

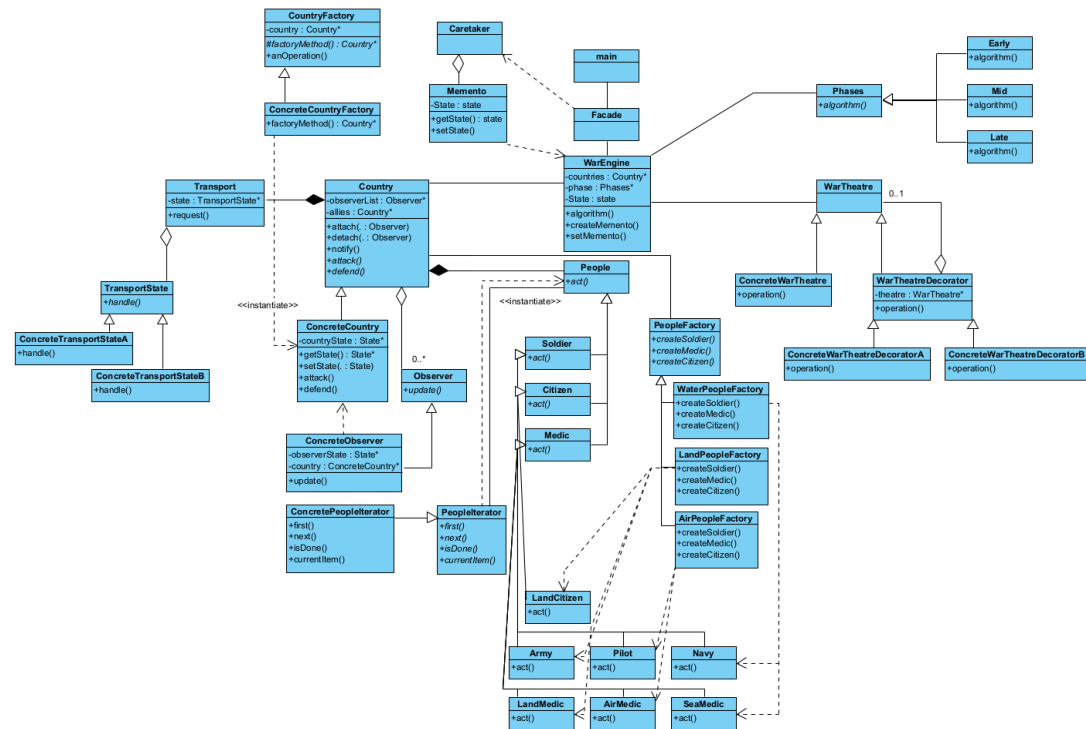
COS214 Project

Google Doc Link: [214 Project](#)

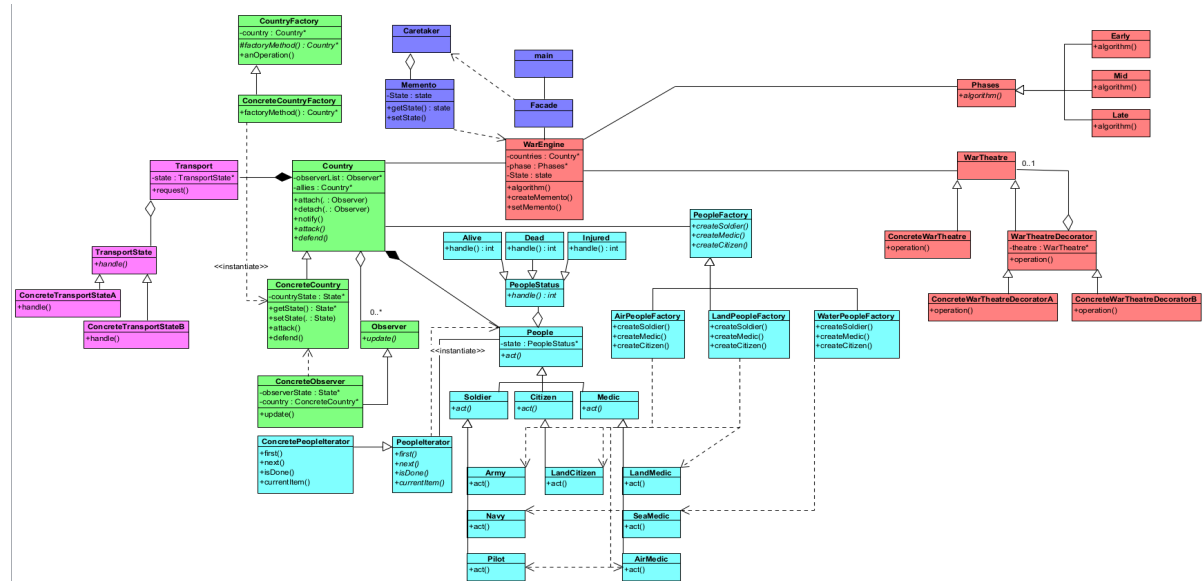
Functional Requirements

- Set up a game for the user to play when the program is started
 - Create multiple countries
 - Create a user country
 - Give every country a random amount of people
- Give the user the ability to choose who they would like to attack
- The system will change the algorithm used depending on the stage of the game
 - Early stage
 - Default stage on system start
 - Is used to initialise the game on start up
 - Middle stage
 - Involves the main game loop
 - Gives each country a turn to attack
 - Instead of attacking a user may opt to repair their transport
 - End stage
 - Deals with the ending of the game once the user dies or enemy countries are defeated
 - Prints out the winner and loser to inform the user about the state of the game
- If a specific country's transport line gets damaged, that country will be severely hindered until they repair it
 - A country with a damaged transport line will only deal 50% of its total damage until repaired
 - A country with a working (fixed) transport line will deal 100% of its damage
- Countries will hold different types of people and these types will do different damage numbers to enemy
 - Soldier types will do the most
 - Citizen types will do medium damage
 - Medic types will do the least (medics have the ability to heal other 'people')
- The system must be capable of undoing a previous move made by the user
 - Every turn a state will be saved at the start of the turn, if then necessary the state can then be reverted to

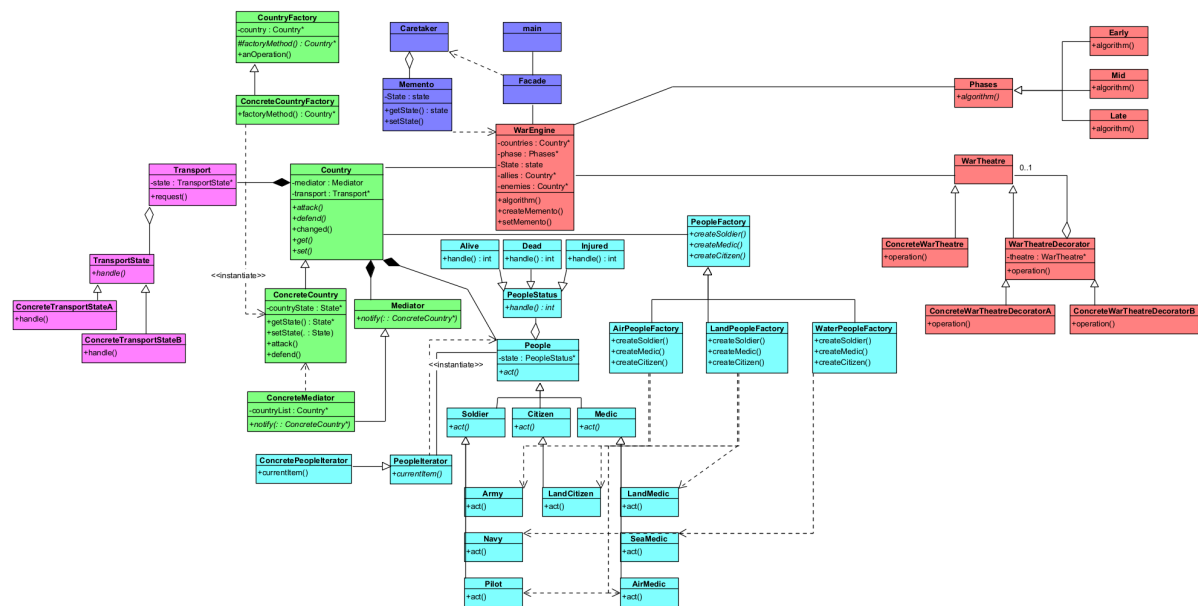
UML Class Diagrams

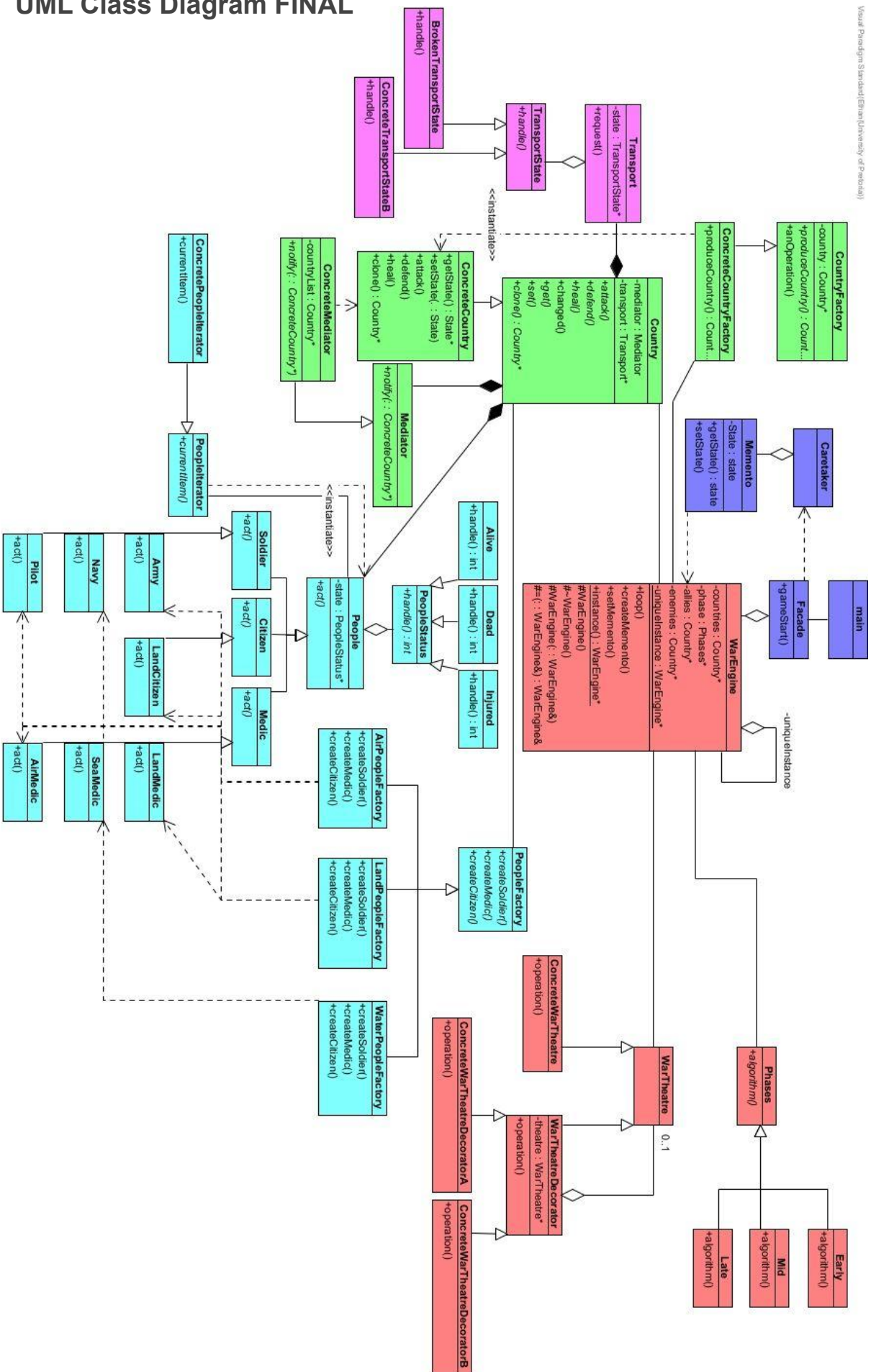


Class Diagram V1

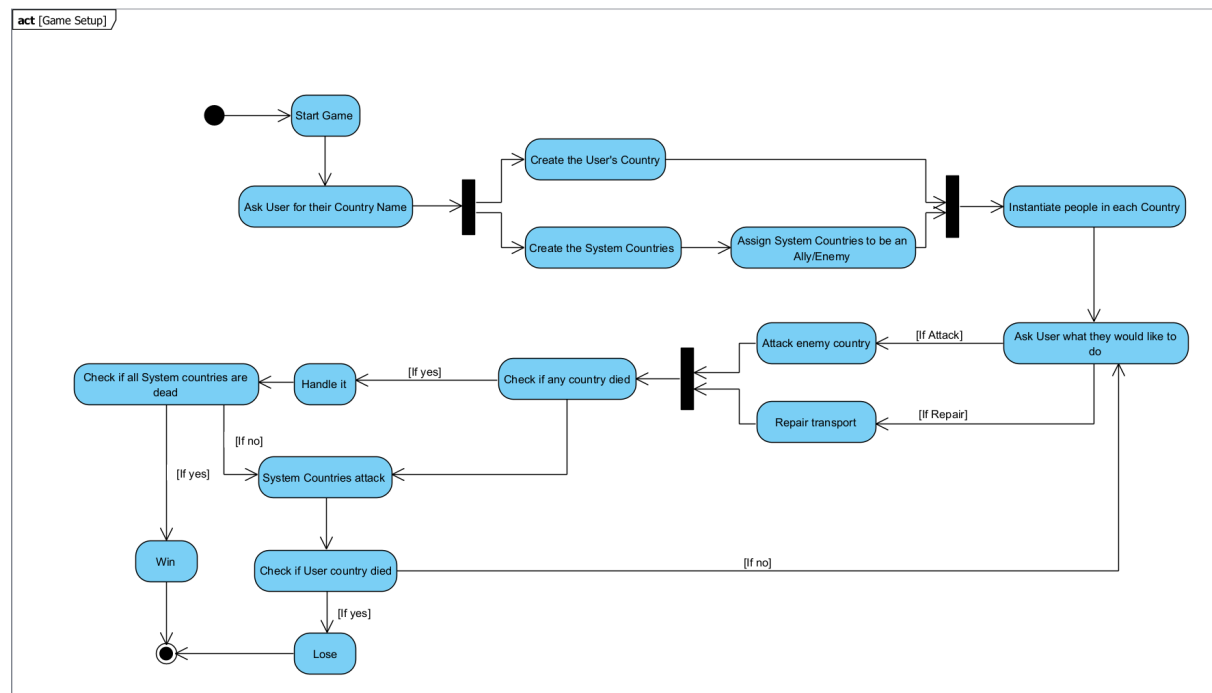


Class Diagram V3

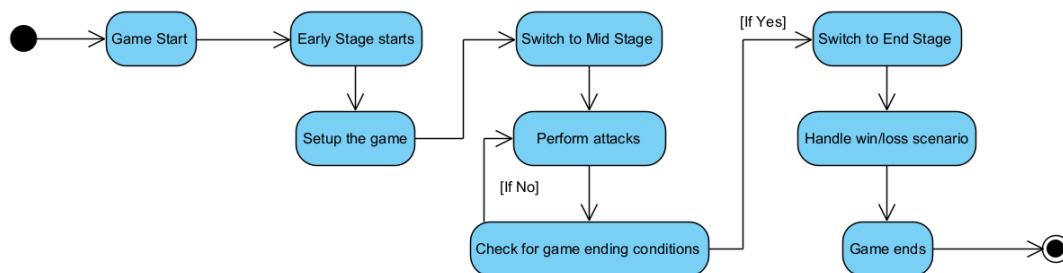




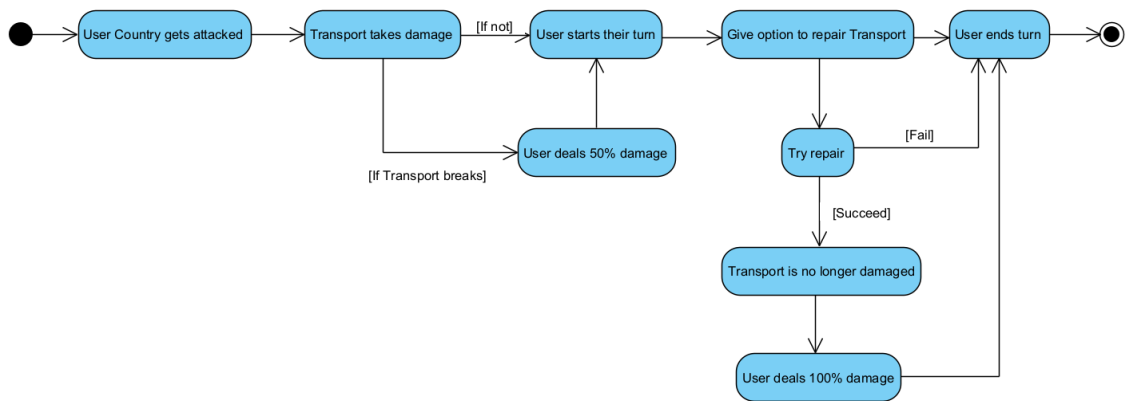
UML Activity Diagrams



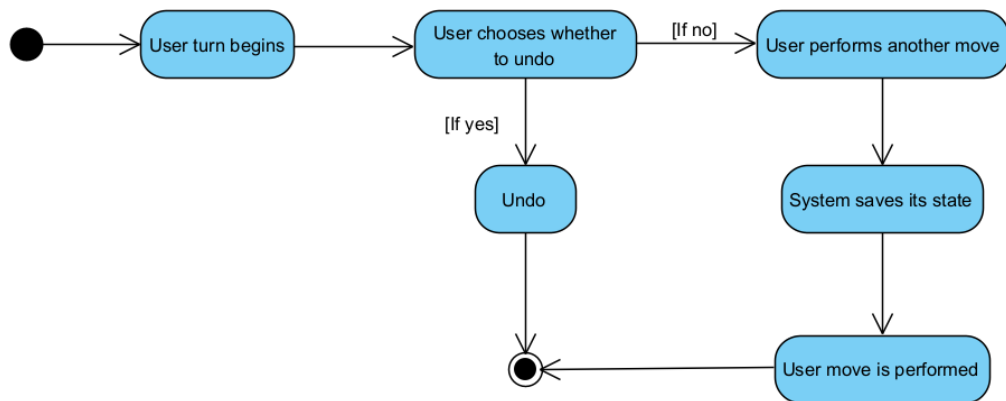
Game Setup



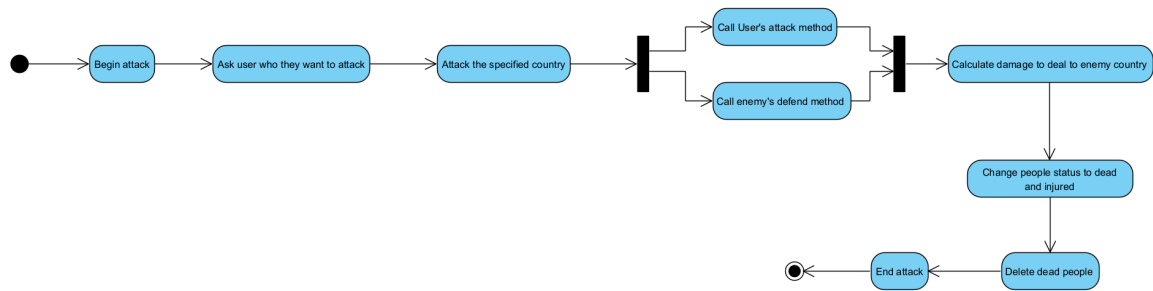
War Engine Game Loop Algorithms



Transport Lines



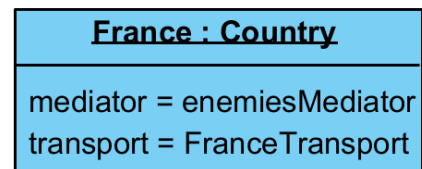
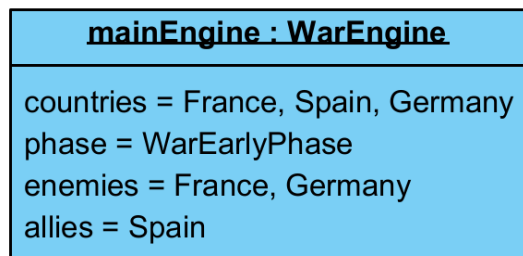
Memento/Undoing moves



Attacking another country

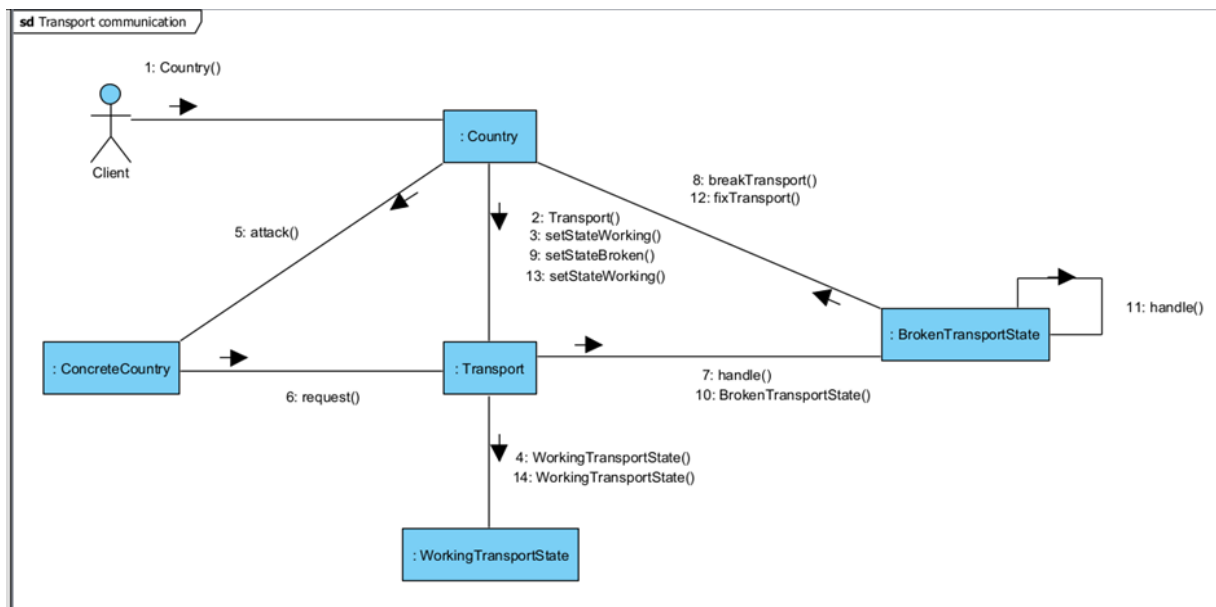
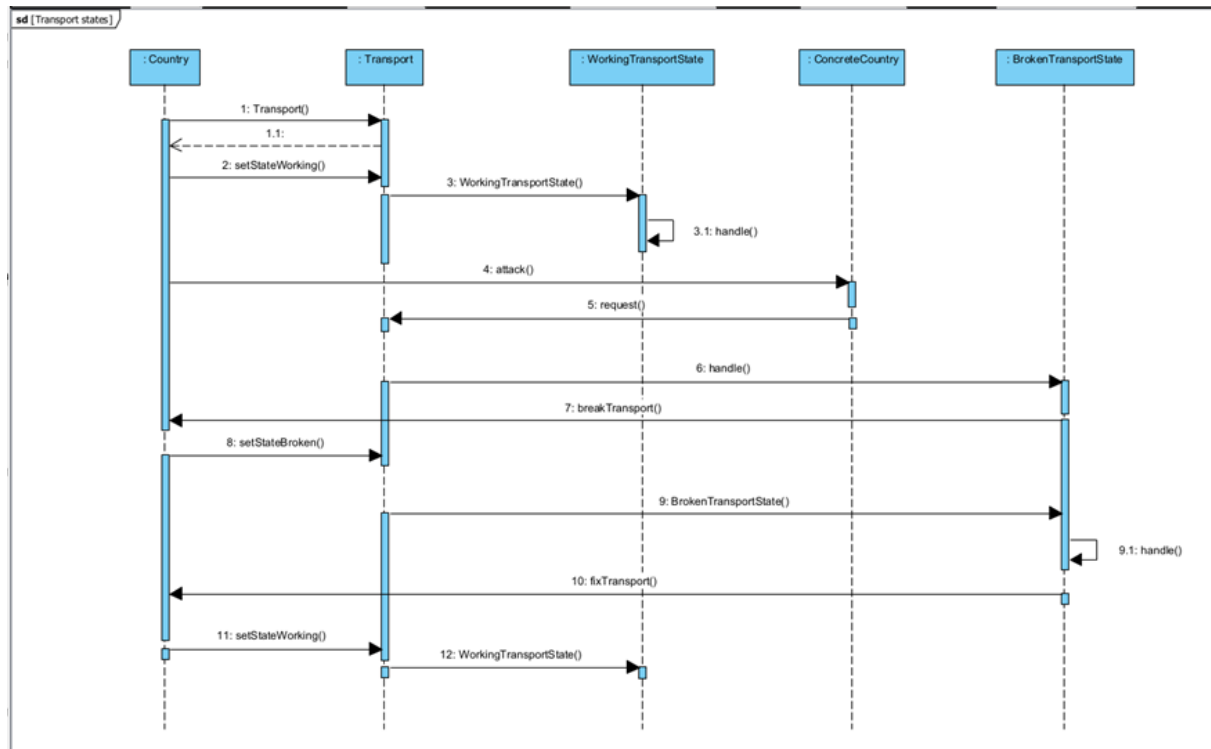
Object diagrams of WarEngine and Country

Visual Paradigm Standard (Wan du Toit (University of Pretoria))

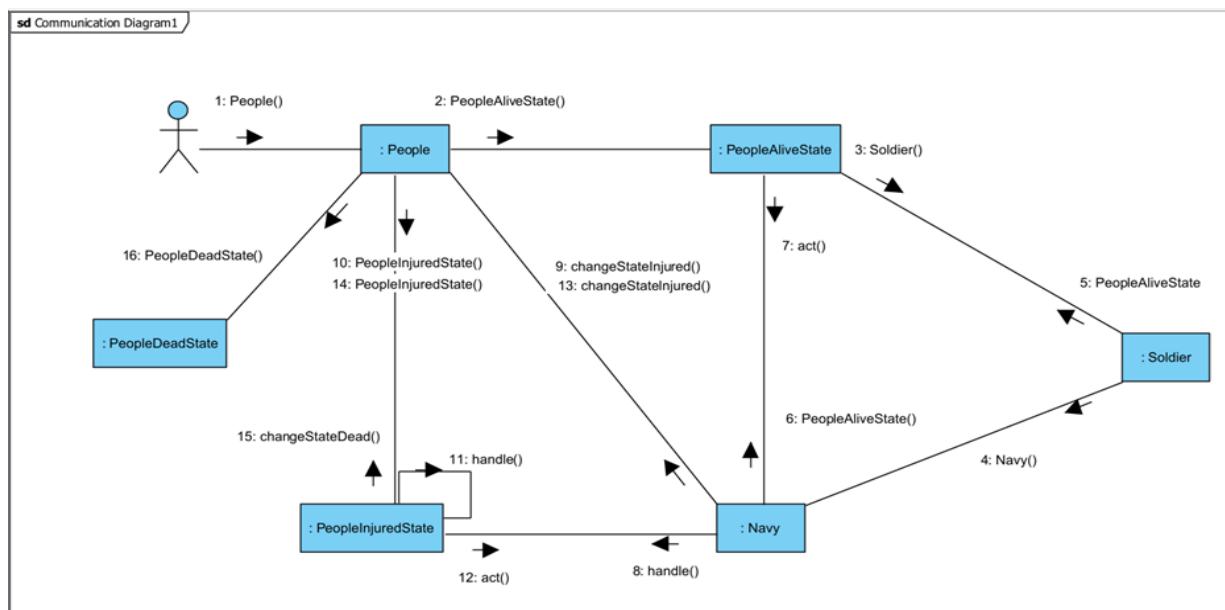
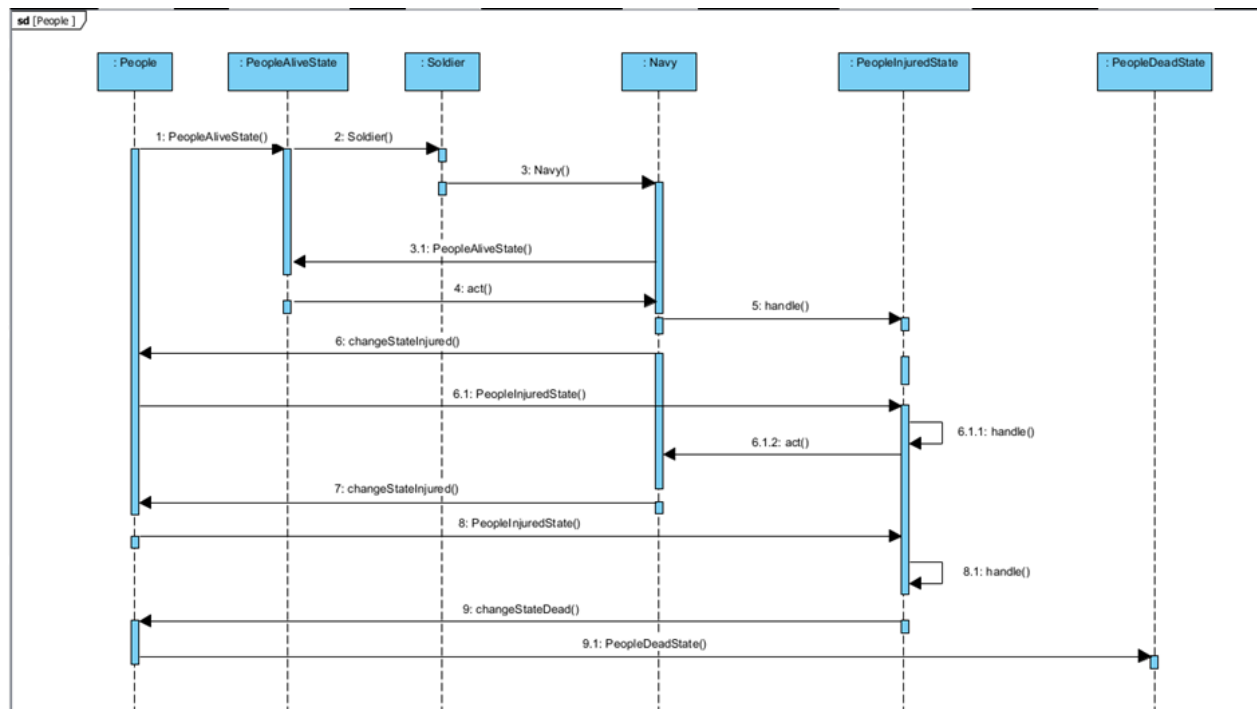


Sequence and Communication diagrams

Passing of Transport state objects



Passing of PeopleStatus state objects



Research

What is War?

War is defined as an intense or violent conflict between two separate parties. These parties usually have differing ideals that cause this specific conflict. Total war is a kind of warfare that involves not only military targets but also civilians, which can result in devastating loss of non-combatant lives.

While some Polemologists consider war to be an aspect built into our human nature, others tend to argue that it is as a result of the specific economic, cultural, and ecological circumstances that people are exposed to.

The Phases of Warfare

When considering war in general, it is useful to outline a basic form of the **phases of warfare** that can occur:

- **Phase 1: Intelligence** - It is important to understand exactly who you are fighting and what they are capable of. It is also important to find out who your allies are and who all of your enemies will be during the duration of the war. This phase will usually involve gaining information about your opposition.
- **Phase 2: War** - During this phase movement of armies and firepower will take place, this is done with the intention to break the enemy's will and reduce their ability to resist. This is the phase where actual fighting and loss of life takes place. Usually the army with a larger number of people and better strategy would result in victory.
- **Phase 3: Occupation** - This involves occupying the country or portion that has been attacked. This is usually done to achieve the political result that was desired when the war began.
- **Phase 4: Pacification** - During this phase the remaining rebellious people are pacified and any remaining will to resist is broken. This effectively declares a winner of the war.

Different Types of Warfare

There are many different classified types of war such as biological warfare, chemical warfare, cold warfare, conventional warfare, nuclear warfare, and total war. Of these, conventional warfare is the most common. It is generally classified as a war in which nuclear and chemical weapons are not used. On the opposite spectrum, total war is warfare in which anything goes. There is a total disregard for the laws of war and no limits on the types of people that are targeted, whether they are military or civilian.

Examples of Types of Warfare

Listed below are various classifications of warfare that were mentioned above, as well as explanations to accompany each type:

- **Biological warfare:** The use of biological toxins or infection agents as a strategic move to harm the opposing side, this can be anything from using pathogens to kill soldiers or to damage supplies (food).
- **Chemical warfare:** The deliberate use of chemicals to defeat the opposition can be as literal as killing them in seconds, or to weaken their mind. Chemicals can also be used to enhance soldiers for a short period of time (like the use of cocaine).
- **Cold warfare:** Warfare without the deliberate use of weapons. It is a tension scenario between two forces. These forces can cause proxy wars to show off their power.
- **Conventional warfare:** Defined as warfare on power. Where the target/objective is the opposing teams military and not landmarks or civilians. The war is well-defined and can be seen as a “modern war”.
- **Nuclear warfare:** The use of nuclear warheads to utterly destroy the targeted location. In contrast to conventional warfare, nuclear warfare often produces destruction in a much shorter time and can result in a long-lasting radiological result.
- **Total war:** Warfare with no restrictions on weaponry/target/objective/casualties. Rules of war are disregarded.

The Generic Components of Warfare

Warfare is made up of various components that together create war as we commonly understand it. Listed below are some of the components of war that we identified and implemented as a part of our War Engine, as well as explanations for each of them:

- **Entities:** There are many entities involved in warfare that form a part of each parties' population, military, transportation systems, etc. Entities include but are not limited to soldiers, medics, civilians, allied countries, transportation vehicles, transportation lines, factories and armies.
- **War Theatres:** In warfare, a war theatre is defined as an area in which important military events occur as a result of the war. The war theatre includes the land and sea area as well as the airspace that could potentially become involved in the war's operations and tactics.
- **Transportation:** Transportation plays a big role in the success or failure of an entity during warfare. It is critical that transport systems remain intact as they are used to move goods, services, people and soldiers (among other things). In an event where an entity's transportation systems are crippled, the entity would face severe challenges.

- **Phases of warfare:** Specific information about the component regarding the various phases of war is given above under the section titled *The Phases of Warfare*.
- **Strategy:** As the war wages on, a party will sometimes make changes to their strategy. For example, sometimes it is useful to adopt a more defensive approach, and armies would have to be withdrawn from the front lines. Another example is when a party decides to spend more money on research and development to achieve the upper-hand over their opponents in this way. There are many strategies that may be employed in warfare, and each has its own strengths and weaknesses.

Summary

In conclusion, war is defined as extreme conflict between parties over an ideal, characterised by intense violence, fighting and destruction. There are various strategies which parties may adopt for use in the war and various phases of war in which these strategies differ. Components of warfare are the elements that make up the war itself, and these components differ as the type of warfare varies from conventional warfare to total warfare.

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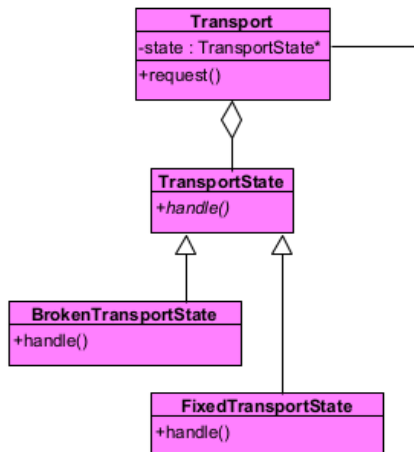
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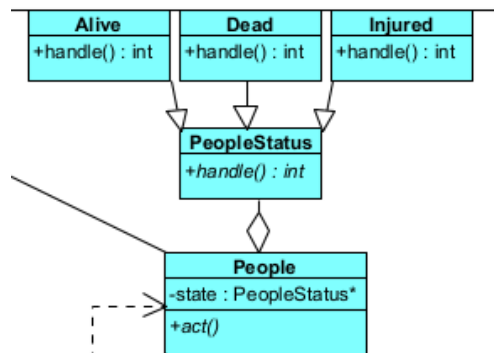
Report

How the System's Design was Abstracted and Implemented

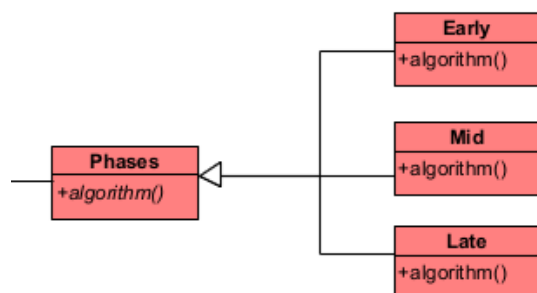
When thinking about how to design this system, several things had to be taken into consideration. Multiple countries needed to exist, each with their own set of variables. It was decided that each Country would have its own Transport, as well as its own array of people that live within that Country. The Transport would have its own states, being either fixed or broken.



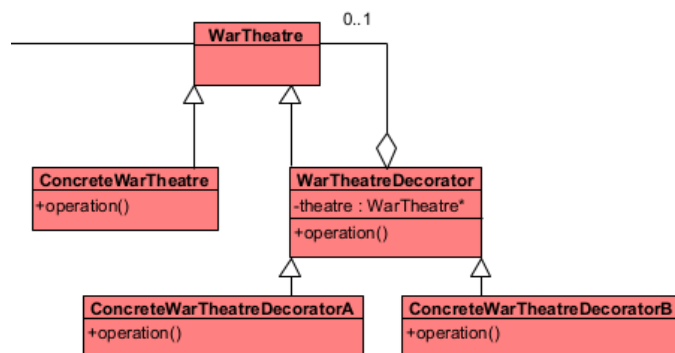
The people in each country would also have their own types, either a Soldier, Medic, or a Citizen. This lets us account for some of the people that would be around during an actual war. These people can also have their state changed in order to account for some people being injured during the war.



The actual war will have several phases that it can go through, ranging from an Early phase through to a Late phase, with each dealing with a different section of the war.



Every war takes place in a different location which means that different types of combat can take place depending on where the war is situated. To help handle this in the system, a decorator can be used to change which kinds of people can be instantiated in each country. E.g. Land, Water, Air



Design Patterns Used

1. Abstract Factory
2. Iterator
3. State
4. Factory Method
5. Template Method
6. Strategy
7. Prototype
8. Memento
9. Singleton
10. Façade
11. Decorator
12. Mediator

How Each Pattern was Implemented

- The **Abstract Factory** design pattern was implemented to allow us to produce People objects that form a part of each Country. The generic types of People are Soldiers, Citizens and Medics, however, there are more specialised types of each of these. These specialised types are each instantiated depending on the location of the WarTheatre that the war is taking place in. The **Abstract Factory** design pattern allows us to create these families of related objects without specifying the specific Concrete Classes that we are instantiating.

- The **Iterator** design pattern was implemented in the People hierarchy in order to make it easier to iterate through all the People within a Country, without exposing the underlying representation of the People class.
- The **State** design pattern has two applications within the program (within the Transport hierarchy, and within the People hierarchy). It acts as a damage modifier in each instance. In the Transport hierarchy, the pattern is used to control the state of the Transport lines that each country possesses (broken or fixed). A Country with a BrokenTransportState will deal less damage as a whole to the opposing People and Country. Within the People hierarchy, the **State** design pattern is also used as a damage modifier to alter the amount of damage that a single People object can deal. A person can be Alive, Injured or Dead. The PeopleStatus will control which one of these states a person is in and will handle the damage dealt by that person accordingly.
- The **Factory Method** design pattern is implemented within the Country hierarchy, and the **Factory Method** itself, *produceCountry()*, is used to instantiate all the countries that form a part of the War Engine in each instance. This pattern allows us to have a generic interface for creating Country objects that lets the Country subclasses decide which class to instantiate.
- The **Template Method** design pattern is used for the *act()* as well as the *attack()* and *defend()* methods in the People and Country classes respectively. The use of this design pattern allows us to defer some steps of the generic **Template Method** to the appropriate subclasses so that they may redefine some parts of the algorithm without changing its structure.
- The **Strategy** design pattern is used to control the algorithm for the main game loop and affects how the game is played out. This **Strategy** will be changed at different stages of the game. The use of this pattern allows us to run a single game loop method and requires that only the strategy is switched out when the stage of the game needs to be changed.
- The **Prototype** pattern allows the user to make a clone of any Country and effectively saves the state that the country object is currently in. Can be used in conjunction with the memento pattern to make it easier to save the state of the game.
- The **Memento** design pattern has been implemented to capture the state of the game on a user's turn, which will give the user the ability to undo their previous move and restore the game object to the state it was in after the previous turn, in the case that the user made an error.
- The **Singleton** design pattern is applied to the WarEngine and ensures that only a single instance of the WarEngine can exist. We make use of the "Meyer's Implementation", because this particular implementation helps deal with most of the problems that can occur during construction of the Singleton, while simultaneously dealing with the issues that can arise with the other forms of implementation.

- The **Façade** design pattern is used to provide a unified interface to the set of interfaces that are involved in our program. The **Façade** pattern allows us to hide unnecessary details and complications from the user and provides a clean, intuitive and high-level interface for the user to interact with that makes the system easier to use.
- The **Decorator** design pattern is used to control the WarTheatre in our program. This will control the types of People that are created by the Abstract People Factory (whether Land, Water, or Air) depending on the types of combat that can take place in the current WarTheatre. The design pattern is used to attach additional responsibilities to the WarTheatre class dynamically, providing a flexible alternative to creating subclasses to achieve this extended functionality.
- The **Mediator** design pattern is implemented in the Country hierarchy to allow the Country objects to change or update their state if they are notified that the object they are dependent on changes its state.