



Platform: PC

Target Audience: Teen+

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GAME440 - Object-Oriented Analysis and Design

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1. General Info

1.1. Game Summary

ManaCraft is a competitive tower defense game with a strong focus on teamwork, strategy and resource management. Two teams composed of one to three players will face off against each other on a symmetrical map with paths leading to the opponent's main base. Each player will have the ability to summon minions to attack the opposing team's main base and will also have to set up stationary defenses against the oncoming hordes of minions that could be dispatched by the opposing team. The game will be 2D and played from an isometric perspective with a mouse and keyboard.

1.2. Backstory

The land of Elementia is a wondrous place where a magical force called Mana flows freely. The citizens of Elementia learnt how to use this Mana to manipulate their environment. Some of these citizens were naturally gifted and understood the intricacies of Mana better than most. These masters of magic called themselves wizards; and devoted their lives towards analyzing Mana and practising magic.

During their studies, wizards would try to determine the origin of Mana, which inadvertently caused a rift between two groups of wizards. One group believed that the Goddess of Light created Mana, and then Elementia and all things, from it. They called themselves The Illuminated. Another group of wizards, The Dark Ones, saw the chaos and entropy inherent in the world. They believed that everything originated from Chaos and the constant entropy is driving everything back towards Chaos and the inevitable return and rule of their master: The Chaos Beast.

The rift between these two factions continued to grow until, eventually, violence broke out in the name of their respective ideologies. The wizards learnt to use Mana to bend the very elements to their will in order to summon defenses; and learnt to create horrific beasts from Mana, imbued with the primal elements, for their armies.

Thus began the Mana Wars...

1.3. Mechanics Overview

Summon Tower

- Summons a tower (reducing Mana from the total Mana pool) that will attack any enemy minions that come within it's range.

Summon Minion

- Summons a minion (reducing Mana from the total Mana pool but increasing Mana per Second) that will attempt to reach the opposing team's main base, which causes the opposing team to lose life.

Research Minion Type

- Researches a new minion type (reducing Mana) which allows for the summoning of a new minion type with improved stats.

Research Tower Type

- Researches a new tower type (reducing Mana) which allows for the summoning of a new tower type with improved stats.

Upgrade Minion

- Increases the effectiveness of a minion type (reducing Mana) by allowing the player to spawn higher level versions of that minion type.

Upgrade Tower

- Increases the effectiveness of one tower (reducing Mana) by increasing the stats of that tower.

2. Gameplay

2.1. Elemental Effects

2.1.1. Element Types

Element	Weak Against	Strong Against
Fire	Water	Earth
Water	Wind	Fire
Earth	Fire	Wind
Wind	Earth	Water

2.1.2. Attack Types

Structures in ManaCraft will have varying damage types, hit areas, and effects that allow for the players to strategically counter particular minion types.

Direct Damage

- A tower can have a simple direct damage attack which deals damage to a single minion alone.

Point Blank Area of Effect

- An area of effect attack that deals damage to all minions within a given range around the tower.

Ground Targeted Area of Effect

- A area of effect attack that targets the ground instead of a particular minion and deals damage to all minions within a range of the point of impact.

Cone AoE

- A conal area of effect attack originating from the tower, extending outwards, which deals damage to all minions within the area of the cone.

Chain AoE

- A direct damage attack that deals damage to a single minion and then bounces to up to N other minions if they're within a given range.

2.1.3. Elemental Damage Types

Fire - Burning

- Deals a damage over time by a percentage and/or absolute amount.

Water / Ice - Drenched / Frozen

- Slows movement speed by a percentage.

Wind - Piercing

- Ignores a certain amount of armour.

Earth - Stun

- Stuns the target for X seconds and that unit becomes immune to future stuns for X seconds.

2.1.4. Resistances

Minion Type	Wind Resistance %	Fire Resistance %	Water Resistance %	Earth Resistance %	Normal Resistance %
Normal	0%	0%	0%	0%	0%
Fire	0%	25%	-25%	0%	0%
Water	-25%	0%	25%	0%	0%
Earth	0%	-25%	0%	25%	0%
Wind	25%	0%	0%	-25%	0%

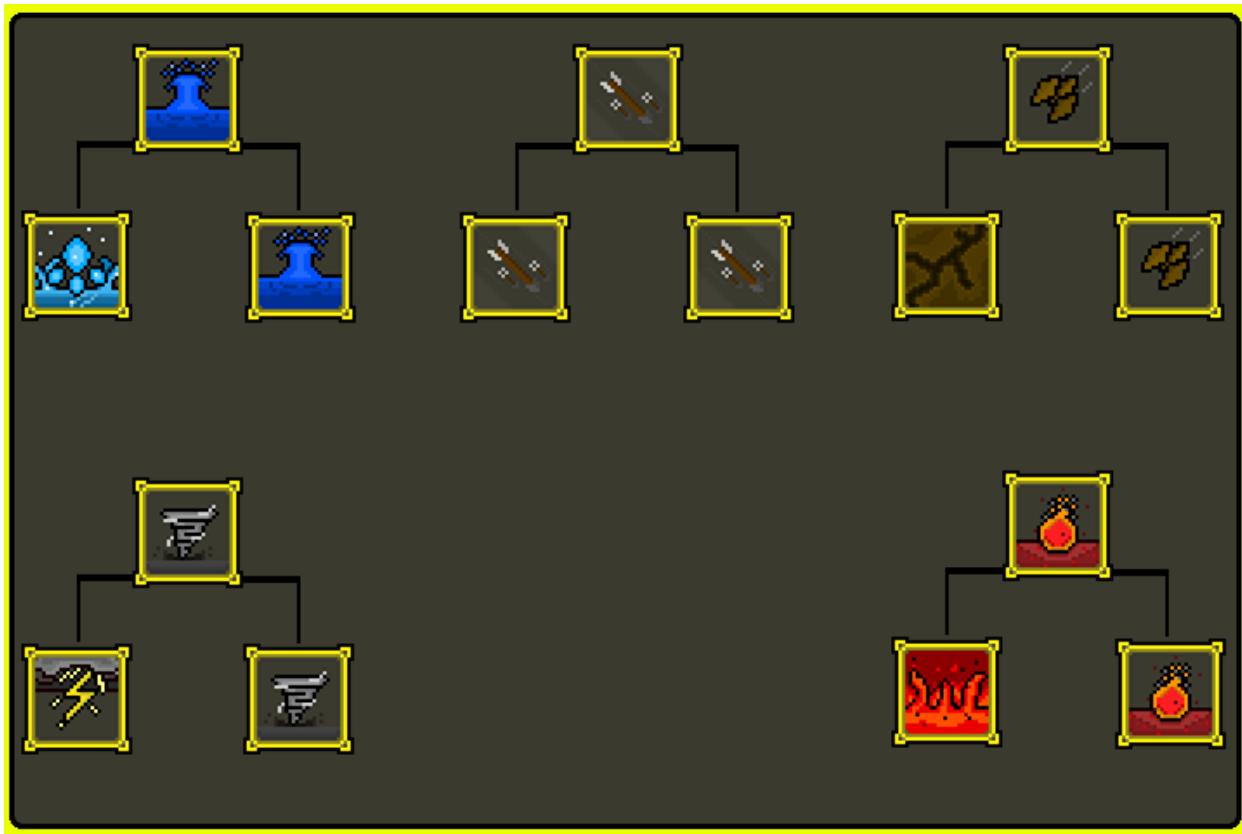
Note: Numbers are subject to change.

2.2. Towers

2.2.1. Tech Tree

- In total, there will be 15 towers, each of which can be upgraded from Level 1 to Level 3.
 - The player begins with an Arrow Tower that simply does physical damage and has no special effects.
 - Players may research Fire, Water, Wind, or Earth. Researching Fire, for example, will unlock the Level 1 Fire tower which deals direct damage and applies a damage over time to the target minion.
 - For more information on tower damage types, see 2.1.3 Damage Types.
 - At that point, the player can now research two different Fire technologies.
 - Each technology will have a Mana cost associated with it, and each type of tower can be upgraded from Level 1 to Level 3, which increases various tower stats.
 - Research cost will be determined by what the player has already previously researched.
 - For example, researching into the Fire element three times may cost 50, 150, then 500 Mana. At that point, researching into the Water element three times may cost 550, 650, then 1000 Mana.
 - Each upgrade will increase the cost of similar upgrades for the other elements. So the initial Fire upgrade will increase the cost of every other initial Element upgrade by 500 Mana.
- Note: Numbers are subject to change.*

Example tech trees for each Element.



Example tech trees for each Element. All tech tree icons by Tyler Remazki.

2.2.2. Statistics

These stats will be shown on tooltips when hovering the mouse over a tower.

- Cost

- The cost in Mana to build the tower

- Damage & Element

- (ex: 4 w/ Element Symbol) (ex: fire/wind/water/ice/physical/earth)



- Range

- The distance that the tower is able to hit a minion at. Calculated and displayed in 'Tiles'. This is also displayed with a translucent indicator on the map)



- Firing Rate

- (the number of times a tower can fire per second ex: 0.3 w/ SandClock)



- DPS

- The damage that the tower is able to output per second. This statistic is displayed to the player for easy comparisons to other towers.

- Attack Type

- (ex: Text or visual indicator) (ex: AOE)



- Element Type

- The type of damage done by the tower

- Special Effect

- Details of the elemental special effect caused by the tower

- Sell Amount

- (ex: 10 w/ Mana Symbol)



- Owner

- (ex: Owned By: PlayerName)

- *These stats will be shown when necessary*

- Summon Cost

- (ex: 10 w/ Mana Symbol)

- Upgrade Cost

- (ex: 10 w/ Mana Symbol)

- Research Cost

- (ex: 10 w/ Mana Symbol)

2.2.3. Tower List

All the towers available to be built in the game are listed below. A table that lists their statistics is provided, and the respective descriptions follows below the table.

Basic Towers

Name	Cost	Damage	Range	Firing Rate	DPS	Attack Type	Element Type
Arrow Tower	40	2	4	2	4	Single Target	Phys
Cannon Tower	90	4	3	0.5	2	AoE(2)*	Phys
Ballista Tower	80	5	5	2	10	Single Target	Phys

* Note: In the Attack Type Field, the number in brackets after AoE types indicates the size (typically radius) of the actual aoe effect and is explained further in the descriptions of the towers.

Arrow Tower:

- Description: This is the Basic Non-Elemental Tower available to all players at the start of every game. This tower continuously shoots an arrow at any single minion that is in range of the tower.
- Additional Effect: None

Cannon Tower

- Description: This is the area of effect upgrade of the Arrow Tower. This tower launches cannonballs at any minion that is in range of the tower. The cannonballs deal damage to all minions within an area of effect (range 2) of the minion that was hit.
- Additional Effect: None

Ballista Tower

- Description: This is the direct damage upgrade of the Arrow Tower. This tower fires a massive ballista bolt at the target.
- Additional Effect: None

Fire Towers

Name	Cost	Damage	Range	Firing Rate	DPS	Attack Type	Element Type
Flame Tower	50	3	5	1.2	3.6	Single Target	Fire
Fireball Tower	120	7	3	0.3	2.1	GT AOE(3)	Fire
Igniter Tower	100	0*	5	1.3	0	Single Target	Fire

* Note: The tower does no direct damage but puts a heavy DoT on targets. See Description below

Flame Tower

- Description: This is the Basic Fire Tower that can be researched by players. This tower continuously shoots fire at any single minion that is in range of the tower. Each minion hit receives the debuff described below.
- Additional Effect: Non-stackable damage over time debuff that deals 2 DPS for 4 seconds.

Fireball Tower

- Description: This is the area of effect upgrade of the Flame Tower. This tower fires a large fireball at the ground under a minion that is in range of the tower, which deals damage to all minions within an area of effect (range 3) of where the ground was impacted. Each minion hit receives the debuff described below.
- Additional Effect: Non-stackable damage over time debuff that deals 3 DPS for 5 seconds.

Igniter Tower

- Description: This is the direct damage upgrade of the Flame Tower. This tower sets its target on fire. While it does no direct damage, it applies a heavy debuff to its target as listed below.
- Additional Effect: Non-stackable damage over time debuff that deals 15 DPS for 4 seconds.

Water Towers

Name	Cost	Damage	Range	Firing Rate	DPS	Attack Type	Element Type
Water Blast Tower	50	3	5	1.3	3.9	Single Target	Water
Tidal Wave Tower	120	2	3	0.5	1	Cone AOE(3)	Water
Frost Beam Tower	100	6	4	1.5	9	Single Target	Water

Water Blast Tower

- *Description:* This is the Basic Water Tower that can be researched by players. This tower continuously shoots water at any single minion that is in range of the tower. Each minion hit receives the debuff described below.
- *Additional Effect:* Non-stackable movement speed debuff that reduces movement speed by 30%.

Tidal Wave Tower

- *Description:* This is the area of effect upgrade of the Water Blast Tower. This tower continuously shoots a wave of water at multiple minions in a cone area of effect when in range of the tower. Each minion hit receives the debuff described below.
- *Additional Effect:* Non-stackable movement speed debuff that reduces movement speed by 50%.

Frost Beam Tower

- *Description:* This is the direct damage upgrade of the Water Blast Tower. This tower shoots a deadly, freezing beam at its target, which receives the debuff described below.
- *Additional Effect:* Non-stackable movement speed debuff that reduces movement speed by 40%.

Earth Towers

Name	Cost	Damage	Range	Firing Rate	DPS	Attack Type	Element Type
Rock Shard Tower	50	4	4	1.1	4.4	Single Target	Earth
Earthquake Tower	120	6	0	0.5	3	PB AOE(2)	Earth
Boulder Tower	100	9	4	1.33	12	Single Target	Earth

Rock Shard Tower

- *Description:* This is the Basic Earth Tower that can be researched by players. This tower continuously shoots shards of rock at any single minion that is in range of the tower. Each minion hit has a 15% chance to receive the debuff described below. Any minion that receives this debuff will become immune to future stun debuffs for a short period of time.
- *Additional Effect:* Non-stackable stun debuff that prevents any movement for 1 second.

Earthquake Tower

- *Description:* This is the area of effect upgrade of the Rock Shard Tower. This tower creates localized earthquakes that cause damage in an area of effect damage of radius 2 of the tower. Each minion hit has a 20% chance to receive the debuff described below. Any minion that receives this debuff will become immune to future stun debuffs for a short period of time.
- *Additional Effect:* Non-stackable stun debuff that prevents any movement for 0.75 seconds.

Boulder Tower

- *Description:* This is the direct damage upgrade of the Rock Shard Tower. This tower hurls a massive boulder at any single minion that is in range of the tower. Each minion hit has a 20% chance to receive the debuff described below. Any minion that receives this debuff will become immune to future stun debuffs for a short period of time.
- *Additional Effect:* Non-stackable stun debuff that prevents any movement for 2 seconds.

Wind Towers

Name	Cost	Damage	Range	Firing Rate	DPS	Attack Type	Element Type
Gust Tower	50	2	4	1.9	3.8	Single Target	Wind
Lightning Tower	120	3	5	1.2	3.6	Chain AOE(5 Jumps, Range 1)	Wind
Wind Slash Tower	100	6	4	2	12	Single Target	Wind

Gust Tower

- *Description:* This is the Basic Wind Tower that can be researched by players. This tower continuously releases a gust of wind at any single minion that is in range of the tower.
- *Additional Effect:* Allows the tower to bypass 2 points of armour.

Lightning Tower

- *Description:* This is the area of effect upgrade of the Gust Tower. This tower discharges bolts of lightning at any minion that is in range. This lightning bolt will continue to chain up to five times assuming a different minion that has not already been hit by it is within range 1.
- *Additional Effect:* Allows the tower to bypass 3 points of armour.

Wind Slash Tower

- *Description:* This is the direct damage upgrade of the Gust Tower. This tower fires deadly blasts of shearing wind any minion that is in range of the tower.
- *Additional Effect:* Allows the tower to bypass 4 points of armour.

2.2.4. Building Mechanics

2.2.4.1. Selecting A Tower

- A button on the right side of the screen allows the player to open the build window. This displays the available towers, as well as the elemental categories that the player can research a later time.
- These elemental categories will open their corresponding menus that display both your researched towers, and towers available for research.
- Mousing over any of the tower icons will display a tooltip with tower statistics (see 2.2.2 Statistics). This will also display the research cost for unresearched towers.

2.2.4.2. Placing A Tower

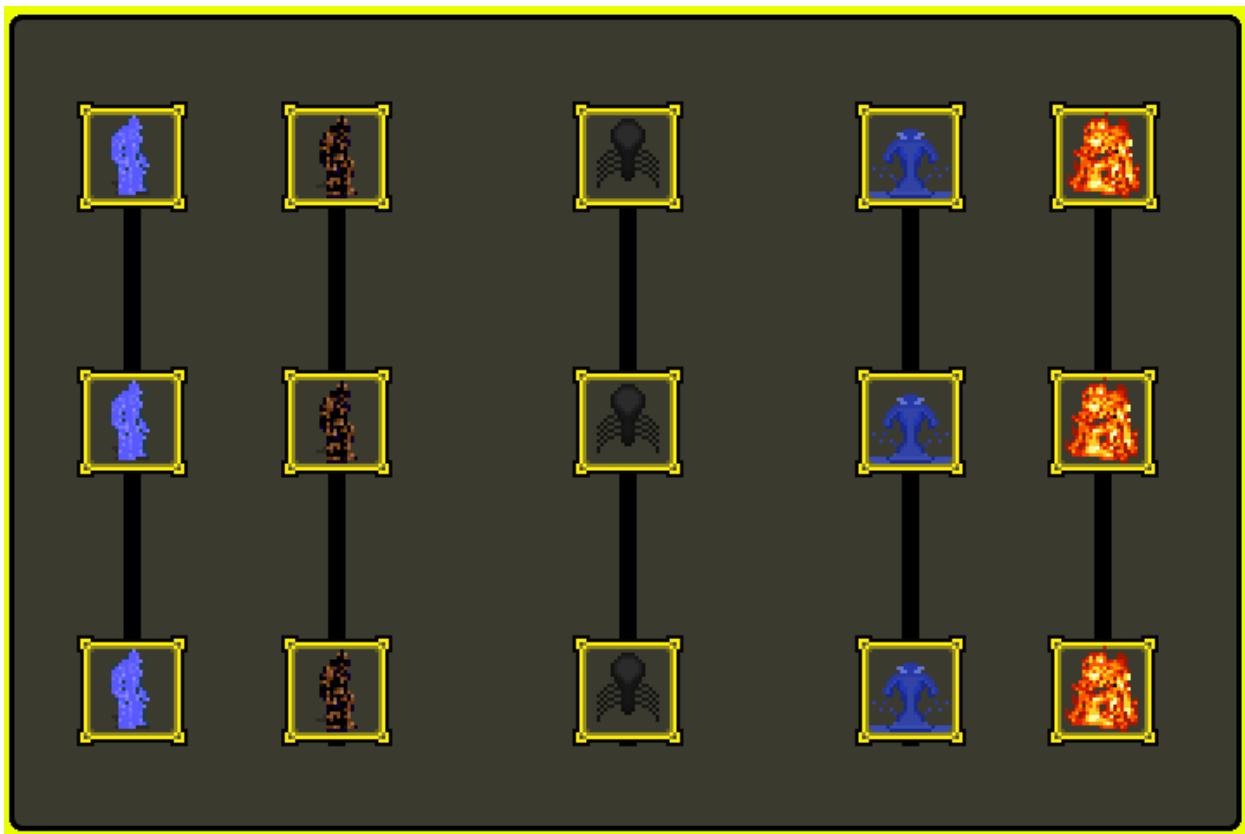
- Towers that are available to be built are fully coloured, while towers that have not been researched yet are greyed out.
- Clicking on an available tower icon attaches the corresponding tower to the mouse pointer (only if the required resources are available)
- A coloured overlay will show up on the player's screen that visually indicates where the player can or can not place the tower. This is represented by the hue of the tile - Green and red will indicate whether the player may or may not build on it respectively.
- If the tile is green and the player left clicks with a tower attached to the cursor, he/she will be able to build their previously selected tower.

2.2.4.3. Zone Of Influence

- Each team will have their own “Zone Of Influence”
- Players on the team can only build towers on tiles that are within this radius of influence.
- At the beginning of each game, the main base generates zone of influence around itself.
- This means that initially, the players will only be able to build close to the main base.
- As more towers are built, they project their own zones of influence and unlock more tiles to be built upon
- The zone of influence is shared by all the players in the team. This encourages teammates to coordinate and come up with strategies for optimal tower placement.
- Tiles in grey indicate that they are buildable but are not within the team’s zone of influence yet.
- This mechanic also works to capture resource nodes: resources nodes that are within a team’s zone of influence is owned by the team.

2.3. Minions

2.3.1. Tech Tree



Note: Placeholder only.

2.3.2. Statistics

Minion Stats:

- **Cost:** The amount of Mana deducted from the player's Mana Pool when summoning the minion
- **Bonus MpS:** The amount by which the player's MpS is increased upon spawning the minion
- **Health:** The amount of health a minion has. Health will be displayed as a whole number but stored as a decimal on the back end. (Ex: 107.42 / 180.0 displayed as 107 / 180)
- **Damage:** How much life is removed from the opposing team when the minion reaches that team's main base. (Ex: 3)
- **Type:** Each minion will have a type which will help the user determine what the preferred counter is. (Ex: "Fast")
- **Resistance:** The resistance to each type of elemental damage

- *Armour*: Damage Mitigation applied as a percentage reduction, after reduction to the incoming damage from resistance
- *Movement Speed*: How fast they move in pixels per second. This value is displayed as a number with 1 decimal point. (Ex: 15.012 displayed as 15.0).

Note: If any stat is temporarily affected by a debuff on the minion, then that will be displayed. (Ex: Original movement speed of 15.0 will be displayed as 11.0 (-4.0) and 11.0 will be in red along with the -4.0)

2.3.3. Summoning Mechanics

- Each player can summon a minion which will be spawned in each of the opposing team's lanes at portals at the midpoint of the map.
- The minions will attempt to reach the opponent's main base by walking along their lane.
- When a player spawns a minion, that player's Mana will be reduced by the cost of the Minion.
- In addition, the player's Mana Per Second (MpS) will be increased by the bonus income value associated with summoning that Minion.
- If the minion reaches the opposing team's main base, then that team's lives will be reduced by the Minion's damage amount and the minion will disappear.
- Once the minion despawns, either upon death or upon reaching the enemy base, the bonus MpS is taken away from the player.

2.3.4. Minion Types

Physical Minions

Note: All assets are placeholders



https://wiki.themanaworld.org/index.php/User:Fother/Pixel_Art

- Spiders are basic minions that have no special strengths or vulnerabilities.

Name	Level	Cost	Bonus MpS	Health	Damage	Resistances (Phys/Fire/Water/Earth/Wind)	Armour	Speed
Garden Spider	1	20	0.2	10	2	0/0/0/0/0	1	20
Tarantula	2	40	0.4	30	4	0/0/0/0/0	3	20
Goliath Spider	3	100	1.0	90	7	0/0/0/0/0	7	15

Fire Minions

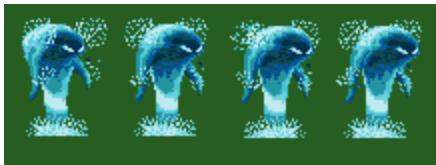


http://www.deviantart.com/morelikethis/101451148?view_mode=2

- All Fire Minions spawn in clusters of 3. This makes them vulnerable to AoE but they could overwhelm defenses that are more single target oriented.

Name	Level	Cost	Bonus MpS	Health	Damage	Resistances (Phys/Fire/Water/Earth/Wind)	Armour	Speed
Blazelings	1	30	0.3	4X3	1X3	0/25/-25/0/0	2	20
Blaze Elemental	2	60	0.6	16X3	2X3	0/25/-25/0/0	3.5	25
Fire Lords	3	120	1.2	33X3	4X3	0/25/-25/0/0	7.5	30

Water Minions



http://www.sprites-resource.com/mobile_phone/soul of darkness/sheet/46524

- All Water minions have a natural resistance against AoE damage (extra armour vs AoE damage) but are not very durable otherwise.

Name	Level	Cost	Bonus MpS	Health	Damage	Resistances (Phys/Fire/Water/Earth/Wind)	Armour	Speed
Sea Spray	1	30	0.3	10	3	0/0/25/0/-25	2(+1)	20
Water Elemental	2	60	0.6	40	6	0/0/25/0/-25	3(+2)	25
Tidal Lord	3	120	1.2	85	12	0/0/25/0/-25	7(+2)	30

Earth Minions



<http://spritedatabase.net/file/14028>

- Earth Minions are more sturdy and have extra Health and more Armour but are slightly slower than other minions.

Name	Level	Cost	Bonus MpS	Health	Damage	Resistances (Phys/Fire/Water/Earth/Wind)	Armour	Speed
Pebble	1	30	0.3	15	3	0/-25/0/25/0	3	15
Rock Elemental	2	60	0.6	55	6	0/-25/0/25/0	4.5	20
Granite Lord	3	120	1.2	120	12	0/-25/0/25/0	9	25

Wind Minions



<http://www.giantitp.com/forums/showthread.php?t=142545&page=2>

- Wind Minions are significantly faster than other minions but have average statistics otherwise.

Name	Level	Cost	Bonus MpS	Health	Damage	Resistances (Phys/Fire/Water/Earth/Wind)	Armour	Speed
Gust	1	30	0.3	12	3	0/0/0/-25/25	2	25
Wind Elemental	2	60	0.6	48	6	0/0/0/-25/25	3.5	32
Storm Lord	3	120	1.2	100	12	0/0/0/-25/25	7.5	40

2.4. Tower vs Minion Engagement

- Any given tower checks if any minion is within its range
- Each minion that is within the tower's range gets added to its target list
- Any minion that dies or leaves the tower's range gets removed from the target list
- The tower checks if its reload timer is up and fires at the first minion in its list (if any)
- The minion that is hit takes damage as per the following formula:

Damage Taken formula:

$$\text{Incoming Damage} = \text{Tower Damage} * (100 - \text{Minion Elemental Resistance}) / 100$$

$$\text{Minion HP} = \text{Incoming Damage} * (10 - \text{Minion Armour}) / 10$$

Example 1:

Let's say an Earth tower is attacking a heavily armoured, Earth type monster:

Tower Damage = 4

Minion Elemental Resistance = 25%

Incoming Damage = $4 * (100 - 25) / 100 = 3$

Minion Armour = 8

$$\text{Damage} = 3 * (10 - 8) / 10 = 0.6$$

$$\text{Minion Health} - = 0.6$$

Example 2:

A Water tower is attacking a lightly armoured, Fire type monster:

$$\text{Tower Damage} = 6$$

$$\text{Minion Elemental Resistance} = -25\%$$

$$\text{Incoming Damage} = 6 * (100 - (-25)) / 100 = 7.5$$

$$\text{Minion Armour} = 3$$

$$\text{Damage} = 7.5 * (10 - 3) / 10 = 5.25$$

$$\text{Minion Health} - = 5.25$$

Example 3:

A Wind tower is attacking a heavily armoured, Fire type monster:

$$\text{Tower Damage} = 2$$

$$\text{Minion Elemental Resistance} = 0\%$$

$$\text{Incoming Damage} = 2 * (100 - 0) / 100 = 2$$

$$\text{Minion Armour} = 8$$

$$\text{Wind Tower Armour Penetration} = 2$$

$$\text{Minion Effective Armour} = 6$$

$$\text{Damage} = 2 * (10 - 6) / 10 = 0.8$$

$$\text{Minion Health} - = 0.8$$

- A minion will die when its health reaches zero.

2.5. Economy

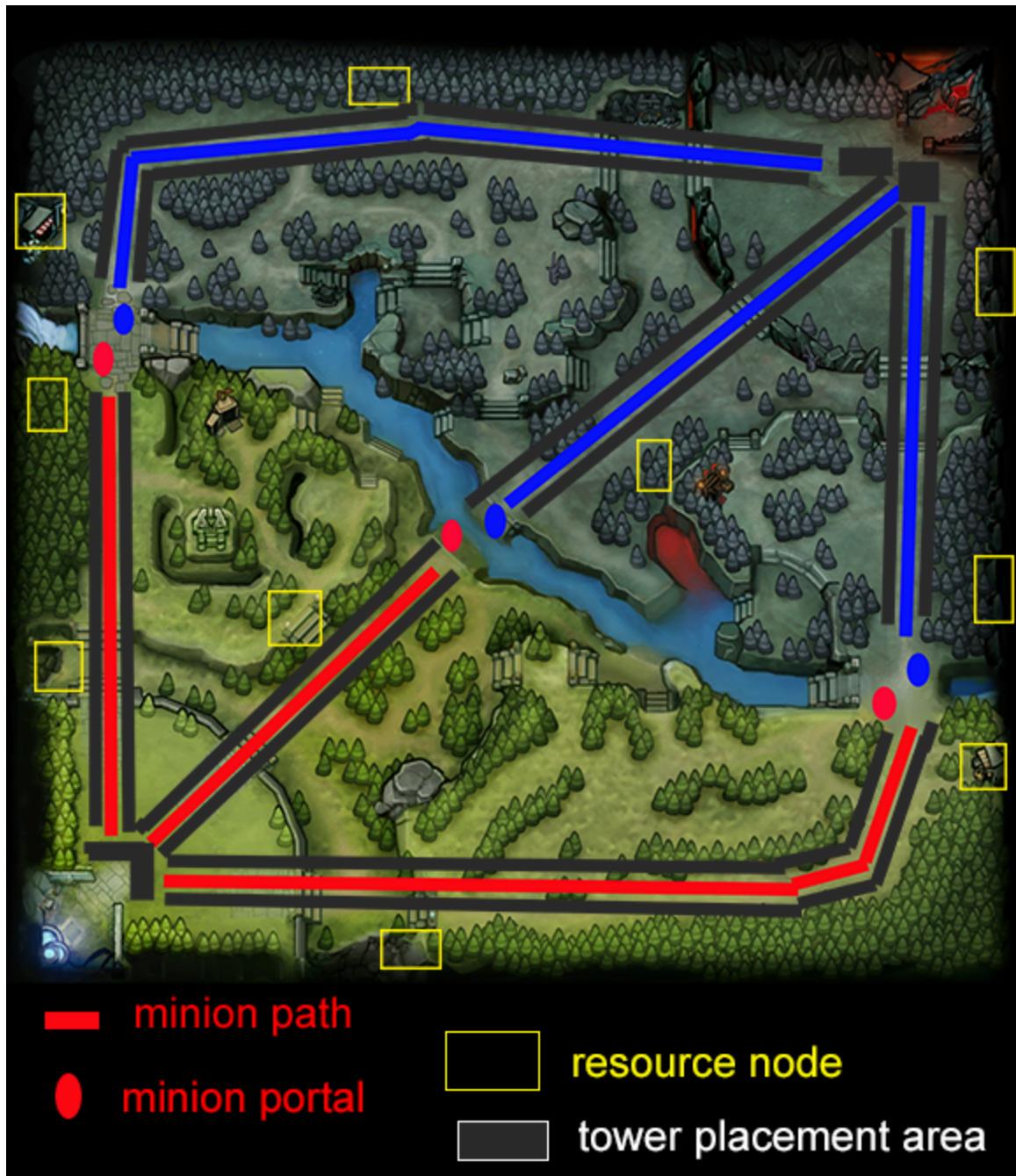
- Each player will start with 1000 Mana.
- Each player will have a total amount of Mana, as well as a Mana per second (MpS) amount.
- Their Mana will continue to increase by the MpS amount throughout the game.
- Player Mana and MpS will be displayed to the player as whole numbers, but will be calculated as decimals in the backend.
- Each player can use their Mana to:
 - summon new towers (increasing defense)
 - spawn minions (applying offensive pressure and increasing their economy)
 - advance tower tech (increasing future defense capabilities)
 - advance minion tech (increasing future offensive capabilities)
- Mana can be gained by killing minions that have been spawned by the opposing team.
- When a minion is killed, the bounty (in Mana) will first be multiplied by the Mana gained modifier and then the Mana will be given to each player which will be based on who contributed towards killing it.
- Any player who owns a tower that has hit the minion at least once will be added to the assisters list.
- The minion's bounty (Mana) value would be equally divided by the number of assisters and

given to each of them.

- This rewards assisters with Mana even though they might not have scored the killing blow.
- The amount of Mana gained by killing creeps can be increased by capturing resource nodes that are found around the map. Each player that captures a node will increase their team's "Mana gained modifier."
- Each player can increase their Mana per Second rate by spawning minions. Inexpensive minions will slightly increase this value, whereas more expensive creeps will greatly increase this value.
- If the "minion reward on base attack" game option is enabled then once a team's minion reaches the opposing team's base, they will be awarded a certain amount of mana, based on the value of the minion.

2.6. Level Design

2.6.1. Example Map



Map from Dota2

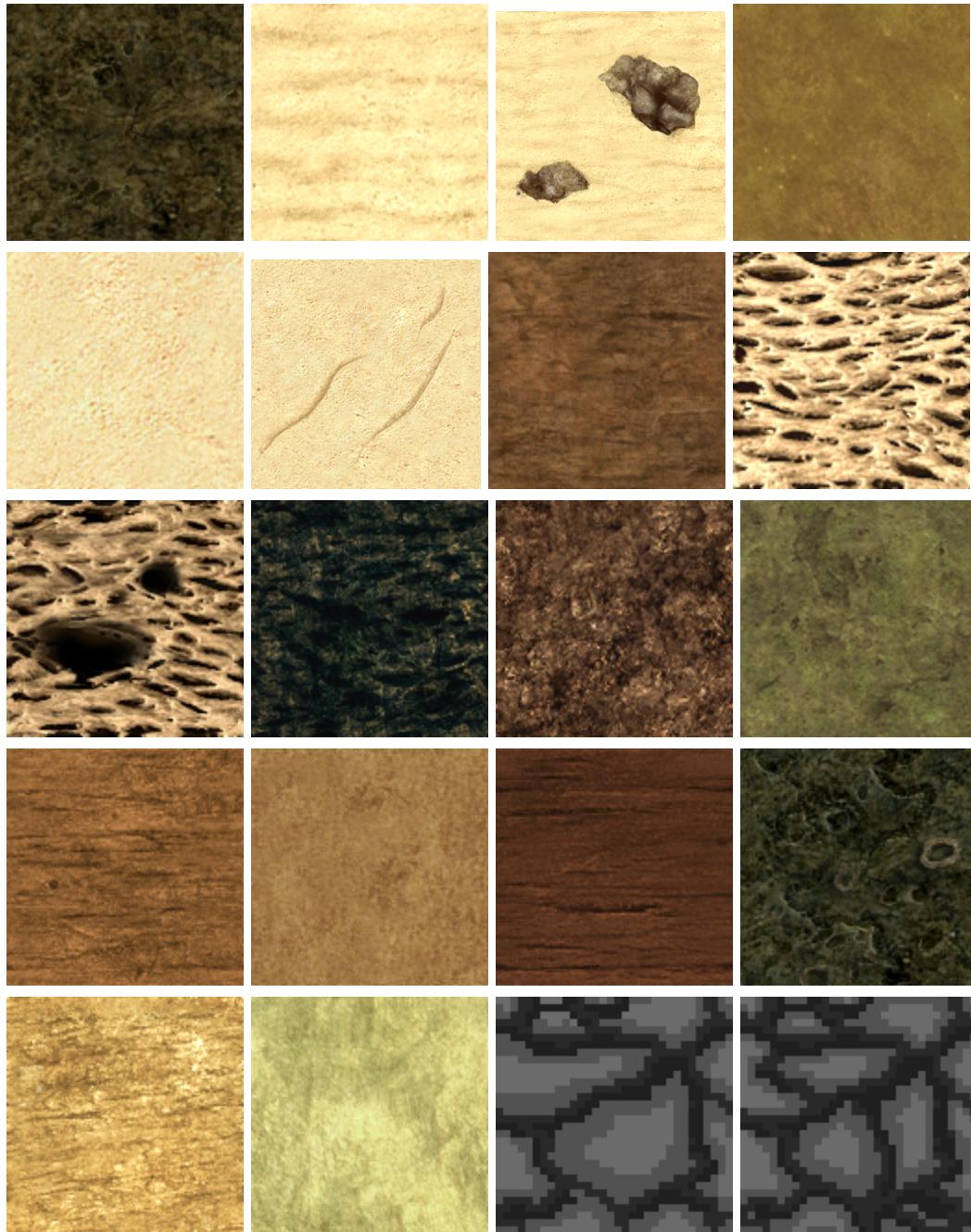
<http://www.devilesk.com/dota2/apps/interactivemap/>

-Note: Subject to change.

2.6.2. Tilesets

- Example tilesets for environments are as follows.

Note: These will be changed to conform to the art style of the game.



2.7. 60 Seconds of Typical Gameplay

Note: Gameplay varies based on how many players on each team. There's far more of a team focus when there's multiple players on each team as opposed to a one versus one game.

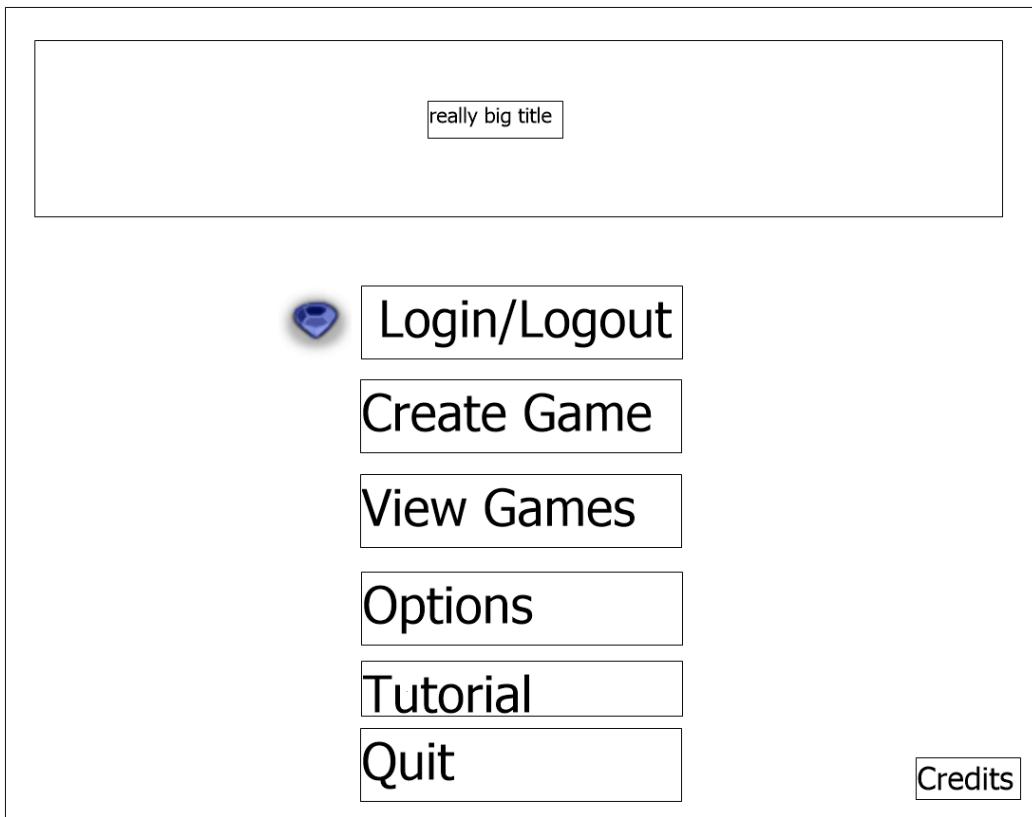
- The game begins and the players start to collaborate, using the chat system, regarding which lanes they will focus on and which resource nodes they will first work towards.
- During the game, they must maintain a delicate balance of economy, offense and defense, in order to maximize income and minimize lives lost throughout the game.
- Players must discuss who will research what technologies in order to ensure maximum flexibility and maximum effectiveness throughout the game.
- The players also must work together as each lane will need various tower types. The choke point that is just prior to the team's main base must also be adequately covered in order to prevent minion leaks from getting through.
- The players must be careful with what they choose to invest in and they must be even more careful in regards to tower placement. Well-placed towers increase the team's overall effectiveness. It allows them to reap the benefits of summoning more minions than a team who did not place their towers effectively and therefore must spend more Mana on towers.
- For example, let's say at around 10 mins into a game, Team 1 has all 3 lanes of the map equally covered with Fire and Wind towers. They have been doing well against Team 2's Earth minions so far.
- Team 1 has expanded extensively and captured 2 of the 3 resource nodes on the map.
- Suddenly one of the players on Team 1 realizes that Team 2 has been saving up some mana and has researched level 2 Fire minions and summoned a number of them.
- Team 1's Fire and Water towers will not be very effective against the incoming horde of Fire minions due to their resistance to Fire damage.
- The player communicates that to his team and one of the players on the team decides to research Water towers to effectively combat the Fire minions. The Tidal Wave tower will be critical to slow down the groups of Fire minions while the Frost Beam tower and the existing Lightning towers will work to thin the Fire minion ranks.
- Team 2's Fire minions do manage to push in and chip away at Team 1's base while Team 1 is trying to save up the Mana to construct the new towers.
- Eventually, due to their already superior income, Team 1 manages to erect several Water towers at key locations and turns the tide of the game back in their favour.

3. GUI

3.1. Scenes, Mockups & controls

Note: All controls are on key/button down unless otherwise stated (except for Mouse Over which is a special case).

3.1.1. Main Menu



Login/Logout

- Clicking Login transitions in a Login popup window for the user.
- The Login window should be centered and have a textfield for the User Name.
- It should also have an X and a Checkmark button that the user will push to confirm their User Name. If the user clicks X, the popup window will be removed and the scene will return to its original state. If the user clicks the Checkmark, the popup window will change to Please Wait... while the server either sends a confirmation that the player is now logged in, or some other message. (Ex: That username is currently logged in, or invalid user name due to length/special character, dirty words, etc)
- Clicking Logout transitions in a Logout popup window which asks the user for confirmation.
- If the player is not logged in, then "Login" will be displayed.
- If the player is logged in, then "Logout" will be displayed.

Create Game

- Disabled when the player is not logged in.
- Clicking Create Game transitions in a Please Wait... popup window which waits for the server to send confirmation that the game has been created. After that, it will transition to the Game Lobby scene. If it takes an excess of 30 seconds to receive confirmation from the server, the request will fail and the popup window should be changed accordingly to reflect this to the user.

View Games

- Disabled when the client is not logged in.
- Clicking View Games will transition to the Game Viewer scene which displays the games currently in progress.

Options

- Clicking Options will transition to the Options Menu scene which displays various settings.

Quit

- Clicking the Quit button transitions in a confirmation popup window. If a user confirms their decision, they will be logged out (if they are logged in) and the game will exit.

Controls:

Left Click (On Left Click Up)

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level

Down Arrow / S

- Moves the current menu selection down one level

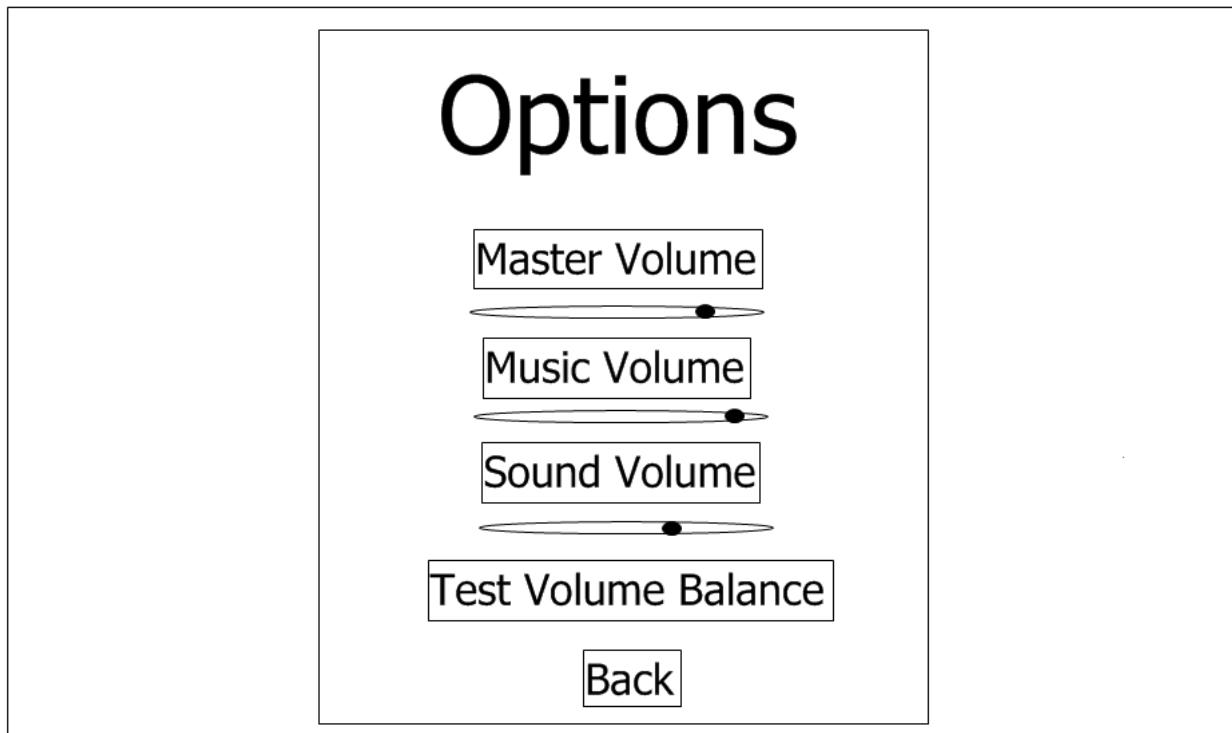
Enter or Space

- Selects the current menu selection. Also achieved by left clicking the same thing.

Esc

- Exits out of any pop up window (default selection of No for confirmation windows). This is also the equivalent of pressing enter when the Quit button is selected or left clicking the Quit button.

3.1.1.1. Options Menu



Master Volume

- Sliding this volume bar will set the master volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Music Volume

- Sliding this volume bar will set the music volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Sound Volume

- Sliding this volume bar will set the sound volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Test Volume Balance

- Clicking this button will play a list of assorted game sounds to simulate what gameplay would sound like with the given volume settings. When it's currently being tested, the button text will be changed to "End Test" which the user can press again to stop the test. During the test, the volume can still be changed dynamically through the slider bars.

Back

- Clicking this button will transition back to the previous scene (either Main Menu or Game Play scene).

Controls:

Left Click (On Left Click Up)

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level

Down Arrow / S

- Moves the current menu selection down one level

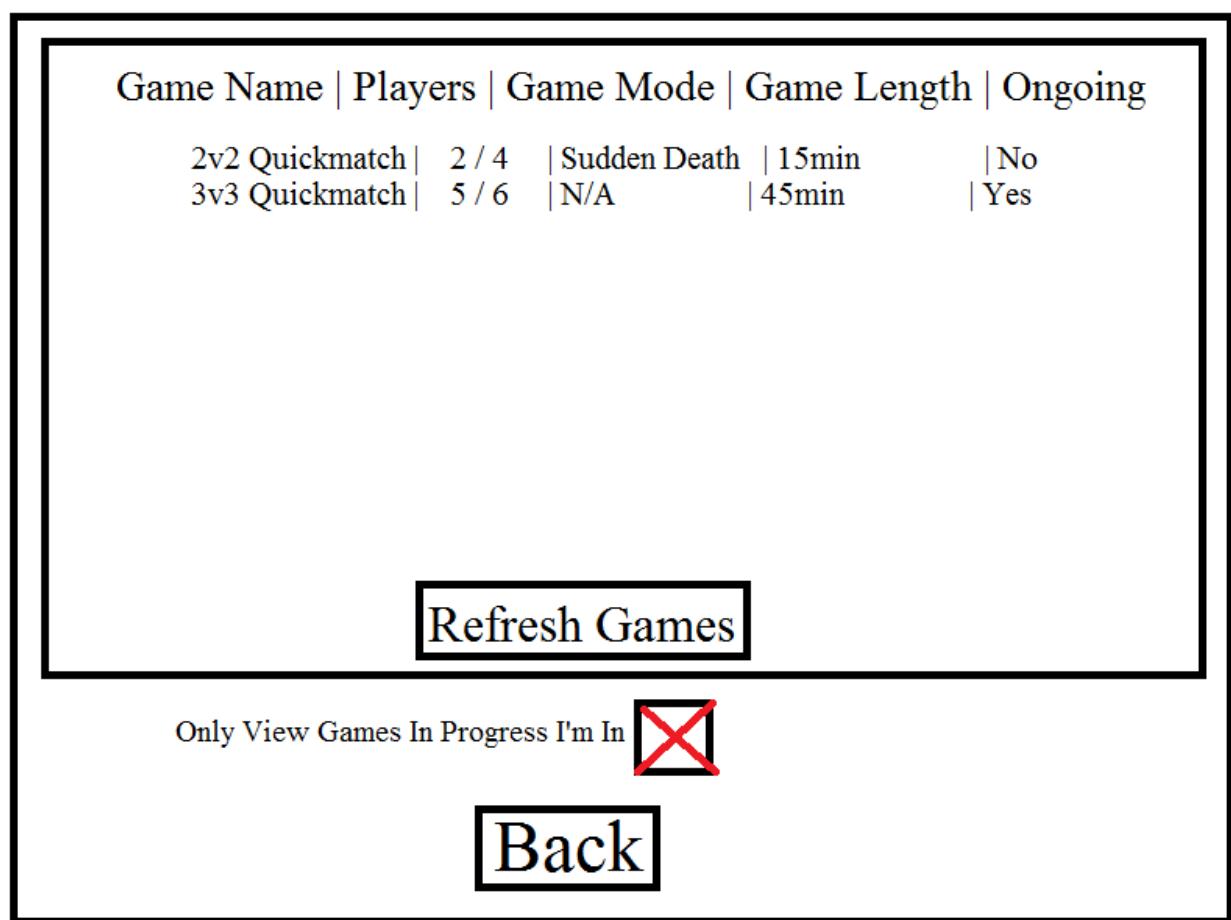
Enter or Space

- Selects the current menu selection. Also achieved by left clicking the same thing.

Esc

- Transitions back to the previous scene (Main Menu).

3.1.2. Game Viewer Scene



Game List

- This list will allow the player to view and join games. It allows for ascending and descending column sorting. When a player clicks on a game, the row that that game is in will be highlighted. Double clicking that game will cause the player to join that game.

Refresh Games

- Clicking this button will clear all of the games from the list and request a new refreshed list from the server.

Only View Games In Progress

- This checkbox allows the player to view games that are saved that they're currently in.

Back

- Clicking Back will transition back to the previous scene (Main Menu).

Controls:

Left Click

- Left clicking a column will sort the list of games by that column. If the list of games are already sorted by that column, then left clicking the column will toggle the order at which they're sorted (ascending / descending).

- Left clicking a game will select the game that the cursor is currently over. Double left clicking the game that the cursor is currently over will select and join that game.

- Left clicking is also used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Mouse Wheel

- The player can use the mouse wheel to scroll up and down through the list of games.

Up Arrow / W

- Selects the game above the current selected game (if any), otherwise does nothing. If a game isn't currently selected, then it moves the menu selection up one level. Holding down this key will cause the same effect as pushing the key multiple times per second.

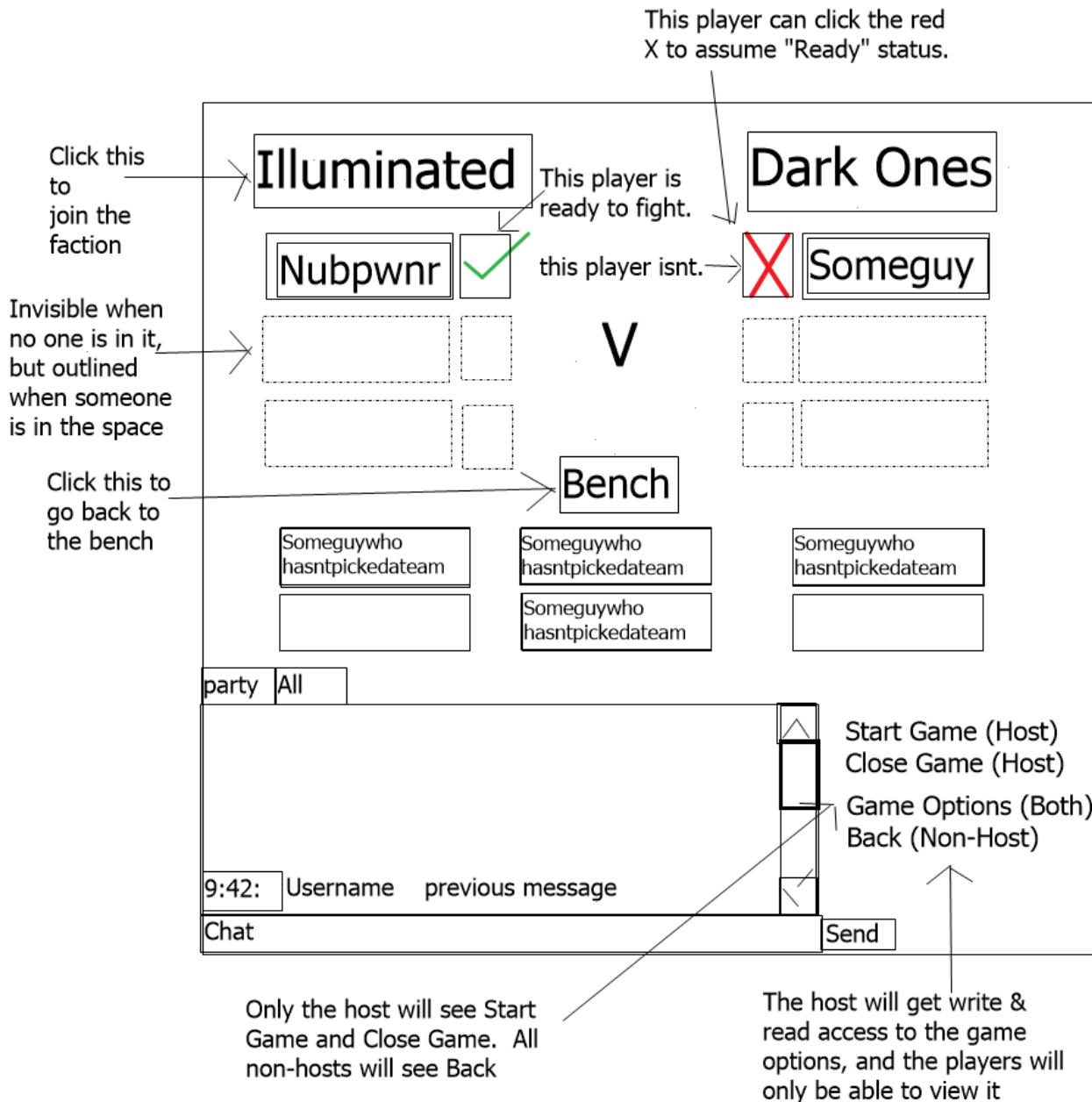
Down Arrow / S

- Selects the game below the currently selected game (if any), otherwise does nothing. If a game isn't currently selected, then it moves the menu selection down one level. Holding down this key will cause the same effect as pushing the key multiple times per second.

Esc

- Deselects the current selected game (if any). If a game isn't currently selected, then it transitions back to the previous scene (Main Menu).

3.1.3. Game Lobby



The Illuminated

- Clicking this button will move the player to The Illuminated team if there's space. If the player is already on a team and is ready, then this does nothing.

The Dark Ones

- Clicking this button will move the player to The Dark Ones team if there's space. If the player is already on a team and is ready, then this does nothing.

Bench

- Clicking this button will move the player to the bench. If the player is already on a team and is ready, then this does nothing.

Ready

- Clicking this button will toggle the player from not ready to ready, and ready to not ready. When the player is ready, the player cannot move to another team.

Start Game

- Clicking this button will start the game if the teams are equal and every player on both teams is ready. This option is disabled for every player except the host. The teams must be balanced or this option is greyed out.

Game Options

- Clicking this button will transition to the game options scene. The game options can only be changed by the host, but other players can still view the current game options.

Back

- Clicking this button will leave the game (and disband it if the host is the one leaving).

Controls:

Left Click (On Left Click Up)

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current selection up one level up until the Bench selection.

Down Arrow / S

- Moves the current selection down one level.

Left Arrow / A

- Moves the current selection to the team on the left side, or moves the current selection to the Bench if the team on the right was selected.

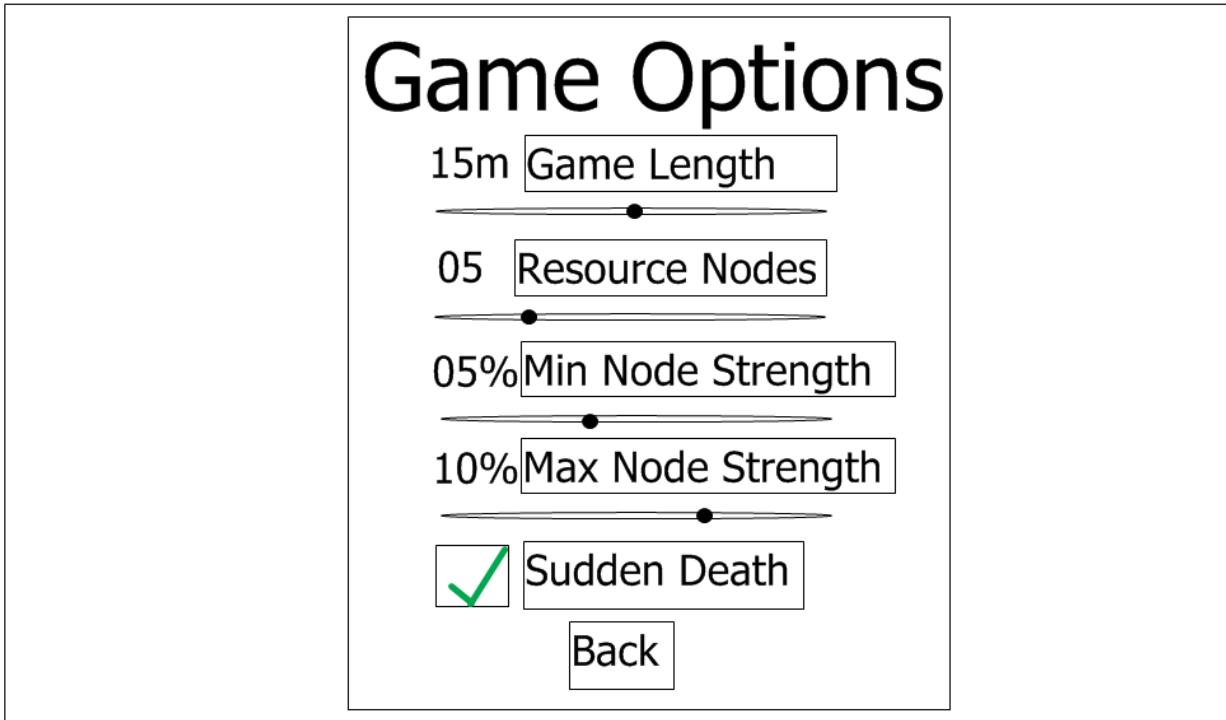
Right Arrow / D

- Moves the current selection to the team on the right side, or moves the current selection to the Bench if the team on the left was selected.

Enter / Space

- If a team is selected, will move the player to that team (if that player is already on that team, it will toggle their ready state). If a menu option is selected, will select that menu option. Left clicking those items will accomplish the same thing.

3.1.3.1. Multiplayer Game Options Menu



Resource Node Count

- Modifying this value will change the number of resource nodes that appear in each lane in the game.

Resource Node Strength

- Modifying this value will change the additional bounty percentage modifier that each resource node adds.

Max Game Length

- Modifying this value will change the maximum game length to the length specified.

Sudden Death

- Enabling this option will cause all minions to become invulnerable to damage when the time runs out.

Back

- Clicking this button transitions back into the game lobby scene.

Controls:

Left Click

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level.

Down Arrow / S

- Moves the current menu selection down one level.

Left Arrow / A

- Decreases the slider on the current menu selection by 5% or by 1 (depending on what the value is).

Right Arrow / D

- Decreases the slider on the current menu selection by 5% or by 1 (depending on what the value is).

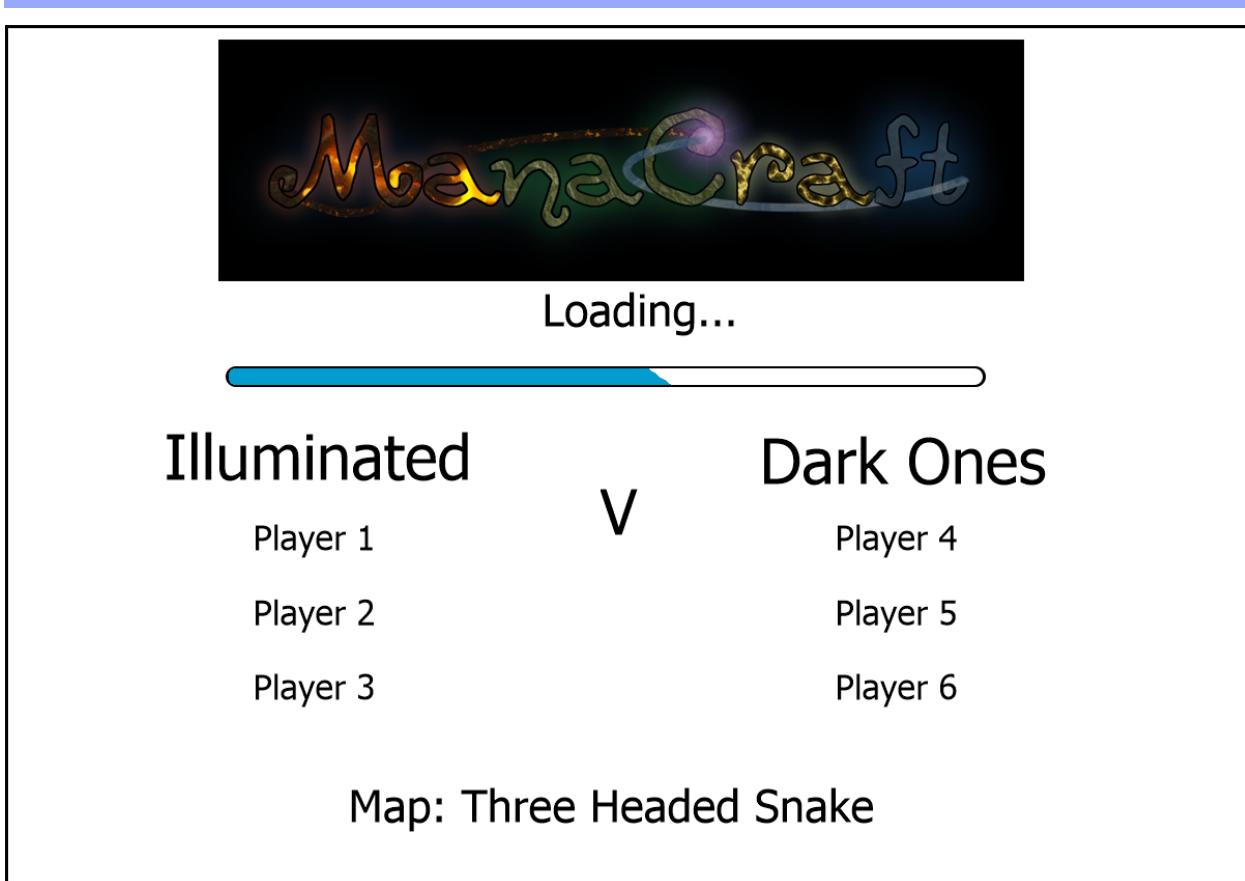
Enter / Space

- Accepts the current selection and return to the Last Opened Menu.

Esc

- Cancels the current selection, returns the setting to what they were before the menu was opened and closes the menu to the previous scene (Game Viewer Scene or Game Scene).

3.1.4. Game Loading Screen

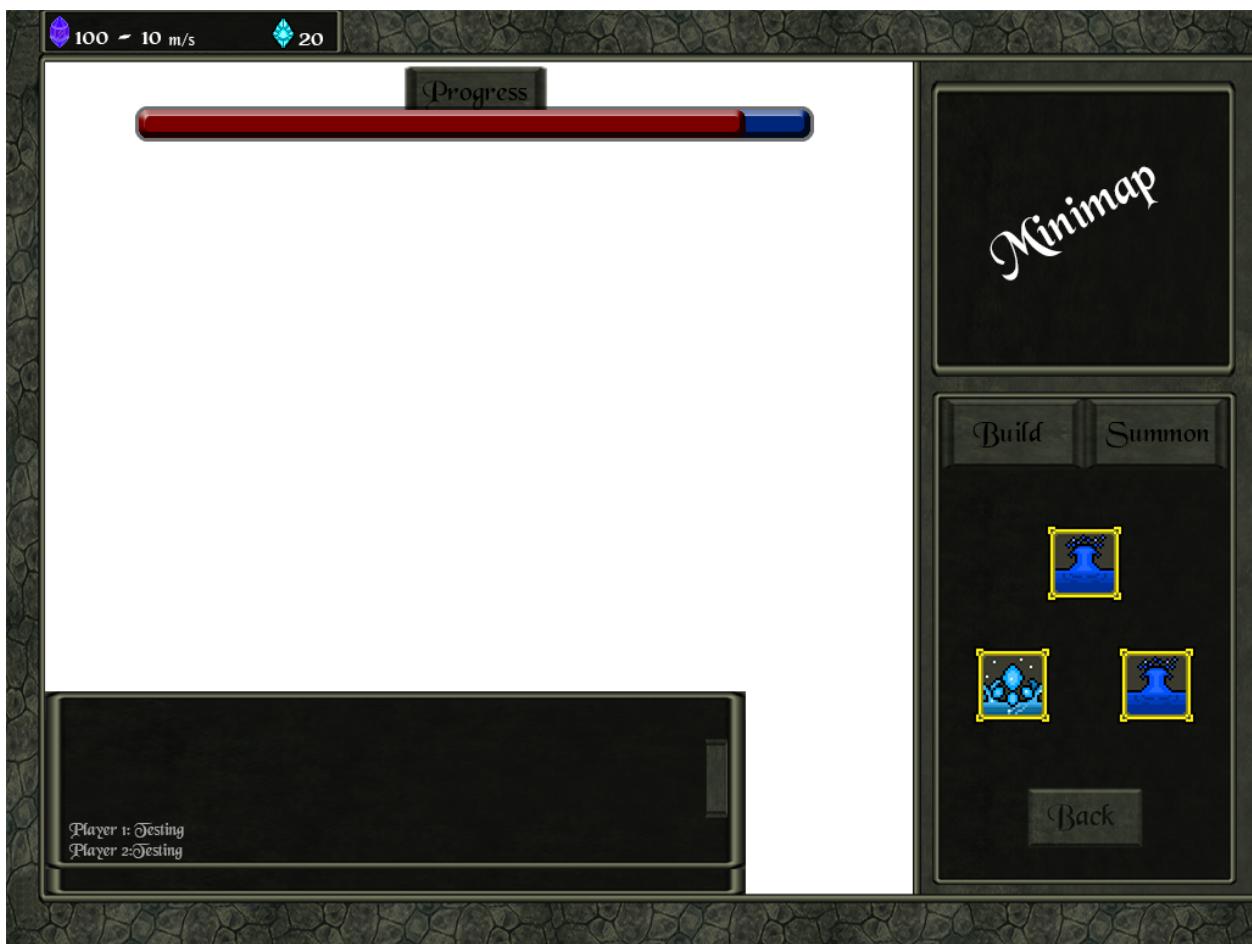


- This screen shows the players who are about to start a game that is currently loading as well as the map they will be playing on.

Controls:

- No controls are required as this is a loading screen.

3.1.5. Game Scene



Controls:

Left Click

- Clicking the left mouse button can: select a tower for placing, build a tower, summon a minion, upgrade a tower, and upgrade a minion.
- Left clicking is also used to click buttons.

Mouse Over

- Moving the mouse over a tower will display a tooltip containing information on that tower.

Mouse Wheel

- Using the mouse wheel will cause the camera to zoom in and out (depending on which direction the wheel is turning).

Up/Left/Down/Right Arrow & W/A/S/D

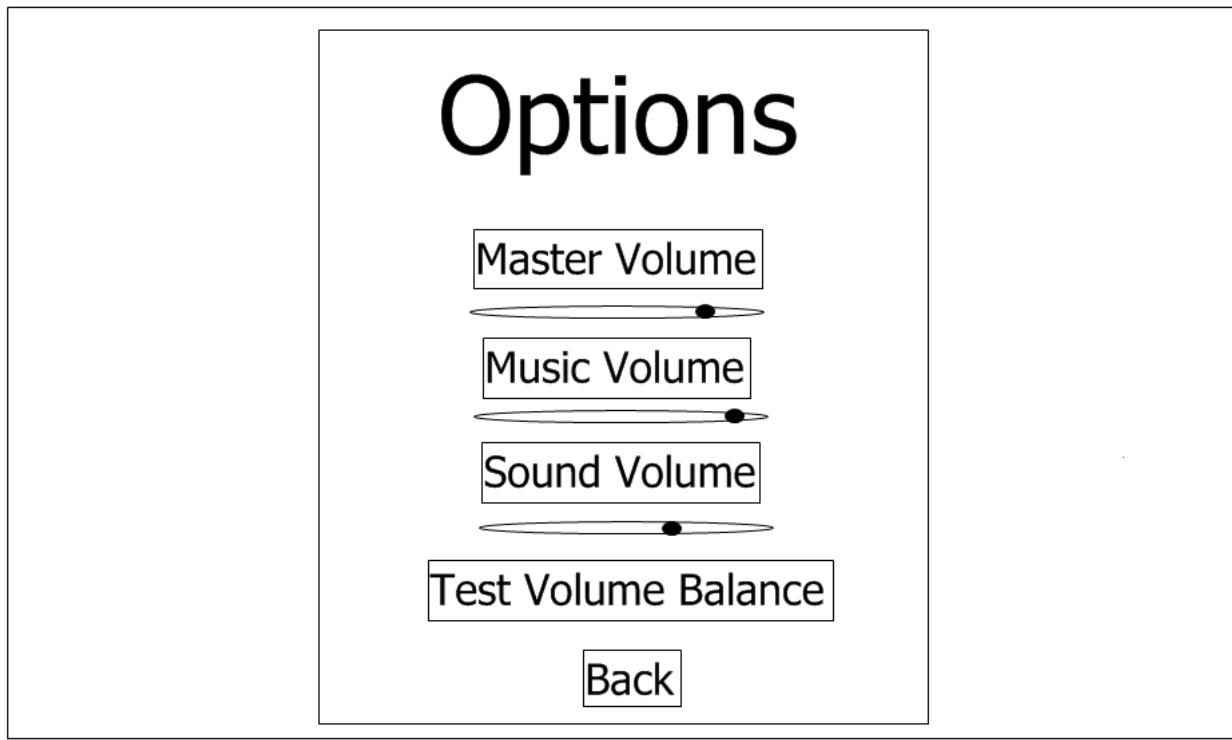
- These keys (when held down) will move the current view toward the corresponding direction. This can also be done by moving the mouse cursor to the edge of the screen.

Esc

- Esc will first deselect any tower that's been selected for building, and then it will toggle the

game menu.

3.1.5.1. Options Menu



Master Volume

- Sliding this volume bar will set the master volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Music Volume

- Sliding this volume bar will set the music volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Sound Volume

- Sliding this volume bar will set the sound volume to 0% if it's at the left side of the slider, and 100% if it's at the right side of the slider.

Test Volume Balance

- Clicking this button will play a list of assorted game sounds to simulate what gameplay would sound like with the given volume settings. When it's currently being tested, the button text will be changed to "End Test" which the user can press again to stop the test. During the test, the volume can still be changed dynamically through the slider bars.

Back

- Clicking this button will transition back to the previous scene (either Main Menu or Game Play scene).

Controls:

Left Click

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level

Down Arrow / S

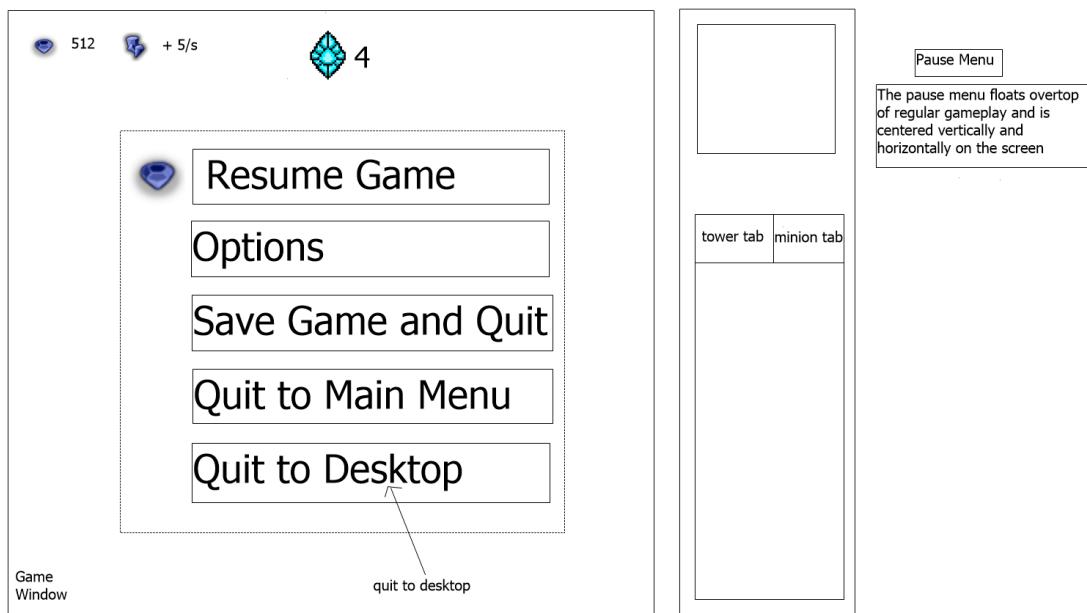
- Moves the current menu selection down one level

Enter or Space - Selects the current menu selection. Also achieved by left clicking the same thing.

Esc

- Transitions back to the previous scene (Game Scene).

3.1.5.2. Pause Menu



This menu comes up if a pause request is seconded (more than 1 person wants to pause the game) the pause request has a team global cooldown of 30 seconds. The host has control during the pause menu and is the only player who has access to saving a game. If the host quits everyone gets kicked before the host and then the game shuts down.

Controls:

Left Click

- Left clicking is used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level

Down Arrow / S

- Moves the current menu selection down one level

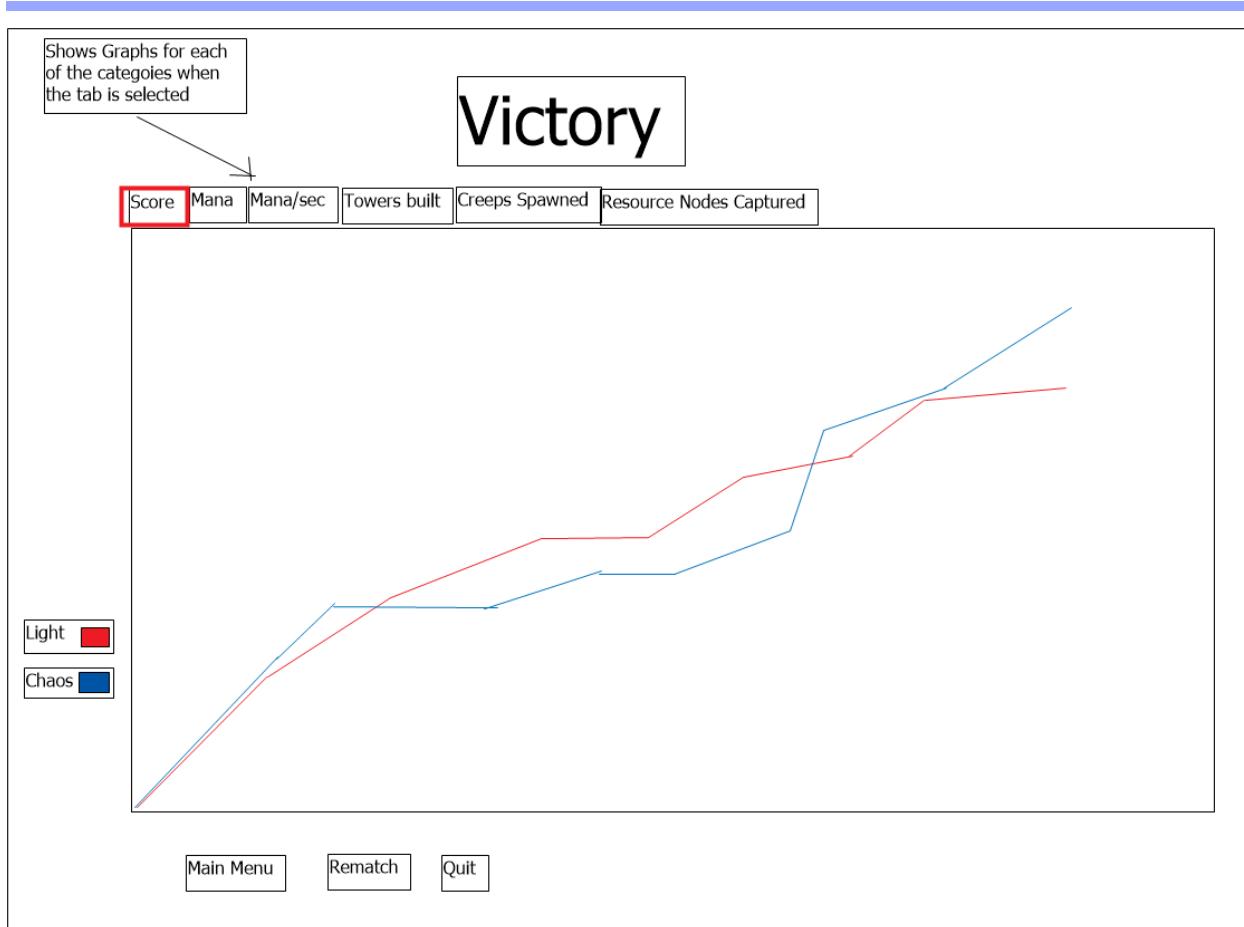
Enter or Space

- Selects the current menu selection. Also achieved by left clicking the same thing.

Esc

- Transitions back to the previous scene (Game Scene).

3.1.6. Victory/Defeat Menu



Score

- Clicking the Score tab will display the Score graph.
- This graph displays the total score of each team at 15 second intervals.

Mana

- Clicking the Mana tab will display the Mana graph.
- This graph displays the total mana count of each team at 15 second intervals.

Mana per Second

- Clicking the Mana per Second tab will display the Mana per Second graph.
- This graph displays the total mana per second count of each team at 15 second intervals.

Towers Built

- Clicking the Towers Built tab will display the Towers Built graph.
- This graph displays the total towers built count of each team at 15 second intervals.

Minions Summoned

- Clicking the Minions Summoned tab will display the Minions Summoned graph.
- This graph displays the total value of the minions that were summoned of each team at 15 second intervals.

Resource Nodes Held

- Clicking the Resource Nodes Held tab will display the Resource Nodes Held graph.
- This graph displays the total resource nodes held by each team at 15 second intervals.

Main Menu

- Clicking the Main Menu button will return the player to the main menu.
- Since the player has left the game, the rematch button will be disabled for all other players who are still in the victory / defeat menu.

Rematch

- Clicking the Rematch button will prompt everyone who participated in the game for a rematch.
- The user that initiated the Rematch will see a popup window that says "Waiting for other players..." as well as how many players opted in for a Rematch out of how many people were in that game. (Ex: 3 / 4 players). For the players that didn't initiate the Rematch, a confirmation window will pop up asking if they want a rematch. If they choose yes, the pop up window transitions to the popup window that informs the player that it's "Waiting for other players..." (See above for full description). If at any point a user had already clicked "Main Menu" or clicked "No" on the rematch popup window, then the rematch option will be disabled and anyone who was waiting on other players will receive a popup window that informs them that a player has already left the game and a rematch is no longer possible.

Quit

- Clicking the Quit button will cause a confirmation window to popup asking if the player wants to exit to the desktop. If the player selects Yes, the game exits and if he/she chooses No, It goes back to the Victory(or Defeat) screen.

Controls:

Left Click

- Left clicking can be used to select a tab.
- Left clicking is also used to click buttons.

Mouse Over

- Mousing over a button will change the current menu selection to that selection.

Up Arrow / W

- Moves the current menu selection up one level

Down Arrow / S

- Moves the current menu selection down one level

Left Arrow / A

- Selects the tab that's to the left of the currently selected tab.

Right Arrow / D

- Selects the tab that's to the right of the currently selected tab.

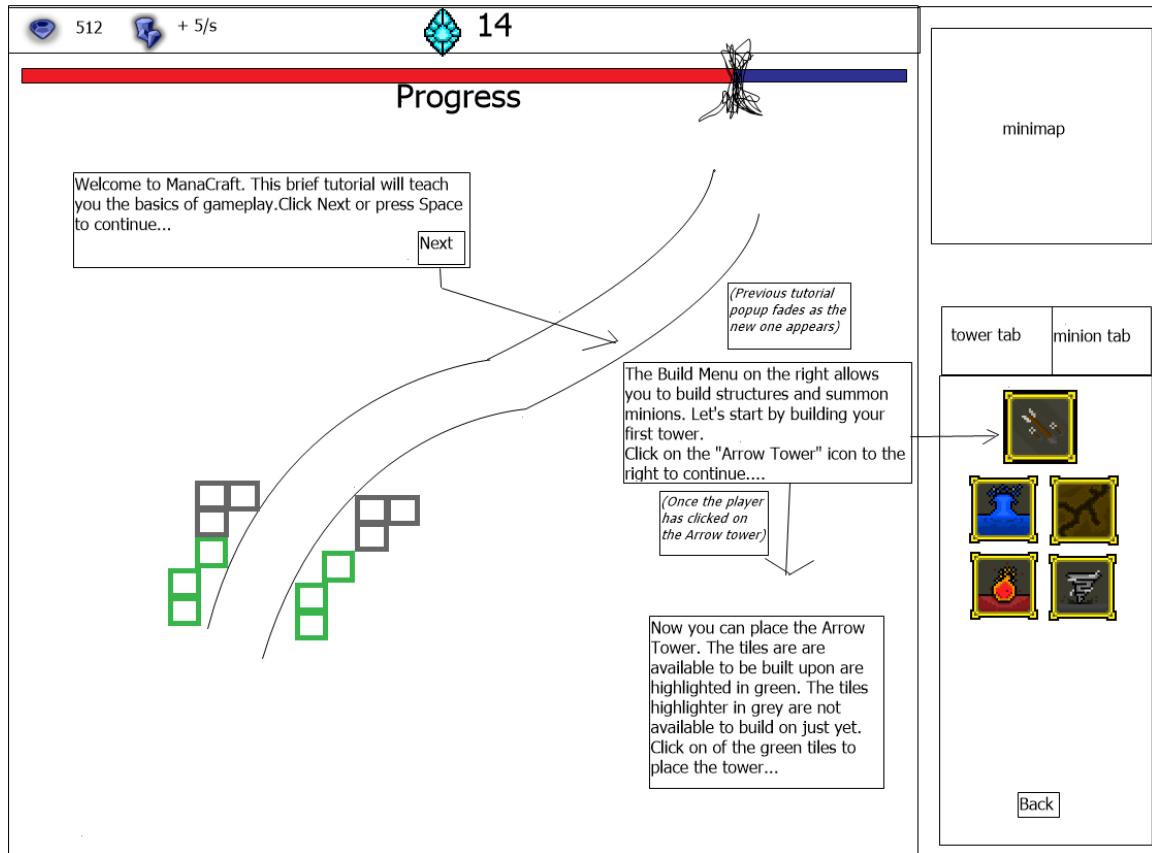
Enter or Space

- Selects the current menu selection. Also achieved by left clicking the same thing.

Escape

- Transitions back to the previous scene (Game Scene).

3.1.7. Tutorial Scene

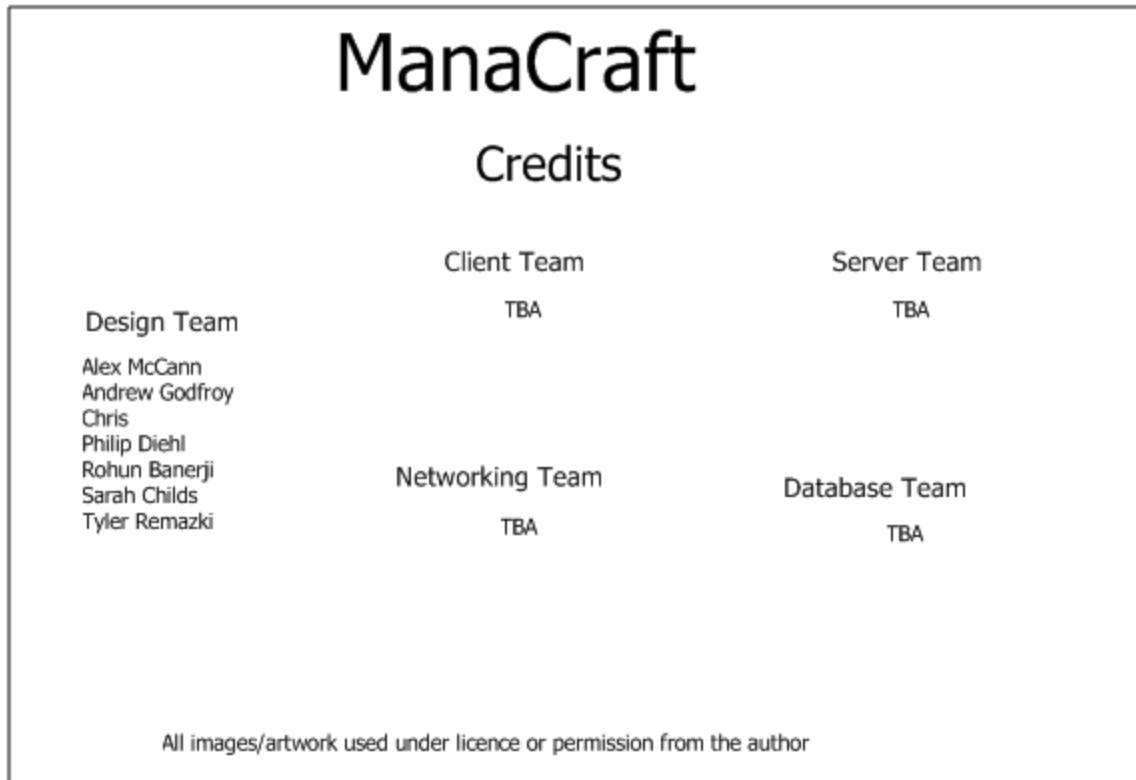


- Same as Game Scene.

Controls:

- Controls are as per Game Scene.

3.1.8. Credits Scene



Lists all the teams and members.

Controls:

Any Key

- Transitions back to the previous scene (Main Menu).

3.2. Music

Menu Music

- One song will be used for the pre-game menus. This song must be loopable.

Gameplay Music

- Multiple songs will be used for in-game music. These songs do not need to be loopable as the player will have the option of selecting which song to play.

Victory Music

- One song will be used for when the player is victorious. This song will be played once and does not need to be loopable.

Defeat Music

- One song will be used for when the player is defeated. This song will be played once and does not need to be loopable.

Opening Music

- One song will be used for the opening cinematic. This song must be loopable.

Credits Music

- One song will be used for the credits. This song must be loopable.

3.3. Sound Effects

Sound Effects are only played for the individual player when his/her viewport includes the source of the sound

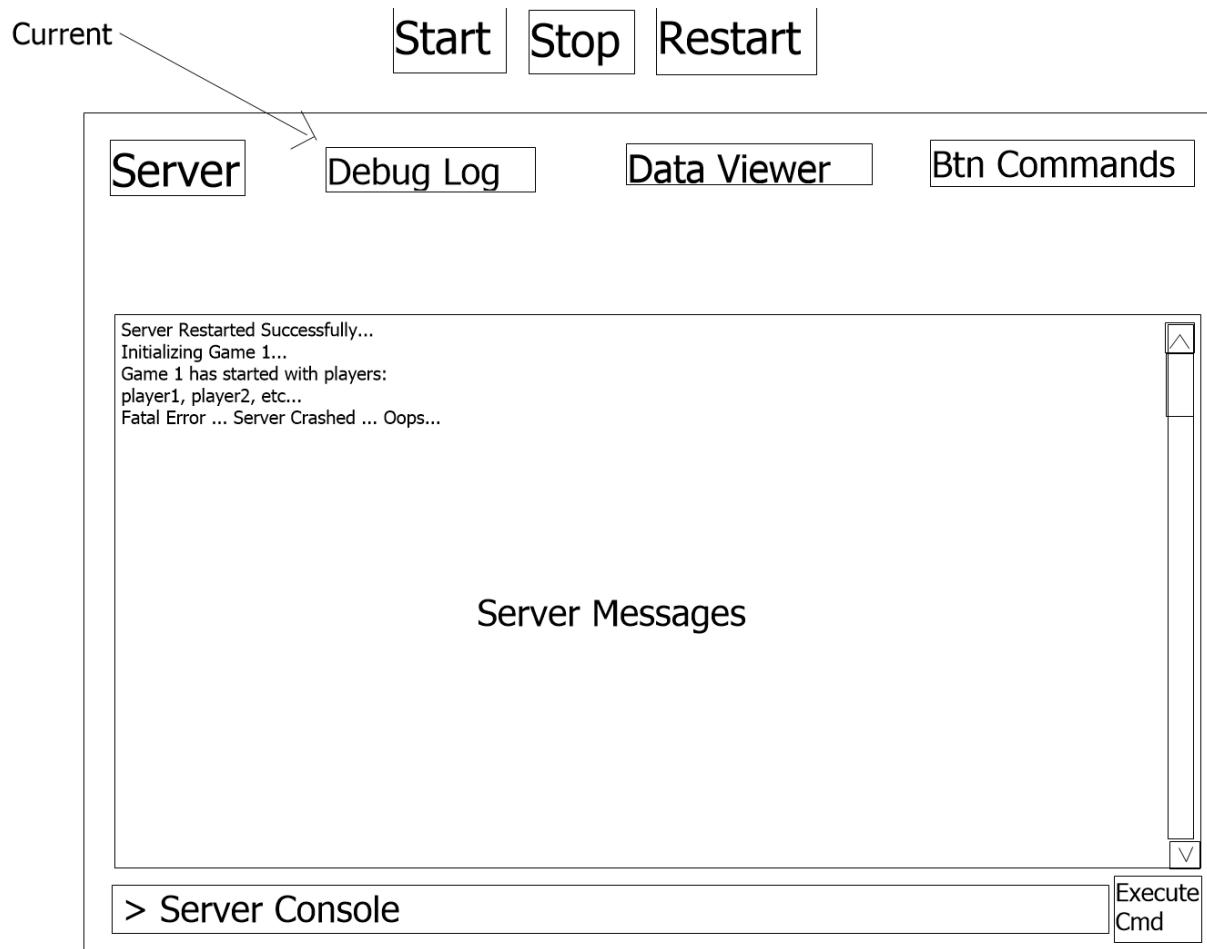
- Normal Tower Attack (Very Short)
- Fire Tower Attack (Very Short)
- Wind Tower Attack (Very Short)
- Earth Tower Attack (Very Short)
- Water Tower Attack (Very Short)
- Minion Teleport In (Very Short)
- Minion Was Hit (Very Short)
- Minion Teleport Out (Very Short)
- Tower Built (Short)
- Tower Sold (Short)
- Tower Upgrade Purchased (Short-Medium)
- Minion Upgrade Purchased (Short-Medium)
- Button Click (Short)
- Error (Short)
- Menu Open (Short)
- Menu Close (Short)
- Server Message Received (Short)

4. Server

4.1. Server GUI

4.1.1. Debug Log

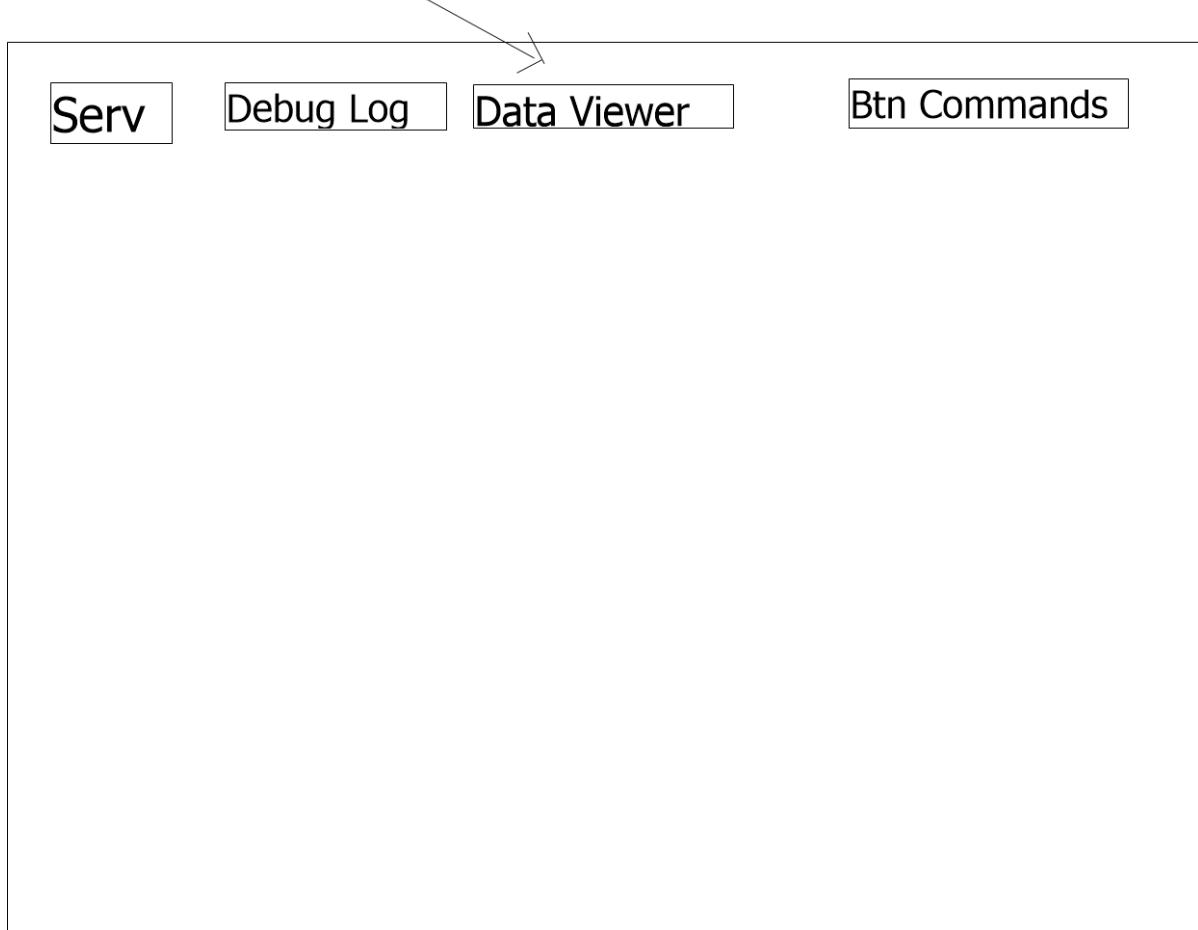
The server will have a GUI with the following functionality: Add Session, Delete Session, Start Session, End Session, Broadcast Message, Send Message, Start Server, Stop Server, Restart Server, Kick Player, and Ban Player.



Server Commands:

- ./Tell Username Message
- ./Whisper Username Message
- ./Help
- ./Kick Username
- ./Ban Username
- ./Shutdown-save
- ./Shutdown-nosave
- ./Restart delayInSecs (default 0)
- ./PauseGame gameID
- ./EndGame gameID

4.1.2. Data Viewer



4.1.3. Button Commands

Serve	Debug Log	Data Viewer	Btn Commands
Start		Shutdown	
Save To Database		Clear Database	
Max Online	5	Accept	<input checked="" type="checkbox"/>
Max Active	8	Allow Game	<input checked="" type="checkbox"/>
GameID			
New	Start	End	

4.2. Server Broadcast System

The server will be able to send broadcast messages to all clients with important information such as:

- Achievements earned by the client / client's team members
- 15 / 10 / 5 Minute Remaining Warnings
- Emergency Server Shutdown / Restart
- Admin Messages

5. Competitive Analysis

5.1. Defense Grid: The Awakening

5.1.1. What Is It?

Defense Grid is a 3D Strategy Tower Defence game where players defend Power Cores at the end of the level using their towers to build a maze. Within the game, towers can be upgraded and enemies get stronger and more numerous as the waves go on. Defense Grid, released on PC in December of 2008 and released on Xbox Live in September of 2009 making over 3 million dollars in combined platform sales and winning numerous awards. In addition, it gained a fanbase among Tower Defence fans which allowed it to surpass a 1 Million dollar kickstarter for extra content.



5.1.2. What Makes ManaCraft Better?

What makes ManaCraft better is the online multiplayer. In Defense Grid players simply face off against AI, which eventually gets predictable, and by extension, less fun. On the other hand, our game will feature competitive multiplayer allowing players to feel challenged, in addition to ensuring that every game will feel unique and fun.

5.2. Plants vs Zombies

5.2.1. What Is It?

Plants Vs Zombies, made by PopCap Games, is a fast paced tower defence where players take on the role of household gardeners, planting plants which are used to attack oncoming waves of zombies. The main objective of Plants vs Zombies is to use your plants to stop zombies from reaching your house (and eating your brains). Plants vs Zombies has grown to become a large and extremely successful franchise, generating several million dollars in revenue.



5.2.2. What Makes ManaCraft Better?

While Plants vs Zombies is first, and foremost, a singleplayer game with a tacked on multiplayer mode; ManaCraft will be designed with multiplayer in mind and will offer a more refined and fulfilling multiplayer experience.

5.3. Elemental TD

5.3.1. What Is It?

ElementTD is a popular custom game mode for Blizzard RTS Games, available for the original Warcraft Series, StarCraft 1 and StarCraft 2. ElementTD has been downloaded more than 70,000 times; with the unofficial Flash remake having been downloaded and played more than 140 Million times.



5.3.2. What Makes ManaCraft Better?

Being a standalone game, ManaCraft provides players with an improved Tower Defence game without forcing them to purchase another game. And because our game will be built from ground-up to be a multiplayer tower defense game, the mechanics will be far more refined and well-balanced. In addition, our game will focus on the player vs player action making it challenging and giving it last appeal.

5.4. Anomaly 2

5.4.1. What Is It?

Anomaly 2 is a twist on the traditional tower defense genre, in that it has the player configuring and controlling a convoy of vehicles that have to make it past the enemy's defensive structures, in the single player campaign. The multiplayer of Anomaly 2 pits one player, controlling the vehicles, against the other player, who is building towers. The multiplayer can get very competitive as each player tries to outwit the other.



5.4.2. What Makes ManaCraft Better?

While the asymmetrical nature of Anomaly 2's multiplayer makes it feel refreshing compared to other tower defense games, it also gives rise to several balance issues that can be difficult to resolve easily. ManaCraft, on the other hand, has both teams building towers and spawning minions at the same time so it retains the intensity, if not adding more. In addition, in ManaCraft, both teams have access to the same technology; although, they can choose to go down different paths. This assures that both competing teams are completely symmetrical, so there are no balance issues that cannot be fixed easily.

6. Teams

6.1. Design Team

- Alex McCann
- Tyler Remazki
- Philip Diehl
- Rohun Banerji
- Sarah Childs
- Andrew Godfroy
- Chris Devlieger

6.2. Client Team

TBA

6.3. Server Team

TBA

6.4. Database Team

TBA

6.5. Network Team

TBA

“Remember ... ask yourself:
What’s the problem I’m trying to solve?”
-Jeff Fisher
