Conquer the Seas

# Design Document

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Section 1: Introduction

# 1.1: Purpose

This section of the Design Document will outline the purpose of the entire design document. It should be read regardless of the further intentions of the reader, as it will describe which sections will be most relevant for different types of readers using this document. This is a living document, in that it will continue to be edited and modified throughout the design process until its eventual completion and submission.

## 1.1.1: Foreword

Conquer the Seas is the first game being developed by the in-house software team LIFDOFF for the McGill University Software Engineering Project course. The purpose of this document is to describe the technical design of the software in detail. The purpose of this document is to describe the software design of the Conquer the Seas game and to explain how and why these designs were chosen. This document will detail the design, specifications, programming management, and test cases and testing procedures of the game.

## 1.1.2: Scope

**Section 2** will start with the architectural considerations, then move to design considerations, and finally go in-depth into describing the high-level design of the game. This includes the discussion of the design pattern, the final domain model, and the final deployment diagram. **Section 3** will detail the actual software organization, including a view of the subsystems in both text and drawing. This will contain a detailed breakdown of one specific subsystem, with UML class diagrams and a list and explanation of class variables for this subsystem. There will also be a critical section which contains algorithm selection, critical code snippets, a state chart, and calling sequence diagram. **Section 4** discusses programming management by outlining the directory structure and programming tools, software building method, coding agreement, mitigation procedures, installation procedures, and training guidelines. **Section 5** will describe the test cases and testing procedures used for this project. This includes a description of test-driven development, functional test cases, the error logger, and how we built classes for auto-testing. **Section 6** is the appendix, which contains definitions and other useful information.

# 1.2: Audience

This document can be read from several different perspectives. It assumes a rudimentary knowledge of computer games and ideally some experience in software development. Regardless, the types of readers and which sections apply most importantly to them are as follows:

## 1.2.1: Game players

For the reader whose main focus is playing the game, **Section 4** will be the most pertinent. This section will contain information about how the game is stored locally on the user's machine, and will contain information about the install and setup of the game. It also contains the system requirements of the game. **Section 3** may also be of interest if the player wishes to modify code or see the inner workings of how the game is designed.

## 1.2.2: Developers

For the reader whose main focus is understanding and possibly modifying the code, **Section 3** will be the most important. This section outlines the specifics of the code, going into great depth about all aspects of the structure of the code. It also details algorithms used and has many detailed diagrams to explain the module/object decomposition. Individual subsystems are described in detail, so a developer could read this to understand how the software was written from the ground up.

# 1.3: References, Terms, Definitions

Conquer the Seas is a large software project that uses many technologies that will be discussed throughout this document. This section contains a listing of terms and abbreviations that will be used and may be referred back to for maximum clarity in further sections. It also contains references to the other two documents written for this software project so far.

## 1.3.1: References

Two documents have been written previous to this document. The Preliminary Design Document contained information about the basic functionality and gameplay of the game. It also contained a timeline of milestones and deliverables for which the project still holds to. The second document is the Requirements Document, which describes all of the functions and specifications of the game and is based on the IEEE 830 standard. It also contains many terms and definitions (including acronyms) that will be useful throughout this document as well. Reading these two documents before this document would give the reader a much greater understanding of the project. An implementation document will be released in the weeks following the submission of this document.

## 1.3.2: Terms and Definitions

This section is a list of terms and definitions that are essential to understanding the rest of the document. Other acronyms have been previously defined in the Requirements Document in Section 1.3.2.

* **pygame**
  + pygame is a set of Python modules designed for writing games in Python. It is free and released under the LGPL License (http://www.pygame.org/LGPL) and will need to be installed on all user machines along with the corresponding version of Python. For more information about pygame, visit the pygame website: http://www.pygame.org
* **Unified Modeling Language (UML)**
  + Unified Modeling Language (referred to as UML throughout the rest of this document) is a standardized modeling language for graphical representations of software design and software systems. Diagrams in this document will follow UML specifications.
* **Sprite**
  + A sprite is a 2-dimensional image or animated image used in video game graphics. In the context of Conquer the Seas, sprites will be used to draw and animate the different units and items. These graphics will be created entirely by the development team.
* **HTTP**
  + Hypertext transfer protocol. A request-response protocol that is used to send and receive data over the internet. In this project, it is used for non-LAN clients to connect to the server.

# 1.4: Polices and Tactics

This section outlines the goals of this document and this version of the software build, as well as the guidelines and development methods used for creating this document.

## 1.4.1: Goals

The software project outlined in this document is intended to achieve and address the following goals:

* Create a video game that is enjoyable to a diverse user base
* Incorporate advanced features like networked multiplayer and loading/saving of networked games
* Use detailed design methods that allow for easy-to-understand code which in turn may be modified by players or other developers

## 1.4.2: Guidelines

This document will be developed and maintained according to specific guidelines to maintain consistency throughout the document. The guidelines this document adheres to are as follows:

* Abbreviations and terms that are used will be defined in **Section 1.3.2** unless otherwise specified

## 1.4.3: Development Methods

This section outlines the methods used in developing this document. This is so that the design of this document can be traced back to these steps. The methods used in developing this document are outlined:

* A general outline of the sections of the document was created first
* Using this general outline, the introduction was fleshed out, with information filled in as relevant sections were completed
* Descriptions and other important explanatory text was added to diagrams
* Terms and definitions section was updated with newly added terms
* Proofreading and extensive editing

Section 2: The Design

# 2.1: Architecture Considerations

In designing Conquer the Seas, we have been using several different techniques and some specific technology. For writing the code, we are using a combination of different text editors: Vim, jEdit, and Notepad++. For maintaining our code and as an online repository, we are using github. Links to further info about these technologies can be found in **Section 6: Appendix.** We did not use an IDE.

The code itself is written in the python programming language. The team designing Conquer the Seas felt that this was the best choice of language because of our familiarity with python. Python is being used in conjunction with a set of modules called pygame. These modules provide lots of support for the creation of games in python, and provides many features we required.

For multiplayer functionality, we are using network sockets to allow multiple machines to connect to a central server. This is built directly in python, without using pygame.

# 2.2: Design Considerations

When designing Conquer the Seas, certain assumptions were made and code was made to fit certain specifications. There were design constraints and assumptions that dictated how the code was to be designed according to the client, and there were also constraints and assumptions made according to real-world issues, like installation or player computer capabilities.

## 2.2.1: Design Constraints and Assumptions

In designing Conquer the Seas, certain constraints were initially placed by the client:

* The game must be turn based
* The game must be multiplayer
* The game must have AI
* The game must have terrain generation
* The game must have resource management

There was also a time constraint placed in that the game must be completed before the end of the semester.

## 2.2.2: Real-world Constraints and Assumptions

In addition to the constraints placed on us by the client, we have also designed according to several real-world constraints and assumptions. The following assumptions were made:

* Users have internet access or are on a networked LAN if they wish to play multiplayer
* Users are running Windows XP or later

In addition to this assumptions, the basic assumptions that user machines are fast enough to run the game, they have a working mouse and keyboard, and so on. The following real-world constraints were kept in mind during design:

* Game must be able to be installed and played simply
* Game must have simple enough controls and/or detailed enough information for first-time players to successfully begin and play through a game

There are also constraints that come from using pygame and python:

* mp3 files are not compatible with pygame, so all sounds will be .ogg files recorded locally by the design team
* Game cannot be good

# 2.3: High Level Design

This section describes the basic architecture of Conquer the Seas. It contains a system overview, a more detailed discussion of the design patterns used, and

## 2.3.1: System Overview

The architecture of Conquer the Seas is at its most basic level a Client - Server architecture. There is one server (hosted on a player's machine) and multiple clients can connect to this server. The user running the server also runs the client, which connects to the server on the user's local machine. This means a user running the server always is a player in the game they are hosting.

Server Clients

This architecture allows for two distinct roles to be filled by users of the software. The server needs to be able to handle multiple incoming connections over LAN or HTTP.

## 2.3.2: Design Pattern Identification

The design pattern used in Conquer the Seas is strictly Client-Server. Each client sends requests (commands) to the server, to which the server responds appropriately. This model provides several benefits. One is that each machine does not need to do all of the computations on the game end, they only need to send requests and receive information. The machine the server is on has the bulk of the computation to do, so ideally it would be hosted on the most powerful computer out of all machines being used to play the game. Another benefit of this design pattern is synchronization - all machines will be submitting their moves to one central server, which will only process and respond to requests once all players have locked in their moves.

The other potential design pattern that could have been used would have been peer-to-peer. Under this pattern, users would connected directly to each other and send moves directly between clients. We opted for the Client-Server model because centralizing all computations to one location made the most sense for this game.

Possibly another diagram here?

## 2.3.3: Final Domain Model

DIAGRAM HERE

## 2.3.4: Final Deployment Diagram

Our final deployment is extremely simple. Individual users will download and install the game on their individual computer (or computers). Each computer will have the full software installed, which includes the capability to host a server and connected to other hosted games as well as play single player against AI.

Individual Users' Machines

These individual machines can connect to each other if they wish to play a networked mutiplayer game. They can connect either over a local network or over HTTP (assuming they all have internet connections).

Section 3: The Specifications

# 3.1: Software Organization

# 3.2: Module / Object Decomposition

# 3.3: Critical Section Specification

Section 4: Programming Management

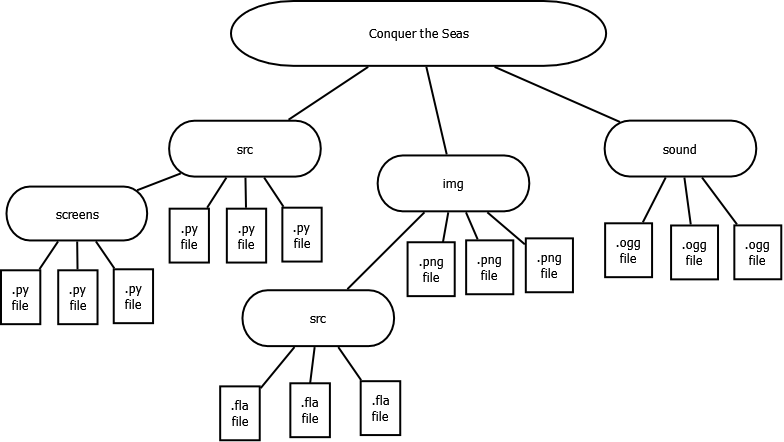
# 4.1: Programming Management Overview

**Section 4** will deal with explaining the tools and processes used in the actual programming of Conquer the Seas. It will explain the different tools used and why they were chosen. It will also describe the software building method we used (Incremental) in more detail, and how revision history is managed.

# 4.2: Directory Structure and Programming Tools

This section describes the organization of the directory used for the game, and the tools used to write and manage code.

## 4.2.1: Directory Structure



This diagram shows the directory structure of Conquer the Seas. In the main folder, named Conquer the Seas, there are three subfolders, as follows:

The first subfolder, src, has the python source files of the game. These are the files that contain the game logic, networking code, and the rest of the source code. There is also a subfolder inside src, named screens, which contains the python files for each of the game screens.

The second subfolder inside the main folder is img, which contains the .png image files used in the game. This subfolder also contains a subfolder, src, which contains .fla flash files used for menus and animations.

The third subfolder, sound, contains the .ogg files that are the sound effects and music in the game. All of these sound files are recorded in-house by the LIFDOFF team.

Saved games can be stored anywhere on the user's machine, and be loaded from any location on the user's machine as well.

## 4.2.2: Programming Tools

While writing the code for Conquer the Seas, several different tools have been used, mainly different text editors and an online code repository. The first text editor, used mainly by one member of the team, is jEdit. jEdit is a text editor for programming that has many useful features, including customizable syntax highlighting (built in for python). The second text editor, used by one member who uses Mac OS X, is Vim. Vim is a vi clone with some additional features and again has syntax highlighting and other conveniences. The third text editor is Notepad++, used by the final member of the team. Much like the other two, it is only a choice of familiarity, and has similar features to the first two. More information about these text editors can be found in the **Appendix** in **Section 6.**

The only code repository used for this project was github, an only code repository and version control system that uses git. It is free for open-source projects and had many features that were useful to the LIFDOFF team during work on Conquer the Seas. Because it uses git, there are easy to use clients available for any operating system that the team is using, which is convenient as one member uses Mac OS X while two members use Windows 7. github also makes it easy to browse and edit our code from any machine with a web browser, alleviating the need to have code hosted on any one specific machine. For more information about github, see the **Appendix** in **Section 6.**

# 4.3: Software Building Method

As stated in our Preliminary Design Document, the method of programming development that we have been using has been incremental. Following this method, we first developed a single player prototype with a simple board and moveable pieces. The next step was to create a second board, with the capability to send units to the other board. The third module was to add multiplayer support to a single computer, then, to add single player versus AI to that single computer. The final necessary module is to add networked multiplayer. Additional modules could be completed after this point, such as improved graphics, dynamically generated terrain, and expansive upgrade trees.

## 4.3.1: Revision History

By using github as an online code repository and version control system, the need to keep track of all revisions is taken care of automatically. Through github, we can always revert back to a previous version of code or of a document. This made our revision history a non-issue. Again, see the **Appendix** in **Section 6** for more information about github.

# 4.4: Coding Agreement

The coding style and practices agreed on by the team were largely unimportant. Because python is being used, the style of the code is already very clean and neat without much room for customization. Whitespace indentation is used to delimit blocks of code, so unlike braces, which allow for variation in placement (using whitespace), there is no customizability. For this project, soft tabs composed of 4 spaces makes up the whitespace used to delimit blocks. Python code is very readable, but it was agreed upon to place as many comments as necessary to understand the code.

# 4.5: Migration Procedures

As all code is being created (aside from the modules given by pygame) from scratch for this project, there was no code to migrate at the beginning of or during this project. As we are not using a database for any storage, all data is maintained locally and simply in the directory of the game. Because of these reasons, no data should ever have to be migrated to any other location or machine apart from the machine the game is installed on.

# 4.6: Installation Procedures

Conquer the Seas will not require installation, merely unzipping the folder to the location the user wishes the game to reside in on their machine. Running the game file will run the game, and a shortcut to this file can be created and placed anywhere on the user's machine for easy access. TALK ABOUT EXE, ETC

# 4.7: Training Guidelines

Section 6: Appendix

# 6.1: Further Info

* Vim: [http://www.Vim.org/](http://www.vim.org/)
* jEdit: [http://jEdit.org/](http://jedit.org/)
* Notepad++: <http://notepad-plus-plus.org/>
* github: <https://github.com/>
* python: <http://python.org/>
* pygame: <http://pygame.org/news.html>