



Carnegie Mellon University
Software Engineering Institute

The First Software Product Line Conference: A Report

Paul C. Clements

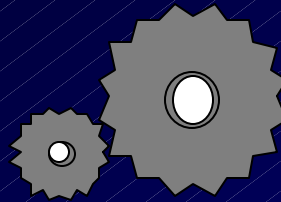
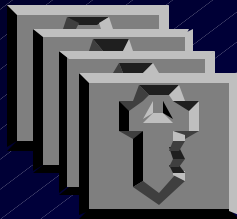
Linda M. Northrop

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Carnegie Mellon University
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SEI Product Line Practice Initiative: The Vision



Product line development is a **low-risk, high-return** proposition.

Techniques for finding and exploiting system commonalities and for controlling variability are **standard software engineering practice** in the DoD, government, and industry.



SEI Product Line Practice Initiative: Strategies

Identify and mature product line practices of demonstrated effectiveness

Integrate and codify a business and technical approach to PLP, accommodating multiple entry points, system types, organizational contexts and domains

Provide materials for implementing product line practice

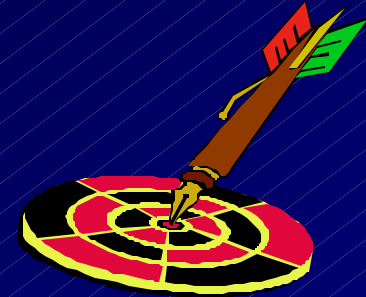
Build a community and an infrastructure to transition product line practice



Transition Strategy

Targeted Transition

- collaborations with customers on actual software product lines
- application of Product Line Technical Probe, OAR, ABD, etc. in customer individual organizations



Widespread Transition

- workshops
- conference
- case studies
- publications
- Web site
- bibliography
- **A Framework for Software Product Lines**
- **Software Product Line Acquisition: a Companion to a Framework for Software Product Lines**





Building a Community

The SEI has held a series of 10 product line practice workshops.

SPLC1 was the first major conference devoted exclusively to the broad array of issues associated with developing software product lines.

August 28-31, 2000, Denver

Goal: 100 attendees, which would be a healthy showing for a “first” conference.



Attendance

185 attendees, from

- **North America (US and Canada)**
- **Europe (8 countries represented)**
- **Asia, Africa, and Australia.**



Most were from commercial organizations, including HP, Nokia, Philips, Bosch, Lucent, Cummins Engines, Motorola, Ericsson, Thomson, General Motors, and others.

Academia and government (especially through government contractors) were well represented.



Conference in a Nutshell

Ten Tutorials

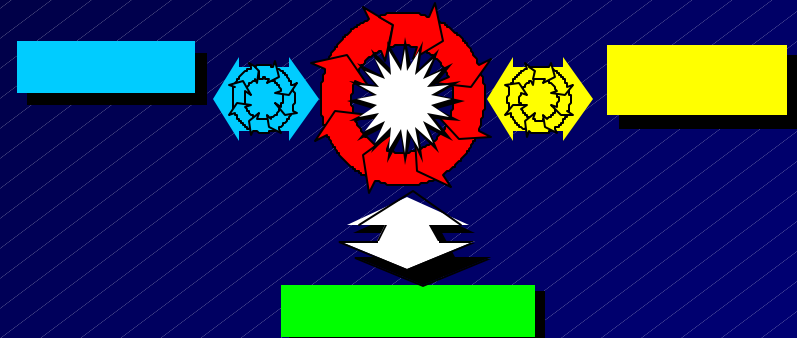
Seven Workshops

One Keynote Presentation

Two Panels

**Twenty-seven Technical Paper Presentations
(fifty-nine papers were submitted)**

And... The Software Product Line Hall of Fame





Organizing Committee

General Chair: Linda Northrop, SEI

Program co-Chairs

- **Alexander Ran, Nokia**
- **Paul Clements, SEI**

Tutorials Chair: Gary Chastek, SEI

Workshop Chair: Felix Bachmann, Robert Bosch Corp.

Proceedings Chair: Pat Donohoe, SEI



SPLC1 Program Committee

- **Sergio Bandinelli,**
European Software Institute
- **Len Bass, SEI**
- **Don Batory, U. Texas Austin**
- **Jan Bosch,**
U. Karlskrona/Ronneby
- **Grady Campbell,**
Prosperity Heights Software
- **TW Cook, MCC**
- **Mike Grier, Raytheon**
- **Emil Jandourek,**
Hewlett-Packard
- **Mehdi Jazayeri, U. Vienna**
- **Jean Jourdan, Thomson-CSF**
- **Philippe Kruchten,**
Rational Software Canada
- **Robert Nord, Siemens USA**
- **Henk Obbink, Philips**
- **David Sharp, Boeing**
- **Karma Sherif, Temple U.**
- **Theo von Bomhard,**
Robert Bosch Corp.
- **David Weiss, Lucent Bell Labs**



Tutorials -1

**COPA: A Component-Oriented Platform
Architecting Method for Families of Software
Intensive Electronic Products (Henk Obbink,
Jürgen Müller, Pierre America, Rob van Ommering)**

**A Feature-Oriented Method for Product Line
Software Engineering (Kyo C. Kang)**

**Designing and Evolving a Product Line
Architecture (Jan Bosch)**

Architecture Synthesis (Mehmet Aksit)



Tutorials -2

**Architecture for Planning Software Product Platforms
(Derek Coleman)**

**TrueScope(tm): A Full Life-cycle Approach to
Develop Software Product Lines (Jean-Marc DeBaud)**

**Product Line Architectures, Aspects, and Reuse (Don
Batory)**

**Process Improvement for Software Product Lines
(Grady Campbell)**



Tutorials -3

Introduction to the Architecture Based Design Method (Felix Bachmann and Len Bass)

Building Reusable Test Assets for a Product Line (John D. McGregor)



Workshops -1

**Combining Architecture, Asset Management, and Culture to Successfully Develop Product Lines.
(Phil McCoog, Hewlett-Packard)**

**Product Line Architecture
(Jean Jourdan, Thomson-CSF/LCA)**

**Architecture Reconstruction and Product Lines
(Christopher Stoermer, Robert Bosch GmbH)**

Measurement Issues for Software Product Line Engineering (Dave Zubrow, SEI)



Workshops -2

**Generative Techniques for Product Lines
(Greg Butler, Concordia University)**

**Product Lines for Command and Control Ground
Systems
(Judy Kerner, The Aerospace Corp.)**

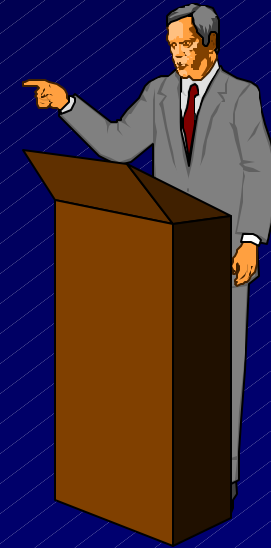
**Embedded System Product Lines
(Kathy Rose, GM Powertrain)**



Keynote

Colin Tully

- **Principal, Colin Tully Associates**
- **Technical Director, European Software Process Improvement Foundation**



Keynote compared product lines with evolution, which uses variability to adapt to changes in environment, folding that variability back into the species' genome as commonality.



Panels -1

"Architecture Design Methods for Software Product Lines"

**Moderator: Robert L. Nord,
Siemens Corporate Research**

Panelists:

- **Len Bass, Software Engineering Institute**
- **Jan Bosch, University of Karlskrona/Ronneby**
- **Christine Hofmeister, Siemens Corporate Research**
- **Kyo C. Kang, Pohang U. of Sci. and Technology**
- **Rob van Ommering, Philips Research Labs**



Panels -2

"Institutionalizing Software Product Lines"

Organizers : Jean Jourdan, Jan Bosch

Panelists:

- **David Weiss, Luccent Bell Labs**
- **Ben Pronk, Philips Research Laboratories**
- **Juha Kuusela, Nokia**
- **Len Bass, Software Engineering Institute**



Technical Paper Sessions

Session 1: Practice and Experience

Session 2: Organization and Management

Session 3: Methods

Session 4: Process

Session 5: Components

Session 6: Architecture

Session 7: Tools and Techniques

Session 8: Domain Engineering



Software Product Line Hall of Fame

Goal: To recognize excellence in software product lines

We hope this is a recurring event.

Members of the product line were voted into the Hall of Fame by attendees at SPLC1.

Criteria were informal, but some mentioned were

- **should have been designed as a product line with explicit attention paid to commonality and variation**
- **should be able to serve as an exemplary model that others can follow**
- **should be a commercial success**





A-7E Avionics System





A-7E Avionics System -2

Software engineering demonstration project by U.S. Navy in mid 1980's.

Pioneered use of information-hiding, abstract interfaces, layered architecture, cooperating sequential processes, and more in embedded hard-real-time systems domain.

Left behind a legacy of model design and documentation. Explicitly addressed families, commonality and variation in design. Laid much of today's product line conceptual groundwork.



For more information...

**Len Bass, Paul Clements, Rick Kazman,
Software Architecture in Practice,
Addison Wesley Longman, 1998**

**Chapter 3: “A-7E: A Case Study in Utilizing
Architectural Structures”**



CelsiusTech ShipSystem 2000





CelsiusTech ShipSystem 2000 -2

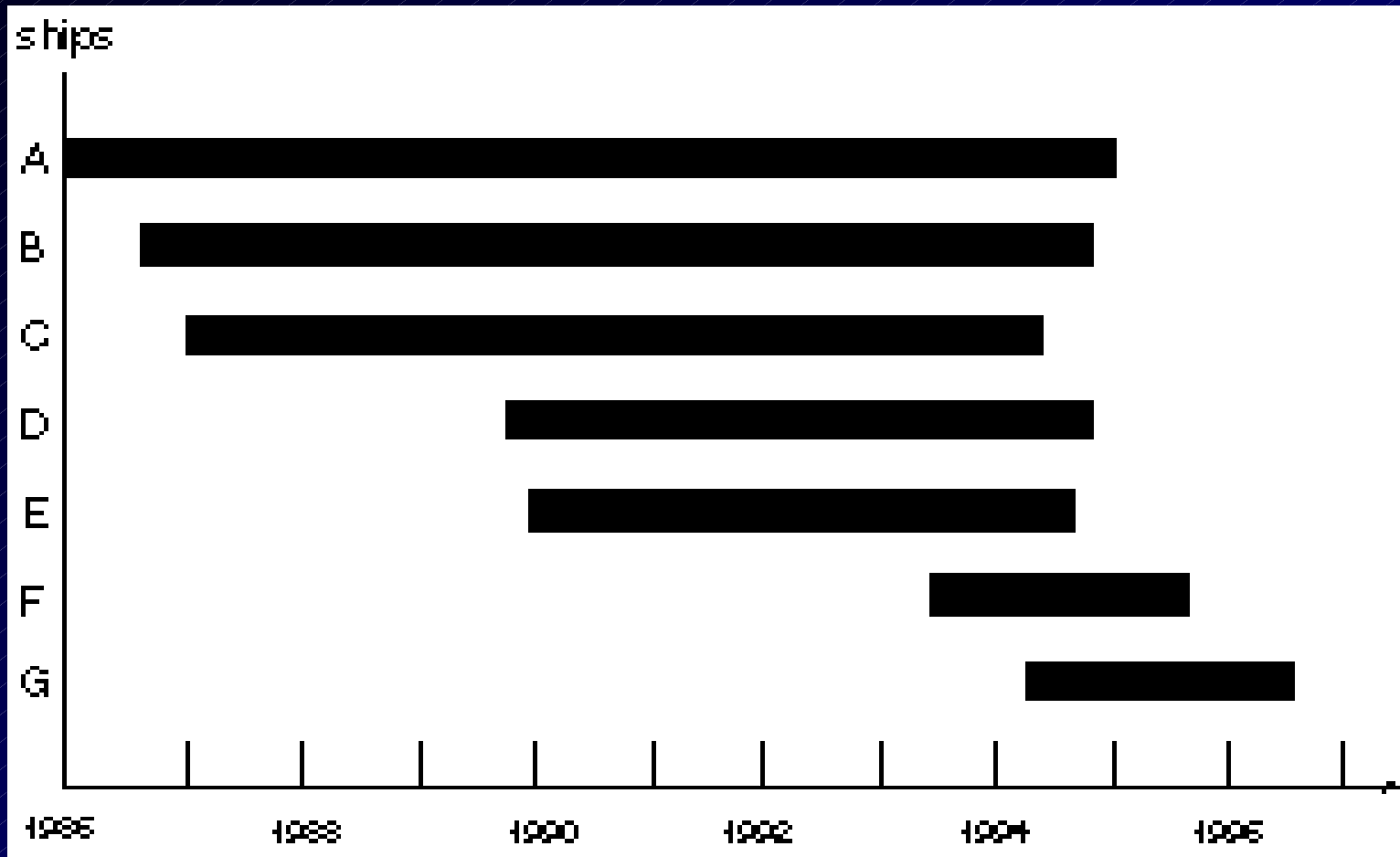
CelsiusTech: Swedish defense contractor with long history of building shipboard command and control systems for Navies around the world.

Late 1980s: Company landed two contracts, each much larger and more complex than anything they had done before.

Solution: Software product line, supported by strong architecture explicitly built for generality across family members.

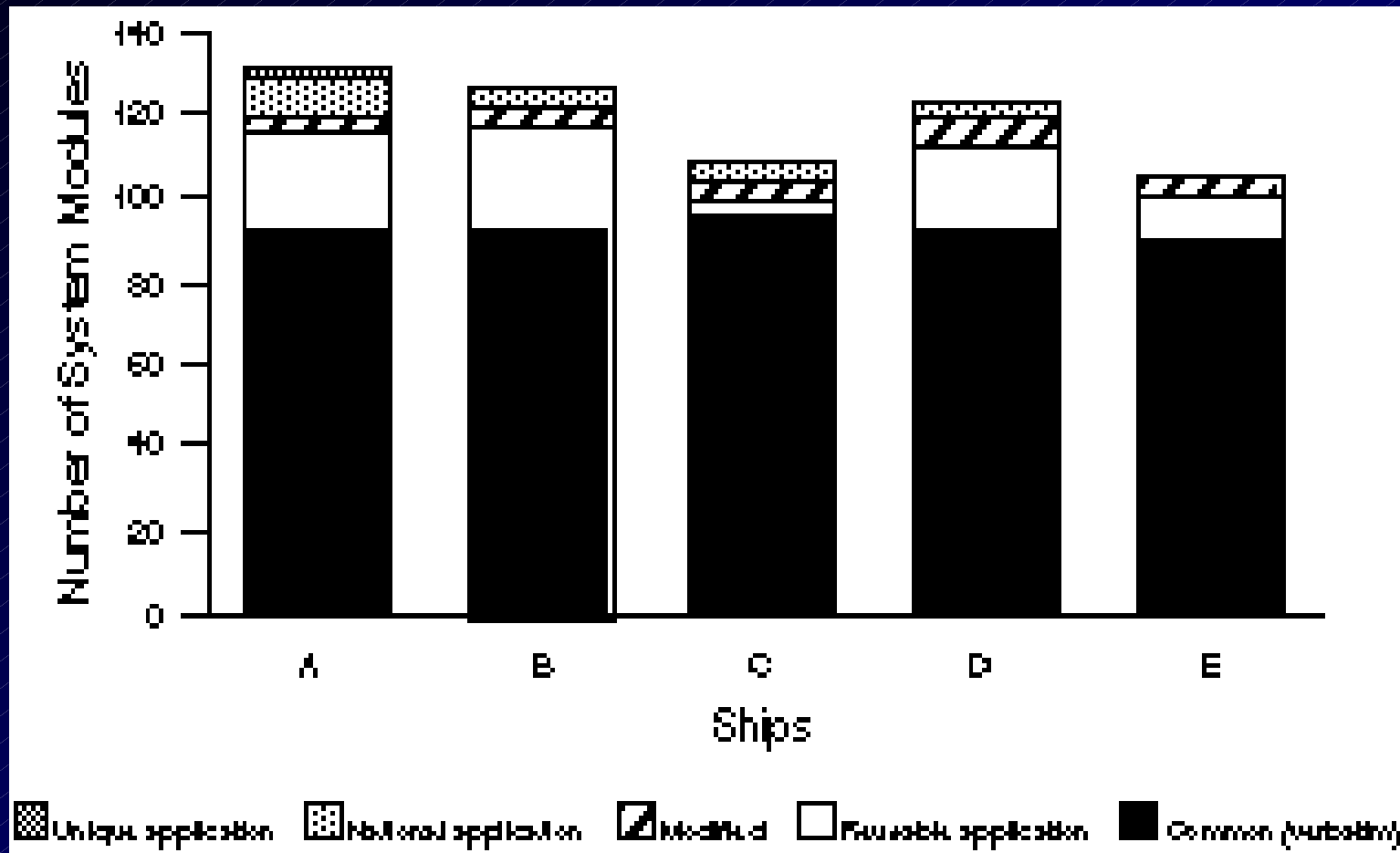


CelsiusTech Schedules



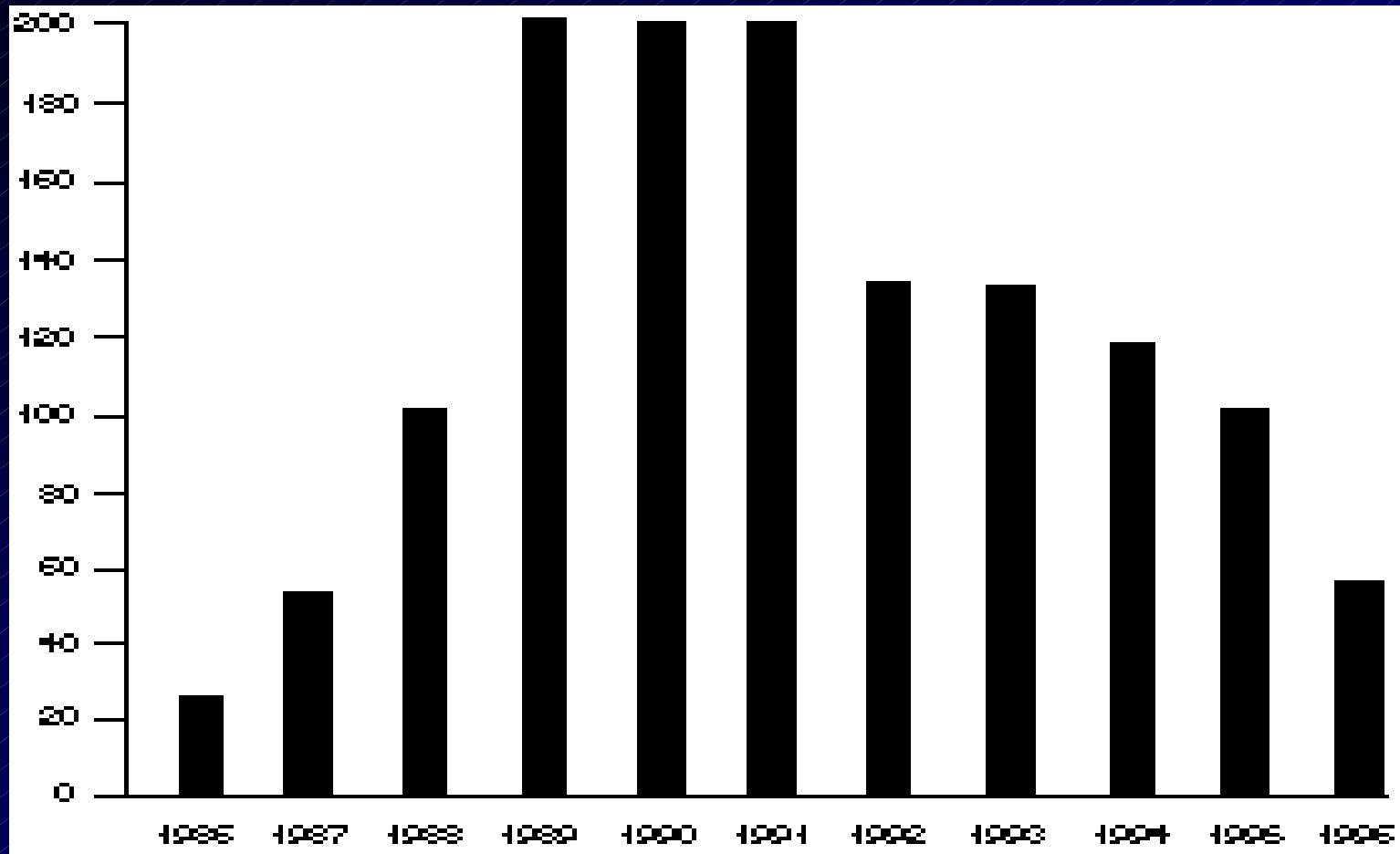


CelsiusTech Reuse





CelsiusTech Staffing





For More Information...

**Lisa Brownsword and Paul Clements, *A Case Study in Successful Product Line Development*,
SEI TR-96-016, 1996.**

**Available on-line at
http://www.sei.cmu.edu/plp/plp_case_studies.html**



H-P “Owen” Software Product Line

A “software cooperative”

A pseudonym, after Robert Owen, founder of the Cooperative Movement.

Conceptual basis:

- de-centralized *product-focused* platform development, performed exclusively by product teams
- enculturation of the “cooperative” ethic



H-P “Owen” -2

Organization

- Owen steering team
- Firmware architect (one per division in the coop)
- Firmware asset lead (one per division in the coop)
- Owen cooperative steward

Culture

- Product groups may join voluntarily, are expected to contribute to the cooperative.
- Informal rules, e.g., “If a component changes less than 5% [when reused] the supplying project/division should attempt to support it.”



H-P “Owen” -3

Results

- **3x time-to-market improvement**
- **4x headcount reduction**
- **results achieved even with parallel development**
- **25x quality improvement**
- **reuse up to 70%**



For more information

**Peter Toft, Derek Coleman, Joni Ohta,
“A Cooperative Model for Cross-Divisional Product
Development for a Software Product Line”**

in

**Patrick Donohoe, Ed., *Software Product Lines:
Experience and Research Directions*, Kluwer
Academic Publishers, 2000.**

**For purchase information send e-mail to
lance.wobus@wkap.com**



Nokia Cellular Telephones

Nokia is a long-time supplier of cell-phone systems and supporting software.

Have had product line approach for some time.

- **Explicit notion of platform (core asset base)**
- **Explicit handling of commonality/variation**
- **Results: Drastic time to market reduction (4x/year to 50x/year)**

No definitive references -- yet.

Stay tuned!



Conference Summary

SPLC1 brought together a burgeoning community in software product lines, and gave it a unified identity.

Architecture remains the dominant technical pillar of software product lines.

Software product lines now represent a recognized development paradigm around the world.

What will the future bring? SPLC2 will tell.



SPLC1 Legacy

World Wide Web:

<http://www.sei.cmu.edu/plp/conf/SPLC.html>

Express your preferences for SPLC2



Quick Post SPLC1 Update

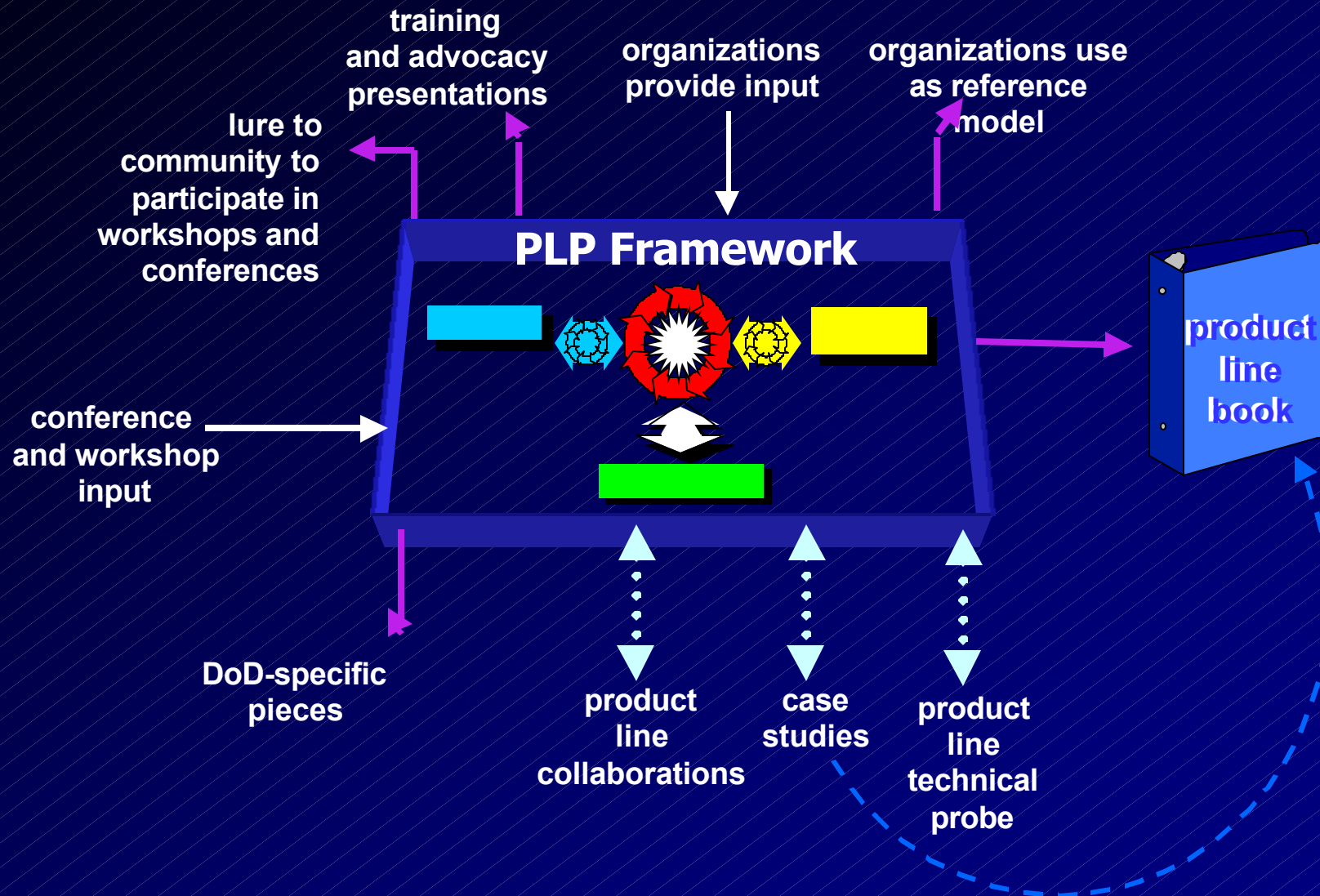
**SEI Product Line Practice Framework Version 3.0
is now available**

- **<http://www.sei.cmu.edu/plp/framework.html>**
- **is used by organizations in their product line efforts**
- **is the basis of the Product Line Technical Probe**

**Product Line Technical Probe has been piloted
and is ready for continued SEI application at
customer sites**

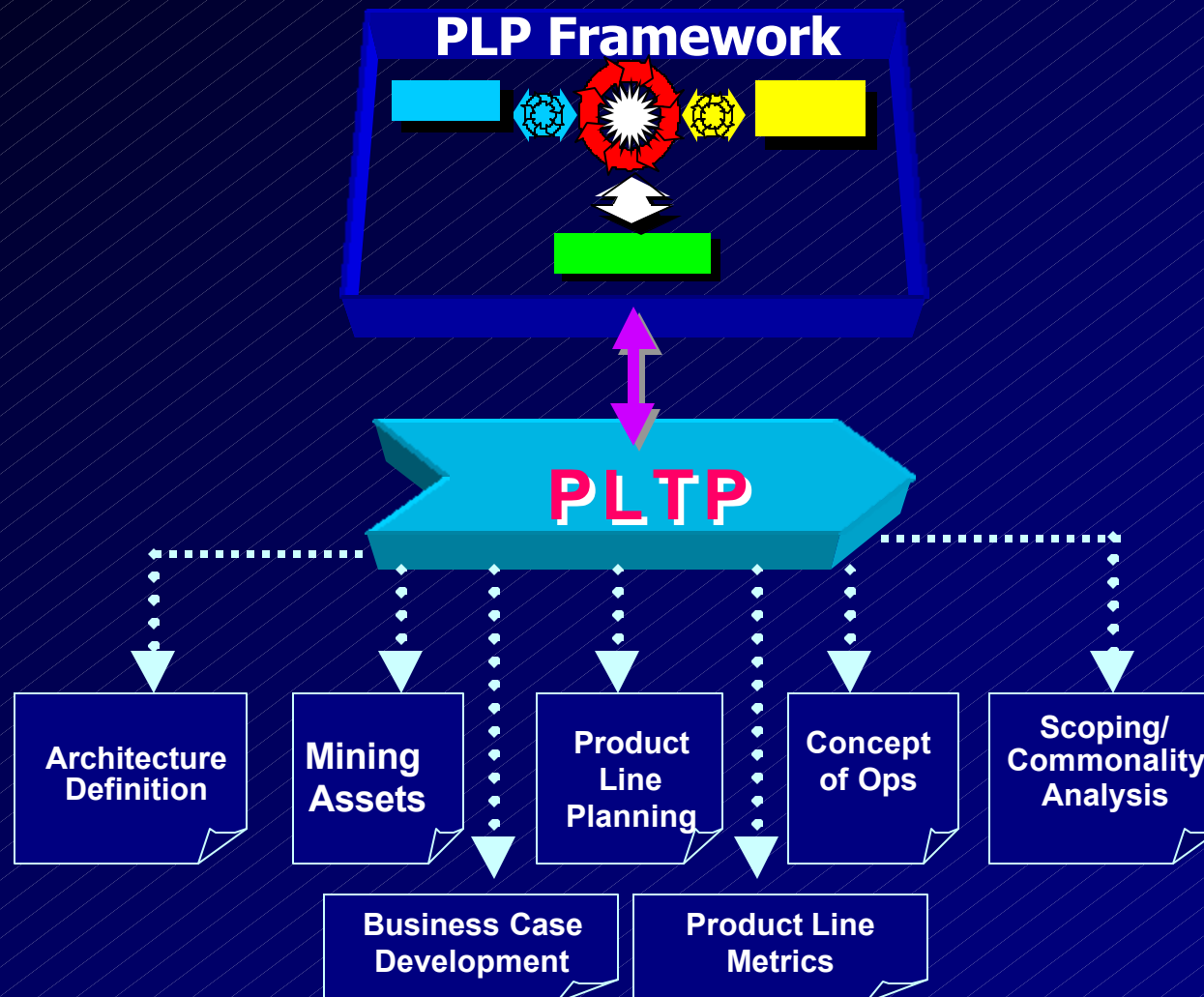


PLP Framework Role





Product Line Technical Probe (PLTP) Role





What's Next

**4th DoD Product Line Practice Workshop
(March 19-20, 2001: Colorado Springs, CO)**

**Acquisition Companion to the Framework
(Summer 2001)**

Framework, Version 4.0 (Summer 2001)

***Software Product Lines: Practices and Patterns*
(Clements, Northrop) (Summer 2001)**



For Additional Information on Working with the SEI

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