NASA and The Future of Fortran

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Agenda

Recent changes to the standard (F2003, F2008)
Upcoming changes (F2015)
Fortran standards process
NASA engagement
The Present of Fortran

Fortran 2008 (ISO/IEC 1539-1:2010)
• Major features: coarrays, DO CONCURRENT, BLOCK, submodules
• Full implementation by Cray

• Major features: polymorphism and OO, C interoperability, IEEE floating control
• Full implementation by Cray, IBM, Intel, PGI

Compiler Support for the Fortran 2003 and 2008 Standards” updated 3X/year in ACM SIGPlan Fortran Forum:
http://portal.acm.org/sigplan/newsletter/fortran/
Fortran 2015 New Features

Integration of two Technical Specification documents
- TS29113 – Further C interoperability
- TS18508 – Additional parallel features

Limited new features and “wart removal”
- Intrinsics COSHAPE, OUT_OF_RANGE, RANDOM_INIT, RANK, REDUCE
- Procedures are recursive by default (unless NON_RECURSIVE)
- IMPLICIT NONE (EXTERNAL) disables implicit interface
- EX edit descriptor for hexadecimal significand
- G\theta \cdot d can now be used for integer, logical, character
Further C Interoperability

Guided by requests from MPI Forum

Assumed type dummy arguments: TYPE(*)

Assumed rank dummy arguments: DIMENSION(..)

“C Descriptors” for passing more information to and from C
  • ISO_Fortran_binding.h declares C descriptors and procedures for manipulating them
  • Fortran compiler automatically creates/interprets these – no visibility from Fortran code

Relaxed restrictions on dummy arguments to BIND(C) procedures:
  • OPTIONAL, ALLOCATABLE, POINTER, assumed-shape, deferred-length character now allowed
Additional Parallel Features

- Teams of images
- Events
- Atomic procedures (ATOMIC_ADD, etc.)
- Collective subroutines (CO_BROADCAST, CO_MAX, etc.)
- Ability to detect “failed images”
Newly Deleted and Obsolescent Features

Deleted features
  - Nonblock DO (not ending on END  DO  or CONTINUE)

Obsolescent features
  - Labeled DO (DO  10  ...)
  - Arithmetic IF
  - BLOCK  DATA
  - EQUIVALENCE
  - COMMON
  - FORALL
Current Fortran 2015 Schedule

2015 – Technical work complete
2016 – Draft standard out for ballot
2017 – Publication

But... Parallel features TS not yet final – may affect schedule!
The Fortran Standard Committees

INCITS PL22.3 (aka “J3”)
- The U.S. Fortran Standards committee
- ~12 member organizations (mostly vendors and federally funded orgs)
- Meets 3 times per year
- http://j3-fortran.org

ISO/IEC JTC1/SC22/WG5
- the international Fortran Working Group
- determines the broad technical content of the Standards
- Delegates to PL22.3 as the Primary Development Body
- http://www.nag.co.uk/sc22wg5/
Changing the standard

Anyone can submit a proposed change, but ...
  • Helps to have an advocate at the meeting.

Anyone can attend meetings, but ...
  • Only members can formally vote.
  • At most one member per organization, but multiple alternates

General advice:
  • The committee prefers *use cases* over feature requests
  • Preserve backward compatibility
  • Consider implementation difficulty for vendors
NASA participation

I recently joined J3 as the NASA representative
  • Note that JPL (Cal Tech) also has a representative
Need mechanisms to solicit requirements and priorities across the agency
How to communicate?
  • Mailing list for NASA-centric discussions of the Fortran standard
    • fortran-users@lists.nasa.gov - low bandwidth
    • Requests/discussions for new features
    • Occasional polls for priorities (not a democracy)
  • Or directly  Thomas.L.Clune@nasa.gov
  • There may be an alternate member at Ames (Henry Jin)
Potential priorities for Fortran 2020

Improved facilities for generic programming
  • C++ Standard Template Library (STL)
  • Parameterized modules

Improved testability of Fortran code
  • Program by contract
    • Mechanism to check preconditions, post-conditions and invariants on interfaces
  • Exception handling

Checking physical units

Extend OO – e.g. Java style interfaces

Deferred rank arrays

...
Thank you!

Questions / discussion