

Compute Shaders

CSCI 4239/5239

**Advanced Computer Graphics
Spring 2024**

Purpose of Compute Shaders

- Lightweight general purpose computing
 - Perform arbitrary computations outside of the vertex/fragment paradigm
 - Access to textures and buffers
 - Does not require additional drivers or run time
 - Easier initialization and invocation than OpenCL
- Requires OpenGL 4.3
 - Example 20 requires GL 4.4

Using the Compute Shader

- Compiles just like other shaders
 - CreateShader(prog, GL_COMPUTE_SHADER, file)
 - Link only one shader into program
- Bind and access buffers
 - glBindBuffer(GL_SHADER_STORAGE_BUFFER, x)
 - glBufferData()
 - Set size and type of buffer
 - glMapBufferRange()
 - Access to buffer on CPU
 - glUnmapBuffer(GL_SHADER_STORAGE_BUFFER);

Running the Compute Shader

- `glUseProgram(compute_shader)`
 - Select program
- `glDispatchCompute(Nx,Ny,Nz)`
 - Run Nx,Ny,Nz groups
- `glDispatchComputeGroupSize(Nx,Ny,Nz,x,y,z)`
 - Set both number of groups and work groups
- `glMemoryBarrier(GL_SHADER_STORAGE_BARRIER_BIT)`
 - Wait for compute shaders

Pre-set Variables in Shader

- `uvec3 gl_NumWorkGroups`
- `uvec3 gl_WorkGroupSize`
- `uvec3 gl_WorkGroupID`
- `uvec3 gl_LocalInvocationID`
- `uvec3 gl_GlobalInvocationID`
- `uvec3 gl_LocalInvocationIndex`
- `gl_GlobalInvocationID =`
`gl_WorkGroupID * gl_WorkGroupSize + gl_LocalInvocationID`
- `gl_LocalInvocationIndex =`
`gl_LocalInvocationID.z * gl_WorkGroupSize.y * gl_WorkGroupSize.x +`
`gl_LocalInvocationID.y * gl_WorkGroupSize.x +`
`gl_LocalInvocationID.x`