Department of Computer Engineering
CmpE 202 – 01
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Team Project - 2

BRAVERY STABLE ARCHITECTURAL PATTERN

Submitted by:

Team “Prodigies”

Team Members:

<<<<<<<<< Student Work >>>>>>>>
Acknowledgement

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Abstract

This project describes a system based on bravery architecture and the stability model for the same. Bravery architecture can be described as a system where people confront fear in the face of pain, danger, uncertainty or intimidation and the stability pattern which is a very intelligent concept in itself. It helps in component reusability and is an extremely extensible concept. As a virtue, courage is covered extensively in Aristotle's Nicomachean Ethics, its vice of deficiency being cowardice, and its vice of excess being boldness.

The objective of the system is to build a core knowledge repository which consists of a pattern for bravery, which can be reused in daily life everywhere. In the previous project we discussed about the traditional models which focused on tangible objects. These tangible objects do not persist and are not of importance in the bigger picture. So the focus and motivation of this project is not on the tangible objects but their reusability. Today’s software industry requires highly reusable software components. And because of the fast day to day advancements in this field, no product remains in the market for a long time. Here reusable component play a very important part. The concept of reusability has been discussed by establishing the EBTs and BOs of Bravery. These EBTs and BOs are non-tangible components.
1 Introduction
The noble task of developing the reusable components for bravery will in turn enable us to apply the concept of showing boldness and reduced cowardice in various very diverse fields, without changing the core concept of application, which is the EBTs (Enduring Business Themes) and the BOs (Business Objects). The EBTs of a system form the core knowledge of a system and the BOs are the ones which execute the concept of the EBTs and help you achieve your goal.

The project starts with the stating of the problem along with its challenges and constraints. After proper understanding of the problem a solution to the stated problem is provided using EBT, BO and IO class diagram. CRC Cards and the behavioral model will also be provided for an in-depth understanding of the solution.

The stability pattern in our project consists of 3 EBTs Bravery, Cognizance and Faith and 12 BOs. Few of the important BOs are AnyRisk, AnyAction, AnyPlan, AnyDamage, AnyWelfare, AnyActor, AnyInvestigation and AnyMechanism.

1. Bravery
   Bravery can be described as a quality that enables you to face danger and pain without showing fear. Bravery is prevalent in almost every part of the project. For any difficult task that needs to get completed needs bravery.

2. Cognizance
   Cognizance can be described as the knowledge and awareness of the current situation. Showing bravery without any cognizance is foolishness. One needs to act with cognizance and not take hasty decisions. Bravery with cognizance makes a very effective combination.

3. Faith
   Faith can be described as belief in something without any proof. Faith, although may seem a very vague concept, but it’s extremely important from the point of view of normal citizens. Normal citizens have faith on the Government that they won’t let you suffer for any problems. The acts of bravery after having cognizance of any serious problems increase the faith of the citizens in the Government.

The above EBTs together with a set of BOs are used to construct a pattern which remains stable over time and thus called the stability model. The project covers all these above concepts of EBTs and the BOs.

2 Pattern Documentation
2.1 Pattern Name
Bravery Stable Architectural Pattern
The topic of our project is Bravery Stable Architectural Pattern. It has been named so because it talks about the great deeds done by heroes of the society. We are all aware of the terrorist attacks that have taken place in the past, causing a lot of destruction. We have developed this stability pattern to model how people like policemen or revolutionaries for instance, have shown courage and bravery to combat terrorism or any unwanted suppression. Our model follows a general template and provides an underlying pattern to model heroic deeds by individuals in the past and similar events in coming future.

Each BO is accompanied by the word ‘ANY’. That is because the pattern is a generic one and each BO is a part of the generic pattern. There can be any type of business object in the Application depending upon the context in which the pattern is being used and hence the pattern is generic so that more number of applications can be designed using the above pattern.

### 2.2 Known As

Bravery Stable Architecture Pattern can be known as “**Heroism** Stable Architecture Pattern” and “**Welfare** Stable Architecture Pattern”. The Heroic Architecture which in a way similar to Bravery Architecture can be defined as - A system where people confront fear in the face of pain, danger, uncertainty or intimidation and the stability pattern which is a very intelligent concept in itself. And similarly Welfare architecture also relates to Bravery Architecture because people who take the initiative of doing something good for public are always brave enough to overcome all problems that come their way.

Everyone who chooses to get into such heroic deeds wants happiness of people around them and they like taking challenges. This concept is closely related to audacity, in the sense that even audacity is act of showing courage. But here we focus upon the altruistic nature of people which motivates them to show signs of courage and bravery and keep public interest before theirs.

### 2.3 Context

The reason we chose Bravery is because of its high reusability. It can be reused in any aspect of life which comprises country’s pride, friendship, independence, terrorism, loyalty and leadership. The concept of bravery is defined as an act of doing things without the fear of its outcome and worrying about the problems coming in the way. The context of Bravery defines the boundary condition of the selected EBT. To achieve the objective of a heroic deed an individual has to be fearless and show all the signs of Bravery. Just being Brave does not stand good. One has to be clever enough and have enough Cognizance about the task he wants to perform or is supposed to do. A sense of Faith is created in the mind of the people who experience such Brave acts and are motivated further to perform similar tasks.

A few scenarios where this can be applied are:

1. **Fight for freedom or independence**: Bravery is one of the very important aspects related to getting independence or freedom from the tyranny of an autocrat. Heroic behavior was displayed by some of the greatest people who devoted their life and career for the wellbeing of the citizens of a country. The boundaries in this scenario can be described when a person stops thinking about his vested interests and works for the progression of his fellow countrymen. A
2.4.1 Stability pattern for Bravery can be described using sub-goals, cognizance and faith.

b. **Anti-terrorist squads or police force:** One of the other important applications of Bravery can be found in functioning of an anti-terrorist squad or police force. These people without even caring about their own lives, work hard to ensure that public safety is being taken care of. They are always willing to lose their life, but let someone die. They leave their own interests and take care of other people’s interest.

c. **Life savors during natural calamity:** Another scenario in which our model can be applied is in the case of a natural calamity. In the past we have seen so many incidents such as floods, volcanic eruptions, earthquakes. During such hard times, life savors without even caring about their own life, perform their duty to save every possible life. A perfect example could be the bravery shown by such people during a flood in Wales, saved lives of as many as thirteen people.

d. **Air Force operations:** The operations carried out by Air Force are probably one of the best examples that incorporate bravery. These brave warriors show no sign of weakness and always perform a commendable job which is expected out of them. There have been numerous incidents in the past, and will keep happening in future, where these brave men would do anything it takes to save their peers and other inhabitants of their country.

2.4 Problem
The potential element of Bravery Stable Patterns is to design a reusable stability pattern which can be applied with any situation having concept of Bravery. This pattern is achieved using three enduring concepts which persist during entire execution of the process. Also, there are sub-goals, which help in achieving the final goal. Also, some specific goals are required to achieve chief as well as sub-goals.

The stability pattern for Bravery can be described using sub-goals, cognizance and faith.

2.4.1 Functional Requirements
- **Bravery:** Bravery is the primary requirement of the system. For bringing any reform or saving people from massacre, someone who has to do the act of bravery. Generally bravery comes with courage and capability to undertake risk. This is generally for welfare of people.
- **Cognizance:** To achieve any important target, knowledge about the domain, task and also the background is required. For this, we need immense amount of data and information has to be extracted from that data. This knowledge is mandatory for achieving any goal.
- **Faith:** This is predominantly important in any system undergoing welfare. Common people have faith on the heroic people who work for betterment of the society. Without this faith, life of common people can be miserable.
- **AnyRisk:** To achieve any task of bravery, there is some amount of risk which is always involved. Any risk in the challenging task is put in front of any actor as an action.
• **AnyAction:** Any task performed by actor which is for betterment of people. It may involve risks and may also help in bringing reforms. It facilitates actor to achieve the goal.

• **AnyActor:** It plays one of the lead roles in the system. It will perform tasks required to achieve bravery for welfare of people.

• **AnyMechanism:** This is any sequence of steps required for executing a particular task. In this case, some mal mechanisms can cause damage and other mechanisms can save the system from damage. This requires certain tools to exist.

• **AnyPlan:** This planning is required for smooth execution of any task. It depends on the cognizance we have as well as how we use the information available. Also, any investigation or mechanism requires planning.

• **AnyDamage:** The damage can be caused by any mal mechanism. This damage in turn leads to diminishing faith of people. Tools like weapons can be used to cause damage.

• **AnyWelfare:** Any mechanism which is done in good faith leads to welfare. Any welfare leads to rise in faith of common people.

• **AnyInvestigation:** Any investigation is performed by an individual or group of investigators. They need a strategy to investigate any task. This investigation occurs at a particular pre-decided location.

• **AnyParty:** Any group or organization is part of AnyParty. It participates in AnyEvents which may be for good or bad. AnyParty may have positive or negative impact on people.

• **AnyEvent:** Any event is a series of action which has some specific consequences. This event generally is handled by a particular party amongst the list of AnyParty.

• **AnyConsequence:** Any action which is performed has an impact and this impact may be beneficial or detrimental to system and existing people. AnyEvent has some consequence. Any mechanism ends with unique consequences.

• **AnyLocation:** AnyEvent takes place at a particular location. This location plays an important role in how the plan will be executed and what its aftermaths will be.

2.4.2 **Non-Functional Requirements**

• **Endurance:** By definition, endurance means ability to tolerate. For achieving any task, there huge amount of stress involved. So, for that endurance is the key requirement to successfully accomplish any task involving bravery.

• **Strength:** Any task of Bravery evidently requires strength. Without strength, any task involving Bravery doesn’t have huge impact. Thus, strength is the key requirement.

• **Compassion:** Showing bravery for benefits of other cannot be accomplished without being compassionate with people. Thus, to do some task for selfless motives requires compassion for people.

2.5 **Constraints and Challenges**

**Constraints**

• Bravery involves zero or more risks

• AnyActor takes one or more risks

• AnyActor performs one or more actions
• One or more investigations uses Cognizance
• Cognizance assists in one or more plans
• One or more investigation follows a particular plan
• One or more mechanisms have AnyPlan
• One or more damage decreases Faith
• AnyWelfare hinders one or more damage
• Faith is increases by one or more act of AnyWelfare
• Bravery is result of one or more welfare
• AnyEvent leads to one or more consequences
• AnyParty participates in one or more events
• AnyEvent occurs at particular location

Challenges

• Identifying accurate EBT i.e enduring business objects is the main challenge. EBT has to be persistent throughout the lifetime of the system.
• Second main challenge is to identify the connectors with BO i.e. Business objects where any IO i.e. Industrial objects can be plugged in to reuse the pattern
• AnyMechanism is always dependent on a plan. Every time we need to perform AnyMechanism in the system, it should follow a well-defined plan. With some flaws in planning, mechanism would fail.
• For AnyInvestigation, we need to have accurate information in form of cognizance. The major challenge is to mine important and useful information from the data we have.
• AnyActor needs to be classified as either as humans, creatures, hardware or software
• AnyParty needs to be identified as either Country, team or organization
• AnyConsequence can be either good or bad. It totally depends on which IO is acting on it. Thus, differentiation between which IOs will have good consequences and which will have bad consequences is of chief importance.
• Other major challenge is to distinguish between AnyActors and AnyParty which can have positive or negative impacts. It is dependent on the IO which is plugged in.

2.6 Solution

2.6.1 Pattern Structure and Participants
The solution tries to provide best possible answer for a reusable pattern on stability and get a generalized solution for all the scenarios which portray concept of “Bravery”. It uses sub-goals like cognizance and faith to achieve the ultimate goal, i.e. portraying Bravery. The penultimate goal of this stability pattern is to apply concept of Bravery in any scenario using non persistent IOs.
2.6.2 Class Diagram

Figure 1 Stability Pattern Solution
### 2.6.3 Class Diagram Reference

**EBT**

<table>
<thead>
<tr>
<th>&lt;P_EBT&gt;Ebravery</th>
<th>&lt;P_EBT&gt;Cognizance</th>
<th>&lt;P_EBT&gt;Faith</th>
</tr>
</thead>
<tbody>
<tr>
<td>-intensity</td>
<td>-type</td>
<td>-strength</td>
</tr>
<tr>
<td>-impact</td>
<td>-level</td>
<td>-reason</td>
</tr>
<tr>
<td>-cause</td>
<td>-purpose</td>
<td>-cause</td>
</tr>
<tr>
<td>-purpose</td>
<td>-effectiveness</td>
<td>-consequence</td>
</tr>
<tr>
<td>-effectiveness</td>
<td>-valueOfKnowledge</td>
<td>-priority</td>
</tr>
<tr>
<td>+show()</td>
<td>+dependsOn()</td>
<td>+giveHope()</td>
</tr>
<tr>
<td>+involveRisk()</td>
<td>+usedBy()</td>
<td>+intensify()</td>
</tr>
<tr>
<td>+fightFor()</td>
<td>+assist()</td>
<td>+affirm()</td>
</tr>
</tbody>
</table>

**BO**

<table>
<thead>
<tr>
<th>&lt;P_BO&gt;AnyRisk</th>
<th>&lt;P_BO&gt;AnyAction</th>
<th>&lt;P_BO&gt;AnyEvent</th>
<th>&lt;P_BO&gt;AnyConsequence</th>
<th>&lt;P_BO&gt;AnyLocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-intensity</td>
<td>-type</td>
<td>-location</td>
<td>-tool</td>
<td></td>
</tr>
<tr>
<td>-type</td>
<td>-toolUsed</td>
<td>-performedBy</td>
<td>-location</td>
<td></td>
</tr>
<tr>
<td>-impact</td>
<td>-data</td>
<td>-detail</td>
<td>-assignee</td>
<td></td>
</tr>
<tr>
<td>-cost</td>
<td>-investigator</td>
<td>-time</td>
<td>-affectedPerson</td>
<td></td>
</tr>
<tr>
<td>-consequence</td>
<td>-investigatorId</td>
<td>-duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+involve()</td>
<td>+analyze()</td>
<td>+execute()</td>
<td>+ccur()</td>
<td></td>
</tr>
<tr>
<td>+endanger()</td>
<td>+plan()</td>
<td>+decide()</td>
<td>+result()</td>
<td></td>
</tr>
<tr>
<td>+affect1c()</td>
<td>+perform()</td>
<td>+result()</td>
<td>+assign()</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>&lt;P_BO&gt;AnyParty</th>
<th>&lt;P_BO&gt;AnyActor</th>
<th>&lt;P_BO&gt;AnyPlan</th>
<th>&lt;P_BO&gt;AnyMechanism</th>
<th>&lt;P_BO&gt;AnyDamage</th>
</tr>
</thead>
<tbody>
<tr>
<td>-name</td>
<td>-name</td>
<td>-planFor</td>
<td>-type</td>
<td></td>
</tr>
<tr>
<td>-head</td>
<td>-height</td>
<td>-planner</td>
<td>-casualty</td>
<td></td>
</tr>
<tr>
<td>-location</td>
<td>-weight</td>
<td>-risk</td>
<td>-reconstructionCost</td>
<td></td>
</tr>
<tr>
<td>-goal</td>
<td>-type</td>
<td>-member</td>
<td>-pollution</td>
<td></td>
</tr>
<tr>
<td>-address</td>
<td>-dateOfBirth</td>
<td>-mechanism</td>
<td>-severity</td>
<td></td>
</tr>
<tr>
<td>+decide()</td>
<td>+dd()</td>
<td>+contain()</td>
<td>-cause</td>
<td></td>
</tr>
<tr>
<td>+perform()</td>
<td>+analyze()</td>
<td>+help()</td>
<td>+diminish()</td>
<td></td>
</tr>
<tr>
<td>+serve()</td>
<td>+live()</td>
<td>+manage()</td>
<td>+makeFerocious()</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2 Stability Pattern - Class Diagram Reference**
### 2.6.4 CRC Card

#### Bravery (Bravery) <EBT>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give support and strength to Freedom Fighter</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>Server</td>
</tr>
<tr>
<td></td>
<td>AnyWelfare</td>
</tr>
<tr>
<td></td>
<td>AnyRisk</td>
</tr>
<tr>
<td></td>
<td>show()</td>
</tr>
<tr>
<td></td>
<td>involveRisk()</td>
</tr>
<tr>
<td></td>
<td>fightFor()</td>
</tr>
</tbody>
</table>

**Attributes:** intensity, impact, cause, purpose, effectiveness

#### Cognizance (Cognizance) <EBT>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help Freedom fighters and British Government by providing information</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>AnyPlan</td>
</tr>
<tr>
<td></td>
<td>AnyInvestigation</td>
</tr>
<tr>
<td></td>
<td>dependsOn()</td>
</tr>
<tr>
<td></td>
<td>usedBy()</td>
</tr>
<tr>
<td></td>
<td>assist()</td>
</tr>
</tbody>
</table>

**Attributes:** type, level, purpose, effectiveness, valueOfKnowledge

#### Faith (Faith) <EBT>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivate people to become brave</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>Server</td>
</tr>
<tr>
<td></td>
<td>AnyWelfare</td>
</tr>
<tr>
<td></td>
<td>AnyDamage</td>
</tr>
<tr>
<td></td>
<td>giveHope()</td>
</tr>
<tr>
<td></td>
<td>intensify()</td>
</tr>
<tr>
<td></td>
<td>affirm()</td>
</tr>
</tbody>
</table>

**Attributes:** strength, reason, cause, consequence, priority

#### AnyRisk (AnyRisk) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform designated operation without considering its after effects</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>Server</td>
</tr>
<tr>
<td></td>
<td>Bravery</td>
</tr>
<tr>
<td></td>
<td>AnyActor</td>
</tr>
<tr>
<td></td>
<td>AnyInvestigation</td>
</tr>
<tr>
<td></td>
<td>involve()</td>
</tr>
<tr>
<td></td>
<td>endanger()</td>
</tr>
<tr>
<td></td>
<td>affectTo()</td>
</tr>
</tbody>
</table>

**Attributes:** intensity, type, impact, cost, consequence
### AnyAction (AnyAction) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform the activity</td>
<td>Client</td>
</tr>
<tr>
<td>AnyActor</td>
<td>leadTo()</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Attributes:** performer, startTime, strength, location, objective

### AnyInvestigation (AnyInvestigation) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform any investigation.</td>
<td>Client</td>
</tr>
<tr>
<td>AnyPlan</td>
<td>analyze()</td>
</tr>
<tr>
<td>Cognizance</td>
<td>plan()</td>
</tr>
<tr>
<td>AnyRisk</td>
<td>perform()</td>
</tr>
</tbody>
</table>

**Attributes:** type, toolUsed, data, investigatorId, investigatorName

### AnyEvent (AnyEvent) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any action that leads to consequences.</td>
<td>Client</td>
</tr>
<tr>
<td>AnyConsequence</td>
<td>execute()</td>
</tr>
<tr>
<td>AnyParty</td>
<td>decide()</td>
</tr>
<tr>
<td>AnyLocation</td>
<td>result()</td>
</tr>
</tbody>
</table>

**Attributes:** location, performedBy, detail, time, duration

### AnyConsequence (AnyConsequence) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result of particular event</td>
<td>Client</td>
</tr>
<tr>
<td>AnyEvent</td>
<td>occur()</td>
</tr>
<tr>
<td></td>
<td>result()</td>
</tr>
<tr>
<td></td>
<td>assign()</td>
</tr>
</tbody>
</table>

**Attributes:** tool, location, assignee, affectedPerson
### AnyLocation(AnyLocation) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place where events occur</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>Server</td>
</tr>
<tr>
<td>AnyEvent</td>
<td>provide()</td>
</tr>
<tr>
<td></td>
<td>accommodate()</td>
</tr>
<tr>
<td></td>
<td>locate()</td>
</tr>
</tbody>
</table>

Attributes: name, address, type, direction, eventType

### AnyParty(AnyParty) <BO>

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work to achieve goal</td>
<td>Client</td>
</tr>
<tr>
<td></td>
<td>Server</td>
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<tr>
<td>AnyEvent</td>
<td>decide()</td>
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<td>perform()</td>
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<td>serve()</td>
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Attributes: name, head, location, goal, address

### AnyActor (AnyActor) <BO>

<table>
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<tr>
<td>Perform designated operation.</td>
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<tr>
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<td>live()</td>
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Attributes: name, height, weight, type, dateOfBirth

### AnyMechanism (AnyMechanism) <BO>

<table>
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<tbody>
<tr>
<td>Define a procedure.</td>
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<td>Server</td>
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<tr>
<td>AnyPlan</td>
<td>participate()</td>
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<tr>
<td></td>
<td>leadToConsequence()</td>
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<tr>
<td></td>
<td>operate()</td>
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</table>

Attributes: type, status, duration, requirement, complexity
### AnyPlan (AnyPlan) <BO>

<table>
<thead>
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<tbody>
<tr>
<td>Assist in achieving a goal.</td>
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<tr>
<td></td>
<td><strong>Client</strong></td>
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<td></td>
<td><strong>Server</strong></td>
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<td><strong>AnyMechanism</strong></td>
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<td><strong>contain()</strong></td>
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<td><strong>help()</strong></td>
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<td><strong>manage()</strong></td>
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Attributes: planFor, planner, risk, member, mechanism

### AnyDamage (AnyDamage) <BO>

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<td>Create disharmony.</td>
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<td><strong>Server</strong></td>
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<tr>
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<td><strong>Faith</strong></td>
</tr>
<tr>
<td></td>
<td><strong>AnyWelfare</strong></td>
</tr>
<tr>
<td></td>
<td><strong>diminish()</strong></td>
</tr>
<tr>
<td></td>
<td><strong>makeFurious()</strong></td>
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<td><strong>irritate()</strong></td>
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</table>

Attributes: casualty, reconstructionCost, pollution, severity, cause

### AnyWelfare (AnyWelfare) <BO>

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<td>Heighten faith.</td>
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<td><strong>Client</strong></td>
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<tr>
<td></td>
<td><strong>Server</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Bravery</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Faith</strong></td>
</tr>
<tr>
<td></td>
<td><strong>ameliorate()</strong></td>
</tr>
<tr>
<td></td>
<td><strong>increaseTrust()</strong></td>
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<tr>
<td></td>
<td><strong>ensureSecurity()</strong></td>
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</table>

Attributes: participant, reason, process, result, urgency

### 2.7 Consequences

- The chief issue with the stability pattern is the complexities faced to identify number of IOs with BOs via hook. The ideal value is three but maximum two IOs are connected via hook to BOs.
- Another problem faced was naming the IOs correctly so that the BO and IO relationship were in sync all the time.
- For gaining accurate and correct information from available knowledge, we need perfect mining tool. Thus, many activities will be dependent on mining tools and the way they are implemented.
2.8  Applicability with the illustrated example

2.8.1  Application 1

2.8.1.1  Case Study

The first case is about the terrorist attacks and its impact. It demonstrates how police officers and government officials showed Bravery and saved people from terrorist attack. The terrorists plan their attack on a building with huge economic significance. The police man and the investigators, get to know about this attack from their intelligence which uses the cognizance to figure out details about the attack. These courageous police officers planned against terrorist and saved people from menace of the terrorism. This in-turn increases faith of people in the police officers.
2.8.1.2 Class Diagram

Figure 3 Application 1 Class Diagram


2.8.1.3 Class Diagram Description

This class diagram is used to understand the Bravery stable architectural patterns for terrorist activities monitored by government officials and police to save normal people from massacre. This chiefly requires Bravery along with cognizance. After the task is achieved, the final result is increase in Faith of common people. This faith is increased by act of policeman and government officials, whereas dampened by acts performed by terrorist groups.

- Bravery (EBT) involves any Risk (BO) which is undertaken by any Actor (BO).
- Policeman (IO) and Investigators (IO) are type of actors who in-turn perform AnyAction (BO).
- Investigator (IO) performs any Investigation (BO) which requires Cognizance (EBT).
- Cognizance (EBT) assists in AnyPlan (BO) which is executed for any Investigation (BO)
- AnyPlan (BO) always AnyMechanism (BO) to follow.
- Investigator (BO) is needed for any RescueOperation (IO) which takes help of Map (IO) which is used by a PoliceMan (IO).
- Policeman (IO) uses GPSDevice (IO) which pairs up with Weapon (IO) to execute AnyPlan (BO).
- TerroristActivity (IO) perfomed by terrorist group(IO) which leads to AnyDamage (BO)
- Government official(IO) monitors activities of the Terrorist group(IO)
- Policeman (IO) is appointed by GovernmentOfficial (IO)
- City (IO) is part of AnyLocation (BO) which is the place where AnyEvent (BO) takes place.
- AnyDamage (BO) decreases Faith(EBT) whereas Faith (EBT) is increased by AnyWelfare (BO)
- AnyDamage (BO) is caused by TerroristGroup (IO)
- City (IO) is attacked by TerroristGroup (IO) hampers AnyWelfare (BO)
- Any consequences(BO) are dealt by GovernmentOfficial (IO) which controls AnyEvent (BO)

2.8.1.4 Use Case

Use Case Title: Foreclose the terrorist attack.

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>AnyPerson</td>
<td>PoliceMan, Investigator</td>
</tr>
<tr>
<td>AnyParty</td>
<td>TerroristGroup, GovernmentOfficial</td>
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</table>

Classes, Attributes, Operations:

<table>
<thead>
<tr>
<th>Classes</th>
<th>Classification</th>
<th>Attributes</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bravery</td>
<td>EBT</td>
<td>intensity, impact</td>
<td>show(), involveRisk()</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cause, purpose,</td>
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</tr>
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<td></td>
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<td>effectiveness</td>
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<td>Cognizance</td>
<td>EBT</td>
<td>type</td>
<td>assist()</td>
</tr>
<tr>
<td>Class</td>
<td>BO</td>
<td>Attributes</td>
<td>Methods</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>-------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Faith</td>
<td>EBT</td>
<td>purpose effectiveness level</td>
<td>intensify()</td>
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<td>reason cause consequence</td>
<td>transpire()</td>
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<tr>
<td>AnyParty</td>
<td>BO</td>
<td>department specialization nature location motive</td>
<td>execute()</td>
</tr>
<tr>
<td>AnyLocation</td>
<td>BO</td>
<td>dimension area appearance constituent population</td>
<td>provideWorkSpace()</td>
</tr>
<tr>
<td>AnyWelfare</td>
<td>BO</td>
<td>participant reason process effect urgency</td>
<td>ameliorate()</td>
</tr>
<tr>
<td>AnyRisk</td>
<td>BO</td>
<td>intensity type impact cost consequence</td>
<td>involve()</td>
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<td>BO</td>
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<td>require()</td>
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<td>BO</td>
<td>Performer</td>
<td>lead()</td>
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<td>Role</td>
<td>IO/BO</td>
<td>Attributes</td>
<td>Methods</td>
</tr>
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<td>-----------------------</td>
<td>-------</td>
<td>------------------------------------------------</td>
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<td>AnyPlan</td>
<td>BO</td>
<td>startTime, strength, location, objective</td>
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<td>AnyMechanism</td>
<td>BO</td>
<td>noOfStep, method, duration, category, complexity</td>
<td>participate()</td>
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<td>AnyConsequence</td>
<td>BO</td>
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<td>AnyDamage</td>
<td>BO</td>
<td>Casualty, reconstructionCost, pollution, severity, cause</td>
<td>diminish()</td>
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<td>PoliceMan</td>
<td>IO</td>
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<td>protect()</td>
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<td>Investigator</td>
<td>IO</td>
<td>Title, specialty, address, socialSecurityNo, age</td>
<td>investigate()</td>
</tr>
<tr>
<td>TerroristGroup</td>
<td>IO</td>
<td>Name, organization, size, basedAt, weaponsUsed</td>
<td>attack()</td>
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<tr>
<td>GovernmentOfficial</td>
<td>IO</td>
<td>officeLocation, natureOfWork, address, experience, unitName</td>
<td>monitor()</td>
</tr>
<tr>
<td>Weapon</td>
<td>IO</td>
<td>type, subtype, weaponGrade</td>
<td>intimidate(), kill()</td>
</tr>
</tbody>
</table>
Use Case Description:

1. **TerroristGroup (IO)** which is **AnyParty (BO)** formed separate groups and planned a terrorist activity (IO) **using** map (IO) to **locate** the place of attack.
   
   a. What was the name of this terrorist group?
   
   b. Where were they planning to attack?

2. **TerroristGroup (IO)** **uses** GPSDevice (IO) to **find** the place of attack which is **AnyLocation (BO)**.
   
   a. Which location did the terrorists choose?
   
   b. What was the significance of this place?

3. **TerroristGroup (IO)** had **planned** to use weapons to **intimidate** the passengers and also **kill** some.
   
   a. Which weapons were going to be used?

4. **Government official (IO)** which is **AnyParty (BO)** and **investigates** Terrorist activities (IO), got to know about this **AnyEvent (BO)** while they were at their **workspace** at **AnyLocation (BO)**
   
   a. What did the government official do with this information?
   
   b. Was the information authentic?

5. **Investigator (IO)** who is **AnyActor (BO)** **started** AnyInvestigation (BO) and collected substantial information. They used several things to assist them, for instance maps (IO).
   
   a. Were the investigators able to find out the exact location of the attack?
   
   b. What all material did they make use of in order to get to the site?
6. AnyInvestigation (BO) done out by investigator (IO), requires AnyPlan (BO) which uses Cognizance (EBT) to find out about the terrorists.
   a. What was the exact plan that investigators followed?

7. Policeman (IO) uses weapon (IO) to perform AnyMechanism (BO) which leads to AnyDamage (BO).
   a. What weapons did the policeman use?

8. investigator (IO) helped the Policeman (IO) to perform a rescueOperation (IO).
   a. Who all were involved in this rescue operation?
   b. Was this operation successful?

9. AnyRisk (BO) had to be carried out by policeman (IO).
   a. What risks were involved in this rescue operation?

10. (IO) which is AnyConsequence (BO).
    a. Were the policemen able to stop the terrorists?
    b. How many policemen were involved in the whole operation?

11. Policeman (IO) with the information provided by investigator (IO) performed a rescueOperation (IO) for AnyWelfare (BO) which increases Faith (EBT) of the people and also ameliorates people.
    a. Did it increase the faith of everyone on the team of investigators and policeman?
    b. Was this rescue operation a success?
### 2.8.1.5 Behavioral Model

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<thead>
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<th>EBT</th>
<th>Cognizance</th>
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<th>Risk</th>
<th>Actor</th>
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<th>AnyPlan</th>
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<th>AnyDamage</th>
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</table>

![Figure 4 Application 1 Sequence Diagram](image)

### 2.8.2 Application 2

#### 2.8.2.1 Case Study

In this example we have tried to apply the Bravery Stable Architectural Model to a real life situation. We can apply the same pattern to show the event of Kakori Robbery done by handful freedom fighters for the sake of freedom. The EBTs of this problem are the same as Bravery, Cognizance and Faith. The main protagonists here are Bhagat Singh and Chandrasekhar Azad. They showed great bravery by robbing the train full with British Government security personnel. They attacked the train only after having enough cognizances about the train and the material in the train. Their heroic act increased the faith in the people’s mind about the achievement of the freedom from Britishers.
2.8.2.2 Class Diagram

Figure 5 Application 2 Class Diagram
2.8.2.3 Class Diagram Description

In this application of freedom fighters, we have applied the Bravery Stable Architectural Pattern model to describe the situation faced by the Freedom Fighters and then the Bravery shown by them to overcome the difficulties. The central theme of the application again is “Bravery”. Due to the immense hardships given to the Indians, a group of Indians show bravery to increase the Faith of other Indians in them and consequently ignite them to show similar brave efforts to eradicate Britishers from India. In an effort to show an example, they attack a train full of money and weapons. The story revolves around AnyActor Freedom Fighters and the Bravery shown by them. Below is a description of the Class Diagram presented to diagrammatically justify the situation:

- Bravery (EBT) is led by the feeling of AnyWelfare (BO) from the FreedomFighter (IO)
- Doing a task of Bravery (EBT) involves AnyRisk (BO) which is undertaken by AnyActor (BO)
- AnyActor (BO) which is FreedomFighter (IO) plans to do an Attack (IO)
- Attack (IO) needs AnyPlan (BO) which involves AnyMechanism (BO)
- AnyMechanism (BO) can be a Gun (IO) which can be used to execute AnyPlan (BO)
- AnyPlan (BO) needs a Map (IO) and Cognizance (EBT) to plan the Attack (IO)
- Attack (IO) is AnyEvent (BO) which takes place at AnyLocation (BO)
- AnyLocation (BO) is the AttackSite (IO) which contains the Train (IO) carrying the Police (IO)
- Police (IO) and BritishGovernment (IO) who do AnyInvestigation (BO) using the available Cognizance (EBT) after the attack are AnyParty (BO) who take part in AnyEvent (BO)
- After the occurrence of AnyEvent (BO) leads to AnyConsequence (BO) like Trial (IO) of FreedomFighter (IO)
- FreedomFighter (IO) are trialed by Judge (IO)
- Judge (IO) who is also AnyActor (BO) does AnyDamage (BO) to the country by ordering the trials of the FreedomFighter (IO) involved in Attack (IO)
- FreedomFighter (IO) had the intention of AnyWelfare (BO) which increases the Faith (EBT) of other fellow Indians to ignite Bravery (EBT) in them

Thus this whole event is planned to increase the Faith (EBT) of Indians to consequently show Bravery (EBT).

2.8.2.4 Use case

Use Case Title: Fight for Freedom

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>AnyActor</td>
<td>FreedomFighter, Judge</td>
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</table>

Classes, Attributes and Operations

<table>
<thead>
<tr>
<th>Classes</th>
<th>Type</th>
<th>Attributes</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bravery</td>
<td>EBT</td>
<td>Intensity</td>
<td>show()</td>
</tr>
<tr>
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<td></td>
<td>impact</td>
<td>involveRisk()</td>
</tr>
<tr>
<td>Class</td>
<td>Type</td>
<td>Attributes</td>
<td>Methods</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Cognizance</td>
<td>EBT</td>
<td>cause, purpose, effectiveness</td>
<td>dependsOn(), usedBy()</td>
</tr>
<tr>
<td>Faith</td>
<td>EBT</td>
<td>strength, reason, cause, consequence, priority</td>
<td>giveHope()</td>
</tr>
<tr>
<td>AnyAction</td>
<td>BO</td>
<td>type, performer, impact, characteristic, objective</td>
<td>leadsTo()</td>
</tr>
<tr>
<td>AnyActor</td>
<td>BO</td>
<td>name, type, height, dateOfBirth</td>
<td>do()</td>
</tr>
<tr>
<td>AnyLocation</td>
<td>BO</td>
<td>population, area, type, direction</td>
<td>provide()</td>
</tr>
<tr>
<td>AnyPlan</td>
<td>BO</td>
<td>planFor, planner, risk, member, mechanism</td>
<td>hasMechanism(), uses()</td>
</tr>
<tr>
<td>AnyMechanism</td>
<td>BO</td>
<td>Type, status, requirement, duration, complexity</td>
<td>endWith()</td>
</tr>
<tr>
<td>AnyConsequence</td>
<td>BO</td>
<td>consequenceName, consequenceType, partyAffected, severity, dependency</td>
<td>causedBy()</td>
</tr>
<tr>
<td>AnyWelfare</td>
<td>BO</td>
<td>Participant, result, reason, process, urgency</td>
<td>increaseFaith(), dampen()</td>
</tr>
<tr>
<td>FreedomFighter</td>
<td>IO</td>
<td>Leader</td>
<td>doWelfare()</td>
</tr>
</tbody>
</table>
Use Case Description:

1) Bravery (EBT) which is shown by FreedomFighters (IO) which involves risk triggers AnyAction which leads to different consequences and which is performed by AnyActor (BO). FreedomFighters are AnyActor (BO) and they fight for the welfare of the country.
   a. What kind of bravery is shown by the FreedomFighters?
   b. What was the motivation behind showing such bravery?

2) Congnizance (EBT) is necessary for any task, which depends upon who the information uses.
   a. Is the cognizance correct?

3) FreedomFighters wanted to do attack the train (IO) which was transporting money and weapons for the British Government (IO).
   a. Which train were they going to attack?
   b. How much money was in there?
4) Train (IO) was going to be attacked at a specific AttackSite (IO) which was situated at AnyLocation (BO). This train (IO) was transporting weapons and money, and was also used to carry police.
   a. Where was the attack site located?

5) This AnyLocation (BO) could be located on map (IO). This AnyLocation (BO) provides attack site (IO).
   a. Where is the AnyLocation located on the map?

6) The map (IO) is used as a guide to make AnyPlan (BO) which uses AnyMechanism (BO).
   a. What sort of plan was being made?
   b. What mechanism was involved in making the plan?

7) AnyMechanism (BO) which is being applied endsWith AnyConsequence (BO). This AnyMechanism (BO) is the attack that is done on the train (IO).
   a. Why attack on train?
   b. What is the reason for attack?

8) AnyConsequence (BO) which is caused by AnyMechanism (BO) is the trial (IO) that is given by the Judge. The Judge (IO) gave trial to the FreedomFighters.
   a. Who was the Judge?
   b. Why did the Judge give trial and not any other punishment?

9) FreedomFighter (IO) were showing the bravery by attacking the train (IO), because they had the intention of AnyWelfare (BO), which would dampen in case of AnyDamage (BO).
   a. Why did they consider the heroic act as welfare towards the country?

10) AnyWelfare (BO) that is done by the FreedomFighters (IO) increases Faith (EBT) and gives hope to the country people, Faith (EBT) that the FreedomFighters will achieve Freedom from the British Government (IO).
    a. How does AnyWelfare increase the Faith of the people?
    b. Why was the British Government not giving Freedom to the country?

Alternatives:

2) FreedomFighters could have attacked some other thing such as an Assembly.
3) Train could have been located at a different location due to the late timings of the train.
6) It is not necessary that every mechanism ends with a consequence. Here the attack could have been done without consequences if the freedom fighters would not get caught.
7) The Judge could have given some other punishment as imprisonment for life.
2.8.2.5 Behavioral Model

Figure 6 Application 2 Sequence Diagram
3 Related Pattern and Implementation Issues

3.1 Traditional Model (Meta Model) with Stable Model (Pattern)

Figure 7 Traditional Class Diagram in Project 1
## Adequacy comparison of Traditional Model and Stability Model

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Adequacy</th>
<th>Traditional Model</th>
<th>Stability Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Logical</td>
<td>Logical adequacy is all about having different pieces tied together with some logic that makes the model easier to comprehend. Logical adequacy is an estimate of how well a tool can describe a model’s behaviors, roles and responsibilities. Traditional model was 85 % logical.</td>
<td>Each part in the stability model is logically connected. This aspect was a bit hard to achieve but we worked on it and finally created a model which is 95% logical.</td>
</tr>
<tr>
<td>2.</td>
<td>Understanding</td>
<td>Understanding adequacy is highly desired in a model. Making the model hard to understand is not a good practice and non-technical people who do not have the technical know-how should be kept in mind when modeling. Traditional model was 90% Understandable.</td>
<td>The stability model is quite understandable. The BOs were chosen such as to make the model easy to understand. We were able to achieve 95% understanding adequacy.</td>
</tr>
<tr>
<td>3.</td>
<td>Notational</td>
<td>Notations used in the model should be consistent throughout, in order to achieve high notational adequacy. A particular standard was maintained and we achieved 90% notational adequacy.</td>
<td>In this model this aspect was taken care of in a better manner and we made sure that every possible notation was included and we stuck to it till the end. We achieved 98% notational adequacy.</td>
</tr>
<tr>
<td>4.</td>
<td>Simplicity</td>
<td>A simplistic model conveys all the information needed by the user to get a good understanding of what actually is there in that model. Traditional model was simple enough and we achieved 92% simplicity.</td>
<td>This model is simple enough to understand as simple words are used and the confusion level has been kept to a minimum. We produced a stability model which is 98% simplistic.</td>
</tr>
<tr>
<td>5.</td>
<td>Descriptive</td>
<td>There is nothing better than having a model which is self-</td>
<td>The stability model is to an extent self-descriptive since, the</td>
</tr>
</tbody>
</table>
If the customer has to make considerable amount of efforts in understanding the model, then future collaboration is not possible. Thus we tried and achieved 85% descriptive adequacy for our model.

Diagram also describes the various types of classes in the pattern - EBT. BO and IO, but it needs more work. The descriptive side of the pattern should get 90%.

4 Measurability

4.1 Quantitative Measurability

4.1.1 Formulation - Computing the software metric

The numbers of methods that are involved in any given model prove to be a very effective quantifier. The total number of methods in any system can be calculated as the product of the number of classes in a system and the operations per class. Mathematically stating it,

\[ T = C \times M \]

Where

- \( T \) = Total number of operations
- \( C \) = Total number of classes in the model
- \( M \) = Number of methods/class

\begin{align*}
\text{a) Traditional Model} \\
& C = 27 \\
& M = 3 \\
& T = 27 \times 3 = 81 \\
\text{b) Stability Model} \\
& C = 15 \\
& M = 3 \\
& T = 15 \times 3 = 45
\end{align*}

4.1.2 Indicator - Comparison of Models

<table>
<thead>
<tr>
<th>Feature</th>
<th>Traditional Model</th>
<th>Stability Model</th>
<th>Verdict</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Classes</td>
<td>27</td>
<td>15</td>
<td>Stability Model</td>
</tr>
<tr>
<td>Total number of</td>
<td>81</td>
<td>45</td>
<td>Stability Model</td>
</tr>
<tr>
<td>operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of applications</td>
<td>1</td>
<td>Multiple. Scenario based.</td>
<td>Stability Model</td>
</tr>
</tbody>
</table>

30
4.1.3 Analysis and Impact
The above analysis shows that the stability pattern (45) has lesser number of operations as compared to the traditional model (81). The lesser the number of operations the lesser is the complexity. The benefit of having lesser numbers of operations in our model is as follows:

a. Lesser number of operations means lesser complexity which in turn leads to wider applicability of the solution.

b. The lesser number of classes in the stability model increases the performance. As it is clearly evident the number of classes in the traditional model is approximately twice the number of classes in the stability model. Is decreases the overall performance and efficiency of the system.

c. The number of applications which can be built on the traditional model is just 1, because of the tangible nature of the system. But the stability model has wide scope of applicability as it follows a non-tangible model by using enduring concepts and business objects. Due to its application in more than 1 application, it reduces the overall cost of the system.

4.2 Qualitative Measurement
Reusability: In today’s world, it’s highly desirable that your model is reusable. Reusability of any product or application refers to the ease with which that application or whole system for that matter can be used over and again, with minor or no modification.

4.2.1 Formulation
The reusability of the model can be known from the total number of classes in the system. Lesser the number, higher the reusability.

4.2.2 Indicator

<table>
<thead>
<tr>
<th>Feature</th>
<th>Traditional Model</th>
<th>Stability Model</th>
<th>Verdict</th>
</tr>
</thead>
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<tr>
<td>Number of Classes</td>
<td>27</td>
<td>15</td>
<td>Stability Model</td>
</tr>
</tbody>
</table>

4.2.3 Analysis and Impact
Due to lesser number of classes in the Stability model it is usually preferred over models which can’t be used again primarily because they reduce design time. Stability model is not application specific and thus free from any dependency on the tangible objects (IOs). Thus, this model is highly reusable, which makes it possible for wide variety of applications to connect or associate with it.

Since, this model is reusable; the cost of implementation is not as high as it is for traditional model. This attributes to the reusable nature of the stability model.
5  Modeling Issues [Extra]

5.1  Abstraction
Stability model has three chief entities: EBT (Enduring Business Themes), BO’s (Business Objects), and IO’s (Industrial Objects).

• EBT contains classes that are persistent and remain throughout the lifecycle of the system. They do not change with time and are constant. It also consists of the core knowledge of the industry or business for which the pattern is designed.
• BO contains classes which connects EBT to real physical objects. BOs are reusable in the pattern design.
• IO layer contains classes which are not persistent. They may change with time. Some IOs stays throughout and some simply die. They are the ones which are altered according to the change in requirements.

5.2  Detailed Study
Throughout the project, we tried to overcome the shortcomings of traditional models. For any pattern to be reusable there has to be some persistent objects which are always there in the system. These objects facilitate the system to persist. So we had a tough time identifying the EBTs. But once, we identify correct EBTs designing patterns becomes simple. Identifying BOs is also important part. BO can be the medium used to achieve the final goal of the system. Whereas IOs are the entities which can change over the time and can be removed from the system. IOs make any system or pattern complete. Thus, IO gives meaning to any pattern.

6  Design and Implementation Issue [Extra]

6.1  Facade Implementation
Façade design pattern essentially provides a simple interface which acts as an alternative to a more complex aggregation of interfaces or subsystems. It is easy enough to use as it apparently conceals the actual implementation details.

It basically lets the client access the system through the use of a simple interface. Thus, the basic purpose of façade is to help an application achieve something without thinking anything about the specifications. Façade is not application specific and it can be used to deal with an existing system which is highly complex. Façade design patterns can also be used to handle systems which are to be built from scratch.

The word ‘façade’ means a showy misrepresentation which hides or conceals something unpleasant. Let’s consider an example of façade design pattern. We consider a store which has a storekeeper and three kinds of goods. This store is full of material and all the things are kept at their respective places. A
client walks up to this storekeeper and asks for something in particular. This client does not know anything about the place of storage of the item that he has asked for. It’s the responsibility of the storekeeper to cater to his requests. Thus, storekeeper acts as a façade, hiding the complexities of his store and client acts as an application.

The java code below shows how this storekeeper acts as a façade.

**Store.java**

```java
package structural.facade;

public interface Store {
    public Goods getGoods();
}
```

The store can very well be an interface. This only returns Goods. The goods are of three types as discussed earlier in this document. RawMaterialGoods, FinishedGoods and PackagingMaterialsGoods. All these classes can implement the Goods interface.

Similarly, the stores are of three types and can implement the Store interface. Let’s have a look at the code for one of the stores.

**FinishedGoodsStore.java**

```java
package structural.facade;

public class FinishedGoodsStore implements Store {
    public Goods getGoods() {
        FinishedGoods finishedGoods = new FinishedGoods();
        return finishedGoods;
    }
}
```

Now let’s consider the facade StoreKeeper.

**StoreKeeper.java**

```java
package structural.facade;
```
public class StoreKeeper {

/**
 * The raw materials are asked for and
 * are returned
 *
 * @return raw materials
 */
public RawMaterialGoods getRawMaterialGoods() {
RawMaterialStore store = new RawMaterialStore();
RawMaterialGoods rawMaterialGoods = (RawMaterialGoods)store.getGoods();
return rawMaterialGoods;
}

/**
 * The packaging materials are asked for and
 * are returned
 *
 * @return packaging materials
 */
public PackingMaterialGoods getPackingMaterialGoods() {
PackingMaterialStore store = new PackingMaterialStore();
PackingMaterialGoods packingMaterialGoods = (PackingMaterialGoods)store.getGoods();
return packingMaterialGoods;
}

/**
 * The finished goods are asked for and
 * are returned
 *
 * @return finished goods
 */
public FinishedGoods getFinishedGoods() {
FinishedGoodsStore store = new FinishedGoodsStore();
FinishedGoods finishedGoods = (FinishedGoods)store.getGoods();
return finishedGoods;
}

}// End of class
This is clear that the complex implementation will be done by StoreKeeper himself. The client will just access the StoreKeeper and ask for either finished goods, packaging material or raw material.

6.2 Inheritance v/s Aggregation
While the implementation, few issues with inheritance and aggregation is observed.

6.2.1 Inheritance:
In object-oriented programming, inheritance is a way to form new classes (instances of which are called objects) using classes that have already been defined.

Model Implemented with Inheritance:
In the class diagram of pattern, TerroristGroup and GovernmentOfficial are inherited from AnyParty.

![Figure 8 Inheritance]

The above model is static and is fixed. It follows the super class. If at all any changes occur in super class that will be affected to sub classes. Subclasses are kind of dependent on its super classes. In inheritance super class can’t hide its method from the subclass.

[Example] Code for Inheritance concept:

Class AnyParty()

Class governmentofficial {
    String name;
    Int age;

governmentofficial() {
}

governmentofficial(String name, int age) {
}
name = n;
age = a;

void getName() {
    System.out.println("name is : " + name);
}

public class display extends Box {
    string height;
display() {
    }
display (string n, int a) {
    super(w, h, d);
    height= m;
    }
    public static void main(String args[]) {
    System.out.println("name is " + dp1.name);
    System.out.println("height is " + dp1.height);
    System.out.println("age is " + dp1.age);
    }
    }

In the above code the class display is derived class from governmentofficial. Now here if
governmentofficial class has any changes then display is also affected.
6.2.2 Aggregation

Aggregation is a form of object composition in object-oriented programming. Aggregation implies encapsulation (hiding) of the parts of the composition. We can aggregate classes by using a (static) inner class.

![Figure 9 Aggregation](image)

**[Example] Code for Aggregation concept:**

```java
public class SavingsAccount {
    Customer customer;
    public SavingsAccount(Customer customer) { this.customer = customer; }
}

public class CheckingAccount {
    Customer customer;
    public CheckingAccount(Customer customer) { this.customer = customer; }
}

public class AccountManager {
    public void fun()
    Customer c = new Customer();
    CheckingAccount checking = new CheckingAccount(c);
    SavingsAccount savings = new SavingsAccount(c);
}
```

In the above code of aggregation, the class AccountManager aggregates the functions of SavingsAccount through an object. So changes in SavingsAccount won’t affect the class AccountManager.
7 Testability [Extra]

If Bravery Architecture Model using Stability Pattern can be used without changing the core design and by only plugging industrial objects for number of applications, then the stability pattern can be said to be testable. In the applications section we have shown two applications namely:

1. Fight for freedom
2. Anti-terrorist squads or police force.

Both these applications do not require any change to the core design of the pattern. Using the scenarios listed, many such scenarios can be deduced and proved that the Bravery Architecture Model using Stability Pattern is stable and testable.

8 Known Usage [Extra]

As we mentioned before the Bravery Stable Architectural Pattern can be reused. Some applications which benefit with the Bravery Stable Architectural Pattern are as follows:

e. **Air Force operations:** The operations carried out by Air Force are probably one of the best examples that incorporate bravery. These brave warriors show no sign of weakness and always perform a commendable job which is expected out of them. There have been numerous incidents in the past, and will keep happening in future, where these brave men would do anything it takes to save their peers and other inhabitants of their country.

f. **Life saviors during natural calamity:** Another scenario in which our model can be applied is in the case of a natural calamity. In the past we have seen so many incidents such as floods, volcanic eruptions, earthquakes. During such hard times, life saviors without even caring about their own life, perform their duty to save every possible life. A perfect example could be the bravery shown by such people during a flood in Wales, saved lives of as many as thirteen people.

9 Lessons Learnt and heuristics [Extra]

Here the final goal of this project is to learn how to design a reusable pattern which can be used across multiple domains. While designing the pattern that is first part of project, we learnt how to design a generic pattern which can be used for all the applications including bravery. Here the main aim was to design basic pattern considering all the perspectives.

The second part of the project was to design an application specific class diagram.

- **Heuristic # 1:** The class diagram should include minimum number of connections between classes because it reduces complexity of the system.
- **Heuristic # 2:** There should be clear interfaces or connectors between BO and IO
10 Conclusions
The project on Bravery Stable Architectural Pattern covers the most primitive aspects of the Software Engineering Stability patterns. The aim of this project was to develop a stability pattern based on Bravery which involved various EBTs (Enduring Business Themes), BOs (Business Objects) and IOs (Industrial Objects). By using these three elements of the stability pattern we developed a highly reusable interface of the pattern and reused it in two different applications. The project also covered the behavior diagrams based on the stability models. To give an insight on the stability model, it was compared with the traditional model and various differences were formulized on different parameters.

11 Work Distribution

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- Prof. Fayad’s portal - http://www.engr.sjsu.edu/fayad
- http://www.swebok.org/
TERRORIST MOVEMENTS AND ITS IMPACTS ON DIFFERENT THINGS

Submitted by:

Team “Prodigies”

Team Members:

<<<<<<<<<<< Student Work >>>>>>>>>>
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1 Abstract

United States Law code defines terrorism as, “Premeditated, politically motivated violence perpetrated against noncombatant targets by sub-national groups or clandestine agents.” Lately there have been many terrorist activities taking place in various parts of the world. This one act of terrorism affects millions of people in many different ways. Our chief aim is to study these impacts. We want to bring out the after effects of the terrorism and how it affects several people in respective ways.

Our motivation to do this topic is very clear. We are very upset with the way of killing innocent people for some selfish purpose. We thus wanted to highlight some of its impacts to lay man, government body, economy of the country and thus world as well as other creatures which are affected.

Here we are going to describe a scenario where a group of terrorists plan attacks which causes destruction at several places and how it affect lives of several people. In our scenario, there are group of terrorists who planned two major attacks to cause heavy destruction.

The first attack was planned through an airplane. Here, the pilot of the plane was involved in the terrorist activity. He crashed the airplane into a building with very high economic significance to the country. This lead to lot of destruction and hence followed the aftermaths of this attacks.

The second attack was planned through suicide bombers. These suicide bombers were covered with heavy explosive materials. And they were located in such a place where there is huge crowd of people located. This evidently caused a huge amount of damage to property as well as human casualties.

The destruction was huge in terms of death of many people, suffering relatives, collapsing of buildings, plane crash and air pollution and also it affected ecosystem to a great extent. The mission of several terrorists to perform destruction was accomplished. But it had caused trouble not only to people who were involved but also to people who were attached in some or other indirect way.

After the attack, there were several activities which took place. All the government personnel tried to find out the root cause of the attack. There were several resources involved in tracing the group which planted the attack. Also, there were many surveillance robots which were fixed on the building, where first attack took place. Thus, security team tried to gather information from those robots. All the security in country was in attention. There were many operations by security department in entire country to check whether there are some other locations where bomb might be located. The officials used sniffer dogs to trace location of the bombs in probable places. Many forensic experts were called, so that they can find out about various possibilities about the attack. Thus all officials were trying to get information on how the attack was planned and who was the master mind behind this attack.

There were different types of impacts affecting various groups of people in different parts of country. We have classified these impacts in three major types: Physical impacts, psychological impacts and economic impacts. The physical impact basically includes life damage, property damage and also animals which are affected by this attack. Attacks like this lead to terrible mental stress and trauma to people.
Those who have eye witnesses such events and are spared from any physical damage, suffer from immense mental trauma. Also, loosing ones near and dear ones is a huge thing to deal with. The whole environment is polluted. People eye others with suspicion and there is an air of mistrust in the way they behave. This entirely spoils the integrity and harmony of the nation. Also, economically country is shaken. The stock exchange suffers, economy is imbalanced and lay man also suffers because of all this activities.

2 Description of Domain

Our domain is to describe about the various impacts of terrorist activities. Terrorist activities affect all sorts of verticals. Various types of impacts can be primarily categorized in the following manner:

1. Economic impacts
2. Psychological impacts
3. Physical/Health impacts

2.1 Economic impacts

The economic impact of terrorism can be calculated from a variety of perspectives. Figure 3 shows the WTC after the plane crashed. There are direct costs to property and immediate effects on productivity, as well as longer term indirect costs of responding to terrorism. These costs can be calculated quite minutely; for example, calculations have been made about how much money would be lost in productivity if we all had to stand in line at the airport for an extra hour every time we flew.
Direct cost can be considered as cost to private sectors, cost to federal government, cost for cleaning up the mess created by terrorist attacks and cost to homeland security department for increasing the security measures to further prevent such attacks. Moreover such attacks cause damage to financial markets too. Further terrorism increases the cost of various supply chains when extra layer of security is added at various ports and land borders to prevent any major security breach. Figure 4 shows the economic fall down graph after the attack.

![Figure 11 Economic crisis after terrorist attacks](image)

**Figure 11** Economic crisis after terrorist attacks

### 2.2 Psychological impacts

Terrorism is about psychology. The above figure 5 shows a terrorist. It is about making ordinary people feel vulnerable, anxious, confused, uncertain, and helpless. Terrorist attacks have the potential to create severe psychological distress and suffering. This suffering increases when victims have seen death of other individuals, experienced loss of family members and friends. If the attacks are extremely violent it may lead to long lasting psychological effects. Various symptoms of psychological effects include feelings of horror, anxiety, depression, and even emotional numbness -- or lack of feelings. People may keep reliving images of the events in the form of nightmares and 'flashbacks,' have difficulty concentrating, not feel close to loved ones, and experience heightened physical tensions or health problems. Below figures show various psychological effects and the mental trauma that the attacks had on the people.
As a result of attacks people develop a chronic state heightened vigilance. Terrorism also leads to Stress, Trauma, and Psychopathology in children. Children at their early stage of development develop severe fear because of traumatic events occurring at their early ages when they are not that understanding.

![Figure 13 Feeling of fear](image1.png)

![Figure 14 Anxious and worried](image2.png)
2.3 Physical/Health impacts
The major physical impact of terrorist attacks is loss of humans, injuries to the same, animal casualties. Fig 9 shows the scene of the building after the bombing attack. Terrorism affects both physical as well as mental health equally. If a radioactive weapon is used to attack then it would lead to permanent or temporary physical ailments, and some cases serious mental problems. If bombs are used for attacks then there is very large possibility that an individual gets physically damaged and lead to disability of some sort. The workers who are working at the attack site can have severe respiratory diseases due to the dust and smoke generated over the site. In some cases
it could also lead to lung cancer. The toxic elements which are produced can affect fetal development. Below figure 10 shows the WTC after the attack.

Figure 17 A firefighter standing near attack site
3 Block Diagram

Figure 18 Block Diagram

4 Description of the Program that is wanted:
The main purpose of this program is to study the effects of the terrorist activities in the past. In this story of ours we have considered a couple of terrorist activities which are as follows:

- Terrorists getting into an airplane and taking control of it with the help of the pilot who himself is a terrorist and then crashing the plane into an economic center.
- A suicide bomber heavily loaded with explosives carried out the explosion in an area packed with people all around and several nearby buildings collapsed due to it and many people lost their lives.

Several people lost their lives and these events caused great deal of destruction in terms of infrastructure as well. The lucky ones who escaped death were not that lucky because many of them suffered from Post-traumatic stress disorder (PTSD). The main impacts of these terrorist attacks were:
• **Economic instability**: Due to the fact that the plane that crashed into the economic center caused great deal of destruction in terms of money that was lost during the attack and the added cost of clearing the debris and reconstruction.

• **Psychological imbalance**: Several people who escaped the attacks or people who witnessed the attacks remained in the state of trauma over a long period of time. People began mistrusting other human beings and had this feeling that nobody is good and that nobody wants peace.

• **Physical losses**: Thousands of lives were lost as a result the attacks. Many people suffered from respiratory illness due to the dust from the pulverized buildings which remained suspended in the air for a long time.

Our main aim is to portray the after effects of the attacks and letting people know how traumatic such incidents can be, so that people start thinking rationally and hopefully such attacks will not be repeated over and again.

5 **Detailed Requirements**

5.1 **Planning the attack:**

- To achieve the desired target successfully, there has to be full proof planning. So behind this terrorist attack, there was a master planner.
- The planner strategized the moves of each and every person involved in the attack. They hired people who could be useful for that attack.
- There were few things to be taken into consideration before implementing the attack. They had to motivate people for sacrificing their life for the cause.
- Thus for this task, they prepared suicide bombers who could attack and also sacrifice their life in this attack.
- Many arrangements had to be made in terms of deciding where to get the arms and ammunitions from, which place to attack and what is the best time to attack to magnify the impact of the attack.
- Also, they had to decide a master plan which involved penetrating in the system. It was very difficult to get into the system breaking some rules and regulations.
- Also, they had to destroy all the proofs which could lead to the master mind behind the plan before they could proceed further.
- There has to be a back-up plan if something goes wrong at any point of time. From terrorist’s point of view, this was the major step and had to be devised carefully to achieve desired result.

5.2 **Preparing for the attack:**

- After the phase of planning, there is implementation of the plan. But before that, all the equipments required for the planning has to be set straight.
- In this case, terrorists need to assemble all the arms and ammunitions required for the attack. The pilot, who was bribed, had to be mentally prepared for the task of crashing the plane.
- Also, people who were involved in attack had to reach their specific destination on time and take their positions.
In this case, there is a supplier who supplies all the required guns, bombs and other explosives to terrorists. This supplier is the chief person who supplies arms to terrorists. He is involved in smuggling things into the country and handing it over to person who actually is going to use them in the attack.

There is an aggregator who aggregates all the materials required for the attack.

Also, one person monitors that all the actions are being performed smoothly.

5.3 Executing the plan:
• After all the planning and preparations, there comes the final day when the plan has to be executed.
• For the first attack, the pilot gets into the plane and prepares himself mentally. He then diverts the plane instead of its destined location to the tower where it is supposed to attack.
• Here it crashes into the tower which is location with very high economic significance. This leads to unexpected chaos in the crowd.
• People start moving here and there in shock and panic. In the same frame of time, terrorists start their attack on the other building.
• Here the suicide bombers have taken their place where they were ordered to. Thus, the clock started ticking and when the right time came, suicide bomber triggered the bomb.
• Because of this the bomb blasted! This took lives of thousands of innocent people.

5.4 Destruction:
• As it was planned, the attacks lead to immense destruction in various terms. There were so many victims who were adversely affected by the bomb blast which took place.
• All the passengers in the plane lost their lives. Also the suicidal attack on the tower not only destroyed the building and took lives of innocent people but also affected the economic scenario.
• The debris of the building was panicky and created very disturbing situation. Many people lost their loved ones and were suffering.
• There were many pet animals which were present in the building which were also killed during the attack. There were many pets that had lost their masters and were sad because of the loss.
• Not only physical things were destroyed but this attack had dampened psychological spirits of the people.

5.5 Analyze the cause:
• Because of the attack, all the security officials were highly alert.
• They tried various methods to find out the root cause of the attacks and also check other prominent places for any traces of bombs or other explosives.
• For first attack, there were various surveillance robots fixed to the buildings. For this, the live streaming was sent to some remote server.
• So the main task was to check those video tapes for any possible evidence about the attackers.
• All the government personnel were highly disturbed and started to take actions to help the affected people. Police and forensic teams started to investigate the matter.
• Also, sniffer dogs were taken to crime locations so that they can look for other bombs or explosives of those types in other places in the country.
• At other prominent public places security was tightened and bomb detectors were used to check for more bombs.

5.6 Studying economic impacts:
• These attacks had disturbed economy to a great extent. Firstly, as the attack was on significant economically important building, there were many quick impacts.
• The finance minister was extremely worried about what would happen next. The stock exchange market was shut down for a period of a week till market could become stable.
• Lay man was also affected by these attacks as everything which was previously available at cheaper rate was now very expensive. Those who had lost the earning member of the family in attack had to face huge amount of problems.
• Also, insurance companies were facing huge loss as they had to compensate people. Everywhere one could see people suffering from economic distress.
• Banks had also suffered a huge loss due to this unexpected change in economy. Thus there were many economic problems all around the place.
• Apart from this airlines suffered from huge loss as people were now afraid of travelling on the plane.

5.7 Studying psychological impacts:
• Apart from economic impacts, there were many psychological impacts on people due to different reasons.
• Many people suffered from huge psychological trauma as they had lost someone they loved or cared for in the attack.
• Some people who had witnessed this event were disturbed and were under shock. Also, people started thinking there is no guarantee of life and hence were suffering a lot.
• Animals that used to enjoy their freedom now were afraid of any loud noises or such intimidating situation.
• Thus psychological experts tried to solve people’s problem by pacifying people and tried to make people feel safe.
• There was mistrust amongst people and they started to speculate about people’s origin.

5.8 Studying physical impacts:
• Definitely these attacks had caused a lot of physical damage. The buildings which were demolished were major physical damage.
• Also, plane which was crashed was destroyed. There were thousands of people who were killed or injured. There were many animals like dog, cat etc who were also killed in this process.
• There were doctors who were there all over the places to see if there was any chance to find some people who were alive and can be treated.
• The corpses had to be identified and delivered to respective families where they belonged. There was a huge physical damage which occurred due to the attack.
5.9  Trying to rebuild:
• After the attacks, it was mandatory to rebuild the buildings which were damaged and start the routine activities.
• For this there were many constructors appointed. The economists started their try to raise the economy which had collapsed due to this attack.

There were many tools and equipments ordered to rehabilitate the buildings and also, government bodies tried to compensate the families for their loss in the attack.

6  Use Cases

6.1 Use Case #1

Use Case Title: Plan

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>SuicideBomber, Planner</td>
</tr>
<tr>
<td>Hardware</td>
<td>SurveillanceRobot</td>
</tr>
</tbody>
</table>

Description:

1) Two simultaneous attacks were planned by the Planner.
   a. In the first one, a plane crashed into the economic epicenter.
   b. In the second attack, a suicide bomber attacked a government building.
2) Planner used various surveillance robot feeds of the government building to analyze the possible entry points.
3) Various weapons and other material to be used were finalized.
4) The airliner to be used was decided upon.

6.2 Use Case #2

Use Case Title: Gather resources

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>Planner</td>
</tr>
<tr>
<td>Software</td>
<td>Tracker</td>
</tr>
</tbody>
</table>

Description:

1) A supplier who supplied illegal arms was contacted to supply all the materials.
2) The resources which were decided during planning phase were aggregated by the Aggregator.
3) Different materials including bombs and guns with its ammunition were gathered.
4) The planner tracked the availability and the transportation of all the required material by using tracking software.
6.3 Use Case #3
Use Case Title: Prepare to attack

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>Pilot, Terrorist, SuicideBomber</td>
</tr>
<tr>
<td>Hardware</td>
<td>SurveillanceRobot</td>
</tr>
</tbody>
</table>

Description:

1) After gathering resources it was now time to actually implement the plan.
2) The terrorists used surveillance robots to collect pictures and decide final position of attack.
3) The pilot of the plane who was himself a terrorist along with other terrorists took their respective positions at the places where they had to attack.
4) The suicide bombers took position near the government building as seen from the surveillance robot feeds on which they were going to attack.

6.4 Use Case #4
Use Case Title: Execute

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>SuicideBomber, Terrorist, Pilot</td>
</tr>
<tr>
<td>Creature</td>
<td>Dog</td>
</tr>
</tbody>
</table>

Description:

1) The different terrorists in the plane killed couple of passengers to terrify others.
2) The pilot who was a terrorist directed the plane towards the building on which the attack was to be done and crashed the aircraft into the building causing severe damage.
3) This damage consequently caused death of several street dogs.
4) On the other hand the suicide bomber proceeded towards the core part of the government building to attack.
5) After they reached to the designated place they blew away themselves, consequently causing damage in the form of lives of several government personnel and damaging the property.

6.5 Use Case #5
Use Case Title: Destroy

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>Victim, GovernmentOfficial</td>
</tr>
<tr>
<td>Creature</td>
<td>Dog</td>
</tr>
</tbody>
</table>

Description:

1) Both the attacks caused a lot of destruction, economically as well as socially.
2) In the first attack destruction was in the form of damage to the building in which the plane crashed. The plane was completely destroyed and victims who were in the plane as well as the building, died.
3) Other people who didn’t die were either severely injured or were affected indirectly by the dust and smoke created by the destruction of the public property.
4) Due to the tremendous amount of smoke and dust which was produced as a result of attack affected the dogs that were in the streets during and after the attack.
5) The second attack also destroyed a major part of the government building and killed many government officials.

6.6 Use Case #6
Use Case Title: Investigate

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>GovernmentOfficial, Investigator</td>
</tr>
<tr>
<td>Hardware</td>
<td>SurveillanceRobot, BombDetector</td>
</tr>
<tr>
<td>Creature</td>
<td>SnifferDog</td>
</tr>
</tbody>
</table>

Description:

1) To analyze the cause of the destruction and the various after effects, government officials from all departments looked at various possibilities and sides of the matter.
2) The police department started interrogating different people to get clues about the terrorists.
3) The forensic experts searched for remains of the bombs along with sniffer dogs to find out trail of terrorists and collect evidence.
4) The city was put under strong surveillance through different surveillance robots 24 hours a day to find any suspicious activities in the surroundings.

6.7 Use Case #7
Use Case Title: Study economic breakdown

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>FinanceMinister, Layman</td>
</tr>
<tr>
<td>Software</td>
<td>DataAnalyzer</td>
</tr>
</tbody>
</table>

Description:
1) Due to the destruction of the building by the plane crash, all the offices which were in the building were also destroyed.

2) Different banks had their head offices in the building so it caused the banks to stop operating for several days. As a result the stock market was closed down. This resulted in a loss of several billion dollars.

3) The finance minister studied the impacts and planned the budget accordingly with the use of data analysis software to invest in rebuilding of the building as well as increasing the security of the nation.

4) The common man i.e. layman who had their jobs and working places in the building were affected severely, because they had lost their jobs. So they were also economically affected due to the attack.

6.8 Use Case #8
Use Case Title: Examine psychological impacts

<table>
<thead>
<tr>
<th>Actors</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>Layman, Psychologist</td>
</tr>
<tr>
<td>Creature</td>
<td>Dog</td>
</tr>
</tbody>
</table>

Description:

1) Due to terrorist attacks layman i.e. common people, suffered post-traumatic stress disorder (PTSD) in the form of sleeping disorders, nightmares, alienation/estrangement and depressions.

2) People initially agreed to group counseling by psychologists but later on demanded individual sessions since they were under so much stress that they could not even listen to painful stories of others.

3) Media coverage of the destruction added to the depression amongst layman.

4) Abnormal behavior was observed in dogs that experienced the attack. They were found to be terrified by high intensity noise.

5) The attack also created a sense of mistrust and fear in the minds of everyone who witnessed the mishap.

6) In contrast, certain people acquired a positive attitude and became even stronger with the help of family and social support, prior experiences, personal characteristics and counseling by psychologists.

6.9 Use Case#9
Use Case Title: Comprehend physical damage
Description:

1) Thousands of officials, financial personnel, workers and other common people lost their lives during the attacks.

2) Dust from the pulverized buildings continued to fill in the air of the city for a long time and caused respiratory illness to layman.

3) Doctors and surgeons had a great deal of work to do within no time after the attacks as they had to take care of several survivors who got injured badly.

4) Not only human beings, but also dogs and other animals died due to the collapse of the building.

6.10 Use case#10
Use Case Title: Rehabilitate

Description:

1) Due to massive destruction, several hundreds of constructors were called for, to build the buildings that collapsed.

2) Several economists conducted meetings regarding the amount of money to be spent for rehabilitation.

3) Lots of construction tools like bulldozers, welding machines, debris collecting robots etc. were used by the constructors to rebuild the affected site.

7 References
1) http://en.wikipedia.org/wiki/September_11_attacks
2) http://en.wikipedia.org/wiki/Economic_effects_arising_from_the_September_11_attacks
3) http://www.nature.com/npp/journal/v30/n10/full/1300817a.html
4) http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA185364
5) http://www.fordham.edu/campus_resources/enewsroom/archives/archive_234.asp