

COMP 4501 - Final Project Proposal + Architecture

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1.1 Description of game

Elemental Engagements is inspired by the RTS game *They are Billions*. The game is an asymmetrical single player RTS, where the player builds and defends against waves of enemies. The player begins the game in the center of the map with a few units and a town center. The objective of the game is to defend the town center as long as possible. To this end, the player can gather resources, train units and build defenses to protect their town center.

There are three classes of combat units - Solder, Ranger, Wizard - which are strong against each other in a rock-paper-scissors triangle. Additionally, each of the combat units can be enchanted with one of three elemental energies - Fire, Water, Nature - that also follow this triangle. Part of the strategy is to create an army of varied units that cover each other's weaknesses.

The player can also build a 4th type of unit called a worker. The worker builds structures and gathers gold for the player. Structures include barracks, which produces combat units; walls, which stop units from passing through; towers which offer vision and can attack; and houses which increases the maximum number of units. Some structures, such as the town center and barrack, allow the player to research upgrades and special abilities. Finally, the player controls a hero unit. The hero is more powerful and customizable than other units. They can use special abilities and build some structures. Controlling the hero unit provides the player with something to do while their units automatically follow orders.

The player manages 3 types of resources: Gold, Mana, and Population. **Gold** is collected from ore deposits by workers. The gold is spent to create new units and structures. **Mana** is generated passively and is used to enchant units with elemental powers. Mana generation can be increased by building pylons. Pylons are most efficient when spaced out far from each other. The player can build pylons in close proximity to each other, which will decrease efficiency but will allow the pylons to be defended easier. **Population** is the maximum number of units a player can build. The population cap can be increased by building more houses.

The enemy AI attacks the player's colony in waves. The enemy uses the same kind of combat units and elemental enchantments as the player. Attacks come from a random direction, as well as with a random army composition. Through research, the

player can unlock scouting technologies that will reveal information such as the direction of attack, primary unit type, or primary unit element. With this information, the player can preemptively build their forces to counter the incoming wave. The enemy has different behaviours in each wave. They may focus on attacking combat units, focus on workers and structures, rush the town center, or use deceit and subterfuge to avoid scouting.

The map has environmental features such as forests, rivers and mountains. These can be used to the player's advantage as natural defenses. Trees can be cut down by workers. While this provides no resources, it gives the player more room to build defenses.

The game is not "winnable" - the goal is to survive as long as possible against the waves of enemies. The most successful strategies the player can adopt is to be resourceful, adaptable, and prepared.

1.2 Description of Game Elements

Dynamic Units

- Hero
 - Unique customizable fighter. Has special abilities and can build some structures.
- Worker
 - Support unit that builds structures and gathers resources. A very weak fighter.
- Soldier
 - Attacks at close range. Has more health and passive health regeneration.
- Ranger
 - Attacks at long range with projectile weapons.
- Wizard
 - Attacks using magic spells. Spells can have a variety of effects and targeting paradigms.

Static Units

- Town Center
 - Produces workers, allows for research, can receive gold ore from workers. The game is over when the town center is destroyed.
- Resource Camp
 - An alternate drop off point for gold ore.
- Barracks
 - Produces combat units and researches upgrades for units. Can be enchanted to produce elemental units.

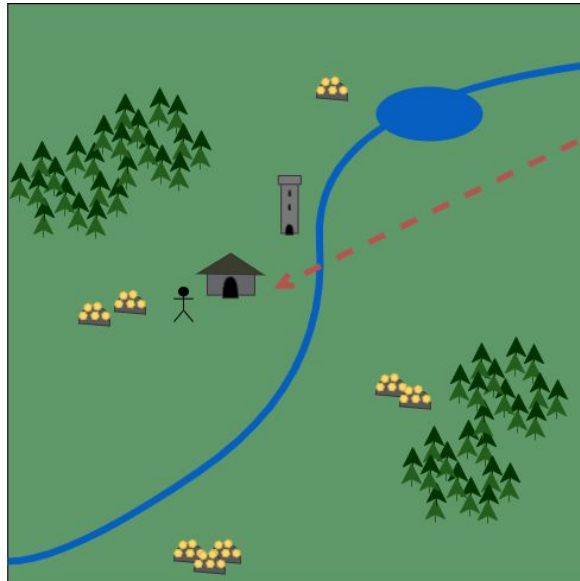
- Watch Tower
 - Has a large vision radius and can attack enemies.
- Walls
 - Blocks passage of units.
- Gates
 - A wall that allows friendly units to pass through.
- Houses
 - Increases population cap.
- Mana Pylons
 - Increases passive mana generation.

Enemy Units

The enemy mostly shares the same combat units as the player

- Soldier
 - Attacks at close range. Has more health and passive health regeneration.
- Ranger
 - Attacks at long range with projectile weapons.
- Wizard
 - Attacks using magic spells. Spells can have a variety of effects and targeting paradigms.
- Siege Engine
 - Does lots of damage to structures. Slow with lots of health.

Environment



- Trees
 - An obstacle that will slow or block passage. Can be used as a natural wall, or destroyed to make room for structures.

- Ore Deposits
 - Mined for gold by workers
- Mountains
 - Blocks passage
- Water
 - Shallow water slows movement, while deep water blocks all passage.

Interactions

Dynamic & Enemies

- Units can attack each other
- Mages can use spells to affect enemies in ways other than damage (for example, slow their movement).

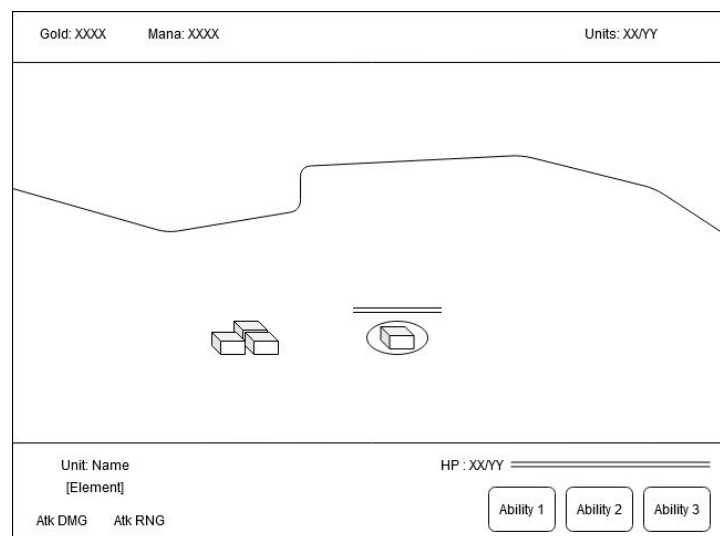
Dynamic & Buildings:

- Workers can drop off gold at the Town Center or Resource Camps
- Units can garrison in buildings
- Workers can repair buildings

Enemies & Buildings:

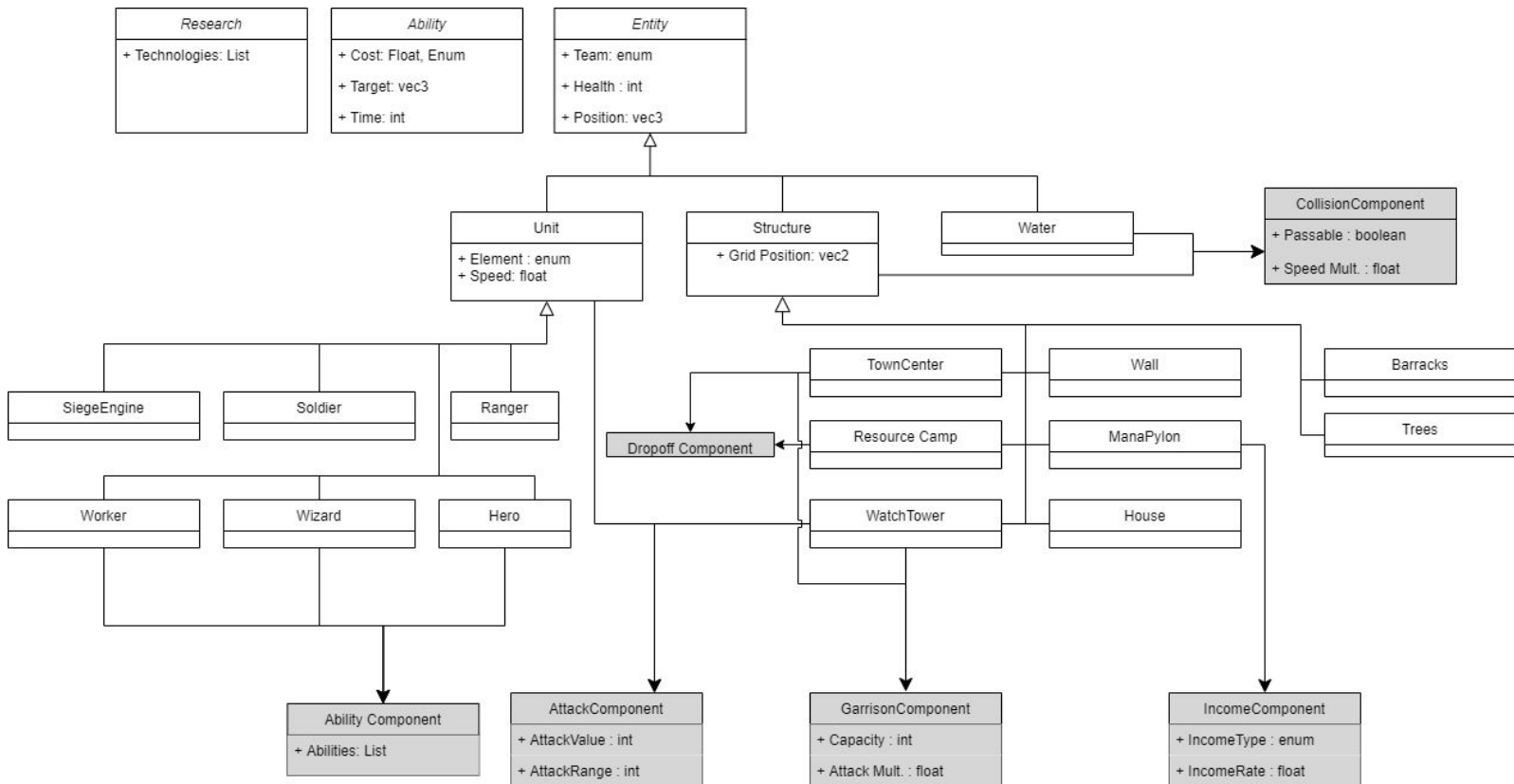
- Enemies can attack buildings
- If garrisoned, buildings can attack enemies
- Enemies will consider buildings during their pathfinding. Under some strategies, they may avoid buildings, or they may focus on isolated buildings.

Other



- Ribbon at the top showing current resources
 - Gold
 - Used to produce units and build structures
 - Gathered manually by workers mining ore deposits
 - Mana
 - Used to upgrade units with elemental buffs
 - Gained passively (passive generation can be increased with pylons)
 - Population
 - Each unit increases total population when produced
 - If player is at maximum capacity, they can't produce more units
 - Capacity can be increased by building houses
- Health Bars
 - Appears above units when they are selected or damaged
- Info Bar (along bottom)
 - Contains selected unit info (HP, range, element, attack strength)
 - Contains contextual commands (build, produce, move, attack, etc.)

2.0 Architecture

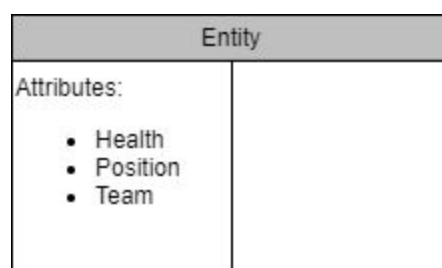


We use both hierarchical and component based design. A hierarchy is used to organise objects that share specific behaviour. Components are used for generic behaviour that may be used by several otherwise distinct classes.

2.1 Classes

High Level Classes

Entity



The highest level class for game objects. Entities exist in the world, have health and belong to a team. Environmental objects may belong to their own “nature” team.

Unit

Unit	
Attributes: <ul style="list-style-type: none">• Element	Inherits: <ul style="list-style-type: none">• Entity
Behaviours: <ul style="list-style-type: none">• Can move	Has Component: <ul style="list-style-type: none">• AttackComponent

A unit can move around the world. Using the attack component, units can attack other entities.

Structure

Structure	
Attributes: <ul style="list-style-type: none">• Exists on grid	Inherits: <ul style="list-style-type: none">• Entity

Structures are static objects that exist on a grid. The player's buildings and objects such as trees are structures.

Ability

Ability	
Attributes: <ul style="list-style-type: none">• Cost• Target• Time	

Entities with the ability component can use abilities. Attached to units these can be magic spells or special commands like building. Attached to structures, abilities can be research or unit production. A list of abilities is displayed when an entity is selected.

Research

Research	
Attributes: <ul style="list-style-type: none">• List of locked and unlocked technology.	Behaviour: <ul style="list-style-type: none">• Manages tech• Receives signals to unlock tech

Research unlocks permanent, passive benefits. These might include new abilities, passive stat boosts or more information on the enemy. The research class is a singleton

which controls all research unlocks. It stores a list of all research, and receives signals to unlock them.

2.2 Components

Attack

Attack Component	
Attributes: <ul style="list-style-type: none">• Damage• Range	Behaviours: <ul style="list-style-type: none">• Can attack

Allows entities to attack other entities. Most units have this, but structures like the watchtower can also attack.

Garrison

Garrison Component	
Attributes: <ul style="list-style-type: none">• Capacity• Attack multiplier	Behaviours: <ul style="list-style-type: none">• Can house units

The garrison component allows a structure to house units. Some structures can attack if a combat unit is housed within. Potentially, a unit with the garrison component could act as a sort of troop carrier.

Ability

Ability Component	
Attributes: <ul style="list-style-type: none">• List of abilities	

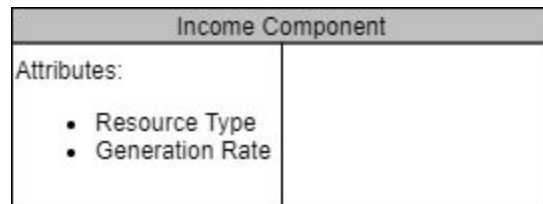
An ability is tied to an entity and can be activated at a cost to produce some effect. The ability component allows an entity to store and display a list of available abilities.

Collision

Collision Component	
Attributes: <ul style="list-style-type: none">• Passable• Speed Modifier	

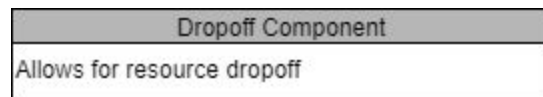
Handles the behaviour of units moving through the entity. The collision component may be completely impassable, or it may slow units down. A team's gates can only be passed through by its own units.

Income



Generates resources over time.

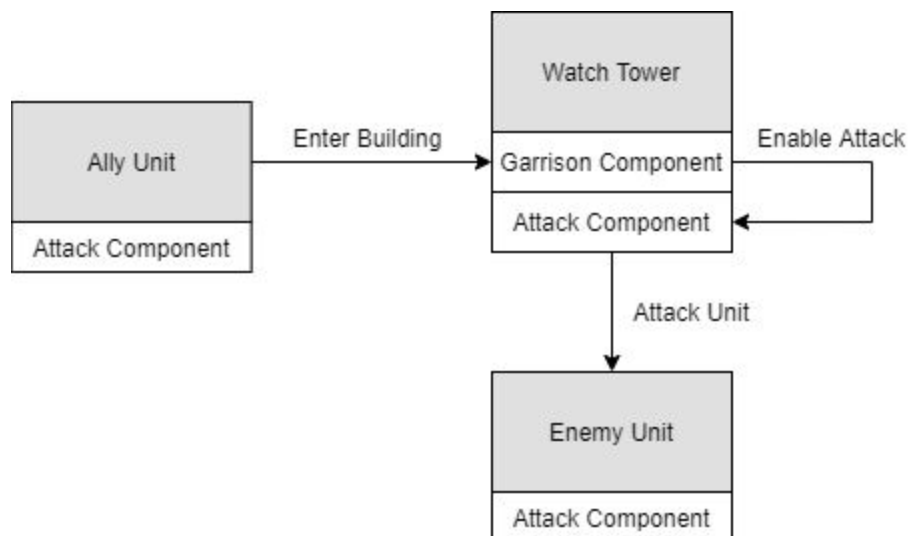
Dropoff



An entity with a dropoff component allows workers to deposit gold and add to the player's total.

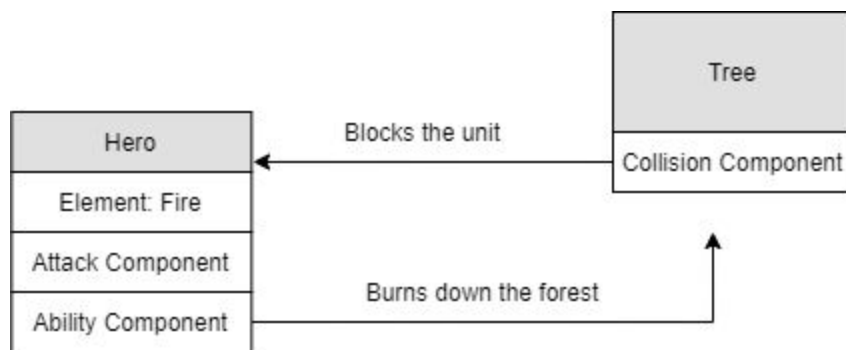
2.3 Examples of interactions

Example 1: Garrison in a tower



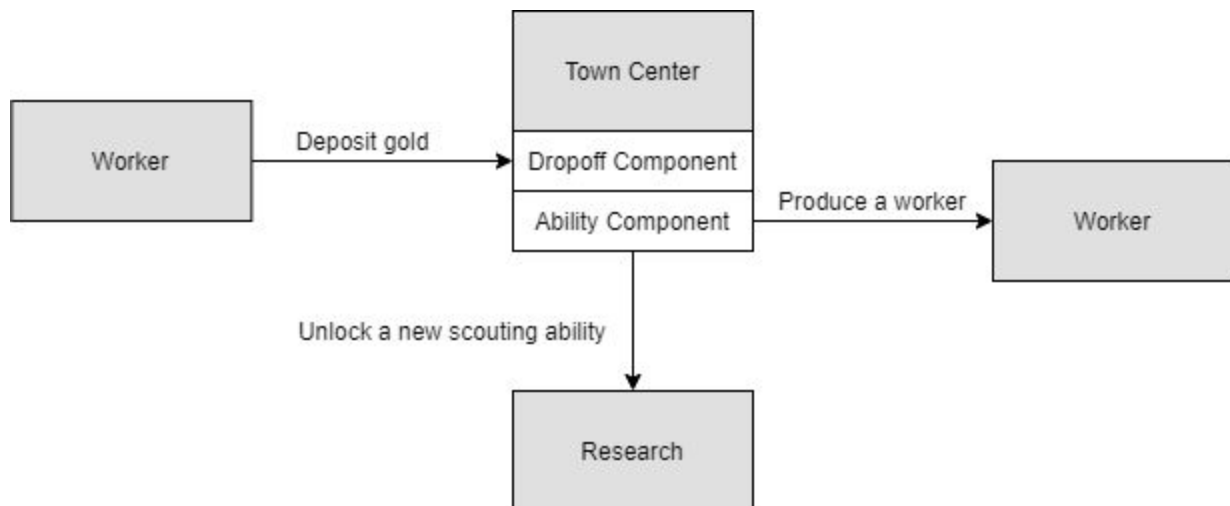
By calling a function in the tower's garrison component, a unit enters the tower. The garrison component sends a signal to the tower's attack component, allowing it to attack an enemy unit.

Example 2: Natural Obstacle



A hero unit is blocked by a forest. Since the hero is enchanted with fire, they use an ability to burn down the forest.

Example 3: Town Center



A worker deposits gold at the town center. Using this new gold, the player activates two of the town center's abilities. They produce a new worker and research technology.