A Comparative Research between SCRUM and RUP using Real Time Embedded Software Development

Strauss Cunha Carvalho  
ITA - Brazilian Aeronautics Institute of Technology  
straus@ita.br

Felipe Rafael Motta Cardoso  
ITA - Brazilian Aeronautics Institute of Technology  
felipemc@ita.br

Adilson Marques da Cunha  
ITA - Brazilian Aeronautics Institute of Technology  
cunha@ita.br

Luiz Paulo Zanetti  
ITA - Brazilian Aeronautics Institute of Technology  
luispaulozanetti@gmail.com

Abstract - This paper describes an academic experience performed by graduate students at the Brazilian Aeronautics Institute of Technology during the 2nd semester of 2011. It happened during a system prototype construction for Real Time Embedded System and Quality, Reliability, and Safety courses. The main idea behind this research was to conduct a comparative investigation between applications of two Software Development Processes: the Scrum and the Rational Unified Process, from system requirements' identification up to a final product delivery.

Keywords - software engineering; software development process; software quality; smart-meter; UML-RT.

I. INTRODUCTION

The Software Development Process (SDP)[1] represents a set of activities performed aiming to generate products with quality, reliability, and safety.

The application of a rigid SDP has forced the involved professionals to perform bureaucratic works with extensive documentation and without aggregation of product values. In contrast, the application of agile SDPs have provided less rigorous controls, reducing the documentation, using an open scope approach, through continuous customer interactions, aggregating values to the delivery of end products.

II. CASE STUDY

A case study named Industrial Smart Meter (SM-IND), based on Smart Grids (SGs) [2] with a minimum of features in a computer system prototype, involving software and hardware, was academically developed and operated, by simulating a real environment on just 17 weeks.

This case study aimed to simulate, on small scale, the management of industrial electric energy, by registering and measuring the produced and requested amount of demanded energy by industrial sectors, to integrate a new decision support system.

In general, SGs represent the application of Information Technology (IT) to a system of electricity distribution. Grids, when integrated with communications and infrastructure systems, may group several sub grids through microgenerators, composing an electrical grid. An SG may enable the integration of various energy sources such as solar, wind, among others.

On this context, a SM-IND Computer System Prototype should be able to provide: (i) measurements of electric energy consumptions; (ii) measurements of electric energy productions; and (iii) energy balance calculations.

The figure 01 shows the work progress of the development team, relating to the development effort with the remaining time to conclude the case study.

III. COMPUTERIZED SYSTEM PROTOTYPE DEVELOPED

Two prototypes were developed, divided into: software and hardware. Both integrate the Real-Time Embedded System used in the SM-IND case study. Sub-sections A and B describe, briefly, the two prototypes built.

A. Software Prototype

The software prototype was developed through the IBM-RRRT [3], that propitiated the automatic generation, in C++, language, of around 80% of the total source code. The complementary code was manually included in the prototype.

A Graphical User Interface (GUI), written in Python [4] language was developed for the activation of electrical devices, simulating hypothetically a supervisory system.

Thus, were generated for the SM-IND case study: 31 Classes; 12,253 lines of code in C++; 374 Functions; 3241 Lines Reviews, and 62 files.
Table 01 shows the features that composes the software prototype source code and Figure 2 shows the respective Kiviat chart.

Table 1. Software Prototype Source Code.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blank lines</td>
<td>1,352</td>
</tr>
<tr>
<td>Code lines</td>
<td>12,253</td>
</tr>
<tr>
<td>Comment lines</td>
<td>3,241</td>
</tr>
<tr>
<td>Declarative statements</td>
<td>1,258</td>
</tr>
<tr>
<td>Executable statements</td>
<td>3,122</td>
</tr>
<tr>
<td>Lines</td>
<td>16,846</td>
</tr>
<tr>
<td>Classes</td>
<td>31</td>
</tr>
<tr>
<td>Functions (Methods)</td>
<td>374</td>
</tr>
<tr>
<td>Files</td>
<td>62</td>
</tr>
<tr>
<td>Inactive lines</td>
<td>94</td>
</tr>
</tbody>
</table>

Figure 2. Kiviat Chart. Source: Authors.

B. Hardware Prototype

Using low cost electronic components, a hardware prototype was developed aiming to emulate the Smart Meter - SM operation, in lesser proportion.

As shown in Figure 03, the hardware prototype operation consists in connecting cable IN AC to the power supply and OUT AC to the electrical equipments whose consumption measure needs to be analyzed. Finally, connected the data cable to the computer's parallel port, propitiating the values to be read by SM-IND software and energy consumption calculations to be performed.

Figure 3. SM-IND Hardware Prototype

IV. RESULTS

For a period of just 17 weeks, was produced: 1) a software prototype; 2) a hardware prototype of a Smart Meter; and 3) the documentation concerning the artifacts inherent the Software Development Processes (SDP) whose comparative research have been done.

To compare the effort involved in using the Scrum and RUP, three variables were adopted as metrics: 1) number of artifacts produced, 2) amount of generated pages, and 3) amount of words written.

Figures 04 shows, in each development phase, the number of the artifacts produced.

Figure 4. The Artifacts Developed in Case Study.

V. CONCLUSION

This paper described an academic experience performed by graduate students at the Brazilian Aeronautics Institute of Technology during the 2nd semester of 2011. A Case Study named “Smart Meter Industry” (SM-IND), was developed by a group of 8 students in an academic semester period of just 17 weeks. Two prototypes were developed, divided into software and hardware. Both integrate the Real-Time Embedded System.

In a comparative study, quantitatively, three metrics were used to measure and compare the effort required to produce documentation in the development stages of the SDP analyzed.

From the results obtained, it can be noticed, quantitatively, the high effort required in the traditional method compared to the agile software development.

REFERENCES