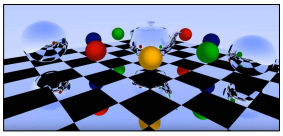
1

Ray Tracing Pipeline Data Structure (RTPDS)

Oregon State University
Mike Bailey
mjb@cs.oregonstate.edu

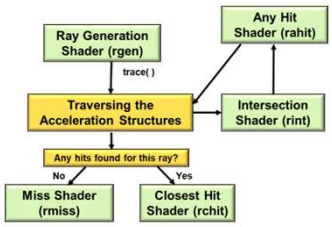


Oregon State University
Computer Graphics

1

2

Ray Trace Pipeline Shader Stages



New shader stage names:

```
VK_SHADER_STAGE_RAYGEN_BIT
VK_SHADER_STAGE_ANY_HIT_BIT
VK_SHADER_STAGE_CLOSEST_HIT_BIT
VK_SHADER_STAGE_MISS_BIT
VK_SHADER_STAGE_INTERSECTION_BIT
VK_SHADER_STAGE_CALLABLE_BIT
```

Oregon State University
Computer Graphics

2

3

Ray Trace Pipeline Data Structure

```
VkPipelineLayout            RayTracePipelineLayout;
VkPipeline                  RayTracePipeline;

VkPipelineLayoutCreateInfo                  vplci;
        vplci.sType                         = VK_STRUCTURE_TYPE_PIPELINE_LAYOUT_CREATE_INFO;
        vplci.pNext                         = nullptr;
        vplci.flags                         = 0;
        vplci.setLayoutCount                = 1;
        vplci.pSetLayouts                   = &descriptorSetLayout;        // as usual
        vplci.pushConstantRangeCount        = 0;                           // as usual
        vplci.pPushConstantRanges           = nullptr;                     // as usual

result = vkCreatePipelineLayout( LogicalDevice, IN &vplci, nullptr, OUT &RayTracePipelineLayout);


VkRayTracingPipelineCreateInfo                  vrtpci;
        vrtpci.sType                        = VK_STRUCTURE_TYPE_RAY_TRACING_PIPELINE_CREATE_INFO;
        vrtpci.pNext                        = nullptr;
        vrtpci.flags                        = 0;
        vrtpci.stageCount                   = << # of shader stages in the ray-trace pipeline >>
        vrtpci.pStages                      = << array of VkPipelineShaderStageCreateInfo >>
        vrtpci.groupCount                   = << # of shader groups in the ray-trace pipeline >>
        vrtpci.pGroups                      = << an array of VkRayTracingShaderGroupCreateInfo >>
        vrtpci.maxRecursionDepth            = MAXRECURSIONS;               // at least 1, perhaps more
        vrtpci.layout                       = RayTracePipelineLayout;
        vrtpci.pDynamicState                = nullptr;
        vrtpci.basePipelineHandle           = VK_NULL_HANDLE;
        vrtpci.basePipelineIndex            = 0;

result = vkCreateRayTracingPipelines( LogicalDevice, VK_NULL_HANDLE, VK_NULL_HANDLE, 1, IN &vrtpci,
        PALLOCATOR, OUT &RayTracePipeline);
```

4

An Array of VkPipelineShaderStageCreateInfo

```
VkPipelineShaderStageCreateInfo                 vpssci[2];
        vpssci[0].sType = VK_STRUCTURE_TYPE_PIPELINE_SHADER_STAGE_CREATE_INFO;
        vpssci[0].pNext = nullptr;
        vpssci[0].flags = 0;
        vpssci[0].stage = VK_SHADER_STAGE_CLOSEST_HIT_VERTEX_BIT;
        vpssci[0].module = closestHitShader;
        vpssci[0].pName = "main";
        vpssci[0].pSpecializationInfo = (VkSpecializationInfo *)nullptr;

        vpssci[1].sType = VK_STRUCTURE_TYPE_PIPELINE_SHADER_STAGE_CREATE_INFO;
        vpssci[1].pNext = nullptr;
        vpssci[1].flags = 0;
        vpssci[1].stage = VK_SHADER_STAGE_MISS_BIT;
        vpssci[1].module = missShader;
        vpssci[1].pName = "main";
        vpssci[1].pSpecializationInfo = (VkSpecializationInfo *)nullptr;

. . .
```

Oregon State University
Computer Graphics

5

An Array of VkRayTracingShaderGroupCreateInfo

```
VkRayTracingShaderGroupCreateInfo                vrtsgci[2];            // one for each shader group
        vrtsgci0].sType = VK_STRUCTURE_TYPE_RAY_TRACING_SHADER_GROUP_CREATE_INFO;
        vrtsgci[0].pNext = nullptr;
        vrtsgci 0].type = VK_RAY_TRACING_SHADER_GROUP_TYPE_TRIANGLES_HIT_GROUP;
        vrtsgci[0].generalShader = << index of Miss Shader in pStages >>;
        vrtsgci[0].closestHitShader = << index of Closest Hit Shader in pStages >>;
        vrtsgci[0].anyHitShader = << index of Any Hit Shader in pStages >>
        vrtsgci[0].pShaderGroupCaptureReplayHandle = (VkSpecializationInfo *)nullptr;

. . .
```

If type is:

vrtsgci 0].type = **VK_RAY_TRACING_SHADER_GROUP_TYPE_PROCEDURAL_HIT_GROUP**;

Then need to provide an:

vrtsgci[0].intersectionShader = …

Oregon State University
Computer Graphics

5