Università della Svizzera italiana

Data Analysis for Performance Annotations

Project Plan

Irene Jacob
irene.jacob@usi.ch

Supervised by:
Professor Antonio Carzaniga
Daniele Rogora

April 5, 2017

1. Motivation

Performance problems in large software systems can be difficult to resolve. In particular, identifying a performance issue in the source code of a large system can be an arduous process, with little guarantee of success. The idea of performance annotations is to provide valuable information regarding the performance characteristics of a piece of code. For example, a performance annotation might relate the running time or space complexity of a function to, say, the size of an input data structure. This information can then be used to optimize a system. With proper analysis, the data received from these annotations could reveal the parts of the system causing performance problems.

2. Goal

There are a number of potential uses of performance annotations. Namely:

1. They can be used as performance assertions, to ensure that a particular function follows its performance requirements. In particular, an annotation may serve as an oracle for tests to detect performance problems.

2. Annotations may also provide useful information in debugging performance problems. For example, a performance annotation may provide information about the memory usage of a function. This information could reveal a possible memory leak, which may otherwise have been difficult to identify by simply examining the code.

3. They can also be seen as a design tool, where systems are designed and implemented to meet certain performance requirements. The annotations of a method, combined with the structure of the code of the system in which this method is used, might allow the developer to deduce the overall performance of the system.

The goal of this project is to derive performance annotations from the execution of a system. In essence, this amounts to recording and analyzing relevant data logged by instrumenting a subject system.

3. Project Description

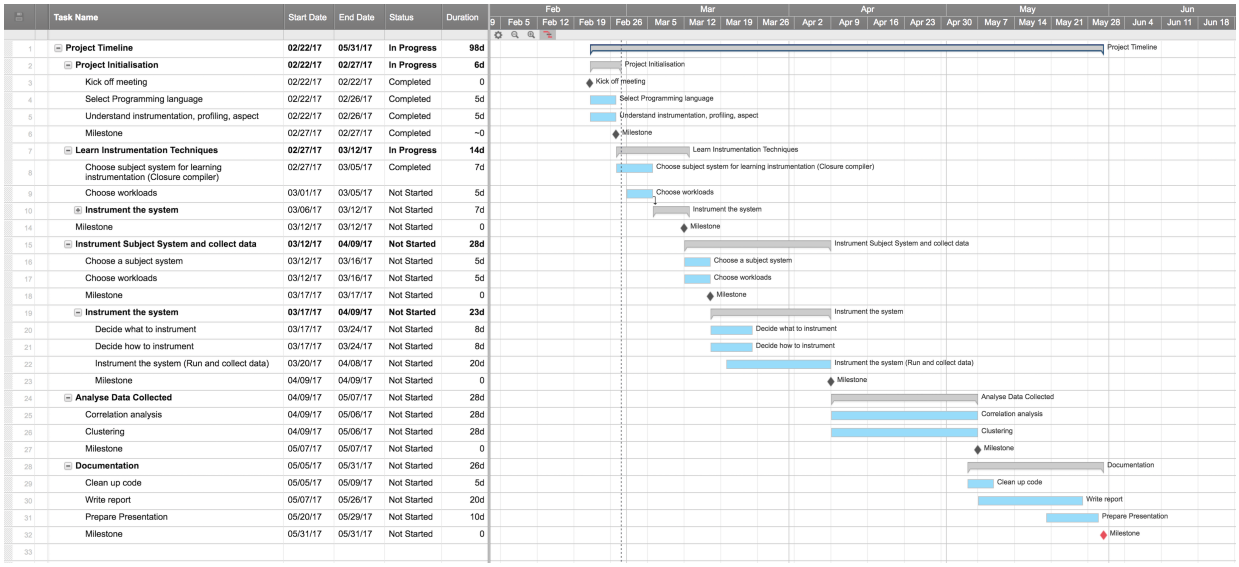
In this project we will instrument a subject system, based on some workload or application scenarios. For example, we could use profiling as an instrument to track the runtime of some function in the system. The performance results received would be recorded and later analyzed using various statistical techniques, and perhaps machine learning. In particular, we will attempt to find a correlation between the performance results and some independent variables (for example, the size of the thread pool). The correlations found would then help derive performance annotations for the subject system (for example an optimal thread pool size).

4. Plan

4.1. Milestones and Tasks

Milestone	Task
M1	Kick-off meeting
M2	Select Programming language Understand what is instrumentation and profiling
M3	Learning how to instrument a system Choose subject system for learning instrumentation (Closure compiler) Choose workloads Instrument the system
M4	Choose a system Choose workloads/ application scenarios (input)
M5	Instrument the system - Decide **what** to instrument - Decide **how** to instrument Choose/implement some independent variable to record with instrument result Run
M6	Correlation analysis Clustering
M7	Clean up code Write report Prepare Presentation

4.2. Timeline



	Task Name	Start Date	End Date	Status	Duration
1	**Project Timeline**	**02/22/17**	**05/31/17**	**In Progress**	**98d**
2	**Project Initialisation**	**02/22/17**	**02/27/17**	**In Progress**	**6d**
3	Kick off meeting	02/22/17	02/22/17	Completed	0
4	Select Programming language	02/22/17	02/26/17	Completed	5d
5	Understand instrumentation, profiling, aspect	02/22/17	02/26/17	Completed	5d
6	Milestone	02/27/17	02/27/17	Completed	~0
7	**Learn Instrumentation Techniques**	**02/27/17**	**03/12/17**	**In Progress**	**14d**
8	Choose subject system for learning instrumentation (Closure compiler)	02/27/17	03/05/17	Completed	7d
9	Choose workloads	03/01/17	03/05/17	Not Started	5d
10	**Instrument the system**	03/06/17	03/12/17	Not Started	7d
14	Milestone	03/12/17	03/12/17	Not Started	0
15	**Instrument Subject System and collect data**	**03/12/17**	**04/09/17**	**Not Started**	**28d**
16	Choose a subject system	03/12/17	03/16/17	Not Started	5d
17	Choose workloads	03/12/17	03/16/17	Not Started	5d
18	Milestone	03/17/17	03/17/17	Not Started	0
19	**Instrument the system**	**03/17/17**	**04/09/17**	**Not Started**	**23d**
20	Decide what to instrument	03/17/17	03/24/17	Not Started	8d
21	Decide how to instrument	03/17/17	03/24/17	Not Started	8d
22	Instrument the system (Run and collect data)	03/20/17	04/08/17	Not Started	20d
23	Milestone	04/09/17	04/09/17	Not Started	0
24	**Analyse Data Collected**	04/09/17	05/07/17	Not Started	28d
25	Correlation analysis	04/09/17	05/06/17	Not Started	28d
26	Clustering	04/09/17	05/06/17	Not Started	28d
27	Milestone	05/07/17	05/07/17	Not Started	0
28	**Documentation**	05/05/17	05/31/17	Not Started	26d
29	Clean up code	05/05/17	05/09/17	Not Started	5d
30	Write report	05/07/17	05/26/17	Not Started	20d
31	Prepare Presentation	05/20/17	05/29/17	Not Started	10d
32	Milestone	05/31/17	05/31/17	Not Started	0
33					

4.3. Project Deliverables:

1. Project Report
2. Poster
3. Source code for instrumenting the system
4. Data collected
5. Analysis of Data