Tortuga Game Design Document

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# Introduction

This is the design document for Tortuga. This is intended to plan out required tasks for the game, as well as serve as an instructional text for modders and others interested in Tortuga’s development cycle.

I have a long road ahead of me, and design docs are never really finished until the project is. So, if you see any italic text, you can consider that to be an incomplete or removed section of text, or an inline comment.

## Elevator Pitch

Tortuga is an open source 2D multiplayer rogue like RPG. The game runs on customizable player run servers, which can hold at least 150 unique players. This project is currently independently created and funded, with the goal of releasing an early version for alpha funding and incorporating community feedback.

## Monetization

I’d like to develop this game as an open source project until I reach alpha, at which point I’ll run a kickstarter and begin taking preorders. The preorder system will work similar to Minecraft’s preorders: players can buy the game during alpha for 50% of the retail price, or 75% during beta. The kickstarter will be used partially to raise awareness of this project at the beginning of the alpha.

Anybody who has purchased this game has access to all of the development files, as well as a license to modify and redistribute the game to anybody else who has also purchased the “vanilla” (unmodified) version. This is to encourage mods and customisation of the game.

# Gameplay

## Player Characters

Each player can create a set of player characters (PCs) that are connected to their account on the server. Each character has standard metadata, including name, sprite, etc. that make that character unique. In addition to this, each character also has a set of statistics (used for combat purposes and progression) and an inventory (their personal items).

If a player’s character runs out of health, and they have no way to save themselves from death, then that character is deleted; this is called permadeath. Any items that the character is holding at the time are also lost (with the possible exception of legendary items).

When a player first logs onto a certain server, they must create a new character. Characters generally cannot be transferred from one server to another, preventing players from importing overpowered characters into a world that isn’t ready for them.

## Player Character Statistics

Each PC has their own unique set of statistics (stats). These stats are divided into two categories: base stats and derived stats. Base stats are the character’s raw skills, which are generated during character creation and are levelled up as the player progresses. Derived stats, which are generally only used during combat, are determined by a combination of a character’s base stats, equipment stats and modifiers from other sources.

Each PC’s base (unmodified) stats are as follows.

* Level (LVL)
* Maximum Health Points (MaxHP)
* Maximum Magic Points (MaxMP)
* Attack (ATK)
* Defence (DEF)
* Intelligence (INT)
* Resistance (RES)
* Accuracy (ACC)
* Evasion (EVS)
* Luck (LUK)

The above stats are also shared by certain items, granting the user bonuses, and by monsters.

## Movement Mechanics

The game is a top down RPG where the players walk around a 2D world, while being unable to pass through solid objects (including walls, water, etc). The player can enter/exit areas by colliding with (i.e. entering) door-like objects; these different areas include buildings, dungeons and combat portals. There will also be the possibility of teleportation at some point.

## Combat Mechanics

Tortuga’s combat consists of a unique drop-in/drop-out multiplayer active time battle system, inspired by earlier Final Fantasy instalments. Battles that a player can participate in will be visible in the game world as “combat portals”. See the next section for more information.

The combat system will allow several people to fight side by side as a group. Each player will be able to choose their own actions, including attacking with their equipped weapons, using spells and items, or fleeing the battle, etc. To prevent a player from taking too many actions too fast, that player must wait for their ATB gauge to fill completely before acting, after which it resets to zero. The speed at which a character’s ATB gauge refills is affected by that character’s speed stat; each player needs 100 “ticks” in their ATB gauge to attack. They can select their specific attack from the menus while their meter is loading, but actions won’t be taken until the meter is full.

*For a speed of 5, it would take 20 seconds to take an action, while for a speed of 50, only 2 seconds are taken, etc. These extreme time delays may seem strange, but I have a hunch that it may be necessary to allow players to search their menus. I’ll make tweaks further down the road.*

*TODO: Stats and equations*

## Combat Portals

A combat portal represents a fight in progress, located in the overworld or a dungeon. Random portals can be generated near players, sucking them in against their will, or static portals can be generated at certain locations as a set boss encounter by the dungeon’s algorithm.

Since permadeath is such a massive aspect of the game, a player must have the ability to flee a battle at any time. Fleeing a battle causes a player to take a penalty such as losing money, experience points, or more. Leaving a battle, if there are still players fighting that battle, does not end the battle itself. Instead, when all monsters inside a combat portal have been defeated, the portal disappears and the remaining players are rewarded. However, if there are no players currently fighting a particular battle and the monsters were not defeated, the battle resets; the monsters regain their full health and are cured of any status ailments.

The complement of the ability to flee a battle is the ability to join a battle in progress. If there are players currently inside a combat portal, a player within sight of the portal will be able to distinguish this. In addition, that player can join the battle to assist the other players, or to possibly cause those players problems (like stealing the loot).

## Permadeath

One of the most significant features of the game is permadeath: deletion of a character upon death. The purpose of this feature is twofold. First, to add an extra layer of challenge to the game, and secondly, to prevent any one character from becoming too powerful without taking risks. Any items (apart from legendary items) that the character owns are dropped where they died.

## Monsters

Monsters are script driven opponents generated inside combat portals, which also drop random rewards when they are killed. At this stage, there are no concrete plans for monsters outside of this.

*TODO: Types of monsters, and their possible algorithms.*

## Items

Items are randomly found throughout the world, or dropped by defeated monsters and players. Item types include consumables (food that increases HP, etc.) equipment (for boosting stats), legendary (unique and hard to find) and mundane (vendor trash, etc).

*TODO: legendary items*

## Equipment

Equipment items are items that can be worn by players to boost certain stats. Each piece of equipment has a certain “type” which dictates what slot it can be used in.

*TODO: Expand these few sections when I’ve reached that part of development.*

# The Game Map

The game’s maps are for the most part procedurally generated. The main world map that connects most of the game world together is called the overworld. The centre of the overworld map (spawning around (0, 0)) is the root town, where players first enter the server. Safe towns, outposts, etc. like this root town are also generated elsewhere, depending on the overworld’s generation algorithm.

The overworld consists of different biomes including mountains, oceans, plains, etc. Different sections are also given difficulty ratings, from zero (for towns, safe zones, etc.) upwards. The difficulty ratings are fixed, meaning that you can be easily outgunned in a dangerous area, so it’s a good idea to keep track of the ratings as you explore.

## Dungeons

Scattered around the overworld are several types of “dungeons”. Unique monsters and items can be found inside, and they usually have one final “boss” monster that drops the biggest reward. Each dungeon has a specific difficulty rating, based partially on its location.

Each area inside a dungeon is procedurally generated, based on various factors including the dungeon’s type, difficulty rating, how deep the player is, and where in the world the dungeon is located. The locations of these dungeons are generated by the overworld algorithm; there are also unique “legendary” dungeons that are guaranteed to spawn with certain parameters.

### Ruins

The ruins are the remains of an ancient civilization. Their structures have multiple levels, with sprawling corridors and halls honeycombing through the ground.

### Towers

Towers are gauntlet-style challenges that get progressively harder the higher you go. Each level in a tower is a simple room, but it has its own monsters and challenges.

### Forests

Forests take up actual space in the overworld, but they do exist in their own instance. They’re often bigger on the inside than the outside, and often have multiple exits. The Forests are single levels, with a mazelike structure.

### Caves

Caves have several exits, often extremely far apart from each other with the cave acting as a fast transit system. However, like other dungeons, caves also have dangerous obstacles, and must be explored to reach the other end. Their structures can be segmented into separate chambers, each with unique features.

## Legendary Dungeons

Legendary dungeons are special cases in the generation algorithm. These unique locations are guaranteed to spawn with certain features in every server, and are often related to the plot or the game as a whole.

# Navigating the Client

*TODO: menus, user interface, etc.*

# Server Management

## Server Mechanics

*TODO: What can a server do, and how does it do it?*

Players can setup their own game server, while other players can connect via the internet or over a LAN. The first time a player connects to a server, they have to create a new character for that specific server.

Server moderators can whitelist or blacklist players, as well as install mods. Mods are packaged in zipped archives, and dropped into the server’s “mods” folder (simplicity here is what I’m aiming for). Actually creating these mods requires knowledge of the scripting API, as well as familiarity with the lua programming language.

At first, only the world generation code can be modified, but eventually new graphics, etc. will be available. More in-depth modding is possible by altering the source code, but this would require obtaining the new programs. For security reasons, the vanilla client will not be allowed to connect to servers with modified source code, and the vanilla server will reject modified clients.

## Server Structure

*TODO: What makes up the “server”*

## Data Storage

*TODO*

## User Accounts

*TODO*

*The player accounts can be handled using Amazon servers down the line, but for now players have to input their username into the configuration file. This username is used by the server, so if two people connect using the same username, there could be problems.*

*Each person who accesses a server must have their own user account. This allows players to keep track of their PCs, items, and other settings. This will also allow a server owner to whitelist or blacklist certain players, as well as other server specific options.*

*Each user account will have a certain number of PC slots. The items, etc. that a character collects stays with that character when a user logs out.*

*The accounts will be stored in a database.*

## Lua Scripting

*TODO: Information on the packaged scripts and the APIs.*

## SQL Scripting

*TODO*

# Development Resources

From this section onwards, this document focuses on the development side of Tortuga. There’s a lot more technobabble, intended for modders and such. This is also the primary documentation for the various components that make up the games codebase.

## Languages and APIs

The languages of choice for creating this game are C++11 and lua, for their large user bases and wide feature sets. Third party libraries I’m using include SDL (Simple DirectMedia Layer), SDL\_net and SQLite3, for much the same reasons.

# Map Structures

*TODO: If I’ve modified the map structures, I’ll need to update this.*

## Region

The game’s map is divided up into units called “Regions”, which are stored in the Region class. This class is fairly simple, requiring the width, height, depth, X and Y positions on creation, and provides two functions for accessing the three dimensional array of tiles.

This class also defines the type Region::type\_t which is the internal storage type for the tiles. Please note that the value 0 is used for empty tiles. region.hpp also defines three macros, REGION\_WIDTH, REGION\_HEIGHT and REGION\_DEPTH, which are used by the RegionPager objects to define the width, height and depth of the regions. Hopefully, these macros are temporary.

## RegionPager

The paging class is divided into two parts: RegionPagerBase and RegionPager. The abstract base class provides access to the correct region objects, via wrapper methods GetTile() and SetTile(). This class also allows the user to set the sizes of the regions, but please note that it is a Very Bad Idea to change this mid program.

The derived class, which takes two template parameters, overrides four abstract methods used for creating, and saving and loading the region objects. The derived class doesn’t do much itself, apart from bridging the gap between the base class and the functor classes provided as template parameters.

## Generator Functors

There are currently two generator functors, BlankGenerator and LuaGenerator. The first creates and cleans up a region object, and simply leaves the default values in place. The second also passes the object to a designated lua function for processing either after creating it or before freeing it.

## Format Functors

The format functors require that the program provide the file path to save the map in before it is used; otherwise its behaviour is undefined. The first, DummyFormat, does literally nothing. The second, LuaFormat, will provide an existing object to lua’s save function, or create a temporary Region, and provide that to lua’s load function. Please note that if the load function returns false, then the specified file was not found and the temporary object is freed instead of being passed to the pager.

## Lua’s Region API

The Region library is written to interact with Region objects as needed. The four most common functions are Save(r, saveDir), Load(r, saveDir), Create(r), and Unload(r). Each of these receives a Region object as a lightuserdata type, while Save() and Load() also receive strings containing the map’s save directory.

Accessors and mutators for the Region objects are also provided. The four functions mentioned above are usually called by the functor objects, and are defined as dummy functions by default. If you want to use them, I recommend redefining them in the server’s start up lua script.

The full list of available library functions (at the time of writing) is:

* Region.SetTile(r, x, y, l, v)
* Region.GetTile(r, x, y, l)
* Region.GetWidth(r)
* Region.GetHeight(r)
* Region.GetDepth(r)
* Region.GetX(r)
* Region.GetY(r)
* Region.Create(r)
* Region.Unload(r)
* Region.Load(r, saveDir)
* Region.Save(r, saveDir)

# Modding Support

*TODO*

# Communication Protocols

*The primary method of communication is a custom UDP protocol.*

*TODO: NETWORKING DOCUMETNATION!!! Document the serialization procedure, and the handshakes.*

# Platforms

At this stage, due to a limited scope and budget, this game will only be available on Windows. Hopefully, I might be able to port it to Linux and Mac eventually.

# Todo List

This section is mostly just rubbish dumped here, that will eventually be moved to a previous part of the document, or outright deleted.

*non-player characters? If I include a storyline further down the road, NPCs would be important.*

*factional warefare? PvP is probably the best focus for this game. Creating guilds, parties, etc. would be a good way to encourage communities on the same server. This might be a better fit for a single shard game.*

*at least a basic chat system is needed at some point. I might leave this out, who knows?*

*money & economy? again, something like this probably wouldn’t fit with a game aiming for 150 people per server.*

*mana nodes? If magic becomes a gameplay mechanic, mana nodes that increase that magic would be useful. Also, faction controlled mana nodes would be pretty cool. It seemed to work for Maridian 59.*

*world gates? Long distance teleportation. For root towns, it could be automatic, but maybe you need to have found other gate to be able to teleport there.*

*This needs some serious editing for consistency*

## Devving: First Name “Al”, Last Name “Gorithm”

*These would be stored as base stats, and then converted into derived stats by various means. Depending on your type of attack (physical or magical) the stats that are used at switched into the algorithm, otherwise the algorithm doesn’t change. This is similar to physical/special attacks in Pokemon.*

*The accuracy/evasion, which are percentages, are calculated like this:*

*return A.accuracy - A.accuracy \* D.evasion >= random(100)*

*So, for an attacker’s accuracy of 90, and a defender’s evasion of 20, there is a 72% chance of the attack landing. Fairly straight forward. I haven’t decided how to calculate critical hits. One possibility is if the RNG’s value is less than, say, 10% of the derived hit’s value (in this case, 7.2%), than the hit is critical. I could also add in a “luck” stat which would replace the 10% value, so that the user can up their own chances of landing a critical hit. Sorry if this wasn’t 100% clear, my documentation skills are not optimal.*

*A few nights ago, while barely awake, I wrote this down:*

*I know this isn’t very clear, and as shown by the corrections, I barely understood it. But the basic outline is this: subtract the defence from the attack until you reach half of the attack, then only reduce it by half of the defence. Continue this until you run out of the defence stat.*

*The problem is, I wrote this:*

*function f(a, d, m)*

*if a <= 1 then return 1 end*

*if a/2 <= d\*m then return a - d\*m end*

*return f(a/2, d\*m - a/2, m/2)*

*end*

*Apart from the fucked syntax, this algorithm is just plain broken. It’s amazing hte shit you write when you’re tired. Anyway, I’m currently loking for something that will work better. I’m wondering if the decreasing-impact curve above is good or not, so any feedback is appreciated.*

*Finally, I created a new release tag, release-0.2, which doesn’t have much to show in the front end, but a lot of trial-and-error work in the backend.*

*OK, any feedback is greatly appreciated. You can find the source here, and the most recent playable build here (windows only, sorry!).*

## data dump & finished algorithm

*(A.attack\*3 + A.attack\*(math.random(A.luck\*100)/10)) - (D.defence + D.defence\*D.evasion)*

*This is fairly stable, as far as the data dump goes. You can find the dump here. I made the minimum attack value 1 instead of 0, just because I feel that fits better. I could always add the attacker’s accuracy to their luck stat later, but whatever. Please note that 1: the player probably won’t be able to equip weapons with a higher level then them, and 2. the player won’t even be able to hit their enemy unless this passes:*

*random(100) <= A.accuracy - A.accuracy \* D.evasion*

## Notes.md Dump

*## Notes*

*The server holds the ultimate version of the world. The server has to handle log ons, logoffs, and world simulation. To do this, the server needs some sort of database system. I'd like to use something that is quick and efficient, which means that I'd probably end up using SQLite or something similar.*

*Monster AI/other world effects should be controlled with customizable scripts/specific file formats.*

*Should the server program have a UI? Or at least allow some sort of input at the terminal?*

*#### Template Item Information:*

*\* item type index*

*\* name*

*\* effect...*

*#### Template Item Information:*

*\* item index*

*\* item type*

*\* quantity*

*#### Equipment*

*Equipment should be items, but should the item object be placed in the equipment slot when it's equiped? Or should the slot gain certain traits, and the item is removed from the game?*

*#### Scratchings*

*\* active time vs wait time battle system*

*\* the terrain you fight on affects the strength of spells and attacks*

*Server Room:*

*\* constructor*

*\* destructor*

*\* roomIndex*

*\* game map*

*\* player list*

*\* monster list*

*\* combat entrance list*

*Multithreading the network packets:*

*\* queue*

*\* function to push to the queue*

*\* function to retreive from the queue*

*\* Get the client running first*

*I read in an article about magic being affected by the environment. What if in the ATB system, magic was affected by what type of terrain you were fighting on? Like, if you were in a volcano, fire magic was more powerful, but ice magic was weaker?*

*Unless you had an ice crystal to draw magic from, which makes up for the lack of ice magic sources, but the crystals only had limited amount of uses?*

*-------------------------*

*source: http://www.gamasutra.com/blogs/EvanJones/20130701/195361/Fewer\_Options\_More\_Meaningful\_Choices.php*

*Compare the tension created by this dynamic to that of the lack of drama inherent in the item system of most Final Fantasy titles. In those games, characters can suffer from a variety of status impairments that last for many battles (poison, blindness, silence, etc.) Each ailment has its own respective curative item that can cure no other ailments. Because the player is not limited by inventory space, she can always carry a wide selection of curative items at all times. Status ailments never feel particularly threatening: removing them is simply a chore to be dealt with rather than an interesting decision to be made. This also reduces the impact of items that can cure any ailment - why should a player be excited to gain access to these panaceas when she’s always had the ability to easily cure any ailment? The choice of what items to bring is rendered unimportant by the large amount of available inventory space.*

*So I'm thinking about Boss Battles for the game. The game will have a drop in-drop out battle system, where if at least one person is still fighting the battle continues, but the people who drop out usually give something up in return (i.e. no exp, lose exp or gold, etc.) This will make permadeath easier on the players.*

*Anyway, for Boss battles, I want to encourage several people to take on a boss at once. one way to do this is to make the boss super strong, but I don't really want to rely on that. Another idea was to have several "minion" creatures that the boss uses.*

*i.e. You're fighting the Frog King, who summons four Frog Knights at the beginning of the battle. Every time a Frog Knight dies, a new one is summoned, so you're never fighting less than five creatures at once. The battle ends when the Frog King is dead, but the king never attacks you directly, instead summoning new Frog Knights, as well as healing and buffing the knights already on the field.*

*To defeat the Frog King, you can't just focus on him, since letting the Frog Knights attack you will almost always result in your death. So to defeat the knights and the king, the best strategy is to stun, incapacitate or draw the attention of the knights to other players, while one person attacks the king directly.*

*Now, although this would take a lot of mid level players to bring down, I could scale the number of knights being summoned in addition to the stats of the creatures for when there's only one or two players in the fight. With the drop in-drop out mechanic, I can scale the combat to match the number of players as well.*

*Anyway, this is ages away. I just wish development could go faster than it is right now. Making a video game is hard work, doubly so when you're doing it solo.*

*P.S. I need to add this post to the GDD.*

*-------------------------*

*## Overall Requirements*

*An unmodified client must be able to connect to any server, be it vanilla, custom or modded.*

*A server must allow the client to operate correctly.*

*If any information causes issues, it must be resolved.*

*If the source of the issue is the vanilla software, than that is the developer's responsibility to bring the software into line with the expected features.*

*If however, the problem is caused by modified software or assets, than it is the responsibility of the server operator to resolve the issue.*

*-------------------------*

*## Server Requirements*

*The server needs to handle the following content.*

*\* server name*

*\* server version (including host name & modification status)*

*\* maximum player count*

*\* logon/logoff protocol*

*\* maintaining the client list (handling dropouts)*

*\* persistent player data (in a database or custom format)*

*#### Game Resource Distribution*

*If the client lacks a resource, the server needs to transmit that resource to the client upon connection.*

*Resources transmitted include but are not limited to:*

*\* map data*

*\* graphical assets*

*\* tilesets*

*\* sprites*

*\* audio assets*

*\* sound effects*

*\* background music*

*\* scripts*

*\* AI scripts*

*\* locational triggers*

*#### World Maps*

*The maps on a server are called rooms. For the data format, See [Map File Format](wiki/Map-File-Format).*

*This is an example of the structure that a server's world can have. This isn't a requirement, but it can offer the easiest solutions.*

*\* a singular "overworld", connecting different locations*

*\* dungeons, possibly instanced*

*\* player owned locations, like pirate ships, depending on a server's theme*

*\* any number of possible rooms running at the same time*

*\* each room is it's own little world*

*#### Game Events*

*This is an ambiguous section, covering several situations.*

*\* instanced dungeons*

*\* player combat*

*\* timed events*

*\* locational events*

*#### Active Entities*

*All entities on the server have a unique, unsigned index.*

*\* players*

*\* monsters*

*\* combat instances*

*\* pirate ships/vehicles*

*\* loot drops*

*-------------------------*

*## Server Architecture*

*#### Modules*

*\* server metadata*

*\* server name*

*\* version*

*\* distribution (official vs custom/name of the owner)*

*\* major.minor.patch*

*\* available map packs, resources, etc.*

*\* player count*

*\* maximum player count*

*\* global client list*

*\* global player list*

*\* global room list*

*\* global combat list -?*

*#### Client Information*

*\* client index*

*\* player index*

*\* channel/address*

*\* last contact time (ping/keep alive)*

*\* ping count (number of times this client has been pinged, disconnect if it's*

*too high)*

*#### Player Information*

*\* player index*

*\* client index*

*\* handle*

*\* avatar*

*\* current location (room, coords)*

*\* inventory list*

*\* equipment list*

*\* friends list*

*#### Room Information*

*\* room index*

*\* map data*

*\* player list*

*\* monster list*

*\* combat list*

*\* loot drop list*

*#### Combat Information*

*\* combat index*

*\* room index*

*\* player list*

*\* monster list*

*-------------------------*

*## Client Requirements*

*The client needs to handle the following content.*

*\* user settings (name, avatar, etc.)*

*\* logon/logoff protocol*

*\* resource downloading/loading*

*\* user input*

*\* drawing to the screen*

*\* playing the correct information*

*\* client index*

*\* player index*

*\* room data*

*\* player list*

*\* monster list*

*\* etc.*

*-------------------------*

*## Client Architecture*

*#### Scenes*

*\* SplashScreen*

*\* start of the program*

*\* load the boilerplate resources*

*\* display the kr-studios logo*

*\* MainMenu*

*\* program hub*

*\* OptionScreen*

*\* custom config saved on exit*

*\* Lobby*

*\* find available servers*

*\* broadcast to the network*

*\* phone home -?*

*\* InWorld*

*\* the player is in a room*

*\* walk around the map*

*\* communicate with others on the map*

*\* InCombat*

*\* the player is in combat*

*\* return to the original room when finished*

*#### Modules*

*\* map system*

*\* players*