Technical Report

Extrapolate and Conquer

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Extrapolate and Conquer

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1 Introduction

The aim of this project was to develop a computer graphics application combining several state-of-the-art techniques into one beautiful and intelligent world.

2 System Core

We built and uses an Entity System as an underlying game engine framework. The idea behind an entity system is that objects should be treated as pure aggregations of data containers, with game logic being separated from objects all together. Instead of having deep class hierarchies and chained method calls, logic for managing specific components is batched on all such components in the system. This provides some advantages over other approaches such that the architecture becomes more flexible and extendable. It is clearer how to build functionality and especially where. Another advantage from the batching is the possibility of much higher performance (maximizing caching and minimizing cache misses) as well as simplifying parallelism of logic processing.

2.1 Entity System

An Entity System consists of three main parts: Entities, Components and Systems. An Entity is simply a label or identifier of an object. A Component is a pure data containers, and each entity has a collection of none to several different components. A System consist of logic for working with primarily one, but sometimes several, components. So, an object is an entity label and a collection of components that belong to it. The object is updated by different systems performing tasks on the components. A simple example used in this project is seen in figure **??**.

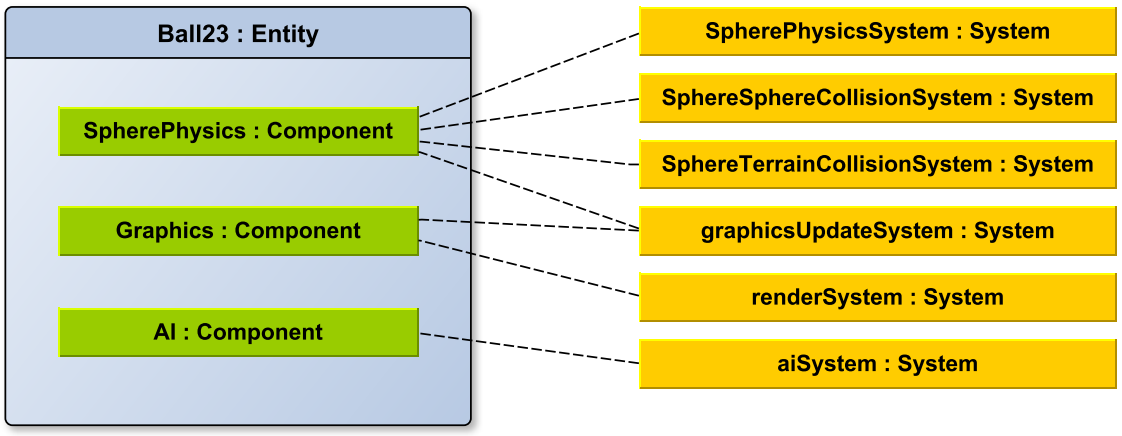


Figure 2.1: Caption

(TODO: reformulera och skriv nedan mer flytande och omarbetat)
* The idea behind: Systems perform on ALL components of a certain type, which is fetched from the EntityManager.
* Our system allows for components to require other components. This means that systems which work on multiple components can be proven to always work by fetching the component which require the others. The require check is performed at compile time and code is generated to handle the specific requirement-tree specified. The program writes part of itself to be maximum efficient and robust, by specifications by the developer in the source code.
* Easy to use (a natural work flow of what goes where and how to solve problems. minimal overhead to use the system), easy to maintain, easy to extend, extremely efficient, trivial to parallelize calculations, verifies consistency at compile time...

2.2 Rendering

2.3 Physics

3 Graphics

Graphics graphics.

3.1 Generating a World

How to world

3.1.1 Sky

The sky is achieved using a high-resolution texture of a sky mapped to a skybox. The mathematical location of the sun is placed as close as possible to the sun appearing in this texture. This gives shadows and shading a natural feel. The texture has been manually modified at the horizon to fade towards a shadowish gray color. The color is the same as the one objects are distance-fogged with. This makes the sky melt into the ocean in a very nice way.

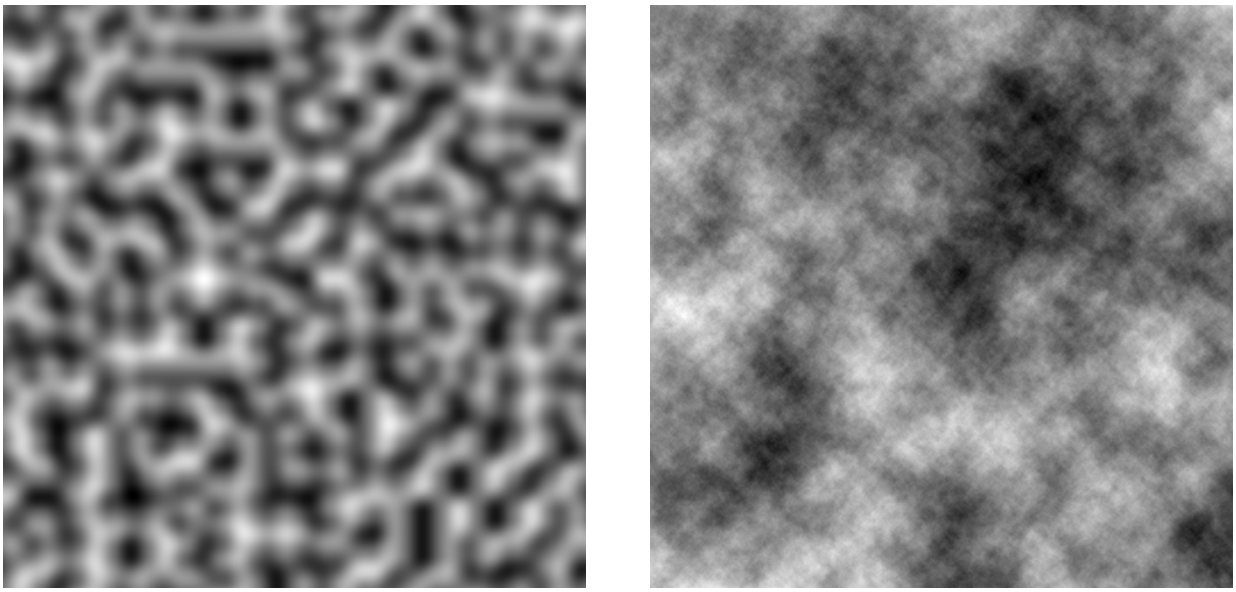
3.1.2 Ocean

Normal-mapped square

3.1.3 Terrain

The terrain is generated by sampling a noise function and translating its value into a height for the current vertex. The noise in this case originates from a Simplex function. However, to get a realistically looking terrain one it is not sufficient to sample this function only once for every vertex.

Fractional Brownian Motion is calculated by sampling the Simplex function at different frequencies and calculating a weighted sum over the samples [1]. The result is a nice looking height map.



(a) Height map generated from single-octave simplex noise (b) Height map generated with Fractional Brownian Motion

Figure 3.1: *Comparison of noise functions*

3.1.4 Content

Trees and rocks

3.2 Visual Effects

Boom hacka lacka

3.2.1 Shadows

Shadows are one those things that can make a scene really come to life.

3.2.2 Fog

Misty ocean

3.2.3 Normal Mapping

Are there really ocean waves?

4 Artificial Intelligence

Ai ai ai ai ai ai ai ai.

5 Conclusions

Awesome

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