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Comments	

Change Requests Analysis Internal Document

Introduction

This document describe the analysis of a three change requests (CRs) analysis conducted for the Lennard Jones simulation system, as proposed by our clients. The change requests are:

CR1:

Due to a new government law on quality assurance of simulation software, any software release should be tested with a dataset containing 100,000 data samples to verify the accuracy of simulation. The samples and reports should be provided to the government IT office to get the approval for release, the approval time is 15 days.

CR2:

The client wants to increase the number of users for the software, therefore, the client requests to include the following simulation methods:

- Molecular dynamics
- Montecarlo methods
- A module to simulate solids
- A module to simulate liquids
- A module to simulate plasma

CR 3:

Due to compatibility reasons, the client desires that the simulation should be developed using an open-source numerical package. This numerical package is new for you, and the learning curve is at least one week.

In the following sections of this document, we analyze the change request (CR) from several fundamental perspectives that are essential for the overall development of the project.

Description of the Document

In the following sections of this document, we analyze each of these CRs from several fundamental perspectives that are essential for the overall development of the project.

Criteria for Identifying Configuration items

The first step in every configuration management (CM) process is to analyze the configuration items (CIs). In this document, we will use the following definition for CIs:

"A configuration item is a module, or part of a system that needs to be modified in order to meet the needs of a change request (CR)"

We consider three modules for our original system:

- GUI
- Simulation module
- Output module

For assessing the impact of a CR on a given module we consider the following criteria:

1. Functionality: to evaluate if implementing a CR would require to add, remove or modify the existing functionality of a module.
2. Data: to assess if the type of data that the module receives, outputs or processes is compatible with the needs of the CR.
3. Performance: to assess if the predefined computational resources of the system will suffice the CR's computational intensity.
4. Dependencies: to check if the module depend on other modules or components that may be affected by the change request.
5. Documentation: to check if the request requires modifications to the existing documentation or the addition of new documentation to reflect the changes made to the module.

Metrics: criteria and scales

Technical analysis

Metric name	Low	Medium	High
Code coverage risk	Below 20%	20%-50%	Above 50%
Technical Debt	Below 10% of available time	10%-20% of available time	Above 20% of available time

Financial analysis

Metric name	Low	Medium	High
Net revenue risk	Below 20%	20%-50%	Above 50%
Return time risk	Before 12 months	12-18 months	After 18 months
Return of investment	Below 10%	10% -20%	20%

PR analysis

Metric name	Low	Medium	High
Referral rate (with respect to current number of clients)	Below 10%	10%-20%	Above 20%

Probability of repeat	Below 30%	30-60%	Above 60%

CR1 Analysis

Statement analysis

After an initial review of the change request (CR), it becomes clear that there is ambiguity regarding the definition of a "dataset containing 100,000 samples." Based on this observation, we have identified two potential scenarios for satisfying the government's new regulation:

- **Scenario A**: The government IT office requires a set of 100,000 data points to assess the accuracy of the system. In this case, the company can generate a simulation with a number of timesteps equal to or greater than the required quantity and save the system measurements for each timestep into a file. This functionality is already present in the proposed software system.
- **Scenario B**: The company is required to provide data from 100,000 independent simulations to comply with the regulation. However, given the high computational and time-intensive nature of these simulations, Scenario B requires further consideration and can be further divided into two sub-scenarios:
    - **B.1**: If the legislation does not specify the characteristics each simulation must possess to be accepted in the dataset, the company could perform simulations with small timesteps and a low upper bound on the number of timesteps to generate the required dataset.
    - **B.2**: If there are specific parameters for the simulations in the dataset, the output of this scenario would be similar to that of B.1 if the simulations are not time-intensive. However, if the simulations are lengthy due to their characteristics, this scenario could be risky for the whole project development.

It is important to note that additional clarification from the government IT office is necessary to determine the most appropriate course of action for complying with the new regulation.

Affected configuration items by CR1

After checking the criteria for identifying the affected configuration items, we conclude that none of the main modules of the system, namely the GUI, Simulation or Output modules; are affected by the needs of complying with the new regulation. The reason for this is that the regulation requires the provision of a dataset containing 100,000 samples, but the existing functionality of the system already includes the ability to generate and save simulation data. Therefore, it is not necessary to modify any of the main modules to comply with the CR.

Although, the CR's computational intensity must be considered in terms of the system's performance. The system must have sufficient computational resources to generate the required dataset within a reasonable amount of time. Whether that is possible or not depends on the specific details of the regulation. Finally, it is important to evaluate the impact of the CR on the system's documentation. **It is also important to ensure that the documentation accurately reflects the requirements of the CR and how they are being met by the system.**

Technical analysis

After carefully examining the requirements of the CR, we have concluded that it does not necessitate any modifications to the existing code modules of the system. Therefore, **the code coverage risk associated with the new regulation is 0%,** as there is no need to perform any code changes.

In addition, we have found that there is no technical debt associated with complying with the new regulation. Technical debt refers to the cost of maintaining software in the future when shortcuts or suboptimal solutions were made during the initial development. As the new regulation does not require any changes to the existing code, we do not anticipate any additional costs or difficulties in maintaining the system in the future.

To assess the impact of the new regulation on the system, we have evaluated the criteria for identifying the affected configuration items, including functionality, data, performance, dependencies, and documentation. Our analysis indicates that none of the main modules of the system, such as the GUI, Simulation, or Output modules, are affected by the new regulation. Therefore, we can conclude that there is no need to modify any of the existing code modules to comply with the new regulation.

In conclusion, our analysis has determined that the new regulation does not pose a need for modifying any of the existing code modules, and therefore the code coverage risk and technical debt associated with complying with the new regulation are both minimal. We recommend to take the necessary actions to comply with the new regulation, but no code changes are necessary.

Financial analysis

For scenario A, there is no financial risk as the simulations with 100,000 timesteps or more were already programmed for the testing phase of the system. Therefore, no additional cost is required to comply with the new regulation.

However, for scenario B, complying with the new regulation could be financially challenging. The regulation requires the company to provide data from 100,000 independent simulations, which is a considerable amount of data. This scenario branches further into two possibilities: B.1 and B.2.

Scenario B.1: This scenario would require a moderate amount of computational resources, which should be factored into the budget. **However, the financial risk associated with this scenario is relatively low.**

Scenario B.2, on the other hand, **has a moderate to high financial risk**, especially if the simulations characteristics make them lengthy. **To define a threshold between B.1 and B.2, we assume that a simulation's acceptable duration is 25 minutes. If the simulation takes longer than this threshold, it will fall into scenario B.2. According to a quick overview of cloud computing prices, to perform 100,000 simulations with a maximum duration of 25 minutes each, it would require around 1500 USD to complete them in a month.**

Therefore, to comply with scenario B.2, the company would need to allocate additional financial resources to cover the cost of running the simulations. This additional cost should be factored into the budget and considered when assessing the financial risk associated with complying with the new regulation.

For scenario A, no additional expenditure is required for human resources as the testing phase of the system already includes simulations with 100,000 timesteps. **However, for scenario B, due to the need of configuring 100,000 independent simulations, a budget of 500 USD is estimated to be required for human resources to oversee and manage the simulation process.**

While the financial risks associated with the proposed CR have been evaluated, **if such costs are incurred, financial resources could be drawn from the unexpected costs reservoirs. However, it is advisable to perform further analysis when other CRs are financially evaluated, as this may affect the availability of resources in the unexpected costs reservoirs.**

In conclusion, complying with scenario A does not pose any financial risk since the simulations required were already programmed. However, complying with scenario B could be financially challenging, especially for scenario B.2, which requires a considerable amount of computational resources. Allocating additional financial resources to cover the cost of running the simulations should be considered when assessing the financial risk associated with complying with the new regulation.

Human resource analysis

In the current project, we have a development team consisting of three experienced programmers who are also responsible for testing. **Given that the team is already fully loaded for the duration of the project, it is essential to evaluate the impact of the new CRs on human resources.**

Scenario A does not require any extra human time, which is excellent news for the development team. Since they are already fully loaded, the team can focus on other aspects of the project without worrying about allocating additional time or resources. **This means**

that there will be no extra costs associated with hiring or training new team members, and the project can proceed as planned.

However**, both instances of scenario B require about 20 hours of extra human labor time. The time is required to configure a set of parameters for each simulation**. To ensure that this work is completed on time, it is essential to have a dedicated resource to manage the task.

To address this issue, we propose hiring an intern to perform the required work. Since the hiring process can be completed in the early stages of the project, the intern's work can be scheduled to take place during the late intermediate stage of the project. This will ensure that the development team is not disrupted and can continue to focus on other critical tasks.

The company will pay the intern about 500 USD for the 20 hours of work, which will be distributed over two months. This payment is reasonable and should not put undue financial pressure on the project. Moreover, it is essential to note that the intern will have a positive impact on the project. Since he will be working on a task that is not part of the development team's core responsibilities.

Infrastructure analysis

The infrastructure analysis for the new regulation compliance project reveals that Scenario A has no infrastructural needs as the existing computing equipment of the company is already capable of performing the required simulations. **Any personal computer within the company can run the simulations, and the processing time is not significant. Therefore, the current infrastructure is sufficient for Scenario A.**

However, for Scenario B, the company's infrastructure cannot meet the requirements. **Performing 100,000 independent simulations on personal computers would take several months, making it impractical for the project's timeline**. **Moreover, purchasing enough computing equipment to handle the workload would cost at least $4000, which is not a viable option for a one-time project. The purchased equipment would be useless after the completion of the project and would require a significant amount of space and specialized power infrastructure.**

The infrastructure analysis committee has decided that renting cloud services is the best option for handling Scenario B. By utilizing cloud computing, we can reduce the time required for performing simulations by half, while keeping the budget around $1500. An overview of cloud computing prices has shown that performing 100,000 simulations with the an estimated average computing time length of 25 minutes would require approximately $1500 for completion in one month. Therefore, renting cloud services is a cost-effective solution for Scenario B.

Timeline impact analysis

The timeline impact analysis is an important aspect to consider for the project's viability. For Scenario A, the timeline impact is expected to be negligible since the dataset could be obtained way before the project's deadline. Furthermore, the company can provide the dataset to the government IT office in such a date that even considering the 15 day time of approval, it won't impact the project's deadline.

Similarly, for Scenario B.1, the timeline impact is expected to be null. The company has enough time to carry out the simulations, given that the infrastructure requirements are met. **However, for Scenario B.2, there is a lot of uncertainty regarding the timeline impact since it depends on the specific needs of the regulation. The first-time estimation suggests a possible delay of about 15 days until approval. Still, this depends on the particular regulations' considerations.**

It is crucial to consult the existing contract for analyzing what such a delay would signify to the project's viability. The delay could impact the project's completion date, leading to additional costs and delaying the project's delivery. Therefore, it is essential to evaluate the specific needs of the regulation in advance and consider possible delays in the timeline impact analysis.