Abstract

RASSP is an initiative to create a new process for the development of military signal processors. The objective of RASSP is to specify a process and produce an environment that reduces both the development cycle time and the life cycle support cost while increasing the product quality, all by a factor of four (4x improvement).

1.0 Introduction

The RDE is the electronic environment from which the DSP Designer has ready access to the resources that s/he needs to carry out the design, implementation, validation, and support of DSP systems. These resources are in the form of Process, Tools, and Data in a distributed development and support environment. The RDE is depicted in figure 1.
The RDE is required to manage the user's process and to provide the user with on-line access to various project and engineering databases. The instantiation of a process will be unique for a given user. For this reason the RDE is designed to be flexible enough to capture virtually any process. Either the RASSP process that is being developed as part of the development program, a user-defined process, or a combination of the RASSP process coupled with the user process. A user will be presented with the process flow and the RDE will manage the process by controlling the sequence of process steps. Once a process is established for a given user, a set of tools is mapped to the process. In practice the process flow will be realized by a series of tool invocations that operate on the design data as it matures through the development process. This design data along with the tool libraries and project documentation is to be managed by the RDE as well. The data management capability includes check in, check out, data promotion, and version control of the project data. In addition the RDE will serve as a conduit to other resources available across the internet. These include such things as access to other RDE users, electronic access to vendor products and vendor information, on-line access to DSP consulting services, as well as on-line training.

In summary, the factors that contribute to the 4x cycle time, cost, and quality improvement goals include:

- Automated Flow Manager
- Active Control and Monitoring of the Process
- Encapsulation the tools from end-to-end
- Migration to a standard data representation
- Availability of network resources
- Reuse libraries of designs, components, and software
- Ensures better access to reusable designs and implementations
- Ensures that the process flow cannot be circumvented (inadvertently or otherwise)
- Ensures that the user can proceed through the process with no discontinuity
- Ensures that the design data can proceed through the process with no format incompatibilities
- Ensures that the required design aide is available on demand

Paragraph 2.0 describes how the RDE development fits within the overall Lockheed Sanders program. Paragraph 3.0 describes the set of RDE services. Paragraph 4.0 provides a summary of the RDE objectives. Paragraph 5.0 summarizes the progress to date, as well as the plan for
the immediate and long term development. Paragraph 6.0 highlights the experiences and lessons learned during the first year, and paragraph 7.0 is the conclusion.

2.0 The Lockheed Sanders program structure

The RASSP program is divided into four (4) Functional areas as shown in figure 2. These correspond to the Systems Team, the RDE Team, the Demonstration Team, and the Proliferation Team. Each of the four functional areas is being managed by one of the Lockheed Sanders team members as shown. Each functional area is composed of an Integrated Product and Process Development Team (IPPDT) which means that even though there is a single lead identified, the team itself is composed of members from each of the four companies. The RDE is managed by Motorola, but work is being executed by team members at Lockheed, Motorola, Hughes, and ISX as if they were a single (virtual) corporation. This distributed working environment is the precursor for the implementation of the Electronic Information Corporation (EIC), wherein users connected to the Internet work cooperatively with the best process and tools to design and build a system more rapidly. The EIC is the commercial entity that has been formed to ultimately market the RASSP process and environment in the commercial marketplace.

The activities within each of the IPPDT's are structured such that the output of one team provides the input to another team's activities. The System Team is responsible for defining the process improvements on a periodic basis which is captured in the RASSP Process and Methodology document, this serves as the input to the RDE. The RDE provides the user environment that captures the process in a series of executable process steps. The demonstration team exercises the RDE by developing a DSP system (F-14 InfraRed Search and Track processor), and thereby validates the RASSP process and environment in a genuine development effort. And the Proliferation team is responsible for fielding the validated process.
**3.0 RDE enterprise framework services**

The RDE serves as the interface between the user and the design process. The process is a series of steps with each step in the process being characterized by a set of input conditions and events, a functional description, and a set of output conditions and events. The process flow is captured as part of the RDE configuration upon system startup and the user exercises the process via the RDE. As such, the RDE architecture provides a set of services to the user to facilitate this process flow. These services are referred to as the Enterprise Framework (EFW) services and consists of a Common User Interface, Document Management, Tool Encapsulation/Integration, Communication Management, and Work Flow Management. Each are described in more detail below. A set of design tools is encapsulated within the RDE. Each of the design tools maps to one or more process steps and implements the process function(s) associated with the corresponding subset of the process. Figure 3 provides an example view of three generic process steps.

Note that the simple process illustrated includes 3 process steps. Tool A maps to Step 1 and Tool B maps to both Step 2 and Step 3. Several input/output conditions (documents) and events are also depicted. The documents are stored in a "VAULT" that serves as the storage area for documents that have been released (internally or formally). The RDE is required to control the sequence from step 1, to step 2, to step 3. The sequence of events is as follows:
1. Before executing Process Step 1, the RDE checks that the input conditions and events are satisfied. In the example the RDE verifies that the two documents (A and B) are available from the vault and that both reviewers (A and B) have given their approval to proceed to the next process step. If a format conversion is required for Document A or B, or both, the RDE performs this translation.

2. The user invokes Tool A via the RDE user interface.

3. Tool A executes step A and Document C is the result. The user checks the document into the vault when it is ready for review.

4. The RDE sends a review notification to a pre-defined set of reviewers (in this case Reviewer C).

5. Reviewer C reviews and approves the document.

6. The user then invokes Process Step 2.

7. Before executing Process Step 2, the RDE checks that the input conditions and events are satisfied. If a format conversion is required for Document C, the RDE performs this translation.

8. Steps 2 and 3 execute via tool B and Document D is generated. The user checks the document into the vault when it is complete.

The set Enterprise Framework Services being developed for the RDE is shown in figure 4. A brief description of each of the services is included below.

**Common User Interface (CUI)**

The CUI provides the user with a common look and feel from the RDE desktop. The functions provided within the CUI will allow the users to configure the process to be implemented and define the promotion hierarchy (maturity levels) for the design documents. In addition users will be able to view the on-line services and databases as well as to launch the tools by double-clicking on process steps that have been activated by the RDE.

**Document Management**

The Document Management service manages the product design database. It provides capabilities for the users to search based on a set of user-defined criteria. It also provides Check-In and Check-Out, Design Folder management, Version Control, Document review and approval facilities, as well as Document State Management.

**Tool encapsulation/integration**
This service facilitates the encapsulation and integration of tools for inclusion in the RDE. Tools will be encapsulated without requiring the vendor to change their tool. This facilitates a heterogeneous set of tools to work together.

Communication management

The Communication Management Services provide both the Message and Event Management facilities. Message management includes interfacing to email servers for review notification as well as automatic notification based on event detection. Event management includes signaling a set of defined users when a configured event is detected.

Work flow management

The work flow management service includes Work Flow Automation, Work Flow Enforcement, Work Flow Editing, and Work Flow Simulation. In addition the work flow manager serves as the collection point for the RASSP process and product metrics.

4.0 RDE objectives

The specific objectives of the RDE IPPDT include the following:

- To first provide a prototype of the RDE (RDE release 0.1) to the Demonstration team that will meet the needs of the model year 1 demonstration vehicle.
- To define a set of RASSP EFW requirements.
- To evaluate the current state-of-the-shelf of EFW’s that are on the market today. The evaluation validates the degree of conformance to the RASSP EFW requirements.
- To develop a strategy for implementing the RASSP EFW
- Work with standards organization(s) in developing a set of EFW service standards.
- Implement a RASSP process that is developed by the systems team.
- Evaluate tools and technologies that support that RASSP process implementation.
- Encapsulate a set of tools that support the process.
- Collect process and product metrics designed to measure cycle time, cost, and quality
- Make periodic upgrades as new process improvements are proposed.
- Provide three (3) formal releases of the RDE (1.0, 2.0, and 3.0)

5.0 First year progress

Figure 5 illustrates the RDE progress to date. The major thrusts of the RDE development include the prototype development effort (release 0.1) and the EFW evaluation and down select. The 0.1 release was reviewed and released internally in May of this year. Build 1 of the next release (release 1.0) was kicked off in early June. The EFW evaluation has progressed to the final down select and the RDE team has chosen to use the Cadence EFW services.
The result of the EFW evaluation proved that the current state-of-the-shelf for EFWs satisfy only 50% of the RASSP requirements that were defined. As such, the Lockheed Team is initiating a partnership with Cadence whereby the RDE IPPDT will feed the RASSP requirements to Cadence. Cadence and the RDE team will then join forces to implement the desired EFW enhancements.

In addition, the team is at a point where a standards organization is required to help define the set of EFW interfaces and functions. Therefore, we have initiated discussions with the CFI organization to facilitate the understanding and definition of a set of EFW standards. The goal is to develop the first complete, CFI-compliant EFW using the combined forces of the RDE IPPDT, Cadence, and CFI.

6.0 Experiences/lessons learned

- All team members have gone through some growing pains in learning to function in the virtual corporation environment brought on by the IPPDT. In the beginning we struggled to learn each other's systems, terminology, acronyms, company culture. The IPPDT relationship between the member companies is significantly different than the typical prime/sub relationship that most of the team have been used to working in. It took some time as each of us learned how to function and relate within this unique program structure. A greater understanding of each other's systems coupled with the enhanced electronic capability (electronic video conferencing and file sharing) have reduced the impact of this distributed environment.
- The composition of the RDE took some time to define as well. It was established early on that any definition of the RDE could not include the design tools since these were not being procured as part of the RASSP contract. Some confusion arose with respect to the EFW services. They are at the heart of the RDE architecture, yet they are commercially available tools as well. This left only the tool wrappers and data
translators, which did not constitute a commercially viable product.

We reached consensus as a result of the EFW evaluations. The EFW services are to be enhanced on the contract and therefore it was concluded that the RDE would include the EFW as part of the deliverable.

- Designing the RDE in light of the commercialization requirements has proven to be a challenge as well. The RDE product must be sustained by both the military and commercial marketplaces after the development program. The OPEN vs. PROPRIETARY nature of the respective processes, tools, and design data has caused some difficulty in the early design phases of the RDE.

- The current state-of-the-shelf for the EFW capability was also a surprise. Design Frameworks are not a new concept. However, existing frameworks are designed to support a given vendor's tool set and not the requirements of the RASSP enterprise.

- A tool procurement plan was a long time in the making. As mentioned above, there is no provision for buying tools for inclusion into the RDE on the contract. The tool list is now over 100 tools and buying the tools on contractor's capital dollars proved to be problematic. The goal was to procure the tools for free so that we could integrate the CAD vendor tools into our system and thereby allow a wide variety of heterogeneous tools to work together.

  This was a nice goal but, some vendors are cooperating and others are not. So a two part plan was implemented to manage the tool procurement activity.

  PART 1: If a tool could be procured either in trade for consulting services or on a Maintenance-Only agreement, the cost is allowed on the contract.

  PART 2: If a tool could only be procured by buying a license. It is to be charged in a round robin fashion to the respective team member's capital budget.

7.0 Conclusions

The successful corporations of the 1990's and beyond will look very different than the corporations of today. Competition and the demand to produce quality products at a greatly reduced cost are what Government and commercial consumers demand today. In addition, users and consumers want their requirements met at the time they demand. Therefore, these same low cost, high quality products must be developed at a much improved time to market.

What is required is for the technology suppliers of the future to pool their resources and to take advantage of the emerging electronic marketplace. And by doing so respond to the cycle time, cost, and quality demands of today's market. Virtual corporations and distributed engineering environments are the enablers for companies wishing to compete.

RASSP is a program that will meet this challenge of the future. The Lockheed Sanders team is on the leading edge in not only developing the design environment of the future, it has structured the development program to be a virtual corporation. Thereby allowing the RASSP development team to better understand how the needs of the virtual corporation of the future map to the requirements of the RASSP Design Environment.

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