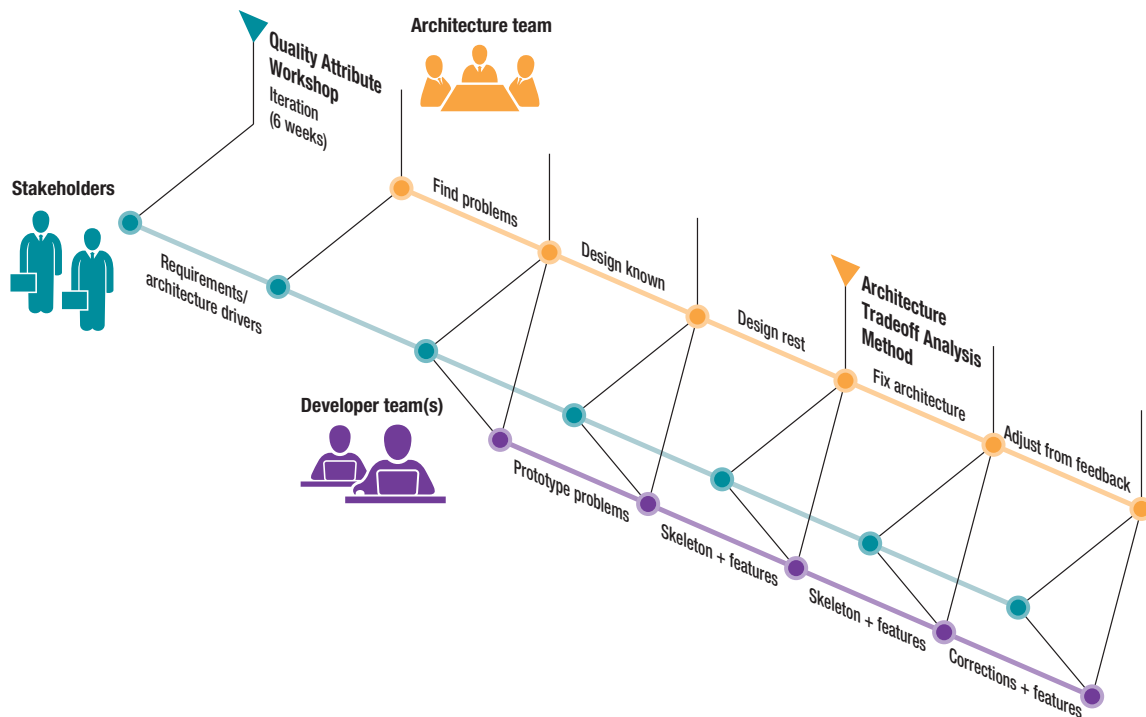# Working Together: The Team Software Process and Architecture-Centric Engineering

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Bursatec, the technology organization of Groupo Bolsa Mexicana de Valores (BMV, the Mexican Stock Exchange), recently undertook a project to develop one system that would replace three existing trading engines. Given the competitiveness of global financial markets and recent interest in Latin American economies, Bursatec needed a reliable and fast new system that could work ceaselessly throughout the day and handle sharp fluctuations in trading volume. To meet these demands, the SEI suggested combining elements of its architecture-centric engineering (ACE) method, which uses software architecture to guide system development, with its Team Software Process (TSP), which teaches software developers the skills they need to make and track plans and produce high-quality products.

ACE methods focus on what to build; TSP methods focus on how to build it. ACE is the discipline of using architecture as a focal point for performing ongoing analyses to gain increasing levels of confidence that systems will support an organization's business goals.

The SEI created TSP to build high-performance teams that

- plan, manage, and own their commitments;
- produce quality products at lower cost; and
- achieve their best performance.

Approach

While TSP can be used to manage all aspects of the software-development phase, from requirements elicitation to implementation and testing, this was the first time that the approach had been applied to ACE methods. The combination of these approaches offered Bursatec architects and developers a disciplined method for developing the software for their new trading engine. Through 6 major development cycles including 14 or so iterations over 21 months, the overall team developed more than 260,000 lines of code, spending only about 12 percent of their effort on architecture and approximately 14.5 percent of effort in unit testing, performance testing, and integration testing.

In contrast, a typical project of this scale would normally expend at least twice this much effort in testing—an unfortunately realistic expectation in the software industry. System testing at Bursatec proceeded on schedule with a very low defect count (unusual for non-TSP projects). The early investment in architecture and a detailed, data-driven approach to managing both schedule and quality resulted in less testing throughout system development.

Another benefit of combining ACE with TSP is that the team of Bursatec developers was prepared for inevitable changes in requirements, indeed in changes of any sort over the 21 months of development. When the team received new requirements, it could evaluate them quickly for technical impact and implementation cost in terms of time and effort. With the quality-attribute requirements formally captured, the architecture in place, and detailed development plans at every step, a project with high risk potential in both technical and business terms ran on time, within budget, and generally without the drama that large development efforts often exhibit.

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Results

The development of the new trading system for Bursatec, which was released in September 2012, progressed on schedule and within budget. Tests confirmed that the trading-system performance far exceeded the initial specifications. The combination of ACE and TSP proved an ideal approach for the development of the trading system. TSP brought discipline and measurement, while ACE provided a set of robust architectural techniques that focus on business goals and quality requirements. The approaches together support the entire development lifecycle, emphasizing business and quality goals, engineering excellence, defined processes, process discipline, and teamwork.

The architecture coaching coupled with the discipline of TSP helped Bursatec build a competent architecture team that produced excellent results: the team hit its milestones and the project finished on time; early performance tests and other quality measures indicated that reliability and quality goals were met along the way; no known defects carried into the final development cycle; and system performance goals were met.

"We are very happy with the results, said Dr. Enrique Ibarra, director general of Bursatec. "Because we are Mexico's only stock exchange, we're essentially a national utility. We could not bring the market down during this process. So, one of our key success indicators was zero disruption of service. We met this key indicator." Ibarra attributed this result to focusing a lot of attention on quality early in the software development process—a fundamental principle of SEI methods. "And that paid off," he added.

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To Learn More

Developing Architecture-Centric Engineering Within TSP
This blog post describes the challenges Bursatec faced and outlines how working with the SEI and combining ACE with TSP helped them address those challenges. http://blog.sei.cmu.edu/post.cfm/developing-architecture-centric-engineering-within-tsp

Using TSP to Architect a New Trading System
This blog post focuses on the development of the system architecture for Bursatec within the TSP framework.
http://blog.sei.cmu.edu/post.cfm/using-tsp-to-architect-a-new-trading-system

Launch of High-Speed, High-Capacity Trading System Caps SEI's Successful Multi-Year Engagement with Mexican Bourse (news story on SEI website)
http://www.sei.cmu.edu/newsitems/BMV.cfm

Combining Architecture-Centric Engineering with the Team Software Process
Robert Nord, Jim McHale, Felix Bachmann
Technical Report
This report contains a description of an architecture-centric life-cycle model that uses the Carnegie Mellon Software Engineering Institute's architecture-centric engineering (ACE) methods embedded in a Team Software Process (TSP) framework and our experience in piloting the approach in an actual development effort. The SEI had the opportunity to realize this vision beginning in summer of 2009. At that time, the SEI began a project with Bursatec, the IT arm of La Bolsa Mexicana de Valores (the Mexican Stock Exchange), to replace its main online stock trading engine with one that would also incorporate trading of other financial instruments such as options and futures. The project had aggressive goals for performance and delivery, and as the face of Mexico's financial markets to the world, the new trading engine needed to function flawlessly. Download full report at http://www.sei.cmu.edu/library/abstracts/reports/10tr031.cfm