Software Engineering and the Systems Approach:
A Conversation with Barry Boehm

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INTRODUCTION

IJITSA is honored by the fact that this issue presents an interview with probably the most significant figure in the field of software engineering since its inception and one of its founders, Professor Barry W. Boehm. He has published many seminal books and papers that have shaped the foundations of software engineering. We have included in the references just a small sample of his numerous publications addressing some of the fundamental issues in this field in recent years. They cover diverse topics ranging from a comparison of agile development methods and software engineering (Boehm & Turner, 2004) to reflections on enhancing software engineering education (Boehm, 2006c). A thought-provoking review of the evolution of software engineering and its current challenges is presented in Boehm (2006b), while his thoughts on the need to integrate more closely software and systems engineering are reflected in Boehm (2006a) and Boehm and Lane (2006). The questions we asked Professor Boehm relate to his significant contributions to software engineering and enhancing its links to the systems approach.

Dr. Barry Boehm is the TRW Professor of Software Engineering and Director, Center for Software Engineering, University of Southern California. He received his B.A. degree from Harvard in 1957 and his M.S. and Ph.D. degrees from UCLA in 1961 and 1964, all in mathematics. He also received an honorary Sc.D. in computer science from the University of Massachusetts in 2000. He served within the U.S. Department of Defense (DoD) as Director of the DARPA Information Science and Technology Office, and as Director of the DDR&E Software and Computer Technology Office. He worked at TRW from 1973 to 1989, culminating as Chief Scientist of the Defense Systems Group, and at the Rand Corporation from 1959 to 1973, culminating as Head of the Information Sciences Department. He was a Programmer-Analyst at General Dynamics between 1955 and 1959.

Professor Boehm's current research interests focus on value-based software engineering, including a method for integrating a software system's process models, product models, property models, and success models called Model-Based (System) Architecting and Soft-

ware Engineering (MBASE). His contributions to the field include the Constructive Cost Model (COCOMO), the Spiral Model of the software process, the Theory W (win-win) approach to software management and requirements determination, the foundations for the areas of software risk management and software quality factor analysis, and two advanced software engineering environments: the TRW Software Productivity System and Quantum Leap Environment. He has served on the boards of several scientific journals, including the *IEEE Transactions on Software Engineering*, *IEEE Computer*, *IEEE Software*, *ACM Computing Reviews*, *Automated Software Engineering*, *Software Process*, and *Information and Software Technology*. He has served as Chair of the AIAA Technical Committee on Computer Systems, Chair of the IEEE Technical Committee on Software Engineering, and as a member of the Governing Board of the IEEE Computer Society. He has also served as Chair of the Air Force Scientific Advisory Board's Information Technology Panel, Chair of the NASA Research and Technology Advisory Committee for Guidance, Control, and Information Processing, and Chair of the Board of Visitors for the CMU Software Engineering Institute.

Professor Boehm was the recipient of numerous honors and awards, which include among others the ACM Distinguished Research Award in Software Engineering (1997) and the IEEE Harlan D. Mills Award (2000). He is a Fellow of the primary professional societies in computing (ACM), aerospace (AIAA), electronics (IEEE), and systems engineering (INCOSE), and a member of the National Academy of Engineering.

THE CONVERSATION

IJITSA: Professor Boehm, thank you for agreeing to this interview for IJITSA. You have noted in your previous writings the need for integration of systems engineering and software engineering. Please could you provide your opinion on why the systems approach is useful to software engineering?

Professor Boehm: I think the most convincing reason for that is most of the analyses of the root causes of failed software projects. They tend not to be whether you got your algorithms and data structures correct. They tend to be failures in doing the systems engineering. Getting the wrong requirements, or getting incomplete requirements, or getting the wrong stakeholders to give you requirements, or not understanding the feasibility of the requests, or being able to estimate cost or schedule, or tradeoffs in performance and reliability. So, most of the projects that fail seem to be failing because of failures in doing a good job of systems engineering. As we've tried to teach software engineers here at USC, we find that what we end up doing in the whole first semester of a two-semester course is getting them to learn how to systems engineer the operational concepts, the prototypes, the requirements, the architecture, the plans and get those right before they start doing a lot of detailed programming.

IJITSA: How would you assess the current level of information technology professionals practicing a systems approach? Would you say that the IT community faces a challenge to include more systems thinking in the state of the practice and state of theory in software engineering, information systems or systems engineering?

Professor Boehm: I think there is a bit of a gap in that there are some information technology professionals who are good at business workflows and things like that, but do not have a really deep computer science background as far as knowing whether the COTS products that they rely on are scalable or able to be tailored in ways that are necessary for the application. And on the other hand, there is a bunch of people who major in computer science who know all of that stuff, but don't know much about the business workflows. I think what's really valuable is when you get information technology professionals who have enough depth to do both of those things. And so, with the business-intensive people that do IT in the business school, we have just set up a joint Master's Program where

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