Software Process Improvement – A Survey

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This work deals with the development of a process-centered software engineering environments for production management in software factories. The goal is to present a survey of the software process improvement from the first approaches up to the current simulation techniques related to the software process modeling.

In the conference of Science Committee in 1968, supported by the North Atlantic Treaty Organization, NATO, where it was consolidated the engineering approach for software development, Bemer proposed an approach whose objective was the improvement of the efficiency in using human resource, cost reduction, and maintenance of the most appropriate systems under the point of view of quality [Naur 1968].

In spite of large progress accomplished since then, the current systematic used to produce software still shows evidence of enormous inefficiency under the economic point of view. Data presented by the United States General Accounting Office [GAO 2006] demonstrate that in fiscal 2006 the USA DoD (Department of Defense) will spend as much as US$12 billions on reworking software (30% of its estimated budget of US$40 billions for research development, testing, and evaluation software). This reworking refers to software that probably will not satisfy the necessary operational requirements. An early report [GAO 2004] reveals that in 2004 those values reached the amount of US$8 billions affecting the planned schedules for the project developments.

The involved reworking costs are only a part of the expenses caused by the lack of quality. The real costs shall account for time and money expenses to detect, prevent and correct failures and other undesirable effects so as to guarantee the customer requirements (explicit and implicit) and the fitness of the products to the purpose of their destination [Robles Júnior 1994]. The totality of the involved expenses addressed to the system reworking is known as the (bad) quality costs.

The lack of quality impact on the project costs is significant since the defects are not free; someone is being paid while making them [Deming 1990]. As a consequence, actions taken toward better software quality can produce improvements in the economic efficiency of the production system, and at same time increase the customer satisfaction.

Large part of the applicable approaches for software quality improvement, such as the CMMI for Development [CMMI 2006], the set of 15504 ISO standards [ISO 15504], the ECSS-E-40 Part 1B [ECSS 2003] of the European Space Agency (ESA), the ISO 9000 standards [ISO 9000], [ISO 9001], [ISO 9004], and the National Quality Foundation for Criteria and Excellency [FNQ 2006], enhance the fact that the quality management systems address their approach to the improvement of the process efficiency. This implies that quality of a system or product is highly influenced by the quality of the processes used to develop and maintain them [CMMI-2006]

A software production system can be considered as a processes and activities net where the transformation flow occurs aiming a product that fulfills the needs that motivate its development. This net representation allows a systematic approach whose objective is the optimization of global and individual aspects of the production.

There are two complementary strategies to improve the software production process aiming waste elimination while adding earned value to the final product. The first strategy looks for the optimization of each of the production phases through out earned value analysis, under the customer point of view. The second one involves the workflow optimization to minimize the waiting and process synchronization time, the process inspection and correction needs.

The optimization of the production phases aims the improvement of the earned value associated with each accomplished task during the process development. This is done through a critical analysis to eliminate operations that use resources without adding any earned value to the final product. As the production methods are assessed, new and more efficient methods can be created and adopted. The optimization aims also to redesign the software and the involved tasks in the development for the improvement of the quality and the reduction of the development cost.

In order to optimize the processes it is necessary a better understanding of the workflow, materials and information involved in the several software production phases. This fact conducts to better processes design based on earlier experiences. This also gives direction to teams training, and provides systematic support for people involved in the production. The objective is to generate workflows each time more lean and efficient. Its implementation is done initially through process modeling and its subsequent improvement.

During years several techniques have been developed for the processes implementation. They advanced from simple diagrams that were similar to data flow diagrams (DFD) and grew up to the graphic modeling and execution languages. In spite of the existing differences, all of them implement a set of very similar concepts. They represent activity descriptions, the connection flow among them, the exclusive decision gateways, and tokens representing the simultaneous execution activities until the synchronization for the workflow continuity.

The developed notations are useful to describe static aspects of the software development processes. It does not represent the dynamic reality of the production workflow. To overcome this limitation some initiatives have been taken aiming the integration of the static modeling with the dynamic aspects of the process simulation.

The integration of the dynamic and static aspects of the process modeling and simulation will guide the next steps of this research.

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