

GNU Fortran Internals

For GCC version 16.0.0 (pre-release)

(GCC)

The gfortran team

Published by the Free Software Foundation
51 Franklin Street, Fifth Floor
Boston, MA 02110-1301, USA

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1 Introduction

This manual documents the internals of **gfortran**, the GNU Fortran compiler.

Warning: This document, and the compiler it describes, are still under development. While efforts are made to keep it up-to-date, it might not accurately reflect the status of the most recent GNU Fortran compiler.

At present, this manual is very much a work in progress, containing miscellaneous notes about the internals of the compiler. It is hoped that at some point in the future it will become a reasonably complete guide; in the interim, GNU Fortran developers are strongly encouraged to contribute to it as a way of keeping notes while working on the compiler.

not an error existed. To check the state of the buffer without changing its state or reporting the errors, the `gfc_error_flag_test` function can be used. The `gfc_clear_error` function will clear out any errors in the buffer, without reporting them. The `gfc_warning_check` and `gfc_clear_warning` functions provide equivalent functionality for the warning buffer.

Only one error and one warning can be in the buffers at a time, and buffering another will overwrite the existing one. In cases where one may wish to work on a smaller piece of source code without disturbing an existing error state, the `gfc_push_error`, `gfc_pop_error`, and `gfc_free_error` mechanism exists to implement a stack for the error buffer.

For cases where an error or warning should be reported immediately rather than buffered, the `gfc_error_now` and `gfc_warning_now` functions can be used. Normally, the compiler will continue attempting to parse the program after an error has occurred, but if this is not appropriate, the `gfc_fatal_error` function should be used instead. For errors that are always the result of a bug somewhere in the compiler, the `gfc_internal_error` function should be used.

The syntax for the strings used to produce the error/warning message in the various error and warning functions is similar to the `printf` syntax, with `'%'`-escapes to insert variable values. The details, and the allowable codes, are documented in the `error_print` function in `error.cc`.

3.2.7 Constant Substring References

`EXPR_SUBSTRING` is a special type of expression that encodes a substring reference of a constant string, as in the following code snippet:

```
x = "abcde"(1:2)
```

In this case, `value.character` contains the full string's data as if it was a string constant, but the `ref` member is also set and points to a substring reference as described in the subsection above.

Evaluating Fortran expressions often require things to be done before and after evaluation of the expression, for example code for the allocation of a temporary variable and its subsequent deallocation. Therefore, `gfc_se` contains the members `pre` and `post`, which point to `stmt_block` blocks for code that needs to be executed before and after evaluation of the expression.

When using a local `gfc_se` to convert some expression, it is often necessary to add the generated `pre` and `post` blocks to the `pre` or `post` blocks of the outer `gfc_se`. Code like this (lifted from `trans-expr.cc`) is fairly common:

```
gfc_se cont_se;
tree cont_var;

/* cont_var = is_contiguous (expr); . */
gfc_init_se (&cont_se, parmse);
gfc_conv_is_contiguous_expr (&cont_se, expr);
gfc_add_block_to_block (&se->pre, &(&cont_se)->pre);
gfc_add_modify (&se->pre, cont_var, cont_se.expr);
gfc_add_block_to_block (&se->pre, &(&cont_se)->post);
```

Conversion functions which need a `gfc_se` structure will have a corresponding argument.

`gfc_se` also contains pointers to a `gfc_ss` and a `gfc_loopinfo` structure. These are needed by the scalarizer.

5.3 Translating statements

Translating statements to `tree` is done by functions called `gfc_trans_*`. These functions usually get passed a `gfc_code` structure, evaluate any expressions and then return a `tree` structure.

5.4 Accessing declarations

`gfc_symbol`, `gfc_charlen` and other front-end structures contain a `backend_decl` variable, which contains the `tree` used for accessing that entity in the middle-end.

Accessing declarations is usually done by functions called `gfc_get*`.

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