Silicon Arts Introduces: Industry leading Path Tracing Graphics Technology

April 9th, 2020

GPU Technology Evolution for Enhanced Graphics

Local Illumination
(Current Mobile/Embedded GPU)

Global Illumination
(Ray-tracing GPU for VR)

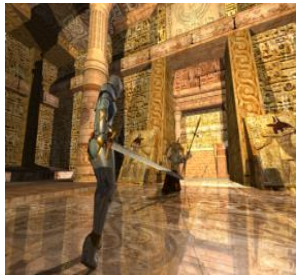
1st GEN
OpenGL ES 1.0/1.1
(Rasterization)

- Color impression on objects

2nd GEN
OpenGL ES 2.0/3.0
(Rasterization + Shader)

- Modifiable object color, modifiable imagery pixel color

3rd GEN
Basic Ray-tracing



- Major effect of light – reflection, refraction, transmission, and shadow

4th GEN
Advanced Ray-tracing

- Realistic shadow and curvature by calculating volume of light

5th GEN
Distribution Ray-tracing & Indirect Illumination

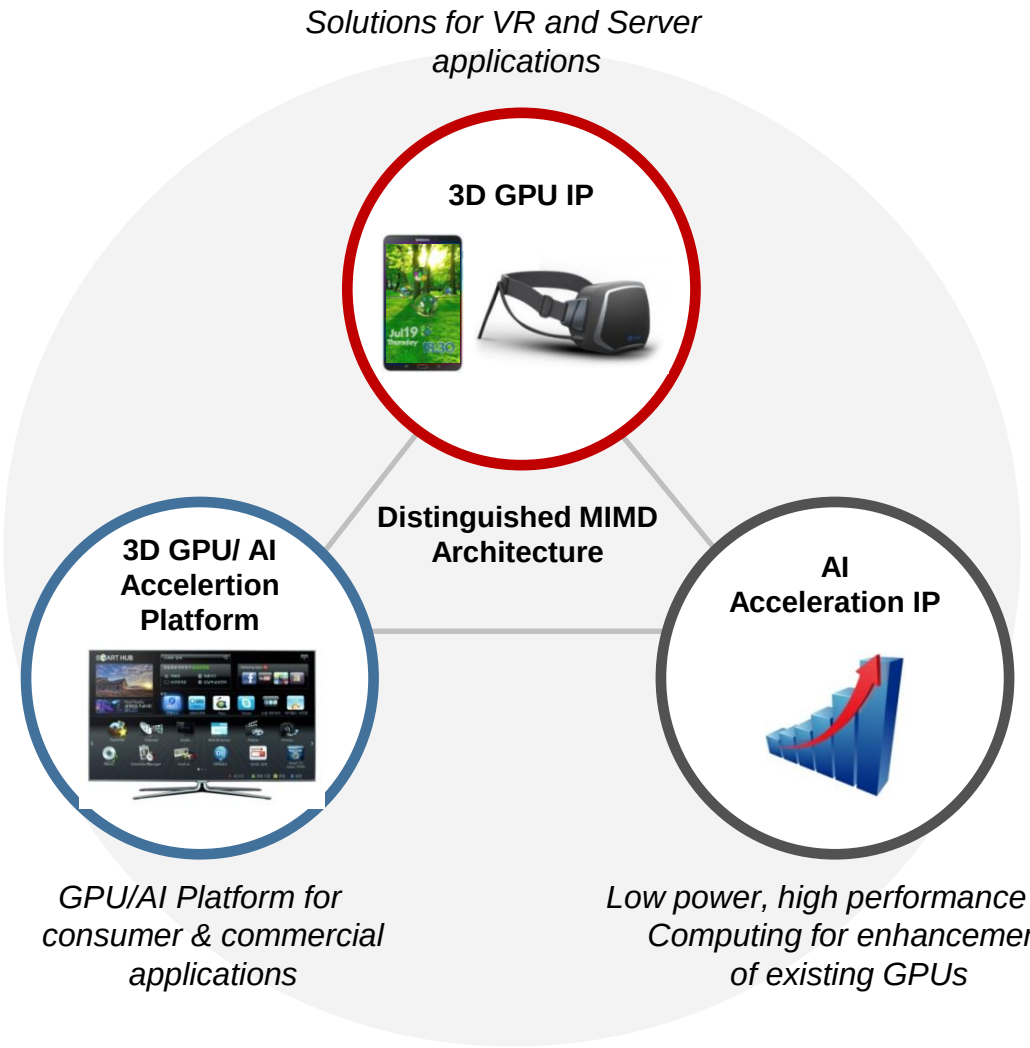
- Diffused and irregular reflection, distance and camera effect

Silicon Arts RayCore MC

Overview of Silicon Arts

- **Leader in GPU technology development with distinguished MIMD architecture and core GPU architecture patents**

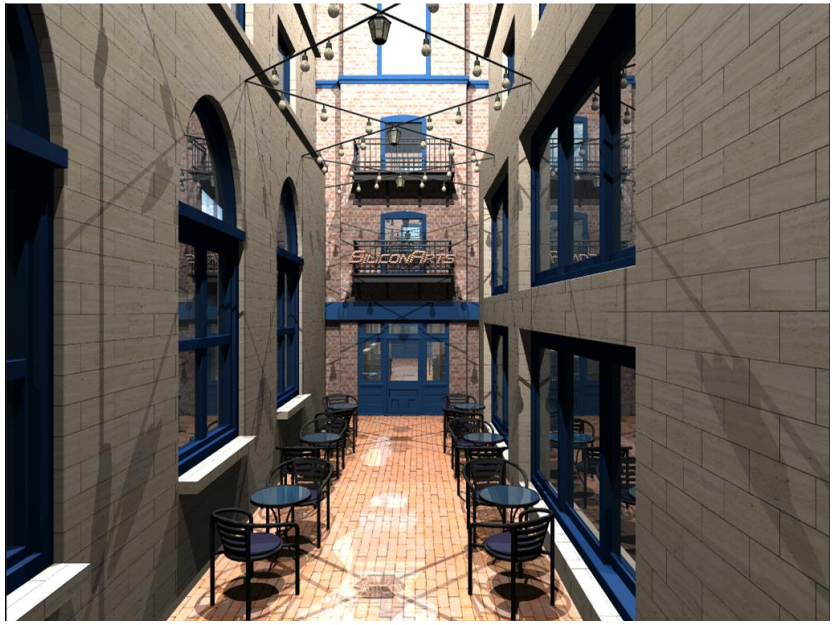
- 3D Graphic Accelerator IP core family
  - **RayCore® Series of** Ray-tracing GPU IP cores
  - **RayTree®** : Real-time KD-tree Generation IP
- **RayTree®** : Semiconductor Chip for Evaluation
- **RayCore®** Software SDK and Drivers



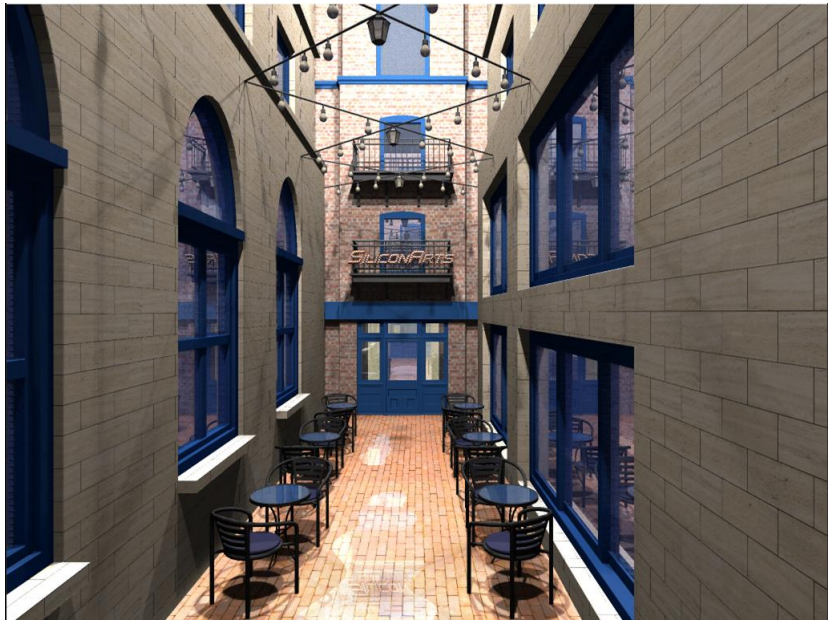
The Roadmap for Enhancing 3D Rendering

Rasterization → **Ray Tracing** → **Path Tracing**

Rasterization with Shadow effects
(RTX1660, Unity Engine)



Ray-tracing
(RTX2070, DirectXR)

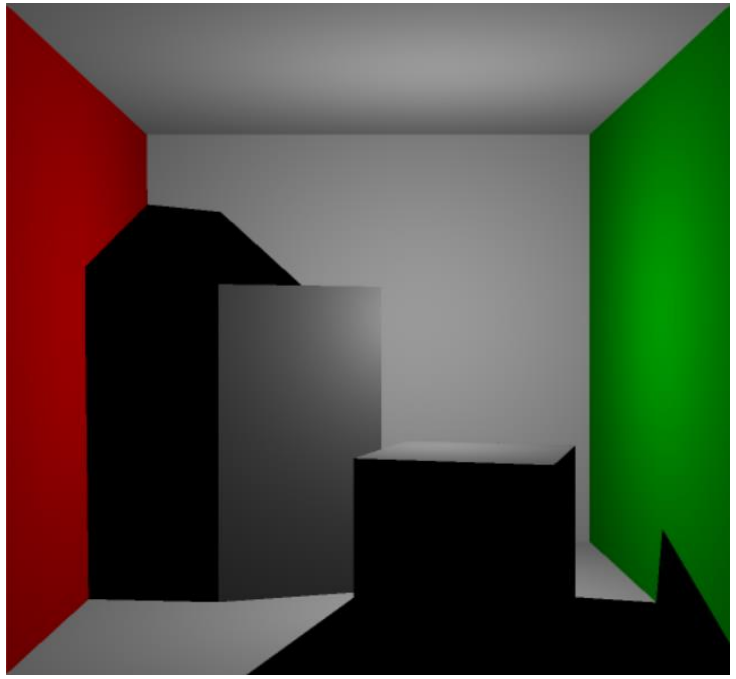


Path-tracing
(RayCore® MC)
soft shadow & indirect illumination

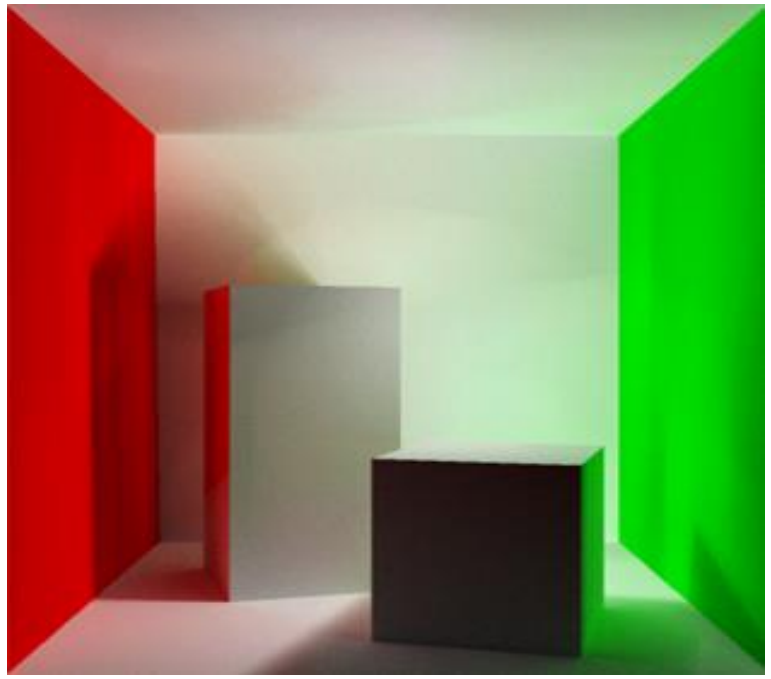
Ray Tracing vs. Path Tracing

- **Same**: Both use 3D ray bounce rendering techniques can express natural and realistic effects of lighting in 3D

  Difference: Reflection(Specular vs Diffuse), Lighting(Direct vs Indirect), Shadow(Hard vs Soft)
- **Goal**: To experience photo-realistic contents in a virtual world



Ray-tracing Simplified Example



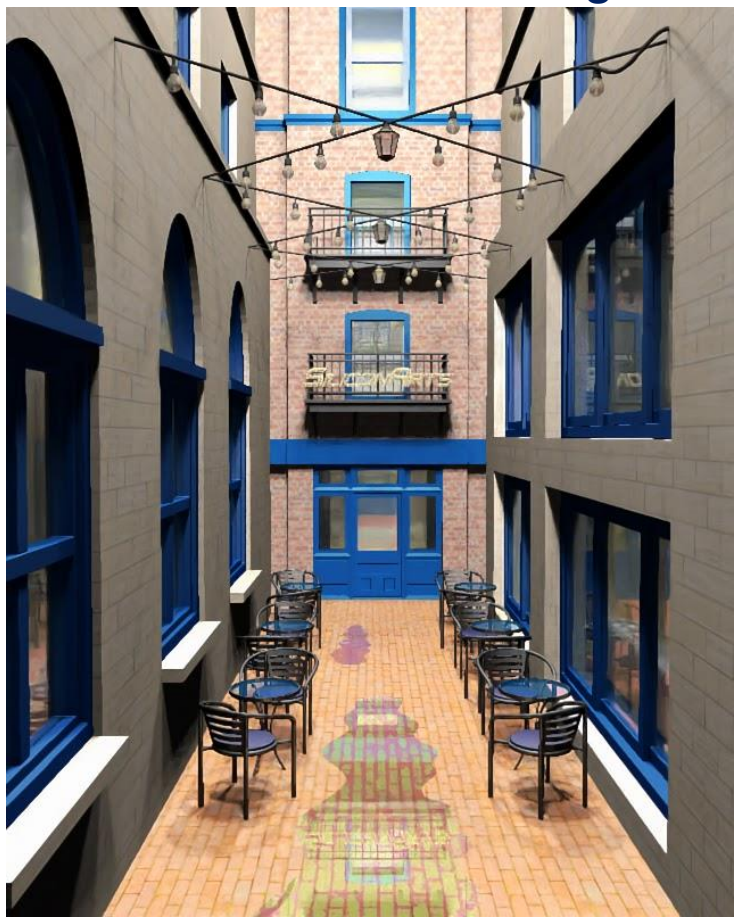
Path-tracing Simplified Example

The Roadmap for Enhancing 3D Rendering

Actual Photograph

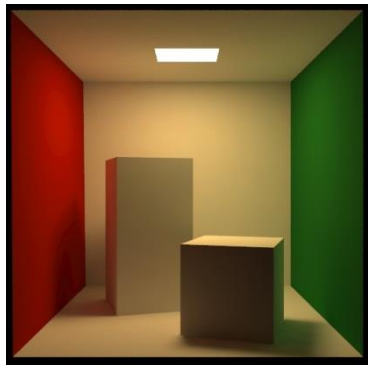
Photograph of Café in Chicago

Path Traced Rendering



Path-tracing (RayCore® MC)
with soft shadow & indirect illumination

RayCore® MC Graphics Features



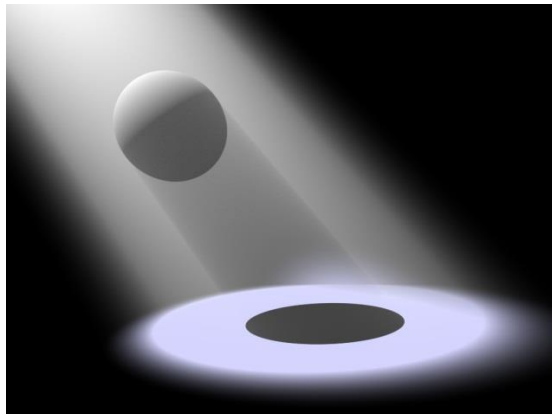
Global illumination

Glossy reflection

Depth of field

Soft shadow

Motion blur



Participating media

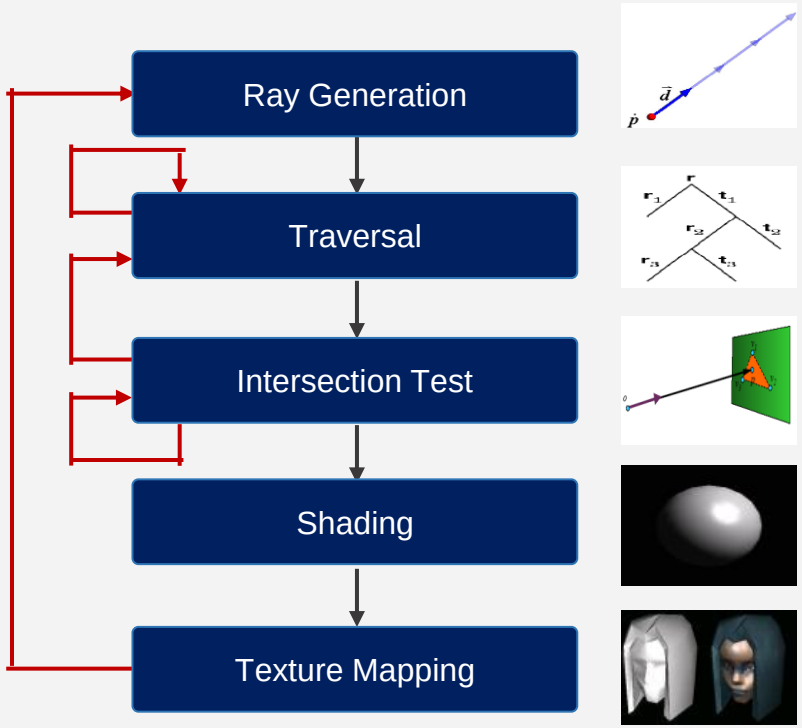
SILICONARTS

The World's First Real-time Path Tracing GPU IP

RayCore® Series MC

Photo-Realistic Graphic Effects: Natural Expression of Light - Reflection, Refraction, Transmission

- **Soft Shadow** effects
- **Indirect Illumination** by Random Ray Generation
- **High performance:** Efficient MIMD architecture
- **Highly Scalable** for any resolution and frame rate
- **Low-Power** suitable for **Mobile/VR/AR Applications**



[Ray Tracing GPU Pipeline]

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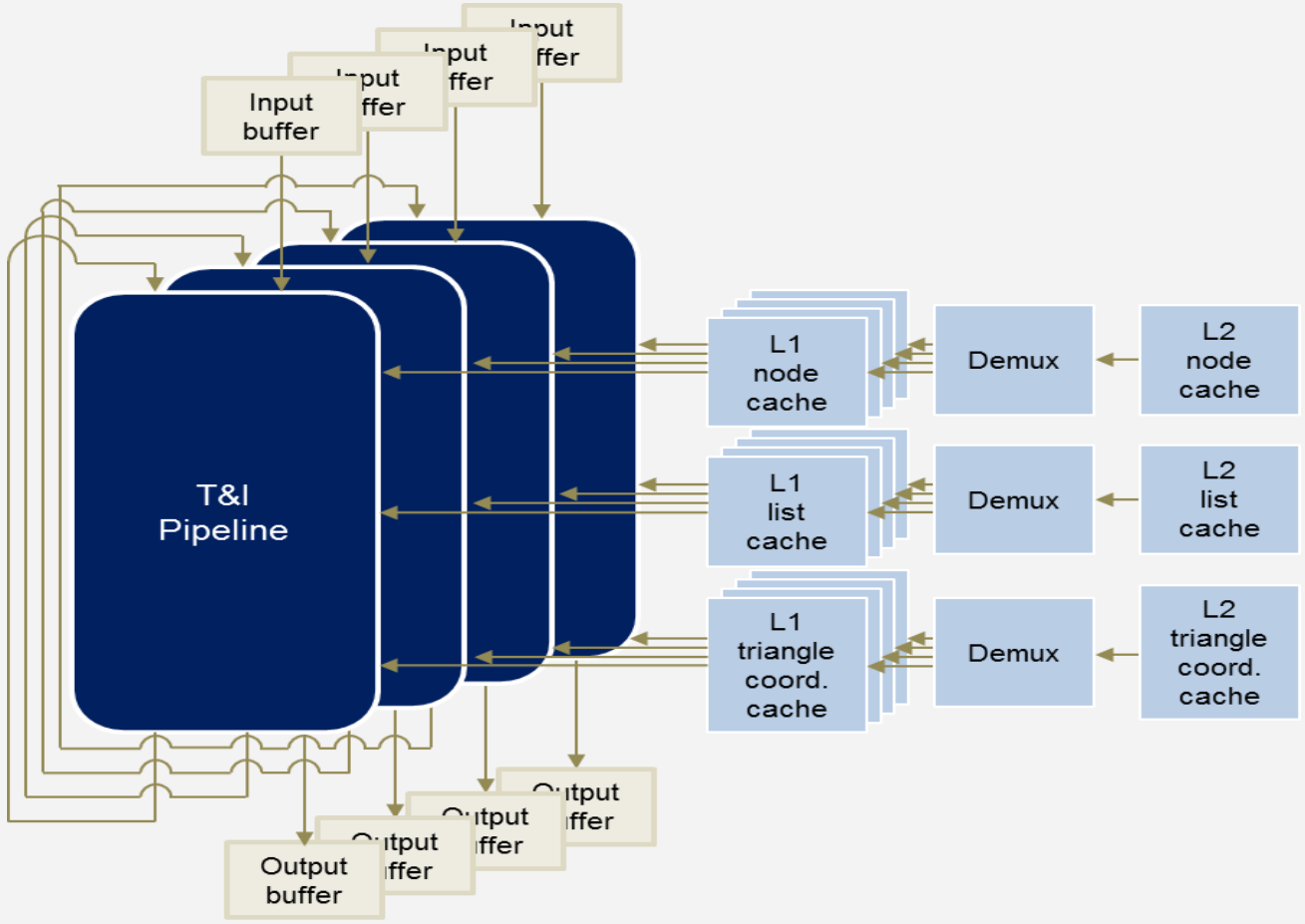
Path Tracing RayCore GPU Core Feature Set

Key Features	Description
Monte-Carlo Ray Generation	Monte-Carlo based diffuse / reflection / refraction / soft-shadow ray generation (Path Tracing) Glossy reflection / transmission Colored shadow on transparent objects, Textured shadow, multi shadows Depth of field, motion blur Multiple secondary ray support (e.g. reflection & refraction ray)
Traversal & Intersection Test	Reduce external memory access time (latency-hiding technique) Early termination support KD-tree, BVH support
Lighting	Point light, spot light, directional light, areal light Multiple light sources support, global lighting
Shading & Texture mapping	Phong shading Texture mapping / Normal mapping / MIP mapping / Alpha-blending (α-texture)
Others	Anti-aliasing Foveated Rendering support for VR Dynamic/static scene support Scalable architecture (multi-cores support)

Core Technology for Path Tracing Acceleration

- **Path tracing logic based on MIMD architecture**
  - MIMD: Multiple Instructions, Multiple Data streams (‘Core Patent’)
  - Parallelized Unified Traversal (KD-tree, BVH-tree*) and Intersection Test Unit
- **Optimized path tracing data path**
  - Scalable pipeline for path/ray tracing
  - Real-time path/ray tracing implementation

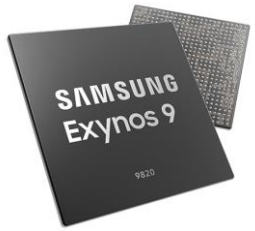


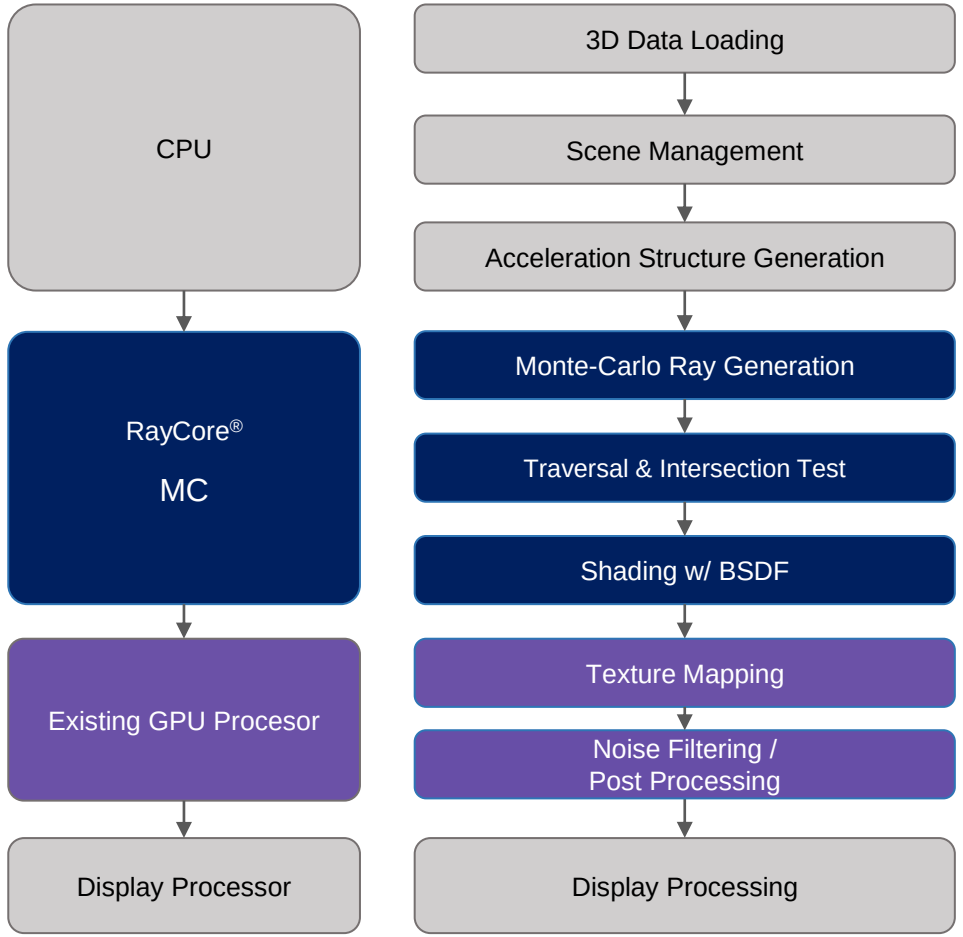
RayCore® MC MIMD Architecture

Extend your existing GPU to a Path Tracing GPU

- **Upgrade your GPU to path tracing**
  - Integrated data flow between the CPU and existing CPU
  - Leverage the existing GPU legacy software
  - Extend API support for Ray Tracing

- **Mobile/Embedded AP (Application Processor)**
  - Smartphone & Tablet
  - VR/AR Devices (HMD: Head Mounted Display)
  - Entertainment Devices (Console Box)





[RayCore® MC Architecture Flow Chart]

RayCore® MC S/W Stack

3D Object Loader / Animation / Camera Control

Extension APIs

Open GL ES

Vulkan

DXR

Platform API

Platform independent Library

Driver/HAL

Platform-dependent low-level S/W

RayCore® Contents

RayCore® Graphics Engine

Commercial 3D Engine & Design Tool's RayCore® Plugins

RayCore® Vulkan/DXR Extension APIs

RayCore® Platform API

RayCore® Driver/HAL

Vulkan / OES / DXR

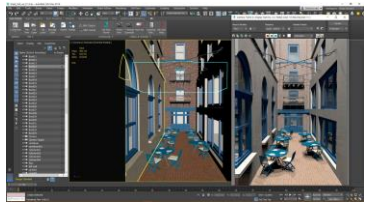
S/W

RayCore® MC GPU

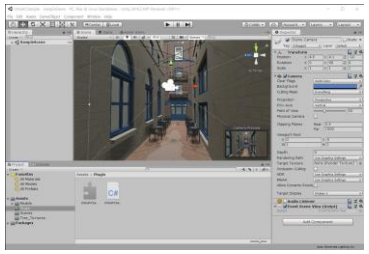
Rasterization GPU

H/W

RayCore® MC S/W Stack



3DS MAX® Plug-in



Unity® Engine Plug-in

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Enable Photo-Realistic Graphics with Path Tracing

- Path Tracing, Monte-Carlo Ray Generation
- Soft Shadow, Direct/Indirect Illumination
- The RayCore MC is a scalable, high performance implementation of Path tracing
- The RayCore MC can augment an existing GPU core
- Required Technology for next generation gaming, mobile and VR/AR