

REUSABLE SOFTWARE PARTS AND THE
SEMI-ABSTRACT DATA TYPE

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The development of reusable software parts has been an area of intense discussion within the software engineering community for many years. More recently, Ada has been promoted as having the facilities for developing reusable software. However, there have been few attempts to validate reusability concepts in practice for real-time embedded applications such as missile navigation, guidance and control. For these applications parts must not only be reusable, but they must also be efficient and easy to use.

Missile guidance, navigation and control applications are noted for severe constraints in terms of processor size and computational requirements. In this paper, the author describes an approach for developing reusable parts for these applications which meet the following reusability criteria:

1. Reusable: Capable of being used/reused in a wide spectrum of applications within the domain for which the parts were developed.
2. Tailorable: Capable of being customized to the precise requirements of the using/reusing applications.
3. Efficient: Capable of operating within an environment which is severely constrained in terms of both memory and execution cycles.
4. Simple to Use: Capable of being effectively used by the average software engineer.
5. Protected Against Misuse: Capable of detecting obvious misuse.

Validating the feasibility of developing reusable parts which possess these characteristics is the basis of the Common Ada Missile Packages Program (CAMP), an Air Force sponsored program under contract to the McDonnell Douglas Astronautics Co. - St. Louis. Under CAMP, over 200 reusable software parts have been developed, including parts for navigation, Kalman Filter, signal processing and autopilot. This paper is an outgrowth of work done on that project.

The author presents six different methods for designing reusable software parts. (These methods are illustrated in the accompanying figure.) The author examines these methods through determining the impact of each method on developing a single part. He compares the methods against four evaluation criteria:

1. Appropriateness of the interface
2. Control for preventing misuse
3. Availability of needed mathematical operators and functions
4. Degree to which user's job is simplified

Each of these criteria is essential for developing parts which can be used, are reusable and are sufficiently efficient for missile navigation, guidance and control applications.

The author proposes the use of a generic approach, called the "Semi-Abstract Data Type" method, for developing reusable parts and provides a rationale for this selection. The semi-abstract data type method makes full use of Ada's generic and strong data typing facilities to create parts which are reusable, tailorable, simple to use and protected from misuse. The method achieves efficiency through the choice of data structures which are compatible with efficient algorithms and through implicit definition of user data structures.

Informal Report by the ARTEWG*

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***ARTEWG - Ada Run-Time Environment Working Group**

This session will provide a status report and an update on the ARTEWG activities.