The ANDF Technology Program at the OSF RI

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1. Introduction

There are two branches of the RI ANDF program: an Advanced Technology branch whose goal is to evaluate the existing technology as a base for productization by vendors; and a Research branch whose goal is to extend the technology in a number of directions.

Our Advanced Technology objectives are as follows:

- *robustness*: to establish that the ANDF technology is capable of handling large scale applications without requiring an extensive maintenance effort.
- *accessibility*: to provide training and documentation to make the ANDF technology more accessible to system vendors (who must provide ANDF installer support) and to software vendors (who must port their applications to the ANDF portability framework).

The ANDF Research objectives are:

- *technology transfer*: to improve access to the ANDF technology for the research community at large by developing components based on freely available software.

1. This memo was written with the assistance of staff from the Grenoble and Cambridge Research Institutes.

- *scalability*: to assure that the ANDF technology can handle massively parallel architectures by investigating both language and intermediate representation issues.
- *formal methods*: to provide technologies which can demonstrate the correctness of ANDF implementations with respect to a robustly defined ANDF specification.

We are conducting this program through in-house research and collaboration with university and industrial partners. The program is supported by OSF funding, direct funding from industrial partners, and government contracts with DARPA and Esprit. The program is open—our results are reported to the technical community and our prototypes are available to OSF members under the ANDF snapshot license as unsupported experimental code.

The next two sections discusses current Advanced Technology and Research projects being pursued to accomplish these objectives. SECTION 4 lists future projects. SECTION 5 summarizes our interactions with the research members of OSF and SECTION 6 concludes with reflections on the technology transfer process to OSF Engineering or directly to vendor companies.

2. Advanced Technology Projects

The goal of these projects is to ensure that the existing technology is adequate for real-world applications. To achieve this goal, the RI will work closely with DRA, the ANDF technology provider, as well as with ISVs, vendors and OSF membership, to ascertain their needs.

The Portability Project

This project is analyzing the applicability of the ANDF technology to a wide variety of application and system software. The intent is to produce guidelines for making applications portable and then utilize these guidelines to port a number of application codes, both freely available and commercially licensed. The principal result of this effort will be an ANDF Porting Guide, which will provide a step-by-step approach to doing an ANDF "Portability" port of application codes. OSF will also formulate training materials suitable for use in conjunction with "hands-on" use of the ANDF technology.

The Robustness Project

This project is focussed on assuring that the ANDF technology is applicable for real world applications, as well as being able to pass industry standard validation and performance suites. OSF has licensed the necessary suites to provide both standard language coverage and benchmark data. OSF has also determined that the available suites do not provide full coverage for all points within the ANDF technology, and thus is developing an additional set of tests, based on regression reports, as well as employing a representative set of the application codes. This project will also verify that the initial ANDF size and performance guidelines are still maintained throughout the technology development cycle.

The Technology Transfer Project

This project is designed to make the ANDF technology itself more accessible to those who are interested in building and delivering ANDF technology components. The initial focus is on making the Installer portion of the technology accessible by providing a bridge between ANDF and the freely available GNU C code generator technology. This will accomplish three goals:

- provide a vehicle for providing additional platforms with ANDF installers, since gcc has many existing ports, with many others under development for new architectures;
- demonstrate the feasibility of interfacing the ANDF technology to existing code generator technologies, including proprietary technologies from system vendors; and
- provide a basis for training materials on utilizing and integrating with the ANDF technology.

3. Research Projects

The aim of these projects is to extend the ANDF technology to areas which are not presently covered. This will include, not only extending the existing base, by providing producers for C++ and F77 and installers for additional machine architectures, but also more fundamental investigations such as the development of validation technology based on formal models and extensions of ANDF to parallel architecture machines.

The High Performance Computing ANDF Project

This project, funded by DARPA, is to investigate the applicability of ANDF and the ANDF technologies to the High Performance Computing community. The project will focus on issues related to detecting and expressing parallelism in ANDF, as well as supporting explicit parallelism, such as that generated by Fortran-90 or C*. It will produce tools which demonstrate the effective use of parallelism in both ANDF and the companion installer(s).

The OMI/GLUE Project

The GLUE (Global Language support and Uniform Environment) project is part of the Open Microprocessor Initiative (OMI), which is funded under the European Esprit program.

There are four major themes to the GLUE project: formal specification and validation; enlarging the core technology, by developing additional producers (C++, F77) and installers (Sparc, Transputer, Alpha, and O1, a processor to be developed by the OMI) and enhancing the ANDF run-time and development environment (by developing a debugger, optimizer, installation manager, etc.); developing ANDF extensions and prototype producers for “advanced languages” (Ada and Lisp); and finally ANDF extensions for parallelism (Occam producer, MIMD installer).

The OSF RI effort will be concentrated on validation of the ANDF technology. However, smaller amounts of manpower are also allocated to tasks within the other areas, including: the support for DCE/RPC; performance evaluation results; and, in collaboration with the other partners, extensions of the ANDF specifications for Ada and Lisp, and for parallelism.

4. Future Projects

These projects are considered valuable for the overall program in ANDF technology, but are not currently funded. As other projects complete or as outside funding is obtained, they may be pursued.

Producer Technology

This project could be a companion to the Technology Transfer Project (P3) except that it would concentrate on issues related to producer technology generating ANDF, rather than installer technology consuming ANDF. The issues here are identifying the portability issues in the language(s) to be considered and then designing a standard interface which properly defers the implementation-defined behaviors to the installer via the ANDF Token mechanism.

5. Communication with the OSF Membership

The OSF RI will continue to promote involvement of the technical communicy and OSF membership in the review and experimentation of ANDF technology through electronic mailing lists, and the ANDF Snapshot Program respectively.

The RI will provide research distributions to OSF members who are ANDF Snapshot licensees and several Snapshots are planned for 1993. The technology is provided as unsupported code.

6. Technology Transfer Plans

There are several technology transfer strategies possible for ANDF in 1993:

- OSF initiates an engineering program to produce a general offering consisting of a specification, reference implementation and validation suites.
- OSF provides a specification and validation suite only. Installers and producers are provided by others.
- ANDF transfers directly to the industry and OSF has no further role. The specification is maintained by a standards organization and the technology is produced by third parties.
- The technolody does not transfer in 93.

Which of these options is selected by OSF will depend on acceptance by vendors. We will assess their willingness to support the technology periodically. Of course, should the technology prove impracticalat this time, then the research program would continue, but no technology transfer would take place in 93.

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