

NANYANG
TECHNOLOGICAL
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CZ3003 - Software System Analysis & Design

Performance Test Results

Project Name: Game of Thrones

Group Name: Team TWO

Lab group: TDDP1

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1 Load Testing

1.1 Non-Functional Requirements

Requirements are tested assuming a load of 1 user. Average time taken is calculated as the mean of 15 runs.

Non-Functional Requirements	Average Time Taken (in seconds)	Status
Query database within 0.5 second	0.025	Pass
Authenticate student within 1 second	0.063	Pass
Register student into database within 1 second	0.042	Pass
Load question within 5 seconds	0.129	Pass
Verify answer within 1 second	0.075	Pass
Update database on completed quest within 5 seconds	0.124	Pass
Update leaderboard within 5 second	0.223	Pass
Update profile within 2 seconds	1.655	Pass
Send PvP within 1 second	0.257	Pass

1.2 Additional Performance Test

1.2.1 Scene Load Time

Scene	Time Taken (in seconds)
Verification Scene	3.859
Lobby Scene	10.172
Quest 1 Scene	9.791
Quest 2 Scene	14.153
Quest 3 Scene	6.411
Quest 4 Scene	5.133
Quest 5 Scene	12.207

1.2.2 Game Profiling

Unity Profiler is run on all scenes in EditMode to check for CPU and memory usage breakdown. Specifically we will look at the following for further analysis:

- **CPU Usage:** Measures where time is spent on the application. Time taken for each action across different frames is shown by the colored areas on the graph.
- **Scene Rendering:** Display statistics and information on what the CPU/GPU do to render the scene.
- **Memory Usage:** Measure the breakdown of memory allocated to the application.

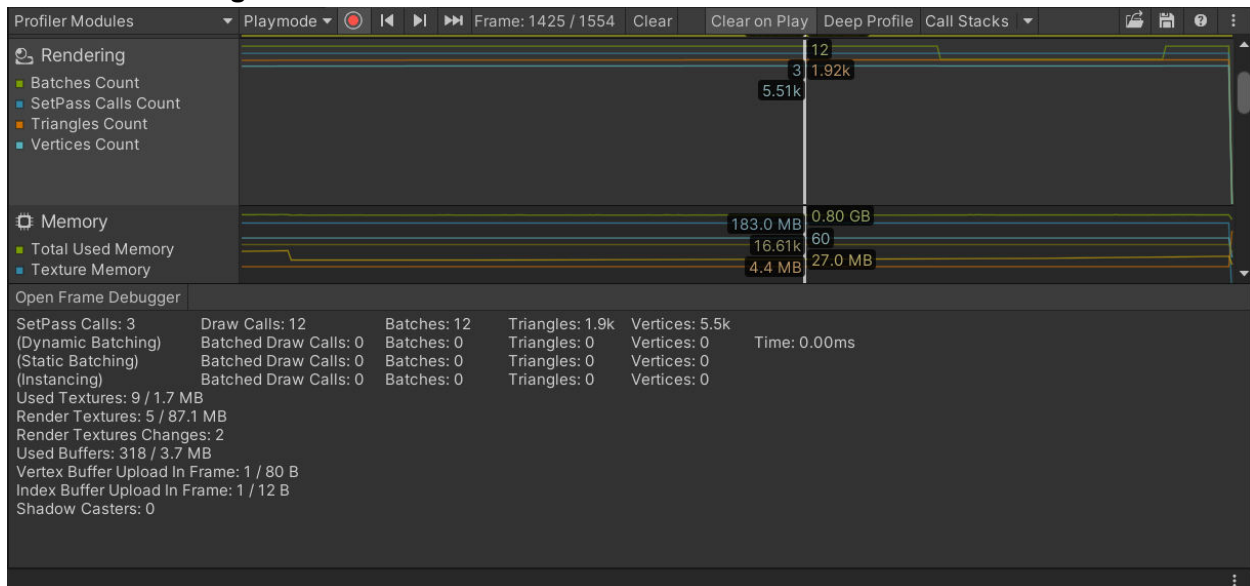
1.2.2.1 Verification Scene

CPU Usage



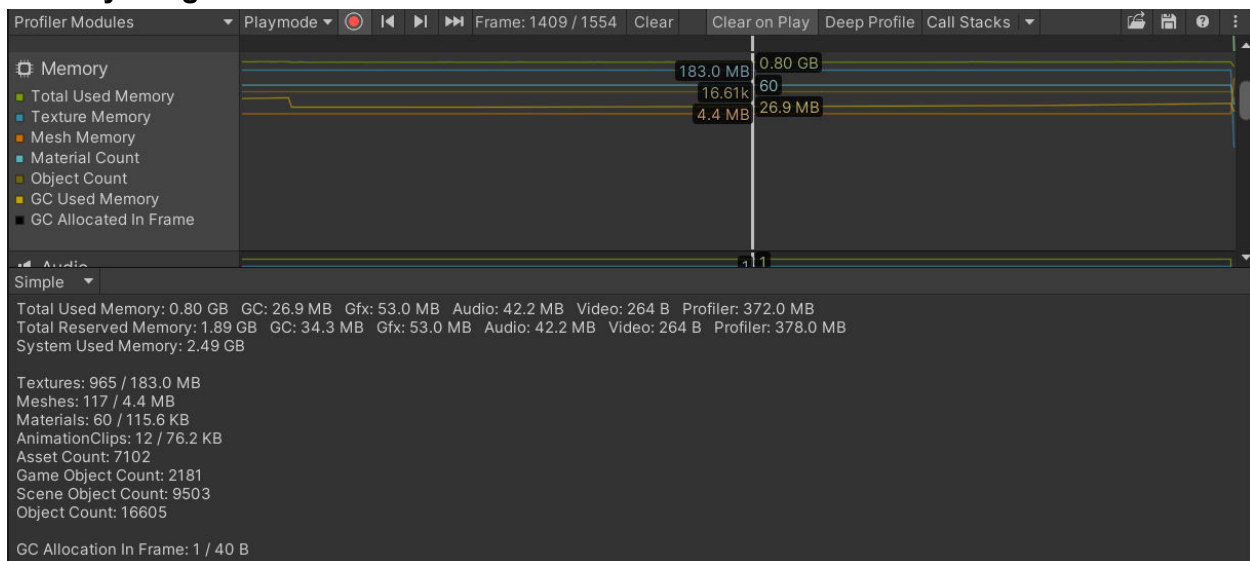
Eliminating the EditorLoop render time, the scene is able to render at 60fps since all frames lie below 16ms.

Scene Rendering



Small number of draw calls and batches are required since the scene consists only of a canvas with few scripts and textures/objects deployed. Minimal effort is required by the CPU and GPU to run this scene.

Memory Usage



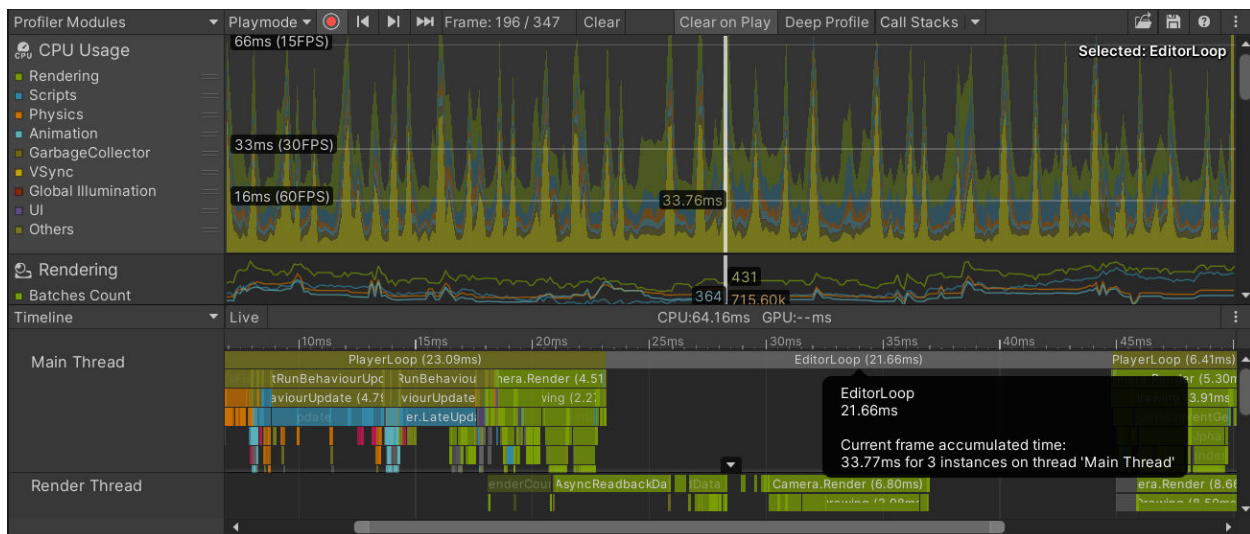
Given that this is a simple scene, memory usage, meshes and material count/memory is comparatively lower to that of the scenes below. However, design of the canvases requires various textures and hence recorded a high texture count of 965.

1.2.2.2 Quest 1 Scene

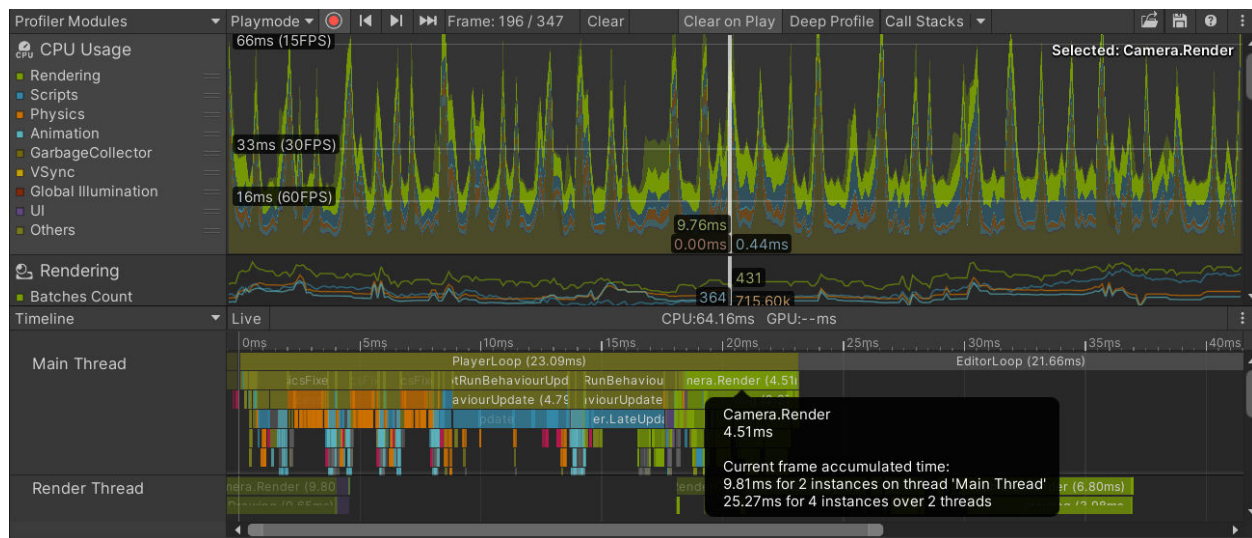
CPU Usage



PlayerLoop is the total time taken for the game to render this particular frame - 196/347 (23.09ms) and measure the performance of the game. It includes the scripts, rendering, animations and all other engine functions.



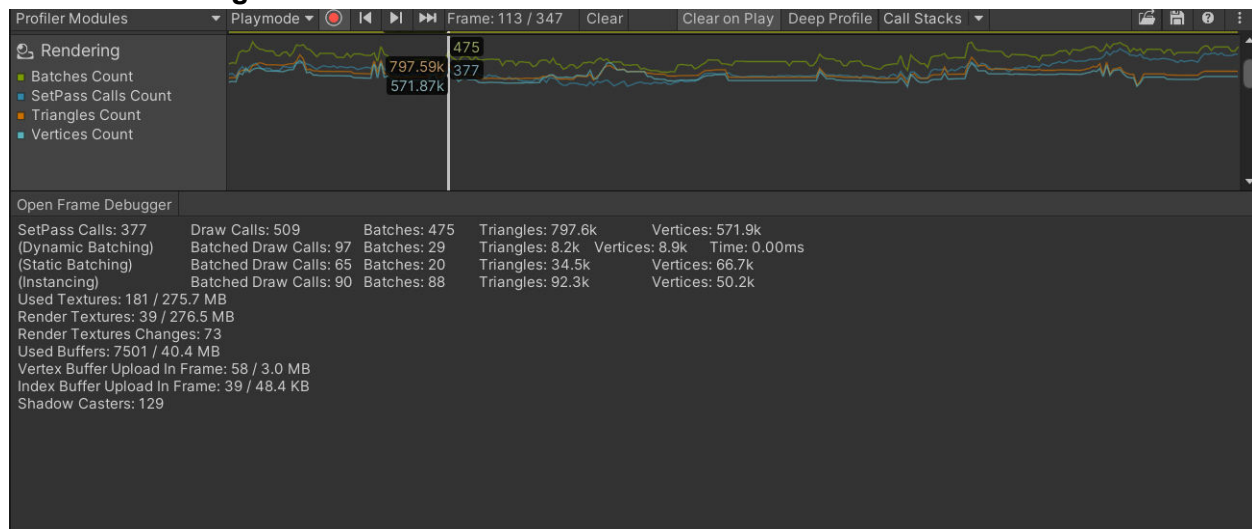
Since the profiler was run on Edit mode, and EditorLoop measures the total time used by Unity Editor for this frame - 196/347 (33.77ms).



Time taken for rendering the camera for this frame (196/347) is 25.27ms. Time taken for these actions across different frames is shown by the green areas on the graph.

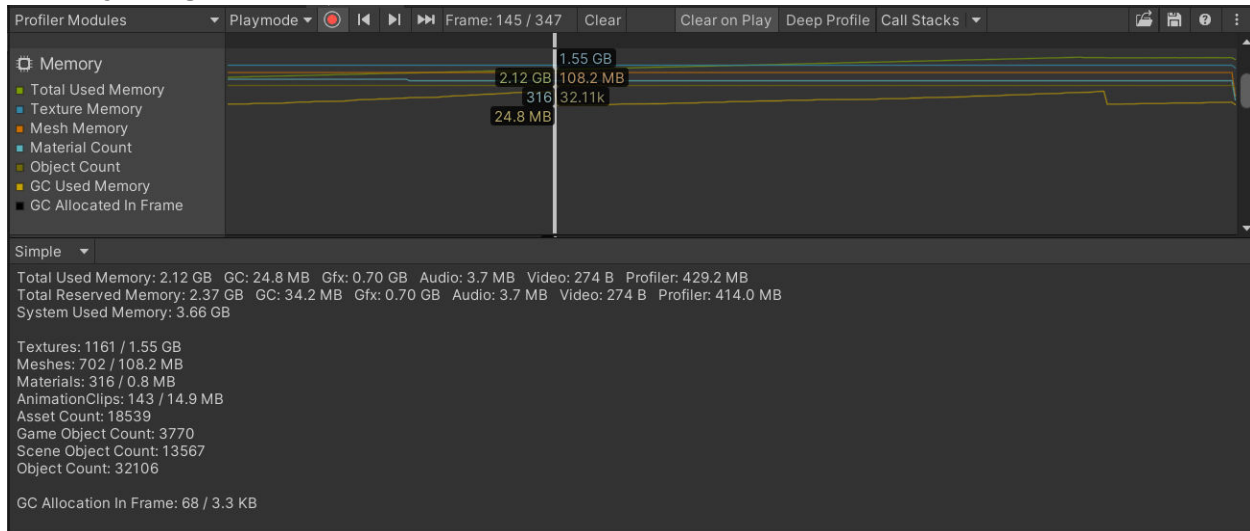
In general, eliminating the EditorLoop CPU usage, the scene was rendered at roughly 30fps since most of the frames' render time, when under PlayerLoop, lies below 33ms.

Scene Rendering



As seen in the debugger, 181 textures/275.7MB memory and 39 RenderTextures/276.5MB were used for frame 113/347.

Memory Usage

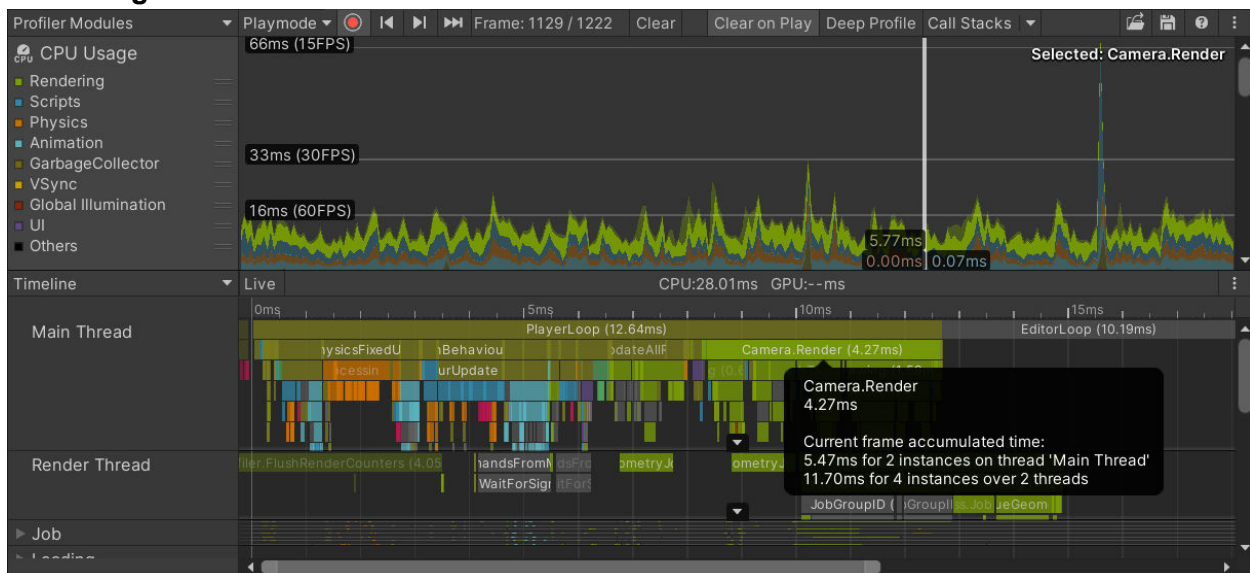


From the statistics, the total used memory that is tracked is 2.12GB, total reserved memory for tracking and pool allocation is 2.37GB, and the system used memory required by the scene is 3.66GB. Since PC RAM is generally at 4GB, 3.66GB will be able to utilise the RAM and run sufficiently fast. Statistics are rather consistent throughout the playmode.

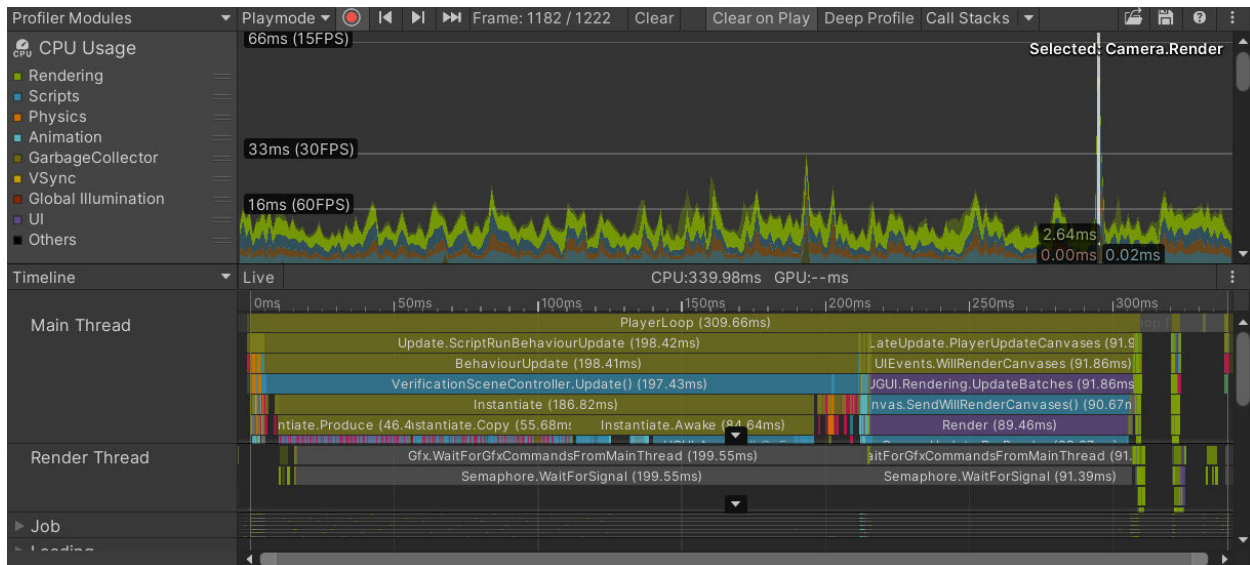
The total texture, mesh and material count and memory used for the scene is also measured as shown.

1.2.2.3 Quest 2 Scene

CPU Usage

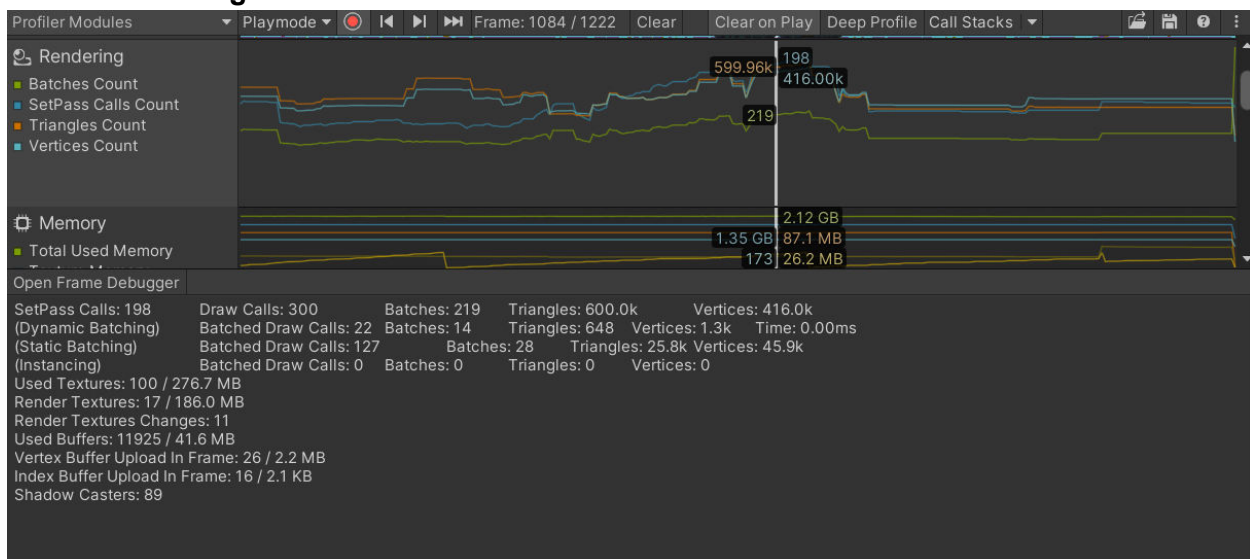


We can see that almost the largest proportion of the time was spent on Camera.Render for the map camera while rendering the PlayerLoop. Eliminating the EditorLoop's CPU usage, almost all frames lie below 33ms as shown and thus the scene can be rendered at 30fps.



An anomaly occurred at frame 1182/1222, when the player was attacked. Much longer time was required to call on `Update.ScriptRunBehaviourUpdate` and `PostLateUpdate.PlayerUpdateCanvases` since the event is an uncommon one.

Scene Rendering



From the graph, more draw calls and batches are required to instantiate the scene. Towards the middle, the player was first triggered to throw Firebolts, resulting in the increase in graph trend.

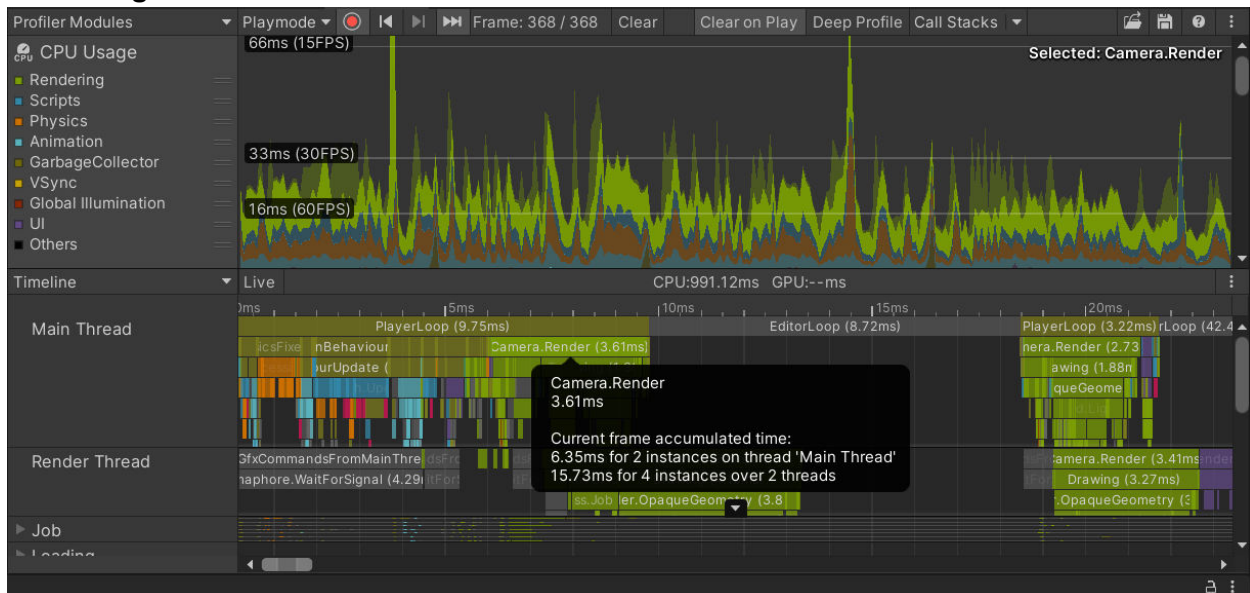
Memory Usage



From the statistics, the total used memory that is tracked is 2.12GB, total reserved memory for tracking and pool allocation is 2.62GB, and the system used memory required by the scene is 4.08GB.

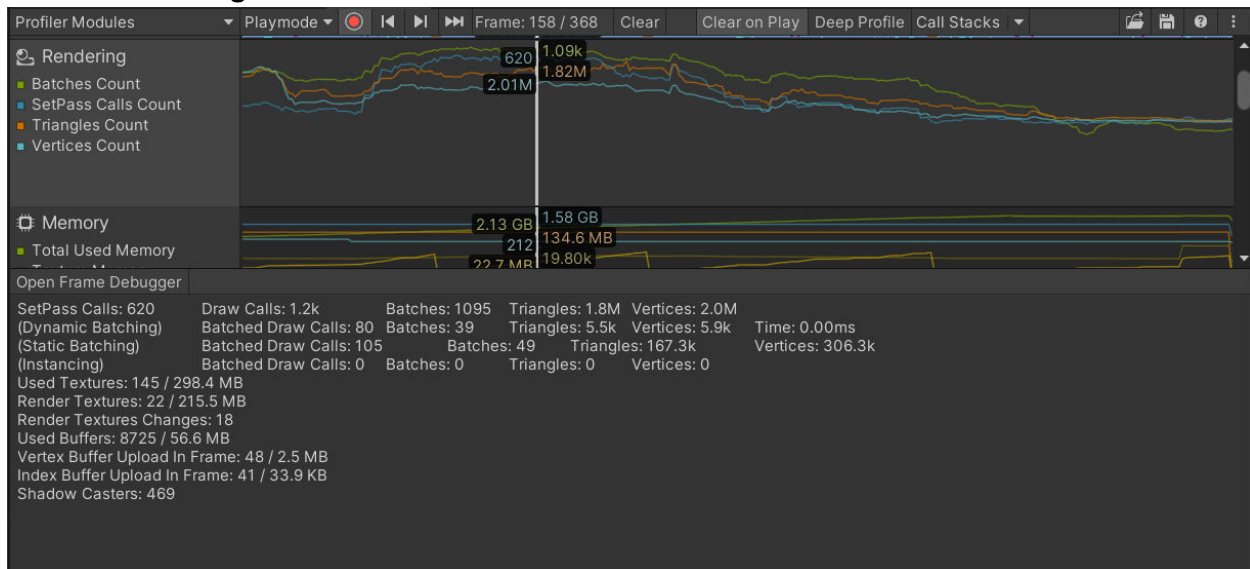
1.2.2.4 Quest 3 Scene

CPU Usage



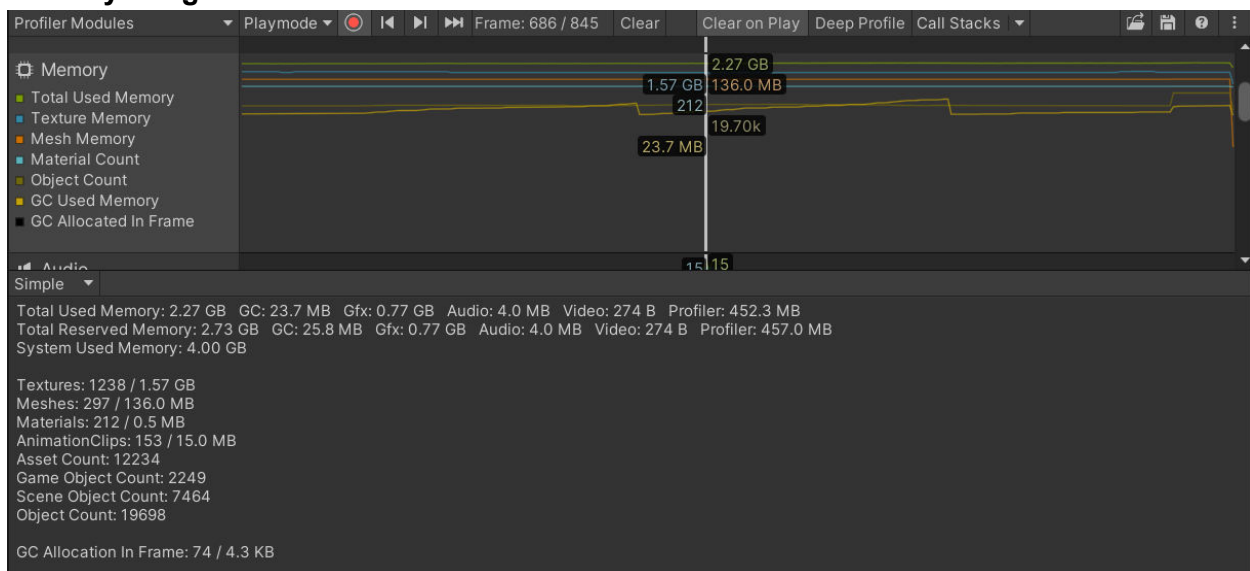
Similar to Quest 2, Camera.Render took almost half the render time in PlayerLoop. However, performance for this scene is worse as it is only rendering at 15fps, with most of the frames falling below 66ms. This is likely due to more computation required for the Camera.Render in this scene.

Scene Rendering



Large number of draw calls and batches implies there are many calls to the graphics API to draw objects as individual or batches.

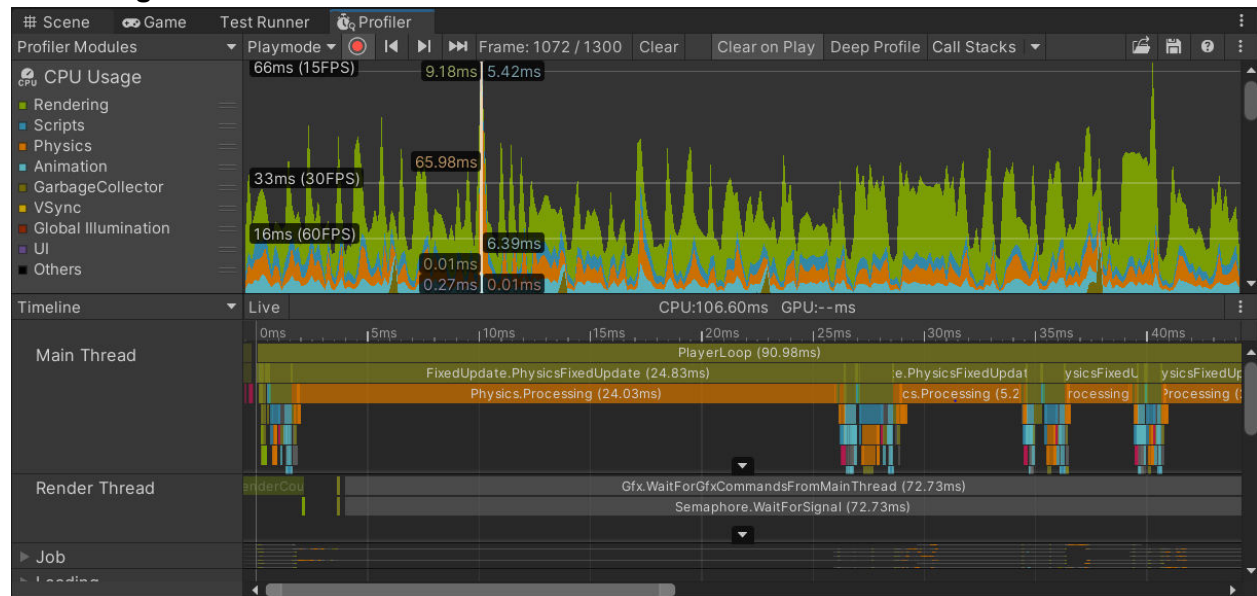
Memory Usage



From the statistics, the total used memory that is tracked is 2.27GB, total reserved memory for tracking and pool allocation is 2.73GB, and the system used memory required by the scene is 4.00GB.

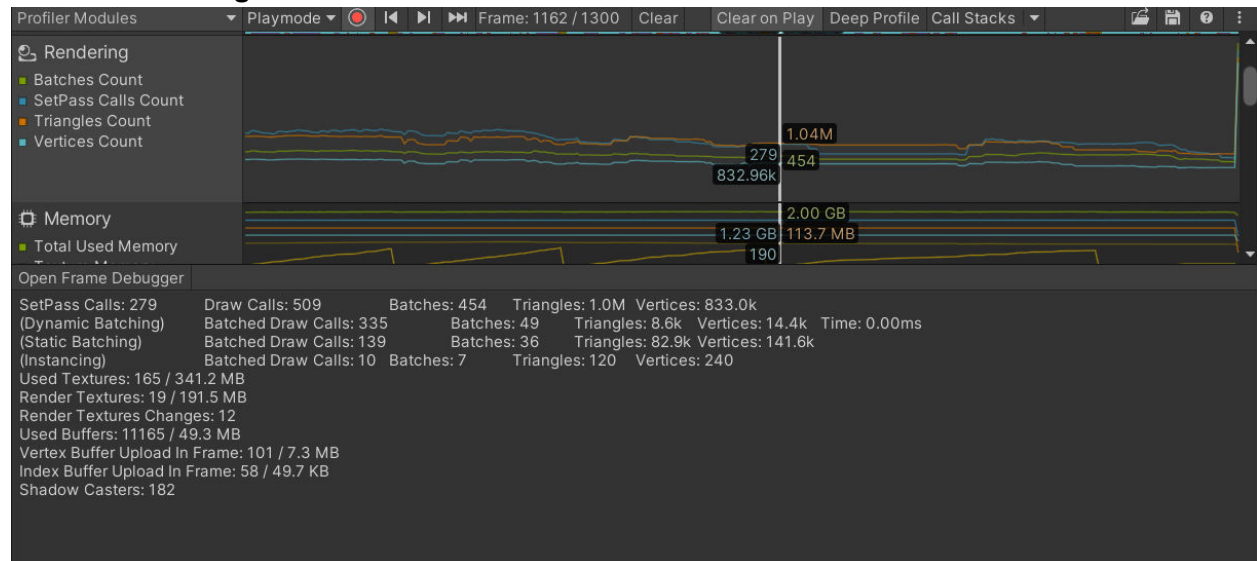
1.2.2.5 Quest 4 Scene

CPU Usage



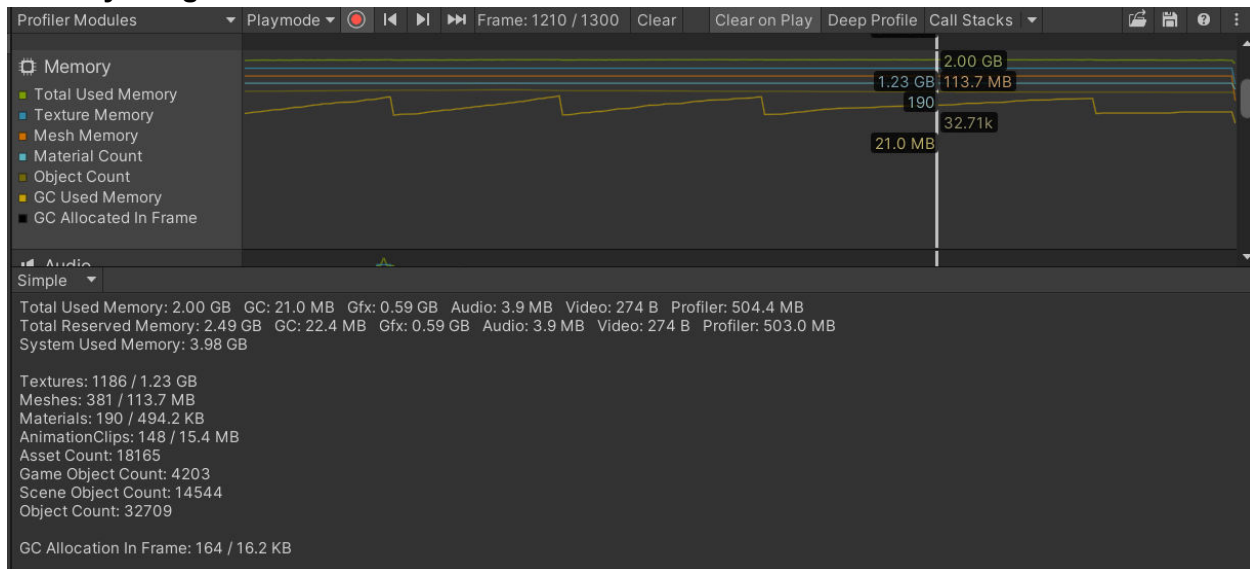
Scene renders at 15fps as seen where all frames lie below 66ms. For frame 1072/1300, it can be seen that Physics Processing took an exceptionally longer time as compared to the rest of the frames.

Scene Rendering



Render statistics for Scene 4 is comparatively lower than that of the previous quest scenes.

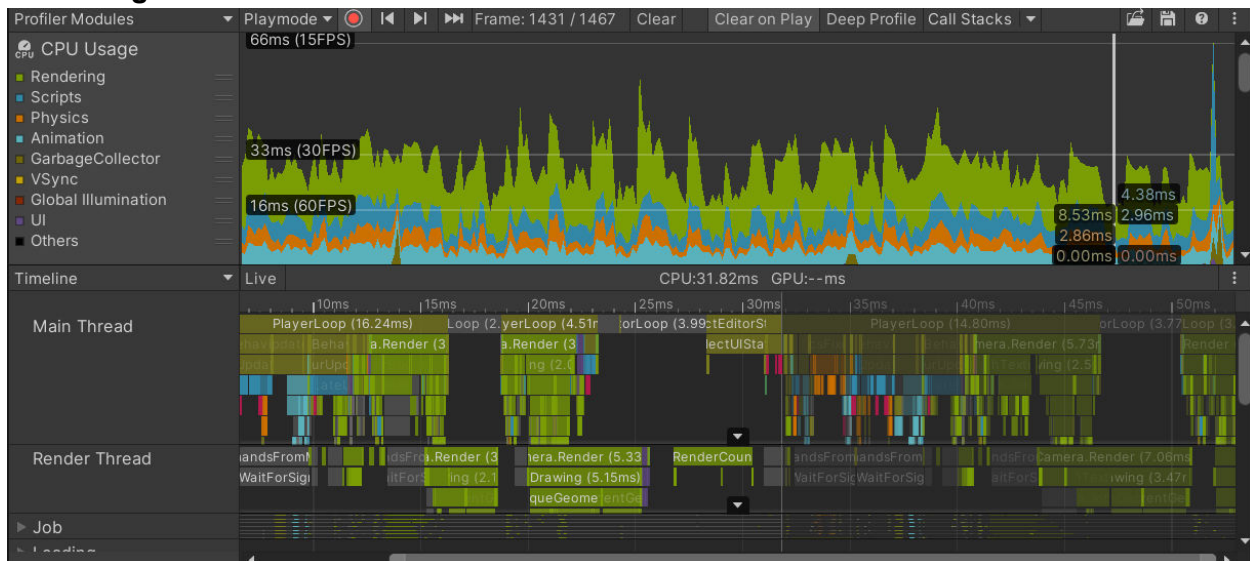
Memory Usage



From the statistics, the total used memory that is tracked is 2.00GB, total reserved memory for tracking and pool allocation is 2.49GB, and the system used memory required by the scene is 3.98GB.

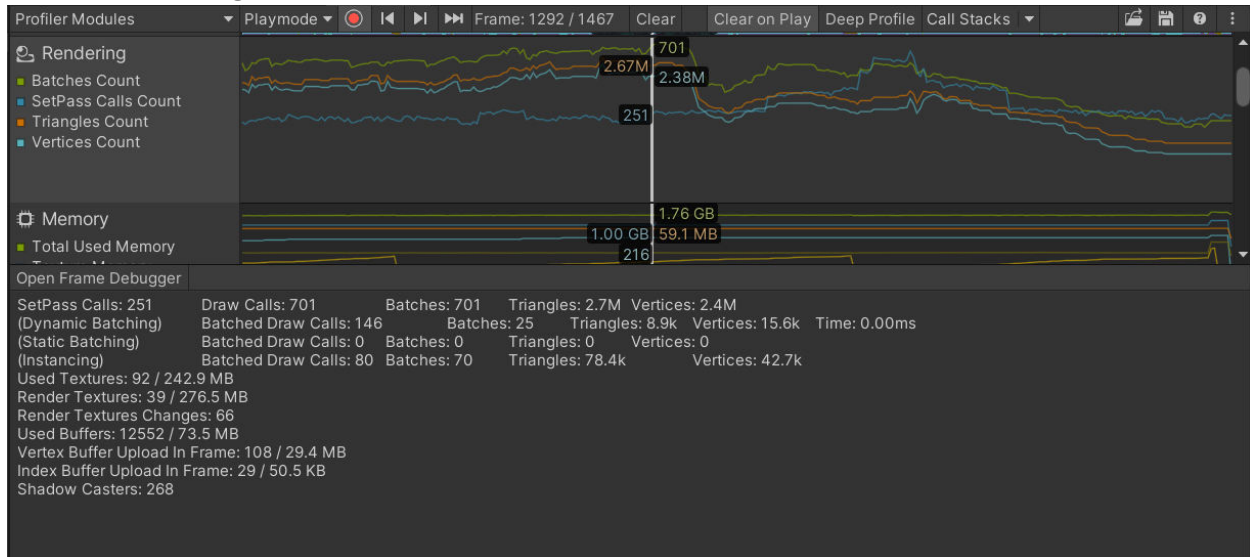
1.2.2.6 Quest 5 Scene

CPU Usage

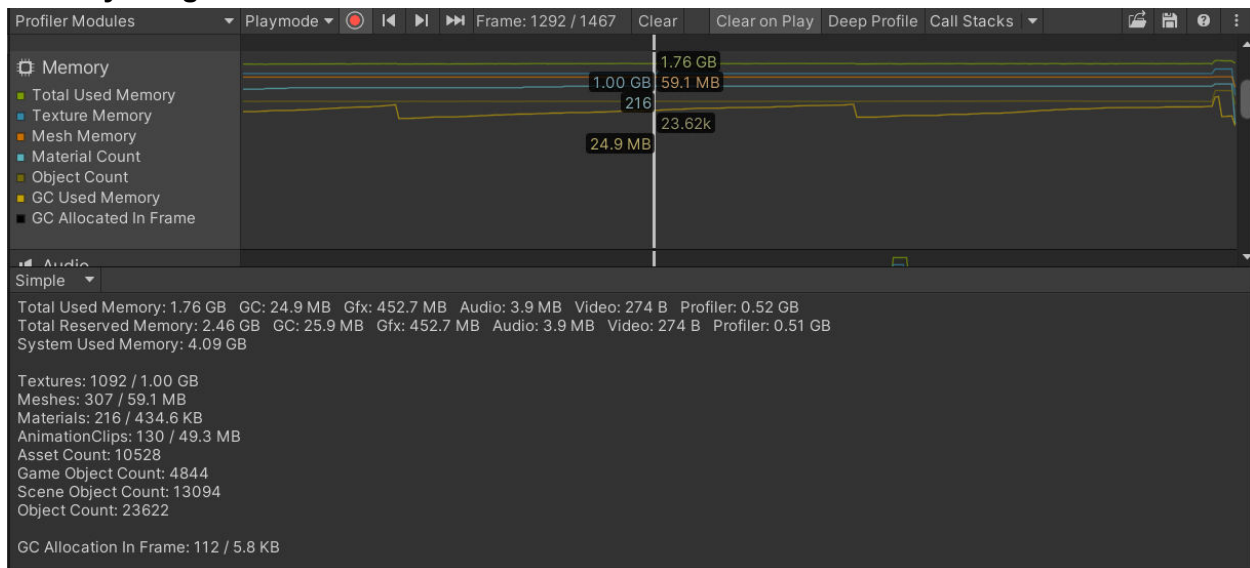


Similar to Quest 3 and 4, scene renders at 15 fps. These might be due to more complicated game objects and scripts to be deployed, resulting in overall longer computation time in PlayerLoop.

Scene Rendering



Memory Usage



From the statistics, the total used memory that is tracked is 1.76GB (lowest), total reserved memory for tracking and pool allocation is 2.46GB, and the system used memory required by the scene is 4.09GB (highest).

2 Stress Testing

2.1 Non-Functional Requirements

Non-Functional Requirements	Average Time Taken (in seconds)	Status
Serve 100 students at any point in time		Pending (100 players required for test run which is not possible given limited resources)
Login authentication from database of 100 records within 1 second	0.358	Pass
Retrieve questions from database of 1000 questions within 5 second	0.567	Pass

*Dummy data is removed after test