Getting Information Back from the Graphics System

Mike Bailey
mjb@cs.oregonstate.edu

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Occlusion Queries count the number of fragments drawn between the `vkCmdBeginQuery` and the `vkCmdEndQuery` that pass both the Depth and Stencil tests. This is commonly used to see what level-of-detail should be used when drawing a complicated object.

Some hints:
- Don’t draw the whole scene – just draw the object you are interested in.
- Don’t draw the whole object – just draw a simple bounding volume at least as big as the object.
- Don’t draw the whole bounding volume – cull away the back faces (two reasons: time and correctness).
- Don’t draw the colors – just draw the depths (especially if the fragment shader is time-consuming).

```cpp
uint32_t fragmentCount;
result = vkGetQueryPoolResults( LogicalDevice, occlusionQueryPool, 0, 1, sizeof(uint32_t), &fragmentCount, 0, VK_QUERY_RESULT_WAIT_BIT );

vkCmdCopyQueryPoolResults( CommandBuffer, occlusionQueryPool, 0, 1, buffer, 0, 0, VK_QUERY_RESULT_WAIT_BIT );
```

Pipeline Statistics Queries count how many of various things get done between the `vkCmdBeginQuery` and the `vkCmdEndQuery`.

```cpp
uint32_t counts[NUM_STATS];
result = vkGetQueryPoolResults( LogicalDevice, statisticsQueryPool, 0, 1, sizeof(uint32_t), &counts, 0, VK_QUERY_RESULT_WAIT_BIT );

vkCmdCopyQueryPoolResults( CommandBuffer, occlusionQueryPool, 0, 1, buffer, 0, 0, VK_QUERY_RESULT_WAIT_BIT );
```

```cpp
VK_QUERY_PIPELINE_STATISTIC_INPUT_ASSEMBLY_VERTICES_BIT
VK_QUERY_PIPELINE_STATISTIC_INPUT_ASSEMBLY_PRIMITIVES_BIT
VK_QUERY_PIPELINE_STATISTIC_VERTEX_SHADER_INVOCATIONS_BIT
VK_QUERY_PIPELINE_STATISTIC_GEOMETRY_SHADER_INVOCATIONS_BIT
VK_QUERY_PIPELINE_STATISTIC_GEOMETRY_SHADER_PRIMITIVES_BIT
VK_QUERY_PIPELINE_STATISTIC_CLIPPING_INVOCATIONS_BIT
VK_QUERY_PIPELINE_STATISTIC_CLIPPING_PRIMITIVES_BIT
```

Timestamp Queries count how many nanoseconds of time elapsed between the `vkCmdBeginQuery` and the `vkCmdEndQuery`.

```cpp
uint64_t nanosecondsCount;
result = vkGetQueryPoolResults( LogicalDevice, timestampQueryPool, 0, 1, sizeof(uint64_t), &nanosecondsCount, 0, VK_QUERY_RESULT_64_BIT | VK_QUERY_RESULT_WAIT_BIT );

vkCmdCopyQueryPoolResults( CommandBuffer, timestampQueryPool, 0, 1, buffer, 0, 0, VK_QUERY_RESULT_64_BIT | VK_QUERY_RESULT_WAIT_BIT );
```

The `vkCmdWriteTimeStamp()` function produces the time between when this function is called and when the first thing reaches the specified pipeline stage. Even though the stages are “bits”, you are supposed to only specify one of them.

```cpp
vkCmdWriteTimeStamp( CommandBuffer, pipelineStages, timestampQueryPool, 0 );
```

```cpp
VK_PIPELINE_STAGE_TOP_OF_PIPE_BIT
VK_PIPELINE_STAGE_DRAW_INDIRECT_BIT
VK_PIPELINE_STAGE_VERTEX_INPUT_BIT
VK_PIPELINE_STAGE_VERTEX_SHADER_BIT
VK_PIPELINE_STAGE_TESSELLATION_CONTROL_SHADER_BIT
```

The `vkCmdGetQueryPoolResults()` function is used to get the results of the queries.

```cpp
vkCmdGetQueryPoolResults( CommandBuffer, queryPool, 0, 1, sizeof(Query), &queryResults, 0, VK_QUERY_RESULT_WAIT_BIT );
```