Evolution of	Metal, ARKIT, and	RealityKit							
2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
iOS 8 iPhone 6 A8 iPad Air 2 A8X iPad mini 3 A7	iOS 9 iPhone 6s A9 iPad Pro 12.9 (1st) A9X iPad mini 4 A8	iOS 10 iPhone 7 A10 Fusion iPad Pro 9.7 A9X	iOS 11 iPhone 8/X A11 Bionic iPad (5th) A9 iPad Pro 10.5 A10X iPad Pro 12.9 (2nd) A10X	iOS 12 iPhone XS/XR A12 Bionic iPad (6th) A10 iPad Pro 11 A12X iPad Pro 12.9 (3rd) A12X	iOS / iPadOS 13 iPhone 11 A13 Bionic iPad Air (3rd) A12 iPad mini (5th) A12 iPad (7th) A10	iOS / iPadOS 14 iPhone 12 A14 Bionic iPhone 12 Pro LiDAR iPad Pro 11 (2nd) A12Z/LiDAR iPad Pro 12.9 (4th) A12Z/LiDAR iPad (8th) A12 iPad Air (4th) A14	iOS / iPadOS 15 iPhone 13 A15 Bionic iPhone 13 Pro LiDAR iPad Pro 12.9 (5th) M1/LiDAR iPad Pro 11 (3rd) M1/LiDAR iPad (9th) A13 iPad mini (6th) A15	iOS / iPadOS 16 iPhone SE (3rd) A15 Bionic iPhone 14 A15 Bionic iPhone 14 Pro A16 iPad Air (5th) M1 iPad Pro 12.9 (6th) M2/LiDAR iPad Pro 11 (4th) M2/LiDAR	iOS / iPadOS 17 iPhone 15 unknown iPhone 15 Pro unknown
Metal	Metal	Metal	Metal 2	Metal 2	Metal 2	Metal 2	Metal 2	Metal 3	Metal 3
 MSL: C++ 11 subset Pre-compile GPU commands Unified shader for compute and render 	 Metal Performan Model I/O: assets subdivision, AO/ 	ance Shader (MPS) ets import/export, l/light map texture	 MPS: Graph API, CNN/RNN Model I/O: Baking ClKernel 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, vImage, 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 AA) Mesh shader (Apple7+: A14+/M1+) Argument buffer API, Unbounded arrays Ray tracing: per-primitive data, Heap, Acceleration Structures, parallel AS build Accelerated machine learning Xcode: dependency viewer, validator metal-cpp: C++ wrapper library PyTorch acceleration MPSGraph: shared event 	 Game Porting ToolKit: Windows/Intel/DirectX12 => macOS/Apple Silicon/Metal3 Metal Shader Converter: DXIL => MetalLib MetalFX: iOS, Up to 3X Upscaling, Support in Metal-cpp Raytracing: Curves geometry descriptor, Indirect acceleration structure building by GPU, Multi-level instancing MPS: Brain floating (bfloat) point, Quantization API, PyToarch 2.0 Backend
			ARKit	ARKit 2	ARKit 3	ARKit 4	ARKit 5	ARKit 6	ARKit 6
			WorldTracking, Plane detectionLight estimationSceneKit, 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 mode, Exif tags Fine-grained camera control ARPlaneExtent class Motion Capture enhancement: Ear joint tracking (2D), better occlusion (3D) Location Anchors: +16 region 	
								 RoomPlan Scanning experience API: realtime model generation, USDZ export Data API: live parametric data 	 RoomPlan Custom ARSession MultiRoom, RoomBuilder/ StructureBuilder
								30x30 ft, 50 lux, LiDAR iPhone/iPad	(single floor, < 2000 sq ft)Export - UUID mapping/Model Provider
				PyCorelmage	RealityKit	RealityKit	RealityKit 2	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 	Reality Converter Beta 5, new Lighting mode support Texture compression 	 Image Capture/Reconstruction API on iOS (iPhone Pro 12+/iPad Pro 2021+) Camera pose output on macOS
				USDZ converter		Reality Converter	• FCS enhancement: systems	USDZ converter	
				 Python-based command line tools 		· macOS app	 Material advancements: Transparency Video Material, PBR material APIs 	Python 3, Apple Silicon supportUpgraded USD versionOBJ, glTF, FBX import improvement	
					Reality Composer	Reality Composer	Animation advancementsCharacter controllerGenerated resources: Face mesh,	Reality Composer	Reality Composer
					· iOS / macOS app	USDZ export, USD Schemas	Generated resources: Face mesh,AudioBufferResourceObject Capture APIs (macOS)		
				AR QuickLook PBR shader	AR QuickLook People Occlusion	AR QuickLook Web Banner: Apple Pay		AR QuickLooknew Lighting mode: brighter,	AR QuickLook
				Texture down-sampling	Nested UDSZs			enhanced contrast, shape definition	

evolution_of_ARKit_RealityKit_Metal_2023.key @AtarayoSD, Jul 2023 CC0