



# THE MONITOR

## SEI Partners with U.S. Army to Promote Architecture-Centric Practices

In 2002, the United States Army kicked off an ambitious initiative to dramatically improve the way it acquired software-intensive systems.

To accomplish this, the Army partnered with the Carnegie Mellon Software Engineering Institute, forming the Army Strategic Software Improvement Program (ASSIP). One of the earliest initiatives undertaken by the ASSIP was to promote the use of architecture-centric practices among Army acquisition programs by increasing the number of acquisition personnel trained in the latest software architecture technologies.

“The SEI believes that software architecture is a key leverage area. If you can start emphasizing architecture in development and acquisition programs, you can take some of the mystery and vagueness out of the software development process,” explained Stephen Blanchette, Jr., a senior member of the SEI’s technical staff. “That puts you on better footing for getting software developed on time and within budget.”

Senior researchers from the SEI’s Research, Technology, and System Solutions (RTSS) Program, which oversees the SEI’s software architecture work, began providing special offerings of the SEI Software Architecture

Curriculum at various Army locations. The result has been an increase in the number of Army software experts trained in modern software architecture practices, including the use of SEI-developed techniques for architecture analysis like the Architecture Tradeoff Analysis Method® (ATAM®) and Quality Attribute Workshop (QAW).

The techniques allow stakeholders to identify the non-functional requirements of a system and to evaluate the software architecture against those requirements to ensure that they have been addressed adequately before further system development begins.

On another front, the SEI hosted an Army Software Architecture Workshop in May 2007. During that workshop, SEI researchers heard from representatives of 10 major Army programs who described their experiences using the ATAM to conduct software architecture evaluations on acquired systems. The conclusion? Army staff reported repeatedly that use of the ATAM and QAW reduced risk in schedule and cost, improved documentation, and resulted in a higher quality product.

“The Army has taken a leadership role in investigating architecture-centric practices and really trying to put them into play for the betterment of Army acquisition,” Blanchette said.

SEI Members at an ATAM Evaluator Training December 4-5. From left, Bernard Reger of U.S. Army Picatinny Arsenal, N.J. and Robert A. Peterson of RA Peterson & Associates Inc., Folsom, Calif. At right, SEI Member Prakash Rao of IBM Global Business Services (an SEI Partner organization) in Worcester, Mass. attended the Software Product Lines class held December 2-3.

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## The Latest from the SEI



**Mark Klein**, deputy director of the Research, Technology, and System Solutions (RTSS) Program and technical lead of the Architecture-Centric Engineering (ACE) Unit at the SEI, sat down to discuss what's going on in the newly formed unit.

Architecture-centric engineering (ACE) is about effectively using architecture to guide system development. According to Mark Klein, who is leading the ACE work at the SEI, "Our goal is to enable the design, implementation, verification, and evolution of software-intensive systems at all scales. The end game is to use architecture to predict and control system quality attributes so that the implemented system will contribute to achieving an organization's business and mission goals."

Klein is leading his team of researchers to address common, real-world problems such as cost-prohibitive system evolution, system unpredictability, and organizations that fail to follow solid architecture-centric practices.

To broaden the applicability of those practices, ACE researchers are now taking the well-established SEI Architecture Tradeoff Analysis Method (ATAM) that is used to evaluate how well an architecture meets its quality attribute requirements, adapting it for system architectures, and building on it for system-of-systems (SoS) architectures. ACE researchers are also investigating how to use qualitative methods, such as the ATAM, in conjunction with analyses performed on formal representations such as those using the Architecture Analysis and

Design Language (AADL). Such analyses might include verifying safety properties by using model checking or ensuring performance properties by using various forms of performance analysis.

Klein's team is also looking at applying notions of architecture to ultra-large-scale (ULS) systems and asking questions such as: What old assumptions will break? Will different quality attributes be involved? What does architecture mean in this setting? "We're still in the initial stages of this research but very excited about it," Klein said. Another line of research that was motivated by the SEI's initial study of ULS systems is computational mechanism design, in particular applying computational auctions to network bandwidth allocation. According to Klein, "We expect this work to help us discover important new aspects for architecture in a ULS systems setting."

While methods, techniques, and tools are prominent parts of the SEI's ACE research, so are the practicing architects who are using them to create and analyze the architecture. Klein said, "If an organization doesn't possess the right skills and knowledge, it can't reap the full benefits of using architecture-centric practices. We set out to define architecture competence and ways to measure it."

The bottom line is that ACE involves using architecture to gain early and increasing levels of confidence that an implementation will satisfy an organization's business and mission goals.

The ATAM variants and the assessment instrument for architecture competence are ready to be pilot-tested. To find out more about them and about the other areas that ACE researchers are investigating, visit [www.sei.cmu.edu/architecture/](http://www.sei.cmu.edu/architecture/).

## SEI Staff Profile: Felix Bachmann



**Felix Bachmann**, a senior researcher from the SEI's Research, Technology, and System Solutions (RTSS) Program, sat down to discuss his latest work in software architecture documentation.

In Felix Bachmann's experience—working both with outside organizations and as a software architect himself—every organization wants to have its software architecture documented, but no one wants the overwhelming job of doing it. Bachmann, a senior member of the SEI's technical staff, explains the problem this way: "Documentation isn't merely created once and then put on the shelf: It has to be updated throughout the product's life cycle. Add to that the fact that the same information appears in many places throughout the documentation, and you have a real maintenance nightmare."

Documenting a software architecture is an important way for architects to communicate their architectures to stakeholders such as developers and management. And that documentation becomes a sort of repository of information and artifacts that can be reused later for other products.

According to Bachmann, some architecture documentation tools exist, but they fall short of what is needed to make the maintenance process

manageable. So he has set out to determine what architects need in a tool to make that possible. He thinks his research could be a strong influence on the development of future documentation tools.

Another problem with documentation is that once it's written, it often goes unread. "Software architects need to learn *how* to write it," Bachmann says. "Many write it for themselves, forgetting all about the stakeholders who'll be reading it." To guide software architects, he helped write the book titled *Documenting Software Architectures* in 2003. He is now working on the second edition of the book, which is due out in 2009.

Bachmann's career at the SEI began in 1996 when he joined as a resident affiliate funded by Robert Bosch GmbH. He came initially to learn about software engineering to help Bosch train its staff of mostly electrical engineers. He successfully applied what he learned to a Bosch project and used that experience to pioneer the first version of the SEI Attribute-Driven Design method. In 2001, he joined the SEI full time and since then has been an integral part of the SEI's team of architecture researchers.

Bachmann sees architecture as more than just a set of methods. "Creating architecture is not some kind of fancy art form that you need to be born with. It's applying knowledge. And if you make it your way of life, you can get great results."



## SATURN 2009 – Architecture at All Scales

“Over the last 15 years, the SEI has become a sort of Mecca for software architecture—a place where anyone who is doing any work related to software architecture must go,” stated Philippe Kruchten, a world-renowned researcher with notable contributions to the rational unified process and a keynote speaker at last year’s SEI Architecture Technology User Network (SATURN) Conference. “SATURN gives you the chance to meet all the great software architecture gurus and writers, the authors of innovative SEI methods, and some of the key users of that technology.”

If you want to learn about architecture technology, stay on top of new techniques and methods, hear real-world success and failure stories from your peers, and network with expert architects, the best way to do it is by attending the SATURN 2009 Conference.

Previous SATURN Conferences have featured keynotes, presentations, and tutorials on how SEI technologies and other architecture tools and practices are used to control key product qualities such as reliability, security, modifiability, performance, and affordability. SATURN 2009 promises to expand on this foundation by covering emerging technologies, best practices, and lessons learned for architecture ranging from enterprise to system and software architectures. Participants will also learn about product quality and how it complements process quality. To reflect this expansion, the theme of the SATURN 2009 Conference is “architecture at all scales.”

For more information about SATURN 2009 or to register beginning on January 12, visit [www.sei.cmu.edu/architecture/saturn/2009/](http://www.sei.cmu.edu/architecture/saturn/2009/).

### SEI Members:

You receive 15% off of the SATURN Conference price.

Don’t miss this great opportunity. Register beginning January 12 at [www.sei.cmu.edu/architecture/saturn/2009/](http://www.sei.cmu.edu/architecture/saturn/2009/).

### SATURN Conferences Offer Invaluable Experience

- internationally celebrated keynote speakers
- presentations by world-class architects
- opportunities to network with SEI architecture leaders
- hands-on training
- ideal environment to exchange ideas
- popular SEI courses in SOA and architecture principles co-located
- tutorials on current and emerging trends

### Who Should Attend

- software architects
- enterprise architects
- systems architects
- chief architects
- IT architects
- senior developers
- project managers

## Noteworthy Technical Reports

### Proceedings of the International Workshop on the Foundations of Service-Oriented Architecture (FSOA 2007)

[www.sei.cmu.edu/publications/documents/08.reports/08sr011.html](http://www.sei.cmu.edu/publications/documents/08.reports/08sr011.html)

### Models for Evaluating and Improving Architecture Competence

[www.sei.cmu.edu/publications/documents/08.reports/08tr006.html](http://www.sei.cmu.edu/publications/documents/08.reports/08tr006.html)

### Using the Vickrey-Clarke-Groves Auction Mechanism for Enhanced Bandwidth Allocation in Tactical Data Networks

[www.sei.cmu.edu/publications/documents/08.reports/08tr004.html](http://www.sei.cmu.edu/publications/documents/08.reports/08tr004.html)

### ASSIP Study of Real-Time Safety-Critical Embedded Software-Intensive System Engineering Practices

[www.sei.cmu.edu/publications/documents/08.reports/08sr001.html](http://www.sei.cmu.edu/publications/documents/08.reports/08sr001.html)

# New Offerings Highlight Growth in SEI Software Architecture Curriculum

## Popular Software Architecture Courses to be Offered in New Ways

The demand for courses in the SEI Software Architecture Curriculum, such as Software Architecture: Principles and Practices (SAPP), is growing each year. In 2007, more than 2,300 people took software architecture courses; in 2008, that number increased to more than 2,400.

The SEI is responding to this increasing demand in two new ways: by licensing others to teach the SAPP course and by planning to offer the courses through a distance learning program in 2009. Qualified individuals can become licensed to teach the SAPP course to others in their company and to external customers. Additional courses in the curriculum will be available for licensing in 2009.

To find out how you can become a licensed instructor, visit [www.sei.cmu.edu/certification/sapp.html](http://www.sei.cmu.edu/certification/sapp.html).

The SEI is also planning to offer these courses online so that students anywhere in the world can take them. Look for information about future online courses at [www.sei.cmu.edu/products/courses/](http://www.sei.cmu.edu/products/courses/).

## SEI Increases Value of Architecture Training with New Examination

In addition, the SEI is enhancing the curriculum to ensure continued excellence in software architecture training by requiring students of the SAPP course to pass an online exam before applying for SAPP instructor certification or registering for the more advanced courses in the curriculum: Software Architecture Design and Analysis (SADA) and ATAM Evaluator Training.

The SEI created the examination to ensure that SAPP students understand the fundamental concepts, principles, and practices of software architecture. This exam requirement complies with the ANSI accreditation program for certification agencies, which requires that successful certification candidates pass an examination based on a set of uniform standards after taking a required sequence of professional-development courses.

For information about this exam, visit [www.sei.cmu.edu/certification/sappexam.html](http://www.sei.cmu.edu/certification/sappexam.html).

## New Course Available:

### MBE Essentials: An Introduction to Model-Based Engineering and AADL

This course focuses on fundamental MBE concepts for engineering real-time, embedded software systems through the definition and documentation of software and system architecture and the validation of system quality attributes. To find out more about this course, which builds on the SAE Architecture Analysis and Design Language (AADL) standard, visit [www.sei.cmu.edu/products/courses/p72.html](http://www.sei.cmu.edu/products/courses/p72.html).

## Software Architecture Curriculum & Certificate Program

The SEI Software Architecture Curriculum is based on decades of experience architecting software-intensive systems and supported by four widely acclaimed books in the SEI Addison-Wesley series. Courses in the curriculum include

- Software Architecture: Principles and Practices
- Documenting Software Architectures
- Software Architecture Design and Analysis
- Software Product Lines
- Architecture Tradeoff Analysis Method (ATAM) Evaluator Training
- ATAM Leader Training

You can complete one or more of the following three specially designed certificate programs:

- Software Architecture Professional
- ATAM Evaluator
- ATAM Lead Evaluator

For information about the SEI Software Architecture Certificate Program, visit [www.sei.cmu.edu/architecture/certificate\\_program.html](http://www.sei.cmu.edu/architecture/certificate_program.html).

## Free Webinar: Exploring Architecture at All Scales

In this webinar, senior SEI researcher Paul Clements will present findings from a U.S. Army architecture workshop that was held in September 2008 under the auspices of the Army Strategic Software Improvement Program (ASSIP). Accomplished practitioners from government, academia, and industry gathered to discuss the various genres of architecture: software, enterprise, system, and system of systems. The workshop's goal was to clarify the relationships among the different genres and to explore and identify their commonalities and differences.

**What** Free Webinar: Exploring Architecture at All Scales  
**When:** January 22, 2009  
**Time:** 1:00 p.m. – 2:00 p.m. EST  
**Register:** <https://www1.gotomeeting.com/register/930959975>

## Related Information:

SEI architecture work - [www.sei.cmu.edu/architecture/](http://www.sei.cmu.edu/architecture/)

SEI Architecture Technology User Network (SATURN) - [www.sei.cmu.edu/architecture/saturn/](http://www.sei.cmu.edu/architecture/saturn/)

SATURN 2009 - [www.sei.cmu.edu/architecture/saturn/2009/](http://www.sei.cmu.edu/architecture/saturn/2009/)



## Member Profile

### Dr. Stefan Ferber

SEI Member Dr. Stefan Ferber, director of the process department in corporate research and advanced engineering at Robert Bosch GmbH in Germany, is an Architecture Tradeoff Analysis Method (ATAM) Lead Evaluator and has been working with the ATAM since 2000, well before the SEI even began certifying individuals in this field. He also serves as the Bosch-SEI Business Point of Contact, specifically for Capability Maturity Model® Integration (CMMI®) topics.

His involvement with software architecture started in 2000 when Bosch adopted the *SEI Framework for Software Product Line Practice*<sup>SM</sup> for several automotive platforms. Ferber became interested in the ATAM—a scenario-based software architecture review method that uses business goals to evaluate the quality of software architecture—because software was becoming increasingly linked to ensuring the quality of embedded systems in vehicles.

This venture resulted in a significant investment by Bosch into exploring best practices in architecture technology. Eight years later, ATAM evaluations are now a requirement every time Bosch rolls out a new product line.

“It’s a policy,” said Ferber, adding that to date, more than 15 evaluations have been conducted. Software architecture is now part of the fabric of every Bosch automotive software organization. “With the ATAM, our architectures are documented better, and we have a much clearer picture of what type of risk we have and how far-reaching those risks are.”

In Ferber’s view, conducting ATAM evaluations has also resulted in more effective communication with stakeholders and increased emphasis on communicating business and technical perspectives to stakeholders.

Ferber described his experiences in 2005 as a keynoter at the SEI Software Architecture Technology User Network (SATURN) Workshop. And while his involvement with software architecture technologies has been extensive, it does not even begin to describe the breadth of his work with the SEI and the leadership role that he has taken in ensuring software quality.

From 2004 to 2007, Ferber served on the International Process Research Consortium (IPRC). This effort, led by the SEI, brought together experts in software process to develop a roadmap for the discipline. In February 2007, the group published *A Process Research Framework*, which serves as a roadmap for those who work in the field.

In his own work, Ferber also uses the Personal Software Process (PSP)—the method for improving the quality and productivity of individual engineers—in his own work.

Ferber was also in on the ground floor of PSP. He reviewed an advance copy of *A Discipline for Software Engineering*, the book that Watts Humphrey, an SEI senior staff member and National Medal of Honor Winner, published in 1994.

Prior to Bosch, Ferber—who holds a Ph.D. and Diploma from the University of Karlsruhe and a Master of Science in Computer Science from the University of Massachusetts, Dartmouth—worked in the research center at DaimlerChrysler in 3D computer vision, robotics, and measurement technologies.

He came to Bosch in 2000 as an internal consultant and researcher on software architectures and product lines. In 2004, he assumed his current role. And while it is not a formal part of his job description, Ferber still participates in ATAM evaluations of software and system architectures.

The impact of the SEI body of knowledge in software architecture has been just as significant on Ferber. He likened it to that of a chef who suddenly receives a recipe for a particular dish that they had been making for years without any type of written instruction.

“There were books, training, definitions, and concepts,” explained Ferber. “This made it so much easier to train and coach my Bosch colleagues. It also made my thinking clearer on how systems are built.”

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## SEI Members Save Even More at SEPG North America 2009!

Just announced! SEI Members will receive a 15 percent discount at SEPG North America, which will be held March 23–26, 2009 in San Jose, Calif.

This premier learning and networking event offers software, systems, and service professionals a one-stop, comprehensive, and cost-effective opportunity to learn how others are improving not only software, but also systems, services, and their development and delivery.

Organizations who have invested in CMMI-based performance improvement have shown remarkable returns on their investment (results are median data of 25 organizations who reported data to the SEI):

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**Please Note:** All discounts are stand-alone. They cannot be combined with group discounts or discounts given to SPINs or any other affiliation.

If you have already registered and you are eligible for an SEI Membership discount, please contact [membership@sei.cmu.edu](mailto:membership@sei.cmu.edu), and we will arrange for a refund.

If you register before Feb. 20, you will receive 15 percent off of the published early-bird rate of \$1,445.

If you register after Feb. 20, you will receive 15 percent off of the published standard rate of \$1,545.

To be eligible for the 15 percent discount on conference registration, you must be a current and active SEI Member.

