7 A9X	iPad (5th) A9 iPad Pro 10.5 A10X iPad Pro 12.9 (2nd) A10X	iPad (6th) A10 iPad Pro 11 A12X iPad Pro 12.9 (3rd) A12X	iPad Air (3rd) A12 iPad mini (5th) A12 iPad (7th) A10	iPad Pro 11(2nd) A12Z/LiDAR iPad Pro 12.9 (4th) A12Z/LiDAR iPad (8th) A12 iPad Air (4th) A14	iPad Pro 12.9 (5th) M1/LiDAR iPad Pro 11 (3rd) M1/LiDAR iPad (9th) A13 iPad mini (6th) A15	iPad Air (5th) M1
Metal	Metal	Metal	Metal 2	Metal 2	Metal 2	Metal 2	Metal 2	Metal 3
MSL: C++ 11 subset Pre-compile GPU commands Unified shader for compute and render	 MetalKit Metal Performance Shade Model I/O: assets import/ subdivision, AO/light map generation 	export,	 MPS: Graph API, CNN/RNN Model I/O: Baking CIKernel with MSL SKRenderer: SpriteKit, SceneKit, ARKit 	 OpenGL/ES, OpenCL: deprecated MPS: Ray-tracing APIs MPS: CNN/RNN training on Device Metal debugger Metal for VR CI Kernel Language deprecated Accelerate simd, vDSP, vlmage, BLAS,etc 	 GPU driven rendering MPS: Ray-tracing, De-noising API Xcode Simulator support MPS: ML support advancement Accelerate Swift-like APIs	 Apple Silicon on Mac: TBDR Ray tracing pipeline integration: generate rays, intersector, shading Metal Function pointers Metal Binary Archive/Dynamic Library Debug: 150+ GPU counters MPSGraph framework 	 Ray Tracing: single pipeline, hybrid rendering Dynamic Library: vertex shader, fragment shader, tile shader Function pointer: rendering, tiling Function stitching ClKernel: stichable functions, dynamic library (A11+) MPSGraph: loop operator, etc Texture Converter (Mac/Win) 	 Fast resource loading Offline compilation MetalFX Upscaling(Spacial/Temporal Mesh shader (Apple7+: A14+/M1+) Argument buffer API, Unbounded arr Ray tracing: per-primitive data, Heap, Acceleration Structures, parallel AS & Accelerated machine learning Xcode: dependency viewer, validator metal-cpp: C++ wrapper library PyTorch acceleration MPSGraph: shared event
			ARKit	ARKit 2	ARKit 3	ARKit 4	ARKit 5	ARKit 6
			 A9+ WorldTracking, Plane detection Light estimation SceneKit, SpriteKit, Metal integration 	 Object detection Image / Face Tracking Environment Texturing World map save / load Sample: SwiftShot 	 People Occlusion (A12+) Motion Capture (A12+) Front + Back Camera (A12+) AR Coaching UI Multi-face tracking (up to 3) Ray-casting Motion Blur, Camera Grain, Depth of field, HDR Environment textures Record and Replay Collaborative Session Sample: SwiftStrike 	 Location Anchors: US cities, A12+ Scene Geometry (LiDAR) Depth API (LiDAR) Face tracking: without TrueDepth 	 Location Anchors: + US cities / London, coaching overlay App Clip Code tracking (A12+) Face tracking: ultra-wide front camera Motion capture: enhanced (A14) 	 4K video mode: 30fps, 16:9 High-res background Photos, HDR m Exif tags Fine-grained camera control ARPlaneExtent class Motion Capture enhancement: Ear joi tracking (2D), better occlusion (3D) Location Anchors: +16 region RoomPlan Scanning experience API: realtime r generation, USDZ export Data API: live parametric data
								30x30 ft, 50 lux, LiDAR iPhone/iPage
				PyCorelmage	RealityKit	RealityKit	RealityKit 2	RealityKit 2
				 Python-based tool, Jupyter notebook inline ClKernel (MSL) 	 ARView, Anchor, Scene, Entity Rendering, Animation, Physics, Synchronization, ECS, Audio Reality File 	 Video Materials Scene Understanding with LiDAR: Object Occlusion, Receives Lighting, Physics, Collision Debug Options 	 Custom Shader: Geometry Modifier, Surface Shader Custom Post Processing: Core Image, MPS, SpriteKit, MSL Dynamic Mesh: creation, inspection, modification at runtime 	
				USDZ converter		Reality Converter	 ECS enhancement: systems, components 	Reality Converter
				 Python-based command line tools 		• macOS app	 Material advancements: Transparency Video Material, PBR material APIs Animation advancements 	 Beta 5, new Lighting mode support Texture compression USDZ converter
					Reality Composer • iOS / macOS app	 Reality Composer USDZ export, USD Schemas 	 Character controller Generated resources: Face mesh, AudioBufferResource 	 Python 3, Apple Silicon support Upgraded USD version OBJ, gITF, FBX import improvement
				AR QuickLook	AR QuickLook	AR QuickLook	Object Capture APIs (macOS)	AR QuickLook
				PBR shaderTexture down-sampling	People OcclusionNested UDSZs	• Web Banner: Apple Pay		 new Lighting mode: brighter, enhanced contrast, shape definition