

Capability-Based Software Cost Estimation (CaBSCE)

Modernizing Software Cost Estimates for Agile and DevSecOps

CaBSCE: A New Method to Align Cost Estimation with Agile and DevSecOps

Agile and DevSecOps methodologies help defense programs achieve flexibility to adapt quickly to changing needs, including the need—as described by the Defense Science Board in 2009—to “match the speed at which new IT capabilities are being introduced in today’s information age.” However, that very flexibility that is so important to mission success makes it difficult to generate accurate cost estimates for software projects. To be accurate, software cost estimation must understand the final product in advance, but Agile and DevSecOps enable changes in requirements, leaving defense programs and contractors struggling to develop cost estimates and defend their budgets.

To support accurate cost estimation while retaining all the benefits of the flexibility afforded by Agile and DevSecOps, the Software Engineering Institute (SEI) is currently developing the Capability-Based Software Cost Estimation (CaBSCE) model.

What Is CaBSCE and What Will It Achieve?

CaBSCE introduces a novel method for cost estimation that puts it on par with modern software practices where flexibility and speed are paramount. It is currently under development by the SEI, and we are designing it specifically for early lifecycle estimates. Our objectives are for the CaBSCE model to

- align with Agile and DevSecOps practices by eliminating estimation dependencies on detailed requirements and specifications
- eliminate the reliance on source lines of code (SLOC) estimates

- improve accuracy in the bidding process by using historical actuals for similar software functions and accounting for architectural and implementation uncertainties
- enable estimates based on Capability Need Statements (CNS), Initial Capabilities Documents (ICD), or Software Initial Capabilities Documents (SW-ICD)
- produce defensible, flexible, and objective cost estimates early in the lifecycle

CaBSCE: How Does It Work?

To develop the method, the SEI will analyze the wealth of software-cost and scheduling data collected by the Department of Defense (DoD) to identify groups of software components with similar functions and features. By identifying such functions, CaBSCE can provide actual effort ranges for similar functions.

For example, GPS navigation components lead travelers to their destinations by performing the following three functions: identify the current location, identify the destination, and determine the path to the destination using trigonometry and artificial intelligence algorithms. Such functions differ from compilers or text parsers, which peruse text either by comparing it to pre-specified patterns or identifying patterns in the text.

The CaBSCE method will describe capability clusters, or groups, of similar software functions. These capability clusters would contain more detail than capabilities identified in CNSs or SW-ICDs, but stakeholders involved at program initiation could identify the required software functions and consider alternate solutions at this level. Figure 1 provides an example of a capability need and how stakeholders can identify software functions to satisfy it.

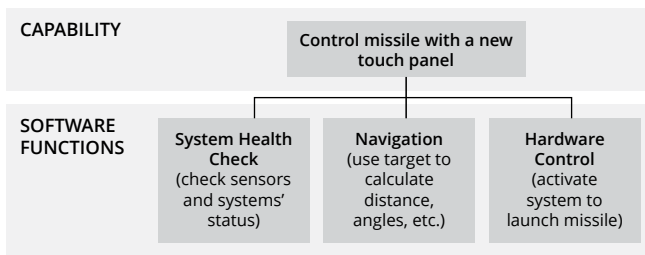


Figure 1: Example of a Capability Need and the Software Functions for Meeting It

The data points underlying the effort ranges may represent different architectural and development decisions, variations between organizations, and varying degrees of related requirements. The model allows for estimates to account for uncertainties in requirements and implementation decisions, and it enables generalization across software application types and organizations.

Collaborate with Us to Help Develop CaBSCE

We need your help to develop this novel method! The SEI is asking organizations to collaborate in data sharing so we can continue to move forward with development of CaBSCE, and we also invite you to help us pilot it.

Share Your Organizational Data

We are seeking data collected at the level of epics, capabilities, or features, with brief descriptions of the implemented software features (e.g., GPS navigation, command and control, etc.) and corresponding effort (hours).

- Contractors will remain owners of any data they share.
- We will not ask for interviews or other commitments.
- We will mask identifying data before analysis.

You can share your data in one of two ways:

- contact us to share your data directly
- execute a non-disclosure agreement (NDA) with us to grant us access to cost and scheduling data that you've already reported to the DoD. Because contractors own the data they collect, the SEI needs permission to access it. To grant access, organizations can execute an NDA with the SEI, and we will take care of the rest.
 - The SEI has a simple, one-page NDA available via web form (contact us for the link).
 - Through enactment of the NDA, contractors will not need to send any data to the SEI. We will obtain it directly from the DoD.

Help Develop and Pilot CaBSCE

We are also looking for organizations or DoD programs to collaborate with us on developing and piloting CaBSCE. This collaboration helps ensure that we work with cost estimators and subject matter experts from your organization to collect the right information, map it appropriately, develop early lifecycle estimates, and apply the CaBSCE model correctly.

There are many benefits of piloting CaBSCE, including the following:

- Receive custom insights and recommendations for improving software cost estimation data collection and model use approaches.
- Enhance staff capability and understanding of software functions, capability needs, and estimation.
- Receive training and custom support assets.
- Become early adaptors in the software cost estimation modernization effort and contribute to improving the state of the practice across the DoD.

About the SEI

Always focused on the future, the Software Engineering Institute (SEI) advances software as a strategic advantage for national security. We lead research and direct transition of software engineering, cybersecurity, and artificial intelligence technologies at the intersection of academia, industry, and government. We serve the nation as a federally funded research and development center (FFRDC) sponsored by the U.S. Department of Defense (DoD) and are based at Carnegie Mellon University, a global research university annually rated among the best for its programs in computer science and engineering.

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