Genesis:
Real-Time Raytracing in Virtual Production

technicolor

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MPC Film |

MRX
Technicolor has the industry’s most prominent portfolio of VFX brands, including MPC, MILL FILM and MR. X. Our VFX studios add VISUAL WONDER and CREATIVE EXPERTISE to film and episodic.

WE ARE A FAMILY OF
CREATIVE VFX BRANDS

Each studio brings their own unique approach to the market while leveraging Technicolor’s R&D teams to harness the new technological demands of compelling
What is Virtual Production?
VR SCOUTING
MOCAP
VIRTUAL CAMERA
LAYERING
Phases of Virtual Production

1) Scout the environment, find shots, dress your set
2) Capture performance, add animations
3) Shoot virtual cameras
4) Iterate and layer
LED WALLS
LED Walls

disguise

ncam®
Rendering Challenges

1) Advanced lighting for DP on set
2) Good approximation of final render
3) Final pixels in real time
AREA LIGHTS
DEPTH OF FIELD
Not enough

- Need more parity with lighting in post
- Need raytracing:
  - Live link with a path tracer
  - Raytracing in engine
Live-Link with Prism
S9197 – Prism & RTX

Victor Yudin, Lead Software Developer, Mill Film

Wednesday, Mar 20, 9:00 AM - 09:50 AM
SJCC Room 230B (Concourse Level)
Live link with RenderMan XPU

- Same framework as Prism (Millefiori)
- Prism is a delegate for Hydra, can replace with RenderMan delegate
- USD enables loading the scene both in engine and in Millefiori
- USD Shade for transferring materials, but still needs lots of work (MaterialX, MDL)
Raytracing in Unity HDRP
DXR INTEGRATION DETAILS
The goal:
- Leverage DXR to improve the quality of our renders
- Different FPS targets based on the use case

The challenges:
- New to DX12 and DXR
- Small team
- Unity low level integration
- New tech, with possible bugs to deal with
AMBIENT OCCLUSION
First effect implemented
Plugin: boils down to a C interface dll
Faced the first issues with Unity integration:

• Data marshalling
• Synchronization
• Delayed reaction of editor events
• Issue with resources lifetime
• Integration of gameworks denoisers
AO: TIMINGS

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<th>16 spp</th>
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<td>denoise</td>
<td>2.1</td>
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HDRP INTEGRATION

- Unity use an AO renderer manager
- Harder to integrate without drilling down in the call stack
- Opted for simpler blit over Unity texture
- Render moves on as usual
- No tricks for increasing contrast
SOFT SHADOWS
SOFT SHADOWS

- Heavy use of area lights
- Previously using in house solution with raymarched depth map.
HDRP INTEGRATION

- Did not find an easy way to get screen-space shadows
- Modified HDRP shader binding extra shadow map
- Multiply final lighting value by shadow
- Crude approximation
- Needed to extract texture from denoiser to C# texture to use it in Unity
Soft Shadows

Experimenting with several ways to combine multiple area lights
Timings

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<td>4.01</td>
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Shadows

- 16 spp
- 4 spp
- 1 spp

Legend: blue = raytracing, orange = denoise
Reflections

Most tricky effect to deal with:
• No way to evaluate a Unity shader on hit
• Marshalling textures and textures lifetime
• Lighting
Reflections

- One bounce only
- No texture marshalling
- Investigating bindless textures
- Only tracking directional light for simple Phong model
- Extra shadow ray
Timings

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Reflections
RECAP

• DXR allowed us to step up quality of renders quite a bit
• Steep learning curve for DX12 and DXR
• Tricky Unity integration
  • Resource life time
  • Editor events
  • Render loop sync
WHAT IS NEXT:

• Investigate new Unity DXR integration
  • Focus more on effects rather than plumbing
  • Performance, performance, performance
Special thanks to the twitter community for RTX and game dev help:

Matt Pettineo - @MyNameIsMJP
Alex Tardif - @longbool
Peter Morley - @Biblo_Shwag
Sebastian Altonen - @SebAltonen
Sebastien Lagarde - @SebLagarde
Kostas Anagnostou - @KostasAAA
Jesper Flicks - @catlikecoding

Special thanks to Nvidia and the outstanding Microsoft Pix Team
THANK YOU!
THE ADVENTURE IS ABOUT TO BEGIN...
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