The KBSA Report

25th Anniversary Edition

KESTREL INSTITUTE
REPORT ON A KNOWLEDGE-BASED SOFTWARE ASSISTANT

A Reprint Celebrating the 25th Anniversary of the
IEEE/ACM International Conference on Automated Software Engineering

About the Logos

The KBSA diamond – The diamond on the cover comes from the KBSA report. The motivation can be found in Section 1.6, which describes the 10 – 15 year development plan, starting as individual facets of the KBSA (a diamond in the rough) that is then chiseled through supporting technology with an overarching framework to become a finished diamond.

The ASE Logo – John Penix developed the ASE logo when he was interning at NASA Ames in the Spring of 1997 – the period when KBSE was transitioning to the ASE conference: "I happened to see The Artist Formerly Known as Prince play at The San Jose State Event Center in California. A few weeks later, I was bored on a plane and started thinking about logos for ASE - or the Conference Formerly Known as KBSE. By turning The Artist's symbol on its side, the symbol looked like it could be transformed to look like a-s-e. Well, it wasn't too hard on paper, but it took a ridiculous amount of time battling Coral Draw on a friend's computer to make the spiral on the S. I showed up at ASE'97 and passed out a few cheaply made t-shirts. I quickly received requests for about 20 more which I shipped off to various points of the globe. For ASE '98, the organizers asked me for the logo file - and it started getting used everywhere. In 2005, I officially handed the rights to the logo to the conference and it now belongs to IEEE."

Credits

This document was edited by Michael Lowry and Charles Pecheur, with graceful contributions from Cordell Green and John Penix.

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Origins of the Automated Software Engineering Conference: The Knowledge-Based Software Assistant

In the early years of Artificial Intelligence research (1956 – 1975) Software Engineering was a frequent topic of investigation for AI techniques. Despite early successes such as Cordell Green's dissertation on synthesis of programs through resolution theorem proving, by the mid-1970s funding sources for research in Software Engineering had been largely separated from those for AI, especially in the United States. However, a small number of researchers throughout the world continued to pursue this synergy. In 1983 the Kestrel Institute, under the leadership of Cordell Green, was funded to host a group of United States researchers in a loosely organized summer-long workshop culminating in the publication of the Knowledge-Based Software Engineering Assistant (KBSA) report; reprinted in this booklet. Program manager Douglas White, with assistance from Sam DiNitto and Nort Fowler, sponsored the workshop and report through the US Air Force Rome Air Development Center. The co-authors of the KBSA report are, from left to right: Cordell Green (Kestrel Institute), Bob Balzer (formerly of the USC ISI), David Luckham (Stanford University), and Charles Rich (formerly of MIT). Thomas Cheetham of Harvard University is not shown.
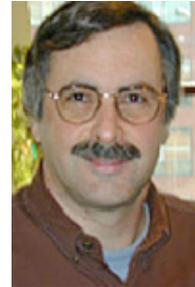
The KBSA report called for radically improving software engineering by formalizing the knowledge for all phases of software engineering. It envisioned three stages of knowledge-based assistance: first, recording decisions and activities made during a software engineering project – a software project knowledge base; second, providing automated inference capability for explaining a software system and supporting maintenance; and finally goal-oriented planning to advise strategies and automate tedious tasks. At the time of the KBSA report, AI was enjoying its first practical successes with diagnostic expert systems, based on encapsulating heuristic expert knowledge as rules manipulated by inference engines. Before KBSA, Rome Labs had investigated the possibility of diagnostic expert systems for software maintenance, and concluded that it was not possible at the time due to the lack of formalized knowledge for software. The KBSA report addressed this gap within the scope of a larger vision.

Funding was approved for the first stage of development of a KBSA, with annual meetings of funders, researchers, and potential stakeholders. These meetings then evolved into the first KBSA conference in 1986. In 1990, under the informal leadership of Lou Hoebel, the KBSA-5 conference was opened to all interested parties, in order to foster technical interaction between KBSA and related research projects. The success of KBSA-5 prompted its evolution to a more encompassing conference. Subsequently in 1991, the conference was renamed the Knowledge-Based Software Engineering Conference, KBSE-6, and began its sponsorship by AAAI, ACM, and the IEEE Computer Society. The expanded program and improved review process made KBSE-6 a resounding success. Subsequent KBSE conferences retained strong ties with the ongoing KBSA program while achieving the scholarly goals of an open conference with high standards for paper reviews.

After more than a decade, the KBSA funded program was winding down by the time of KBSE-11 in 1996. In order to re-invigorate the 1997 conference, co-chairs Yves Ledru, Michael Lowry, and Christopher Welty (shown below left to right) decided to expand the focus along several dimension. ASE-12 was the first of the conferences named Automated Software Engineering, but retained the numbering to indicate continuity. The change in name from "Knowledge-Based Software Engineering" to "Automated Software Engineering" reflected a broadening of the research disciplines represented at the conference – including but no longer limited to knowledge-based or artificial intelligence methods. The common focus was computer-based construction, representation, semantic analysis, reasoning, and understanding, of software artifacts and processes. The scope included fully automatic techniques, and also techniques that supported and cooperated with people. This name better captured how the focus of the conference had expanded with growth and was consistent with the affiliated Journal of Automated Software Engineering.

The ASE-12 conference became fully international, with more papers submitted and accepted from outside the United States than from within the United States. The program committee came from all continents of the world except Africa (and of course Antarctica), and included leaders from a number of cutting-edge software engineering disciplines. With the expanded technical focus and international scope, the number of papers submitted to ASE-12 more than doubled from

KBSE-11. Hence the number of paper tracks doubled from one to two through parallel sessions at the conference.

A number of traditions that remain to this day were started at ASE-12. One of these was to have two program chairs, one from North America and the other from outside North America. Plans were developed to start alternating the conference between North America and other parts of the globe. ASE-15 in 2000 was the first international conference, lead by general chair Yves Ledru and held in Grenoble, France.   The North American conferences are generally held in October or November, while in alternating years they are held in September. These dates are due in part to co-ordination with sponsors ACM and IEEE to avoid conflicts with other sponsored conferences. Another factor was to avoid the usual September start of classes in American Universities when the conference was held in North America and attracts a greater percentage of American participants. Since the year 2000 the alternation of the conference between North America and other parts of the globe has had only one exception: Auckland, New Zealand in 2009, sandwiched between L'Aquila Italy in 2008 and Antwerp, Belgium in 2010. This exception was due to an outstanding conference proposal put together by Professors John Gundy and John Hosking of Auckland University and accepted by the ASE steering committee.

Another tradition started at ASE-12 was the short paper. The goal was to be more inclusive of submitted papers, particularly for promising and innovative research that was not yet mature. Short papers are usually four pages and presented at poster sessions, which is conducive for intense one-on-one discussions that are particularly helpful for maturing research. Short papers have sometimes been controversial in ASE program committees because they don't fit well into the academic tenure track process – more than a poster or an abstract, but not a complete paper representing mature research. Despite this, short papers have a proven track record for ASE, with many examples of research originally presented as a short paper maturing into a best paper at a subsequent ASE conference.

Past KBSE and ASE locations

KBSE
ASE

2009 Auckland
2006 Tokyo
2004 Linz
2010 Antwerp
2008 L'Aquila
2002 Edinburgh
2000 Grenoble
2003 Montreal
1996 Syracuse
1995 Boston
1991 Syracuse
1992 McLean
1993 Chicago
1999 Cocoa Beach
2007 Atlanta
2001 San Diego
1997 Incline Village
2005 Long Beach
1994 Monterey
1998 Honolulu

KBSA and KBSE Conferences: 1986 through 1996

During the eleven years from 1986 through 1996 the conference was closely associated with the Rome Laboratories funded KBSA project. As the KBSA project evolved from initial research to technology demonstration, the conference itself opened to the wider community but maintained its focus on knowledge-based methods. The synopsis below highlights themes of the conference as they evolved over the decade, such as relation to synergistic technologies (e.g., CASE, object-oriented databases), domain-specific versus general purpose KBSE, and technology scaling and transfer.

Today the KBSE name is associated with a different conference: the Joint Conference on Knowledge-Based Software Engineering (JCKBSE), which was first held in Russian May 1994. Although there is some overlap in the topics, JCKBSE emphasizes the software engineering challenges of building knowledge-based systems as opposed to the use of knowledge-based methods for the construction of all types of software.

KBSA-1 through KBSA-4 (1986 to 1989)

Chair: Douglas A. White, Rome Laboratories program manager for KBSA project

In 1986 Rome Laboratories initiated the Knowledge-Based Software Assistance (KBSA) conference. This served as a forum for technical interchange amongst participants in the KBSA project. Additional participants were primarily from the US Department of Defense and its contractor community that were potential users of a KBSA.

From 1987 through 1989 presentations continued to be limited to KBSA project participants and closely related US projects; but with a broader audience.

KBSA-5 September 24-28, 1990

Chairs: Douglas White, Louis Hoebel (Rome Laboratories)
Location: Syracuse Sheraton conference center near Syracuse University (shown below)

In 1990 a deliberate effort was made to open the conference to all interested parties with the goal of fostering cooperation among similar research projects to KBSA. The theme of KBSA-5 was "Bridging the Gap", addressing the problem of inserting new KBSA technology into customer organizations. The conference included five panels: Object-oriented databases for support of the knowledge-base in a KBSA, dynamic documentation and explanation of software systems, comparison of CASE technology with KBSA technology, and bridging the gap and moving paradigm-changing technology into organizations with entrenched procedures. General agreement was reached that KBSA had the best chance in organizations that followed a software process model - and that the KBSA project needed to provide a default process model that could add in KBSA tool capabilities as they matured.

KBSE-6 Sept 22-25, 1991.

Chairs: Peter Selfridge (shown below), Louis Hoebel, Douglas White
Location: Syracuse Sheraton University conference center (shown below).

The conference was renamed to the Knowledge-Based Software Engineering conference to signify opening to a general audience, growing by twenty percent over KBSA-5 with representation from nine countries. Barry Boehm's plenary address described the US Department of Defense software technology plan, with a goal of reducing software costs that in 1991 were $24 billion annually. The plan

included developing technology for reuse (work avoidance), improvements in the software process (working smarter) and advanced tools (working faster through integration of AI with Software Engineering). Challenges for KBSA were described as knowledge capture, knowledge maintenance, knowledge representation, the capability for knowledge-based project database interoperability, and finally scalability. Thomas Cheatham characterized computing in the upcoming decade of the 1990s as being done on networks of workstations. KBSE-6 ended with an open discussion on the goals and status of the KBSE community, with suggestions including gaining wider European participation, more formal tutorials, and maturing KBSE work into realistic domains. A permanent steering committee was formed for long-term guidance of the conference.

KBSE-7 September 20-23, 1992

Location: Tysons Corner, in McLean, Virginia (Washington DC)
Chair: Lewis Johnson of USC Information Sciences Institute (shown below)
Sponsors: IEEE Computer Society, ACM SIGART and SIGSOFT, and AAAI
IEEE and ACM remain co-sponsors of the conference to this day.

Two major themes of KBSE-7 were making KBSE systems domain-oriented to meet the needs in particular applications engineers, and adoption of KBSE systems by software practitioners. Elaine Kant gave an invited talk on automatic programming for scientific programming, such as her SINAPSE tool that generated finite difference programs to simulate partial differential equation models. Gerhard Fischer's invited talk was an overview of a new paradigm for automated design support: Domain-Oriented Design Environments (DODE). Four panels included "Software Process and Knowledge-Based Tools", a panel assessing KBSE research in terms of potential transition to real use, and "Program Understanding - Does It Offer Hope for Aging Software?". The latter became a recurring theme in subsequent years as the Y2000 approached, and its expected problems with software that relied on double-digit dates needing to be re-engineered. Tool demonstrations were featured at KBSE-7, and given equal weight to paper presentations.

The closing discussion at KBSE-6 had pointed out the need for more formal tutorials, and KBSE-7 provided, in the day before the main conference, tutorials on " Knowledge Based Software Reuse Methods and Tools: DoD STARS" (James Solderitsch) and "Automatic Programming" (Dorothy Setliff).

KBSE-8 September 21-23, 1993

Location: Midland Hotel, Chicago Illinois (near Sears Tower, shown below)
Chairs: Bruce Johnson and Bill Sasso of Andersen Consulting, Professor Mehdi Harandi (U. Illinois, shown below)
Sponsors: Rome Laboratory, IEEE Computer Society, ACM SIGART and SIGSOFT, and AAAI.

Tutorials included Introduction to KBSE (Lewis Johnson), a tutorial on Knowledge-Based Software Process Engineering (Walt Scacchi, echoing discussions at KBSA-5) and a tutorial on the Kestrel Interactive Development System (KIDS) by Douglas Smith. Invited talks included "Modeling Processes" by Professor Myloupolos and "A researcher's view of life in a large software development environment," by Eric Sumner of Bell Labs. Panels included the evocatively named "KBSE and Software Engineering: Strangers, Brothers or Identical Twins" (chaired by Peter Selfridge) and "Requirement's Elicitation" chaired by Lewis Johnson. Five hours were allotted to demonstrations.

KBSE-9 September 20-23, 1994

Location: DoubleTree hotel in Monterey, California (view from the harbor below)
Chair: Douglas Smith and Richard Jullig of the Kestrel Institute (left to right)
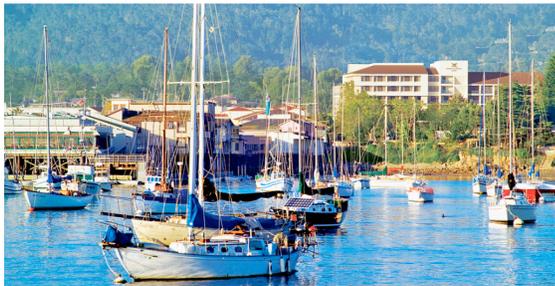
KBSE-9 featured a panel on KBSE Application Development Experience and Impact as well as a panel reviewing progress on the KBSA project. Robert Balzer, one of the co-authors of the original KBSA report, gave the invited talk.

KBSE-10 November 13-15, 1995

Location: Boston Back Bay Hilton, Boston Massachusetts (near Fenway Park, below)
Chairs: Howard Reubenstein (GTE Labs) and Professor Dorothy Setliff (Univ. Pittsburg)

KBSE-10 featured panels on formal methods in KBSE, empirical evaluations of software technology, and legal issues in KBSE. Paper session topics included Synthesis, Formal Methods, Knowledge-Based Environments, Process, Reuse/Reengineering, and Program Understanding. A best paper award was initiated at the conference with publication of an invited journal paper in the Automated Software Engineering journal. The best paper award was shared between Lewis Johnson and Ali Erdem's paper titled "Interactive Explanation of Software Systems" and Michael Lowry and Jeffrey Van Baalen's paper titled "META-AMPHION: Synthesis of Efficient Domain Specific Program Synthesis Systems." Participants enjoyed a banquet at the Science Museum.

KBSE-11 September 26-28, 1996

Location: Syracuse Sheraton conference center near Syracuse University
Chair: Douglas White (Rome Labs) and Christopher Welty (Vassar College)

The conference returned to its roots in the Syracuse – Rome area of upstate New York. Ted Biggerstaff gave the keynote address: "A 15 Year Perspective on Reuse and Generation", and Douglas Smith gave an invited talk "The Truth about KIDS". Tutorials were "Introduction to Knowledge-Based Software Engineering" (Michael Lowry and Lewis Johnson), SPECWARE: Formal Support for Software Composition (Richard Jullig) – a category-theoretic approach to software engineering being developed at the Kestrel Institute, and " Developing Collaborative Applications Using the World Wide Web "(Alison Lee). The Web had become very popular by that time, and the first panel was "How the Web influences KBSE Technology". Loren Traveen chaired the second panel on "Corporate and Organizational Memory". At the close, the chairs of the upcoming 1997 conference led a discussion on the future of KBSE, leading to the decision to expand the scope of the conference and changing the name to its present "Automated Software Engineering".

ASE Conference : 1997 through 2010

| Issue	Year	Location	General Chair	Events	Size	Papers					
				Workshops/ Tutorials	Attend main conf.	submitted	accepted total	accepted long	acc. rate long	accepted short	acc. rate short
ASE-25	2010	Antwerp, BE	C. Pecheur	8 / 5	170	190	64	33	17%	31	16%
ASE-24	2009	Auckland, NZ	J. Grundy	3 / 3	132	222	69	37	17%	32	14%
ASE-23	2008	L'Aquila, IT	P. Inverardi	3 / 1	171	240	66	34	14%	32	13%
ASE-22	2007	Atlanta, US	K Stirewalt	5 / 4	199	300	67	29	10%	38	13%
ASE-21	2006	Tokyo, JP	S. Honiden	4 / 4	200	121	39	22	18%	17	14%
ASE-20	2005	Long Beach, US	D. Redmiles	3 / 4	162	293	63	28	10%	35	12%
ASE-19	2004	Linz, OS	P. Grünbacher	6 / 4	139	183	51	25	14%	26	14%
ASE-18	2003	Montréal, CA	H. Sahraoui	3 / 7	125	170	48	22	13%	26	15%
ASE-17	2002	Edinburgh, UK	J. Richardson	2 / 3	73	175	50	25	14%	25	14%
ASE-16	2001	San Diego, US	D. Richardson	1 / 4	72	164	60	32	20%	28	17%
ASE-15	2000	Grenoble, FR	Y. Ledru	1 / 4	104	125	50	25	20%	25	20%
ASE-14	1999	Cocoa Beach, US	D. Setliff	0 / 4	90	123	50	25	20%	25	20%
ASE-13	1998	Honolulu, US	A Quilici	1 / 5	106	150	44	22	15%	22	15%
ASE-12	1997	Lake Tahoe, US	C. Welty	1 / 4	91	108	47	32	30%	15	14%

The ASE conference is a high-quality conference, generally accepting 10% to 20% of submitted papers as long papers with mature research. It distinguishes itself from other Software Engineering (SE) conferences through its emphasis on tools supporting automation of aspects of SE. Within this emphasis it appeals to a wide range of SE disciplines. With the addition of short papers, the conference is also inclusive of new ideas and maturing research. Attendance and submitted papers have trended upwards, with paper submissions for odd years being generally higher than for even years. One factor is likely the shorter time between paper submissions for even-odd years (fourteen months) than for odd-even years (ten months) due to the alternating September versus November conference dates. Attendance reached a high point in Japan 2007, with many locals registering who got their first exposure to Automated Software Engineering research. Since 2008, attendance has remained relatively robust with only a slight decline due to the economic crisis.

The charts below provide a visual depiction of attendance trends and accepted papers.

Attendance to main conference
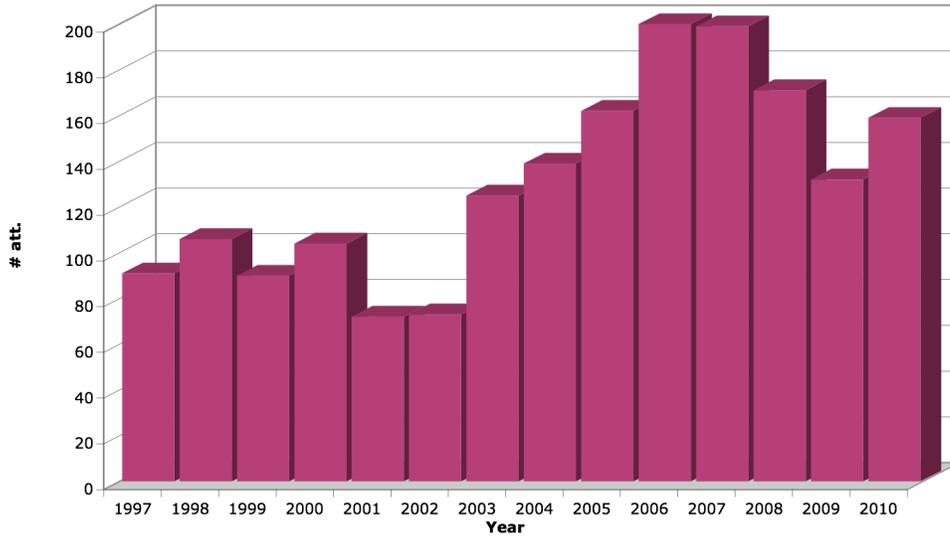
Contributions to main conference
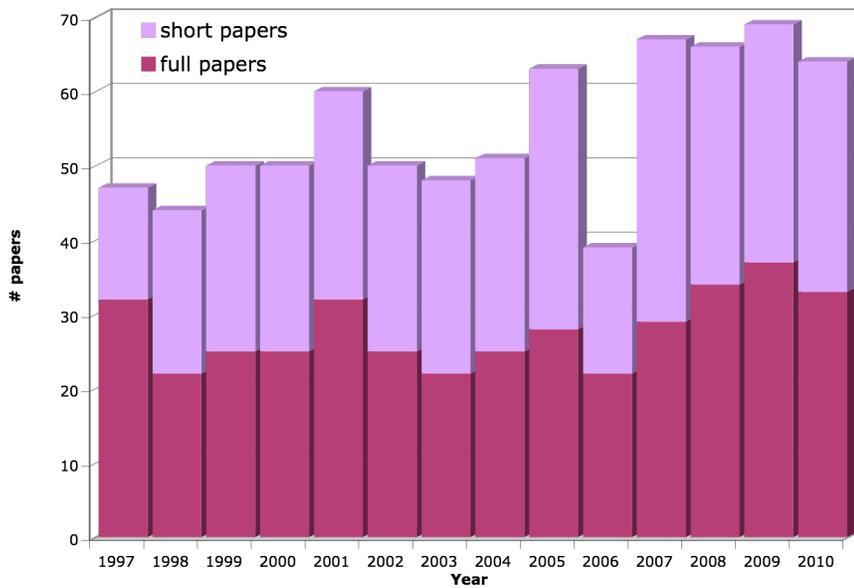
More details on individual conferences can be found at the conference web site:

http://www.ase-conferences.org/ase/past/

Each year, the authors of best papers at ASE are invited to submit an expanded version to the Journal of Automated Software Engineering. It is currently published by Springer, editorial chief Robert Hall—who also serves as the ASE conference steering committee chair:

http://www.springer.com/computer/ai/journal/10515