New Center Will Help Software Development “Grow Up”

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Uc Basili knows the meaning of the phrase “there’s no profit in prophecy.” Basili, professor of software engineering at the University of Maryland, has long championed empirical research and experimentation in the development of large software systems, but his message fell on deaf ears.

“For a long time in the early days, people didn’t even know software had to be measured,” Basili says. “In the late ’60s, software development was about building programs. And then it shifted to building systems—and it didn’t scale up right.”

Not “scaling up right” can cost a project thousands of hours and millions of dollars to correct. That’s where the Center for Empirically Based Software Engineering comes in. Basili and his colleague at the University of Southern California, Barry Boehm, have created CeBASE and are now forging a network of colleagues in industry, the academic community, and research positions to establish CeBASE as an indispensable resource. CeBASE’s resources are intended to help software engineers build on existing empirical data to reduce costs of developing large projects. The center went public in October, announcing it had received a two-year, $2.4 million grant from the US National Science Foundation.

“CeBASE is a recognition that experimentation and the building of empirical models are important,” Basili says. “I wouldn’t say that’s a majority opinion yet—but it’s a large minority opinion.”

CeBASE’s near-term task, says Basili, is to demonstrate that this large minority opinion can be translated into tangible resources, such as a strong Web presence, conferences, books, and a network of researchers willing to share their experimental and empirical software development data. If that can be done in a timely way, he is confident the grant will be renewed, and CeBASE will be well on its way.

“First of all, I think we’ll show there’s a stronger interest in this issue,” he says. “Then, we have to show that we will have some basis of information on that network. We’ll have to show some models that are shared among the community. So the key is that we attract that community.”

Software quality guru Watts Humphrey, whose Personal Software Process and Team...
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Software Process methodologies could be valuable CeBASE resources, says the need for CeBASE is clear, if the support can be garnered. Humphrey agrees that CeBASE's two inaugural areas of emphasis, gathering data on defect reduction and integration of COTS-based systems, will prove attractive given their overriding importance to the industry.

"It's clear that more data and information on this subject can be extremely useful," Humphrey says. "The big issue is actually getting people to do it."

Digital kismet

One private-sector software researcher says there's been a need for something like CeBASE for a long time. Only recently, however, through the combination of several crucial factors—high costs due to defects, more mature development cultures within industry, and more sophisticated technology—was the idea able to become reality.

"It's about time," says Nancy Eickelmann, a research scientist and program manager for Motorola's software process simulation technologies. "If you look back at the June 1986 proceedings of the First Workshop on Empirical Studies of Programmers, it was obvious then we needed more scientific rigor in the industry."

At that time, software project management was very ad hoc, and simply adding more people to write more lines of code was not a cure, hence Fred Brooks' famous "man-month myth" theory; quality-assurance techniques like PSP and TSP did not come around until the early 1990s.

Eickelmann says the necessity to take empirical methods out of the classroom and into industry has been made clear by numerous researchers, who realize the comparable payback for empirically based industrial projects can far surpass the limited benefits achieved in smaller, academic experiments.

However, according to Eickelmann, until the recent maturation of industrial software organizations, there was little rationale for conducting these "experiments in the large."

"Part of the disconnect is, doing an experiment that applies to programming in the large is very costly," she says.

However, the costs incurred due to defects and delays during the development process have compelled the industrial sector to seek ways to improve that process. As those efforts have led to more mature development infrastructures, so too have those infrastructures created a body of high-quality data, and the Internet has given researchers a quick method to share results.

"I think there are enough Level 4 and 5 organizations out there now," says Eickelmann. "The technologies have matured as industry's processes have matured, and we have the ability to use the information like never before. A combination of factors have all come together in time to give CeBASE a chance to become a very valuable resource. There are those who will look at this information and will take the knowledge and use it. You cannot remain competitive in a world where your competition has better information."

And, as the information behind large systems grows correspondingly complex, Eickelmann says CeBASE may serve as the unifying resource that helps developers make sense of it all. An example, she says, is the promising but complicated IBM-pioneered orthogonal defect classification, which, though public-knowledge for almost a decade, hasn't seen wide adoption.

The foundation is laid

CeBASE is not, as its name might imply, a monolithic entity, a central repository from which potential users could take disparate chunks of data in hopes that it may be useful. Instead, CeBASE is actually constructed more along the lines of a cooperative, with principals located at two other university campuses—the University of Nebraska and Mississippi State University—in addition to USC and Maryland, plus partners in research organizations and industry. Ideally, each partner will take information it thinks will be useful in a given situation and will contribute its own data. Students graduating from CeBASE-affiliated universities will go into industry and serve as liaisons between their old and new workplaces.

It doesn't hurt CeBASE's visibility that the final 1999 report of the President's Information Technology Advisory Committee (PITAC) cited a dependence on software that is "often fragile, unreliable, and extremely difficult and labor-intensive to develop." As a result, projects like CeBASE
have been given high priority.

Thus far, the organization's Web site is in its earliest functional stages, including the press release announcing its formation and an update of Boehm's "Industrial Metrics Top 10 List" from the September 1987 issue of Software, entitled "Software Defect Reduction Top 10 List." Boehm, the TRW Professor of Software Engineering at USC, says he hopes to have other functions up and running soon, such as links to projects and experiments done by top researchers and development tools that allow project managers to examine empirical techniques.

"We hope to have some prototype portions going in a month or two. It will take a little time to grow it," says Boehm. There are no full-time CeBASE staff members; currently, the principals and their administrative staffs at their respective campuses also perform CeBASE work.

One of the other principals at CeBASE, Mississippi State University professor Rayford Vaughn, realizes that Boehm and Basili may have the marquee names that will draw attention to the center, but that he and his colleagues at the University of Nebraska, Scott Henssinger, must also spend considerable efforts in making CeBASE resources known regionally.

"We feel like this is incredibly important to us," Vaughn says. "Mississippi is not a state that has a heavy software industry, but we do have an emerging software presence. MCI is headquartered in Jackson, and there are a number of smaller networking companies locating here. Mississippi State, in science and engineering, is the only PhD-granting university in the state. This is an opportunity for us to create a better empirical and research base in the state."

Vaughn is quick to point out that making CeBASE successful at Mississippi State will benefit not just the university, or even just the academic software community in the state. Rather, the goal is to attract academic and industrial partners in the entire region, where proximity to the campus can facilitate face-to-face meetings and the complementary electronic resources can ease information gathering.

Challenges ahead

While the collegial foundation for CeBASE may be well-established, the details of integrating the work of the two founders, let alone other well-known programs such as TCP and Cleanroom, are daunting.

"We had a number of discussions about that," Boehm says. "How are we going to reconcile the different approaches we've been taking over the years into something integrated? Vic's been following a metric path, where you figure out goals first, while I've been working on this spiral model."

"And as we mentioned in the Top 10 article, which references PSP/TPS, we will have a section in the experience base that will include PSP/TPS, Cleanroom, and various techniques to improve quality. That part is relatively straightforward. The more complicated matter is how, and in some cases why, do you want to combine them? Will you eliminate the same set of errors twice?"

While Boehm concedes the backers of any given technique may be prone to be territorial about its supremacy over others, he also believes that, in the end, quality improvement pioneers will see CeBASE as a valuable tool for everyone. "Everybody in the methodology business agrees the big problem is not Methodology A vs. Methodology B, but rather any methodology vs. none," he says. "CeBASE could bring these various models together."

"It's going to be a slow process," Basili says. "I don't see everybody next year going to the Web site to find definitive answers. As a simple example, in instances where technology worked in one place and didn't in another, the question is 'Why?' And those
answers may "be slow in coming."

But for the overall benefit of the software community, he also says that CeBASE could serve as the crucial link between methodologies that drives quality improvement. "To work in the experimental field, you have to be willing to share; it's taken time for people to mature to the level of this kind of discussion," Basili says.

Basili is optimistic that collective maturity will help CeBASE get off to an accelerated pace. CeBASE has already signed memoranda of understanding with 12 organizations, and is also cosponsoring a February research overview at USC. To ensure that organizations expressing interest show their serious intent, Basili says CeBASE may look to models such as the International Software Engineering Research Network, in which new members must present research results at their second meeting, as well as commit to working with another member of the consortium.

What may seem to be an obvious obstacle, protecting confidentiality of data, has already been addressed. Motorola's Eickelmann says the CeBASE principals have been very proactive about protecting confidentiality, while yet another researcher, IBM's Sunita Chulani, has experience in studying, and protecting, sensitive data both in her current role as an IBM professor's PhD students at USC. Chulani is an unabashed backer of the possibilities of CeBASE.

Good synergy

Chulani, whose work for Boehm at USC included a study of a quality model extension to his landmark Cocomo II work, says the combination of her history at USC and her job at IBM has made her a sort of liaison between IBM and CeBASE. Chulani says it will be critical for CeBASE to have its most visible resources up and running soon to attract potential partners.

"This could be a very valuable resource," she says. "If they can't prove themselves in a year, I can't think of any other two individuals who could."

Basili says he has seen signs that perhaps the time is right for a resource such as CeBASE. "It is the time for the software industry to acknowledge that its work and philosophy might be on the verge of wider acceptance. For instance, he says, an engineer recently engaged him in conversation and told him he was beginning to see what Basili has been trying to accomplish—10 years after he heard Basili give a lecture.

Motorola's Eickelmann says the real-world aspect of CeBASE will be vital as its founders ramp up operation.

"A simple Web-based repository wouldn't be effective," she says. "There needs to be a systematic program that supports technology transition. You need tools, documentation, workshops, textbooks, a whole body of support around the technologies."

Eickelmann says the long-established relationships with industry that Boehm has forged at USC and Basili has forged at Maryland will be assets as they begin their CeBASE work. "Any technological change is a 50-50 proposition," she says. "Industries have to pony up at least 50 percent to make it happen."

UCITA Back on the Front Burner

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With legislative storm clouds looming over the Texas effort to pass the Uniform Computer Information Transactions Act (UCITA), opponents of the comprehensive measure hope to force substantial changes to the act or scrub it entirely in favor of something more consumer-friendly.

After passing in Virginia and Maryland last year, UCITA hit a snag in Texas where organized opposition hammered the Texas legislature with criticism even before the bill was filed.

Bill sponsors doubt the act will pass before the legislature adjourns in May.

UCITA opponents—large technology users and consumer rights groups—believe UCITA will give software companies a virtual stranglehold on technology contract negotiations and, by extension, their businesses.