



**Carnegie Mellon
Software Engineering Institute**

SATURN SEI Software Architecture Technology User Network

**Linda Northrop
Director, Product Line Systems**

**Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213**

This work is sponsored by the U.S. Department of Defense.



**Carnegie Mellon
Software Engineering Institute**

Welcome

It is wonderful that you could join us.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE APR 2005		2. REPORT TYPE		3. DATES COVERED 00-00-2005 to 00-00-2005	
4. TITLE AND SUBTITLE SATURN SEI Software Architecture Technology User Network				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Carnegie Mellon University, Software Engineering Institute, Pittsburgh, PA, 15213				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES presentation from the SEI Software Architecture Technology User Network (SATURN) Workshop, April 6-7, 2005, Pittsburgh, PA.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



**Carnegie Mellon
Software Engineering Institute**

Software Engineering Institute

Applied R&D laboratory situated as a college-level unit at Carnegie Mellon University, Pittsburgh, PA, USA

Established in 1984

Technical staff of roughly 400

Offices in

- Pittsburgh, Pennsylvania USA),
- Arlington, Virginia (USA)
- Frankfurt Germany

Purpose: Help others improve their software engineering practices

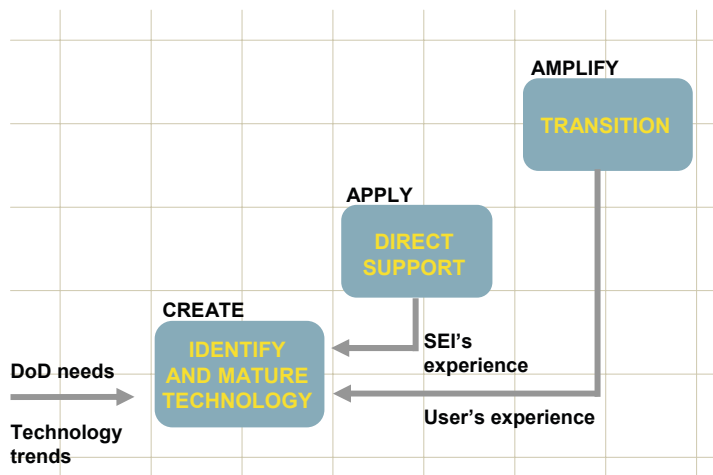


© 2005 by Carnegie Mellon University



**Carnegie Mellon
Software Engineering Institute**

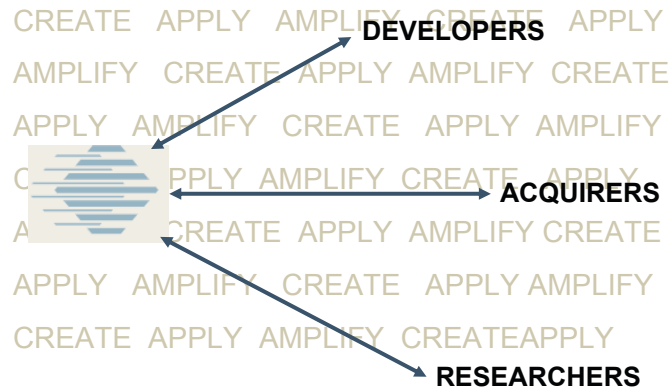
SEI's Strategic Functions



© 2005 by Carnegie Mellon University

page 4

SEI and the Community



SEI Technical Programs

Networked Systems Survivability
CERT, Network Security

Software Engineering Process Management

Dynamic Systems

Interoperability and Integration, Performance Critical Systems

Acquisition Support
Acquisition guidance and support to government organizations

Product Line Systems



Product Line Systems Program

Our Goal: To enable widespread product line practice through architecture-centric development



Our Strategy

Software Architecture
(Software Architecture Technology)

Software Product Lines
(Product Line Practice Initiative)

Component Technology
(Predictable Assembly from Certifiable Components Initiative)



ATA Initiative: In the Beginning

The Architecture Tradeoff Analysis Initiative (ATA) was originally established in 1997 to research, mature, pilot, and transition into use proven software architecture evaluation methods that would, early in the life cycle, identify software architectural risks with respect to system quality goals.

The focus was exclusively on software architecture evaluation with respect to multiple quality attributes and the tradeoffs between them.



ATA Initiative in 1997

Starting Points

Quality attribute/
performance
engineering

Software Architecture
Analysis Method
(SAAM)

Security analysis

Reliability analysis

Software Architecture
Evaluation Best
Practices Report

Software architecture
evaluations

Create

Attribute
tradeoff
analysis
technology

Architecture
evaluation
methods

Apply

Architecture
evaluations

Amplify

Workshops
Web site
Technical Reports
Bibliography



The Need for More

Software architecture evaluation and the ATAM have proven to be effective and beneficial.

But architecture evaluation is only one of the software architecture practices that are needed to reap the benefits of architecture-centric development.

Our work with DoD and other government and commercial organizations made us realize early on that a much broader envelope of software architectural support was needed.



ATA Initiative Today

To better meet the needs of the community, the scope of the ATA Initiative

- has gradually broadened **much beyond architecture evaluation** to our current focus
- was renamed the **Software Architecture Technology Initiative** to better fit its new mission.



SAT in 2005

Starting Points

Quality attribute/
performance
engineering

Software Architecture
Analysis Method
(SAAM)

Security analysis

Reliability analysis

Software Architecture
Evaluation Best
Practices Report

Software architecture
evaluations

Create

Technology

- Attribute-specific models and tactics
- Architecture expert (ArchE)

Integrated life-cycle practices

- Architectural requirements elicitation
- Architecture definition
- Architecture representation
- Architecture evaluation
- Architecture reconstruction

Apply

Architecture
coaching and
practice
application

Architecture
evaluations

Architecture
reconstruction

Amplify

Books
Courses
Certificate Programs
Acquisition Guidelines
Workshops
Technical Reports
Web site



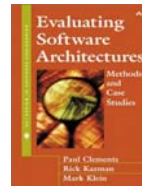
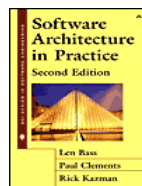
Software Architecture Technology (SAT) Initiative

Purpose:

Enable system developers and acquirers to use effective software architecture practices across the life cycle to ensure predictable product qualities, cost, and schedule

Result:

- achieve quality attribute (reliability, security, modifiability, performance, affordability, etc.) requirements
- predict quality attribute behavior and make practical tradeoffs early



Books on software architecture from the SEI series

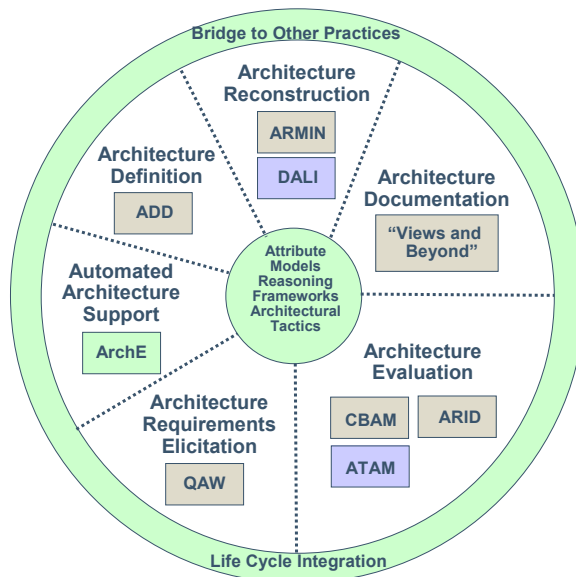


What We Do

1. Enable software acquirers and developers to use **effective software architecture practices** to exert significantly greater control over key product qualities and to mitigate the risks involved in making tradeoffs among these qualities.
2. **Harness and create innovations in quality attribute reasoning and software architecture technology**, enabling and providing **automated support** whenever possible.
3. Contribute to innovations in the area of **self-adaptive architectures**
4. Provide an effective, integrated, widely applicable, and tailorable set of **life-cycle architectural practices and tools** for requirements, design, documentation, evaluation, implementation, testing, and reconstruction.
5. Provide the **bridge to other established software engineering processes and practices** (e.g., Systems Architectures, MDA, TSP, XP, RUP, DoDAF, Enterprise Architectures, CMMI, AOP, and SOA).
6. Train developers, acquirers, and educators to use proven software architecture principles and practices.

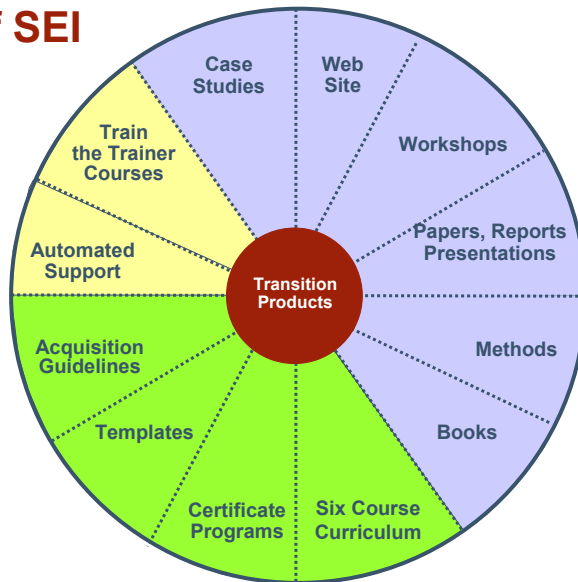


SEI Software Architecture Technology





Transition of SEI Software Architecture Technology



SAT Axioms

1. Software architecture is the bridge between mission/business goals and a software-intensive system.
2. Quality attribute requirements drive software architecture design.
3. Software architecture drives software development through the life cycle.



Architecture-Centric Development Activities

Architecture-specific activities include the following:

- creating the **business case** for the system
- understanding the **requirements**
- creating and/or selecting the architecture
- documenting and communicating the architecture
- analyzing or evaluating the architecture
- implementing the system based on the architecture
- ensuring that the implementation **conforms** to the architecture



Some SEI Techniques and Methods

- creating the **business case** for the system
- understanding the **requirements**
 - *Quality Attribute Workshop (QAW)*
- creating and/or selecting the architecture
 - *Attribute-Driven Design (ADD) and ArchE*
- documenting and communicating the architecture
 - *Views and Beyond Approach*
- analyzing or evaluating the architecture
 - *Architecture Tradeoff Analysis Method (ATAM)*
 - *Cost Benefit Analysis Method (CBAM)*
- implementing the system based on the architecture
- ensuring that the implementation **conforms** to the architecture
 - *ARMIN (and DiscoTect)*



SEI Methods and Quality Attributes

QAW
ADD
ArchE
Views and Beyond
ATAM
CBAM
ARMIN
(DiscoTect)



- are explicitly focused on quality attributes
- directly link to business and mission goals
- explicitly involve system stakeholders
- are grounded in state-of-the-art quality attribute models and reasoning frameworks
- are documented for practitioner consumption
- are applicable to real-world challenges and systems



SEI Software Architecture Curriculum

The software architecture curriculum is a collection of six courses that equip software professionals with state-of-the-art practices so they can efficiently design software-intensive systems that meet their intended business and quality goals.

The curriculum is

- based on decades of experience architecting software-intensive systems
- supported by four widely-acclaimed practitioner books in the SEI Addison-Wesley Series



Certificate Program Course Matrix

ATAM Lead Evaluator: 5 Courses & Coaching				
Software Architecture Professional: 4 Courses	<i>Software Architecture: Principles and Practices</i>	<i>Documenting Software Architectures</i>	<i>Software Architecture Design and Analysis</i>	<i>Software Product Lines</i>
	<i>ATAM Evaluator Training</i>	<i>ATAM Facilitator Training</i>	<i>ATAM Coaching</i>	
	ATAM Evaluator2 courses			



SEI Track Record

The SEI has been working in the area of software architecture for over two decades, with a formal emphasis since 1994.

- created foundational quality attribute models
- created proven architectural methods that are being used worldwide
 - gold standard architecture evaluation methods (SAAM and ATAM)
 - “views and beyond” documentation approach
- sponsored the first international software architecture conference (WICSA), which is now an annual event sponsored by IEEE/IFIP
- wrote four award-winning, seminal books on software architecture for practitioners that have sold over 60,000 copies
- developed a software architecture curriculum and certificate programs for practitioners
- worked directly with organizations to improve their software architectures and their architecture practices
- organizes Software Architecture Workshops for Educators



Impact

- Individuals from more than 180 different companies have taken courses in the SEI Software Architecture Curriculum.
- The SEI ATAM® is used to uncover risks in major systems; for example, the JNIC's Wargame 2000 and MDWAR systems, DDX, DBCB2, and FCS
- Teams at other companies like Raytheon, Boeing, and Robert Bosch GmbH are conducting ATAM architecture evaluations.
- The U.S. Army has launched an Army Software Architecture Initiative based on SEI software architecture technology.



Ongoing SEI Architecture Research

Software architecture life cycle practices

Architectural tactics for specific qualities
performance, usability, security, reliability

Software architecture expert (ArchE)

Self-healing architectures

Connection of software architecture to system architecture, enterprise architecture, RUP, Agile methods, model driven architectures, aspect-oriented programming, Team Software Process, etc.



New on the Transition Front

Program to license the ability to teach Software Architecture Principles and Practices will be available (at last) in July 2005.

Programs to license the ability to teach the other courses in the Software Architecture Curriculum will be gradually introduced over the next several years.

Workshop or one-day course in leading-edge architecture related topics.

Software Architecture Educators' Workshop

SATURN



Software Architecture Today - 1

Organizations big and small are recognizing the importance of software architecture. For example,

- Microsoft
 - Regional Architecture Forums
 - Architect's Council
 - Architect Certification
- Raytheon
 - Architecture Center of Excellence
 - mandatory architecture classes and methods
- IBM
 - Grady Booch writing the online Architect's Handbook
- Automotive domain
 - Siemens, Bosch, and Delphi all have architecture initiatives
- US Army
 - Army Software Architecture Initiative



Software Architecture Today - 2

Books, courses, certificate programs, conferences, workshops on software architecture abound.

New technologies (MDA, SOA, aspects) change the incidentals but the fundamentals of software architecture and quality attributes are enduring.



About SATURN

We felt it was time to

- **bring together** engineers, architects, technical managers, and product managers who are using the architecture-centric methods and approaches developed and promulgated by the SEI SAT Initiative
- to **exchange** their experiences and best practices



SATURN Goals

Share experiences using SEI software architecture technology.

Jointly discuss ideas, issues, and needs with regard to software architecture practices.

Grow a network of those interested in using and improving software architecture practices.



Workshop Agenda

Wednesday and Thursday:

Invited talks and breakout discussion sessions

Wednesday evening: reception at 6:30pm



**Carnegie Mellon
Software Engineering Institute**

Enjoy!



**Carnegie Mellon
Software Engineering Institute**

For More Information

For More Information

Linda Northrop

Director

Product Line Systems Program

Telephone: 412-268-7638

Email: lmn@sei.cmu.edu

U.S. Mail:

Software Engineering Institute

Carnegie Mellon University

Pittsburgh, PA 15213-3890

Business Development

Product Line Systems Program

Jay Douglass

Telephone: 412-268-6834

Email: jcd@sei.cmu.edu

World Wide Web:

<http://www.sei.cmu.edu/pacc>

SEI Fax: 412-268-5758