My Project

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Chapter 1

A Consumer Library Interface to DWARF

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1.1 Suggestions for improvement are welcome.

Your thoughts on the document?

A) Are the section and subsection titles on Main Page meaningful to you?

B) Are the titles on the Modules page meaningful to you?

Anything else you find misleading or confusing? Send suggestions to (libdwarf (at) linuxmail with final characters .org) Sorry about the simple obfuscation to keep bots away.

Thanks in advance for any suggestions.

1.2 Downloading Libdwarf

Project page is at `https://github.com/davea42/libdwarf-code`

There is a Releases area on the project page, click Latest and you will be presented with options to download the source in three different forms.

For details on licensing, see COPYING in the files list.

README.md may be of interest (automatically shown on the project page on github..

Examples of using libdwarf are in doc/checkexamples.c and src/bin/dwarfexamples.

To download source, one can also do:

git clone `https://github.com/davea42/libdwarf-code` **code**

Some tests simply assume the project source base name is **code** which is why the above is as shown. This is a grave historical misfeature that needs to be fixed in the test scripts.

1.3 Introduction

This document describes an interface to *libdwarf*, a library of functions to provide access to DWARF debugging information records, DWARF line number information, DWARF address range and global names information, weak names information, DWARF frame description information, DWARF static function names, DWARF static variables, and DWARF type information. In addition the library provides access to several object sections (created by compiler writers and for debuggers) related to debugging but not mentioned in any DWARF standard.

The DWARF Standard has long mentioned the "Unix International Programming Languages Special Interest Group" (PLSIG), under whose auspices the DWARF committee was formed around 1991. "Unix International" was disbanded in the 1990s and no longer exists.

The DWARF committee published DWARF2 July 27, 1993, DWARF3 in 2005, DWARF4 in 2010, and DWARF5 in 2017.

In the mid 1990s this document and the library it describes (which the committee never endorsed, having decided not to endorse or approve any particular library interface) was made available on the internet by Silicon Graphics, Inc.

In 2005 the DWARF committee began an affiliation with FreeStandards.org. In 2007 FreeStandards.org merged with The Linux Foundation. The DWARF committee dropped its affiliation with FreeStandards.org in 2007 and established the dwarfstd.org website.

See also

`https://www.dwarfstd.org` for current information on standardization activities and a copy of the standard.

1.4 Thread Safety

Libdwarf can safely open multiple Dwarf_Debug pointers simultaneously but all such Dwarf_Debug pointers must be opened within the same thread. And all *libdwarf* calls must be made from within that single (same) thread.

1.5 Error Handling in libdwarf

Essentially every *libdwarf* call could involve dealing with an error (possibly data corruption in the object file). Here we explain the two main approaches the library provides (though we think only one of them is truly appropriate except in toy programs). In all cases where the library returns an error code (almost every library function does) the caller should check whether the returned integer is DW_DLV_OK, DW_DLV_ERROR, or DW_DLV_NO_ENTRY and then act accordingly.

A) The recommended approach is to define a Dwarf_Error and initialize it to 0.

```
Dwarf_Error error = 0;
```

Then, in every call where there is a Dwarf_Error argument pass its address. For example:

```
int res = dwarf_tag(die,DW_TAG_compile_unit,&error);
```

The possible return values to res are, in general:

```
DW_DLV_OK
DW_DLV_NO_ENTRY
DW_DLV_ERROR
```

If **DW_DLV_ERROR** is returned then error is set (by the library) to a pointer to important details about the error and the library will not pass back any data through other pointer arguments. If **DW_DLV_NO_ENTRY** is returned the error argument is ignored by the library and the library will not pass back any data through pointer arguments. If **DW_DLV_OK** is returned argument pointers that are defined as ways to return data to your code are used and values are set in your data by the library.

Some functions cannot possibly return some of these three values. As defined later for each function.

B) An alternative (not recommended) approach is to pass NULL to the error argument.

```
int res = dwarf_tag(die,DW_TAG_compile_unit,NULL);
```

If your initialization provided an 'errhand' function pointer argument (see below) the library will call errhand if an error is encountered. (Your errhand function could exit if you so choose.)

The the library will then return DW_DLV_ERROR, though you will have no way to identify what the error was. Could be a malloc fail or data corruption or an invalid argument to the call, or something else.

That is the whole picture. The library never calls exit() under any circumstances.

1.5.1 Error Handling at Initialization

Each initialization call (for example)

```
Dwarf_Debug   dbg = 0;
const char   *path = "myobjectfile";
char         *true_path = 0;
unsigned int  true_pathlen = 0;
Dwarf_Handler errhand = 0;
Dwarf_Ptr     errarg = 0;
Dwarf_Error   error = 0;
int           res = 0;

res = dwarf_init_path(path,true_path,true_pathlen,
    DW_GROUPNUMBER_ANY,errhand,errarg,&dbg,&error);
```

has two arguments that appear nowhere else in the library.

```
Dwarf_Handler errhand
Dwarf_Ptr     errarg
```

For the **recommended A)** approach:

Just pass NULL to both those arguments. If the initialization call returns DW_DLV_ERROR you should then call

```
dwarf_dealloc_error(dbg,error);
```

to free the Dwarf_Error data because dwarf_finish() does not clean up a dwarf-init error. This works even though *dbg* will be NULL.

For the **not recommended B)** approach:

Because dw_errarg is a general pointer one could create a struct with data of interest and use a pointer to the struct as the dw_errarg. Or one could use an integer or NULL, it just depends what you want to do in the Dwarf_Handler function you write.

If you wish to provide a dw_errhand, define a function (this first example is not a good choice as it terminates the application!).

```
void bad_dw_errhandler(Dwarf_Error error,Dwarf_Ptr ptr)
{
    printf("ERROR Exit on %lx due to error 0x%lx %s\n",
        (unsigned long)ptr,
        (unsigned long)dwarf_errno(error),
        dwarf_errmsg(error));
    exit(1)
}
```

and pass bad_dw_errhandler (as a function pointer, no parentheses).

The Dwarf_Ptr argument your error handler function receives is the value you passed in as dw_errarg, and can be anything, it allows you to associate the callback with a particular dwarf_init∗ call if you wish to make such an association.

By doing an exit() you guarantee that your application abruptly stops. This is only acceptable in toy or practice programs.

A better dw_errhand function is

```
void my_dw_errhandler(Dwarf_Error error,Dwarf_Ptr ptr)
{
    /*  Clearly one could write to a log file or do
        whatever the application finds useful. */
    printf("ERROR on %lx due to error 0x%lx %s\n",
        (unsigned long)ptr,
        (unsigned long)dwarf_errno(error),
        dwarf_errmsg(error));
}
```

because it returns rather than exiting. It is not ideal. The DW_DLV_ERROR code is returned from *libdwarf* and your code can do what it likes with the error situation. The library will continue from the error and will return an error code on returning to your @libdwarf call ... but the calling function will not know what the error was.

```
Dwarf_Ptr x = address of some struct I want in the errhandler;
res = dwarf_init_path(...,my_dw_errhandler,x,... );
if (res == ...)
```

If you do not wish to provide a dw_errhand, just pass both arguments as NULL.

1.5.2 Error Handling Everywhere

So let us examine a simple case where anything could happen. We are taking the **recommended A)** method of using a non-null Dwarf_Error∗:

```
int func(Dwarf_Dbg dbg,Dwarf_Die die, Dwarf_Error* error) {
    Dwarf_Die newdie = 0;
    int       res = 0;

    res = dwarf_siblingof_c(die,&newdie,error);
    if (res != DW_DLV_OK) {
        /*  Whether DW_DLV_ERROR or DW_DLV_NO_ENTRY
            (the latter is actually impossible
            for this function) returning res is the
            appropriate default thing to do. */
        return res;
    }
    /*  Do something with newdie. */
    dwarf_dealloc_die(newdie);
    newdie = 0; /* A good habit... */
    return DW_DLV_OK;
}
```

1.5.2.1 DW_DLV_OK

When res == DW_DLV_OK newdie is a valid pointer and when appropriate we should do dwarf_dealloc_die(newdie). For other *libdwarf* calls the meaning depends on the function called, so read the description of the function you called for more information.

1.5.2.2 DW_DLV_NO_ENTRY

When res == DW_DLV_NO_ENTRY then newdie is not set and there is no error. It means die was the last of a siblinglist. For other *libdwarf* calls the meaning depends on the function called, so read the description of the function you called for more information.

1.5.2.3 DW_DLV_ERROR

When res == DW_DLV_ERROR Something bad happened. The only way to know what happened is to examine the ∗error as in

```
int ev = dwarf_errno(*error);
or
char * msg  = dwarf_errmsg(*error);
```

or both and report that somehow.

The above three values are the only returns possible from the great majority of *libdwarf* functions, and for these functions the return type is always **int** .

If it is a decently large or long-running program then you want to free any local memory you allocated and return res. If it is a small or experimental program print something and exit (possibly leaking memory).

If you want to discard the error report from the dwarf_siblingof_c() call then possibly do

```
dwarf_dealloc_error(dbg,*error);
*error = 0;
return DW_DLV_OK;
```

Except in a special case involving function dwarf_set_de_alloc_flag() (which you will not usually call), any dwarf_dealloc() that is needed will happen automatically when you call dwarf_finish().

1.5.2.4 Slight Performance Enhancement

Very long running library access programs using relevant appropriate dwarf_dealloc calls should consider calling dwarf_set_de_alloc_flag(0). Using this one could get a performance enhancement of perhaps five percent in *libdwarf* CPU time and a reduction in memory use.

Be sure to test using valgrind or -fsanitize to ensure your code really does the extra dwarf_dealloc calls needed since when using dwarf_set_de_alloc_flag(0) dwarf_finish() does only limited cleanup.

1.6 Extracting Data Per Compilation Unit

The library is designed to run a single pass through the set of Compilation Units (CUs), via a sequence of calls to dwarf_next_cu_header_e(). (dwarf_next_cu_header_d() is supported but its use requires that it be immediately followed by a call to dwarf_siblingof_b(). see dwarf_next_cu_header_d().)

Within a CU opened with dwarf_next_cu_header_e() do something (if desired) on the CU_DIE returned, and call dwarf_child() on the CU_DIE to begin recursing through all DIEs. If you save the CU_DIE you can repeat passes beginning with dwarf_child() on the CU_DIE, though it almost certainly faster to remember, in your data structures, what you need from the first pass.

The general plan:
```
create your local data structure(s)

A.  Check your local data structures to see if
    you have what you need
B.  If sufficient data present act on it,
    ensuring your data structures are kept for
    further use.
C.  Otherwise Read a CU, recording relevant data
    in your structures and loop back to A.
```

For an example (best approach)

See also

Example walking CUs(e) or (second-best approach)

Example walking CUs(d) Write your code to record relevant (to you) information from each CU as you go so your code has no need for a second pass through the CUs. This is much much faster than allowing multiple passes would be.

1.7 Line Table Registers

Line Table Registers

Please refer to the DWARF5 Standard for details. The line table registers are named in Section 6.2.2 State Machine Registers and are not much changed from DWARF2.

Certain functions on Dwarf_Line data return values for these 'registers' as these are the data available for debuggers and other tools to relate a code address to a source file name and possibly also to a line number and column-number within the source file.
```
address
op_index
file
line
column
is_stmt
basic_block
end_sequence
prologue_end
epilogue_begin
isa
discriminator
```

1.8 Reading Special Sections Independently

DWARF defines (in each version of DWARF) sections which have a somewhat special character. These are referenced from compilation units and other places and the Standard does not forbid blocks of random bytes at the start or end or between the areas referenced from elsewhere.

Sometimes compilers (or linkers) leave trash behind as a result of optimizations. If there is a lot of space wasted that way it is quality of implementation issue. But usually the wasted space, if any, is small.

Compiler writers or others may be interested in looking at these sections independently so *libdwarf* provides functions that allow reading the sections without reference to what references them.

Abbreviations can be read independently

Strings can be read independently

String Offsets can be read independently

The addr table can be read independently

Those functions allow starting at byte 0 of the section and provide a length so you can calculate the next section offset to call or refer to.

Usually that works fine. If there is some random data somewhere outside of referenced areas or the data format is a gcc extension of an early DWARF version the reader function may fail, returning DW_DLV_ERROR. Such an error is neither a compiler bug nor a *libdwarf* bug.

1.9 Special Frame Registers

In dealing with .debug_frame or .eh_frame there are five values that must be set unless one has relatively few registers in the target ABI (anything under 188 registers, see dwarf.h DW_FRAME_LAST_REG_NUM for this default).

The requirements stem from the design of the section. See the DWARF5 Standard for details. The .debug_frame section is basically the same from DWARF2 on. The .eh_frame section is similar to .debug_frame but is intended to support exception handling and has fields and data not present in .debug_frame.

Keep in mind that register values correspond to columns in the theoretical fully complete line table of a row per pc and a column per register.

There is no time or space penalty in setting **Undefined_Value, Same_Value,** and **CFA_Column** much larger than the **Table_Size**.

Here are the five values.

Table_Size: This sets the number of columns in the theoretical table. It starts at DW_FRAME_LAST_REG_NUM which defaults to 188. This is the only value you might need to change, given the defaults of the others are set reasonably large by default.

Undefined_Value: A register number that means the register value is undefined. For example due to a call clobbering the register. DW_FRAME_UNDEFINED_VAL defaults to 12288. There no such column in the table.

Same_Value: A register number that means the register value is the same as the value at the call. Nothing can have clobbered it. DW_FRAME_SAME_VAL defaults to 12289. There no such column in the table.

Initial_Value: The value must be either DW_FRAME_UNDEFINED_VAL or DW_FRAME_SAME_VAL to represent how most registers are to be thought of at a function call. This is a property of the ABI and instruction set. Specific frame instructions in the CIE or FDE will override this for registers not matching this value.

CFA_Column: A number for the CFA. Defined so we can use a register number to refer to it. DW_FRAME_CFA↩_COL defaults to 12290. There no such column in the table. See libdwarf.h struct Dwarf_Regtable3_s member rt3_cfa_rule or function dwarf_get_fde_info_for_cfa_reg3_b() or function dwarf_get_fde_info_for_cfa_reg3_c() .

A set of functions allow these to be changed at runtime. The set should be called (if needed) immediately after initializing a Dwarf_Debug and before any other calls on that Dwarf_Debug. If just one value (for example, Table↩_Size) needs altering, then just call that single function.

For the library accessing frame data to work properly there are certain invariants that must be true once the set of functions have been called.

REQUIRED:
```
Table_Size      > the number of registers in the ABI.
Undefined_Value != Same_Value
CFA_Column      != Undefined_value
CFA_Column      != Same_value
Initial_Value   == Same_Value ||
    (Initial_Value == Undefined_value)
Undefined_Value > Table_Size
Same_Value      > Table_Size
CFA_Column      > Table_Size
```

1.10 .debug_pubnames etc DWARF2-DWARF4

Each section consists of a header for a specific compilation unit (CU) followed by an a set of tuples, each tuple consisting of an offset of a compilation unit followed by a null-terminated namestring. The tuple set is ended by a 0,0 pair. Then followed with the data for the next CU and so on.

The function set provided for each such section allows one to print all the section data as it literally appears in the section (with headers and tuples) or to treat it as a single array with CU data columns.

Each has a set of 6 functions.
```
Section          typename      Standard
.debug_pubnames  Dwarf_Global  DWARF2-DWARF4
.debug_pubtypes  Dwarf_Global  DWARF3,DWARF4
```

These sections are accessed calling dwarf_globals_by_type() using type of DW_GL_GLOBALS or DW_GL_↩PUBTYPES. Or call dwarf_get_pubtypes().

The following four were defined in SGI/IRIX compilers in the 1990s but were never part of the DWARF standard. These sections are accessed calling dwarf_globals_by_type() using type of DW_GL_FUNCS,DW_GL_↩TYPES,DW_GL_VARS, or DW_GL_WEAKS.

It not likely you will encounter these four sections.
```
.debug_funcs
.debug_typenames
.debug_vars
.debug_weaks
```

1.11 Reading DWARF with no object file present

This most commonly happens with just-in-time compilation, and someone working on the code wants do debug this on-the-fly code in a situation where nothing can be written to disc, but DWARF can be constructed in memory.

For a simple example of this

See also

Demonstrating reading DWARF without a file.

But the *libdwarf* feature can be used in a wide variety of ways.

For example, the DWARF data could be kept in simple files of bytes on the internet. Or on the local net. Or if files can be written locally each section could be kept in a simple stream of bytes in the local file system.

Another example is a non-standard file system, or file format, with the intent of obfuscating the file or the DWARF.

For this to work the code generator must generate standard DWARF.

Overall the idea is a simple one: You write a small handful of functions and supply function pointers and code implementing the functions. These are part of your application or library, not part of *libdwarf*.

You set up a little bit of data with that code (all described below) and then you have essentially written the dwarf↩ _init_path equivalent and you can access compilation units, line tables etc and the standard *libdwarf* function calls work.

Data you need to create involves these types. What follows describes how to fill them in and how to make them work for you.

```
typedef struct Dwarf_Obj_Access_Interface_a_s
    Dwarf_Obj_Access_Interface_a;
struct Dwarf_Obj_Access_Interface_a_s {
    void*                             ai_object;
    const Dwarf_Obj_Access_Methods_a *ai_methods;
};

typedef struct Dwarf_Obj_Access_Methods_a_s
    Dwarf_Obj_Access_Methods_a
struct Dwarf_Obj_Access_Methods_a_s {
    int     (*om_get_section_info)(void* obj,
        Dwarf_Unsigned section_index,
        Dwarf_Obj_Access_Section_a* return_section,
        int* error);
    Dwarf_Small      (*om_get_byte_order)(void* obj);
    Dwarf_Small      (*om_get_length_size)(void* obj);
    Dwarf_Small      (*om_get_pointer_size)(void* obj);
    Dwarf_Unsigned   (*om_get_filesize)(void* obj);

    Dwarf_Unsigned   (*om_get_section_count)(void* obj);
    int              (*om_load_section)(void* obj,
        Dwarf_Unsigned section_index,
        Dwarf_Small** return_data, int* error);
    int              (*om_relocate_a_section)(void* obj,
        Dwarf_Unsigned section_index,
        Dwarf_Debug dbg,
        int* error);
};

typedef struct Dwarf_Obj_Access_Section_a_s
    Dwarf_Obj_Access_Section_a
struct Dwarf_Obj_Access_Section_a_s {
    const char*    as_name;
    Dwarf_Unsigned as_type;
    Dwarf_Unsigned as_flags;
    Dwarf_Addr     as_addr;
    Dwarf_Unsigned as_offset;
    Dwarf_Unsigned as_size;
    Dwarf_Unsigned as_link;
    Dwarf_Unsigned as_info;
    Dwarf_Unsigned as_addralign;
    Dwarf_Unsigned as_entrysize;
};
```

Dwarf_Obj_Access_Section_a: Your implementation of a **om_get_section_info** must fill in a few fields for *libdwarf*. The fields here are standard Elf, but for most you can just use the value zero. We assume here you will not be doing relocations at runtime.

as_name: Here you set a section name via the pointer. The section names must be names as defined in the DWARF standard, so if such do not appear in your data you have to create the strings yourself.

as_type: Fill in zero.

as_flags: Fill in zero.

as_addr: Fill in the address, in local memory, where the bytes of the section are.

as_offset: Fill in zero.

as_size: Fill in the size, in bytes, of the section you are telling *libdwarf* about.

as_link: Fill in zero.

as_info: Fill in zero.

as_addralign: Fill in zero.

as_entrysize: Fill in one(1).

Dwarf_Obj_Access_Methods_a_s: The functions we need to access object data from *libdwarf* are declared here.

In these function pointer declarations 'void ∗obj' is intended to be a pointer (the object field in Dwarf_Obj_Access↩_Interface_s) that hides the library-specific and object-specific data that makes it possible to handle multiple object formats and multiple libraries. It is not required that one handles multiple such in a single *libdwarf* archive/shared-library (but not ruled out either). See dwarf_elf_object_access_internals_t and dwarf_elf_access.c for an example.

Usually the struct **Dwarf_Obj_Access_Methods_a_s** is statically defined and the function pointers are set at compile time.

The om_get_filesize member is new September 4, 2021. Its position is NOT at the end of the list. The member names all now have om_ prefix.

1.12 Section Groups: Split Dwarf, COMDAT groups

A typical executable or shared object is unlikely to have any section groups, and in that case what follows is irrelevant and unimportant.

COMDAT groups are defined by the Elf ABI and enable compilers and linkers to work together to eliminate blocks of duplicate DWARF and duplicate CODE.

Split Dwarf (sometimes referred to as Debug Fission) allows compilers and linkers to separate large amounts of DWARF from the executable, shrinking disk space needed in the executable while allowing full debugging (also applies to shared objects).

See the DWARF5 Standard, Section E.1 Using Compilation Units page 364.

To name COMDAT groups (defined later here) we add the following defines to libdwarf.h (the DWARF standard does not specify how to do any of this).

```
/*  These support opening DWARF5 split dwarf objects and
    Elf SHT_GROUP blocks of DWARF sections. */
#define DW_GROUPNUMBER_ANY  0
#define DW_GROUPNUMBER_BASE 1
#define DW_GROUPNUMBER_DWO  2
```

The DW_GROUPNUMBER_ are used in *libdwarf* functions dwarf_init_path(), dwarf_init_path_dl() and dwarf_init_b(). In all those cases unless you know there is any complexity in your object file, pass in DW_↩GROUPNUMBER_ANY.

To see section groups usage, see the example source:

See also

A simple report on section groups.

Examining Section Group data

The function interface declarations:

See also

dwarf_sec_group_sizes

dwarf_sec_group_map

If an object file has multiple groups *libdwarf* will not reveal contents of more than the single requested group with a given dwarf_init_path() call. One must pass in another groupnumber to another dwarf_init_path(), meaning initialize a new Dwarf_Debug, to get *libdwarf* to access that group.

When opening a Dwarf_Debug the following applies:

If DW_GROUPNUMBER_ANY is passed in *libdwarf* will choose either of DW_GROUPNUMBER_BASE(1) or DW←_GROUPNUMBER_DWO (2) depending on the object content. If both groups one and two are in the object *libdwarf* will chose DW_GROUPNUMBER_BASE.

If DW_GROUPNUMBER_BASE is passed in *libdwarf* will choose it if non-split DWARF is in the object, else the init call will return DW_DLV_NO_ENTRY.

If DW_GROUPNUMBER_DWO is passed in *libdwarf* will choose it if .dwo sections are in the object, else the init will call return DW_DLV_NO_ENTRY.

If a groupnumber greater than two is passed in *libdwarf* accepts it, whether any sections corresponding to that groupnumber exist or not. If the groupnumber is not an actual group the init will call return DW_DLV_NO_ENTRY.

For information on groups "dwarfdump -i" on an object file will show all section group information **unless** the object file is a simple standard object with no .dwo sections and no COMDAT groups (in which case the output will be silent on groups). Look for **Section Groups data** in the dwarfdump output. The groups information will be appearing very early in the dwarfdump output.

Sections that are part of an Elf COMDAT GROUP are assigned a group number > 2. There can be many such COMDAT groups in an object file (but none in an executable or shared object). Each such COMDAT group will have a small set of sections in it and each section in such a group will be assigned the same group number by *libdwarf*.

Sections that are in a .dwp .dwo object file are assigned to DW_GROUPNUMBER_DWO,

Sections not part of a .dwp package file or a.dwo section, or a COMDAT group are assigned DW_←GROUPNUMBER_BASE.

At least one compiler relies on relocations to identify COMDAT groups, but the compiler authors do not publicly document how this works so we ignore such (these COMDAT groups will result in *libdwarf* returning DW_DLV_←ERROR).

Popular compilers and tools are using such sections. There is no detailed documentation that we can find (so far) on how the COMDAT section groups are used, so *libdwarf* is based on observations of what compilers generate.

1.13 Details on separate DWARF object access

There are, at present, three distinct approaches in use to put DWARF information into separate objects to significantly shrink the size of the executable. All of them involve identifying a separate file.

Split Dwarf is one method. It defines the attribute **DW_AT_dwo_name** (if present) as having a file-system appropriate name of the split object with most of the DWARF.

The second is Macos dSYM. It is a convention of placing the DWARF-containing object (separate from the object containing code) in a specific subdirectory tree.

The third involves GNU debuglink and GNU debug_id. These are two distinct ways (outside of DWARF) to provide names of alternative DWARF-containing objects elsewhere in a file system.

If one initializes a Dwarf_Debug object with dwarf_init_path() or dwarf_init_path_dl() appropriately *libdwarf* will automatically open the alternate dSYM or debuglink/debug_id object on the object with most of the DWARF.

See also

https://sourceware.org/gdb/onlinedocs/gdb/Separate-Debug-Files.html

libdwarf provides means to automatically read the alternate object (in place of the one named in the init call) or to suppress that and read the named object file.

```
int dwarf_init_path(const char * dw_path,
char *            dw_true_path_out_buffer,
unsigned int      dw_true_path_bufferlen,
unsigned int      dw_groupnumber,
Dwarf_Handler     dw_errhand,
Dwarf_Ptr         dw_errarg,
Dwarf_Debug*      dw_dbg,
Dwarf_Error*      dw_error);

int dwarf_init_path_dl(const char *dw_path,
char             * true_path_out_buffer,
unsigned         true_path_bufferlen,
unsigned         groupnumber,
Dwarf_Handler    errhand,
Dwarf_Ptr        errarg,
Dwarf_Debug      * ret_dbg,
char             ** dl_path_array,
unsigned int     dl_path_count,
unsigned char    * path_source,
Dwarf_Error      * error);
```

Case 1:

If *dw_true_path_out_buffer* or *dw_true_path_bufferlen* is passed in as zero then the library will not look for an alternative object.

Case 2:

If *dw_true_path_out_buffer* passes a pointer to space you provide and *dw_true_path_bufferlen* passes in the length, in bytes, of the buffer, *libdwarf* will look for alternate DWARF-containing objects. We advise that the caller zero all the bytes in *dw_true_path_out_buffer* before calling.

If the alternate object name (with its null-terminator) is too long to fit in the buffer the call will return DW_DLV_↩ ERROR with dw_error providing error code DW_DLE_PATH_SIZE_TOO_SMALL.

If the alternate object name fits in the buffer *libdwarf* will open and use that alternate file in the returned Dwarf_Dbg.

It is up to callers to notice that *dw_true_path_out_buffer* now contains a string and callers will probably wish to do something with the string.

If the initial byte of *dw_true_path_out_buffer* is a non-null when the call returns then an alternative object was found and opened.

The second function, dwarf_init_path_dl(), is the same as dwarf_init_path() except the _dl version has three additional arguments, as follows:

Pass in NULL or *dw_dl_path_array*, an array of pointers to strings with alternate GNU debuglink paths you want searched. For most people, passing in NULL suffices.

Pass in *dw_dl_path_array_size*, the number of elements in *dw_dl_path_array*.

Pass in *dw_dl_path_source* as NULL or a pointer to char. If non-null *libdwarf* will set it to one of three values:

- DW_PATHSOURCE_basic which means the original input *dw_path* is the one opened in dw_dbg.
- DW_PATHSOURCE_dsym which means a Macos dSYM object was found and is the one opened in dw_dbg. *dw_true_path_out_buffer* contains the dSYM object path.
- DW_PATHSOURCE_debuglink which means a GNU debuglink or GNU debug-id path was found and names the one opened in dw_dbg. *dw_true_path_out_buffer* contains the object path.

1.14 Linking against libdwarf.so (or dll or dylib)

If you wish to do the basic *libdwarf* tests and are linking against a shared library *libdwarf* you must do an install for the tests to succeed (in some environments it is not strictly necessary).

For example, if building with configure, do
```
make
make install
make check
```

You can install anywhere, there is no need to install in a system directory! Creating a temporary directory and installing there suffices. If installed in appropriate system directories that works too.

When compiling to link against a shared library *libdwarf* you **must not define LIBDWARF_STATIC**.

For examples of this for all three build systems read the project shell script
```
scripts/allsimplebuilds.sh
```

1.15 Linking against libdwarf.a

- If you are building an application
- And are linking your application against a static library libdwarf.a
- Then you must ensure that each source file compilation with an include of libdwarf.h has the macro **LIBDWARF_STATIC** defined to your source compilation.
- If *libdwarf* was built with zlib and zstd decompression library enabled you must add -lz -lzstd to the link line of the build of your application.

To pass **LIBDWARF_STATIC** to the preprocessor with Visual Studio:

- Right click on a project name
- In the contextual menu, click on **Properties** at the very bottom.
- In the new window, double click on **C/C++**
- On the right, click on **Preprocessor definitions**
- There is a small down arrow on the right, click on it then click on **Modify**
- Add **LIBDWARF_STATIC** to the values
- Click on **OK** to close the windows

1.16 Suppressing CRC calculation for debuglink

GNU Debuglink-specific issue:

If GNU debuglink is present and considered by dwarf_init_path() or dwarf_init_path_dl() the library may be required to compute a 32bit crc (Cyclic Redundancy Check) on the file found via GNU debuglink.

See also

https://en.wikipedia.org/wiki/Cyclic_redundancy_check

For people doing repeated builds of objects using such the crc check is a waste of time as they know the crc comparison will pass.

For such situations a special interface function lets the dwarf_init_path() or dwarf_init_path_dl() caller suppress the crc check without having any effect on anything else in *libdwarf*.

It might be used as follows (the same pattern applies to dwarf_init_path_dl()) for any program that might do multiple dwarf_init_path() or dwarf_init_path_dl() calls in a single program execution.

```
int res       = 0;
int crc_check= 0;

crc_check = dwarf_suppress_debuglink_crc(1);
res = dwarf_init_path(..usual arguments);
/*  Reset the crc flag to previous value. */
dwarf_suppress_debuglink_crc(crc_check);
/*  Now check res in the usual way. */
```

This pattern ensures the crc check is suppressed for this single dwarf_init_path() or dwarf_init_path_dl() call while leaving the setting unchanged for further dwarf_init_path() or dwarf_init_path_dl() calls in the running program.

1.17 dwsec_mmap

As of version 0.12.0 libdwarf allows callers to select mmap (instead of malloc/read) to access object section DWARF data. Even if mmap is selected it is possible libdwarf will chose to use malloc in specific cases.

If at library build time the required functions/header are not available the following will have no effect.

One way to select mmap is to call
```
dwarf_set_load_preference(Dwarf_Alloc_Mmap);
```

Another way to select mmap is with an environment variable
```
export DWARF_WHICH_ALLOC=mmap
```

so libdwarf will see the variable at runtime.

The environment variable overrides the function call.

Calling dwarf_set_load_preference(0) will return the current overall preference will return the current overall preference, an instance of
```
enum Dwarf_Sec_Alloc_Pref
```

The new function

```
dwarf_get_mmap_count(Dwarf_Debug dw_dbg)
```

returns the application count and size of allocations for DWARF sections from the open Dwarf_Debug pointer.

Each supported build environment has a new build option to prevent libdwarf from assuming that things in the build are always present.

1.18 Recent Changes

We list these with newest first.

Changes 2.1.0 to 2.2.0

Added functions dwarf_lvn_name_direct() dwarf_lvn_name() dwarf_lvn_table_entry() enabling access to all the fields relevant in DWARF6 DW_AT_language_version attributes.

Changes 2.0.0 to 2.1.0

Released 20 July 2025

Corrected (and tested) use of DWARF6 attributes DW_AT_language_name and DW_AT_language_version. As of July 2025 we are not aware of a released compiler providing these attributes.

Added function dwarf_srclanglname() so that DW_AT_language_name attribute values can be accessed. Added dwarf_language_version_data() because dwarf_language_version_string() is not an appropriate function name here. The old name still exists and works.

Added dwarf_srclanglname_version() so that the data provided in DWARF6 DW_AT_language_version can be returned.

Fixed minor warnings from a compiler (dwarfgen) and from meson. No change to output.

Removed heuristic checks for decompress reasonableness as such proved to be ... unreasonable in certain real object files..

Corrected the cmake build of shared-library libdwarfp/CMakeLists.txt

Given an unusual object using debuglink but with no sections with names starting with .debug_ or _eh_frame, libdwarf would complain about not having any DWARF sections and ignore the debuglink data. See github issue 297 for details of the fix.

Changes 0.12.0 to 2.0.0

Released 20 May 2025.

Skipping all versions 1.x.x because before libdwarf used Semantic Versioning gcc built libdwarf.so.1.0.0 .

Fixed a longstanding bug in configure.ac which began to cause builds to fail with recent autoconf.

Fixed a problem in test/CmakeLists.txt that caused current builds to fail on Msys2 Mingw64. Had been working for many months.

Updated the error report (for zlib, zstd) when decompression exceeds a heuristic. Now reports the compressed-len and the uncompressed-len. Increased the heuristic multiple allowed from 16 to 32.

Changes 0.11.1 to 0.12.0

Released 02 April 2025

To optionally support mmap/munmap of object files sections we read we have added a function prototype for struct Dwarf_Obj_Access_Methods_a_s function om_load_section(). This will help when reading multi gigiabyte object files. And we added a function prototype for destructing the object specific data while removing library internal public functions.

If an application does not call any of the functions which are new in v0.12.0 then it will work without recompilation.

Any application calling the new functions (for example, v0.12.0 dwarfdump) will only work with a v0.12.0 libdwarf.

If one is calling dwarf_object_init_b() (almost no one ever calls this function) one is therefore instantiating struct Dwarf_Obj_Access_Methods_a_s oneself, you will surely find that your application will not work with libdwarf 0.↩
12.0. Moreover, recompilation will fail unless you update your source to add the two new pointers to your instantiation (typically just add two zeros or NULLs in that struct instance).

Added new API function dwarf_machine_architecture_a() which has an additional argument added to let dwarfdump create an better .text (etc) address-range for the object file being read for improved checking (fewer incorrect error reports) in dwarfdump -k output.

Up through December 2024 libdwarf could be made to be very very slow (Denial of Service) with calls with thousands of duplicate attributes in an abbreviation list of a specially constructed Compilation Unit.

Beginning 2025 by default that cannot happen as the library quickly notices and returns DW_DLV_ERROR with error details noted. Callers should check the return value and act appropriately, as always, when calling the library.

In case one has (and cannot fix) object files with duplicated attributes one can call a new API function↩
: dwarf_library_allow_dup_attr(). The library defaults to false (0) meaning the checks are done in libdwarf by default. Pass non-zero value to allow duplicate attributes in a Debugging Information Entry through to callers.

Added the ability to select, at runtime, whether libdwarf will use malloc to load section content from an object file being read (previously the only option) or will use mmap instead.
If the build determines mmap is unavailable then malloc will be used.

Added API function dwarf_set_load_preference() giving callers the option to choose the default section load functions. libdwarf now recognizes the environment variable DWARF_WHICH_ALLOC to select whether the library uses mmap or malloc/read to load object section data, and the environment variable values 'DWARF_WHICH_↩
ALLOC=mmap' or 'DWARF_WHICH_ALLOC=malloc' are the only values recognized. A recognized environment variable overrides dwarf_set_load_preference() values. If the libdwarf build determines mmap is unavailable then only malloc will be used.

Added API function dwarf_get_mmap_count() giving callers the ability to determine what section loads were used and the total amount of section data loaded.

Added API function dwarf_get_LANGUAGE_name() to be able to easily get a string for DW_LNAME_Ada etc.

Added API function dwarf_language_version_string(). This returns information defined by DWARF 6 and useful in interpreting DWARF6 language-version strings based on a name accessed from DW_AT_language_name attribute.

Changes 0.11.0 to 0.11.1

Corrected handling of DWARF5 .debug_rnglists and .debug_loclists. No API change, no incompatibilities.

Changes 0.10.1 to 0.11.0

Added function dwarf_get_ranges_baseaddress() to the api to allow dwarfdump and other library callers to easily derive the (cooked) address from the raw data in the DWARF2, DWARF3, DWARF4 .debug_ranges section. An example of use is in doc/checkexamples.c (see examplev).

Changes 0.9.2 to 0.10.1

Released 01 July 2024 (Release 0.10.0 was missing a CMakeLists.txt file and is withdrawn).

Added API function dwarf_get_locdesc_entry_e() to allow dwarfdump to report some data from .debug_loclists more completely – it reports a byte length of each loclist item. This is of little interest to anyone, surely. dwarf_get_locdesc_entry_d() is still what you should be using.

dwarf_debug_addr_table() now supports reading the DWARF4 GNU extension .debug_addr table.

A heuristic sanity check for PE object files was too conservative in limiting VirtualSize to 200MB. A library user has an exe with .debug_info size of over 200MB. Increased the limit to be 2000MB and changed the names of the errors for the three heuristic checks to include *HEURISTIC* so it is easier to know the kind of error/failure it is.

When doing a shared-library build with cmake we were not emitting the correct .so version names nor setting SONAME with the correct version name. This long-standing mistake is now fixed.

Changes 0.9.1 to 0.9.2

Version 0.9.2 released 2 April 2024

Vulnerabilities DW202402-001, DW202402-002,DW202402-003, and DW202403-001 could crash *libdwarf* given a carefully corrupted (fuzzed) DWARF object file. Now the library returns an error for these corruptions. DW_CFA↵ _high_user (in dwarf.h) was a misspelling. Added the correct spelling DW_CFA_hi_user and a comment on the incorrect spelling.

Changes 0.9.0 to 0.9.1

Version 0.9.1 released 27 January 2024

The abbreviation code type returned by dwarf_die_abbrev_code() changed from **int** to **Dwarf_Unsigned** as abbrev codes are not constrained by the DWARF Standard.

The section count returned by dwarf_get_section_count() is now of type **Dwarf_Unsigned**. The previous type of **int** never made sense in *libdwarf*. Callers will, in practice, see the same value as before.

All type-warnings issued by MSVC have been fixed.

Problems reading Macho (Apple) relocatable object files have been fixed.

Each of the build systems available now has an option which eliminates *libdwarf* references to the object section decompression libraries. See the respective READMEs.

Changes 0.8.0 to 0.9.0

Version 0.9.0 released 8 December 2023

Adding functions (rarely needed) for callers with special requirements. Added dwarf_get_section_info_by_name_a() and dwarf_get_section_info_by_index_a() which add dw_section_flags pointer argument to return the object section file flags (whose meaning depends entirely on the object file format), and dw_section_offset pointer argument to return the object-relevant offset of the section (here too the meaning depends on the object format). Also added dwarf_machine_architecture() which returns a few top level data items about the object *libdwarf* has opened, including the 'machine' and 'flags' from object headers (all supported object types).

This adds new library functions dwarf_next_cu_header_e() and dwarf_siblingof_c(). Used exactly as documented dwarf_next_cu_header_d() and dwarf_siblingof_b() work fine and continue to be supported for the forseeable future. However it would be easy to misuse as the requirement that dwarf_siblingof_b() be called immediately after a successful call to dwarf_next_cu_header_d() was never stated and that dependency was impossible to enforce. The dependency was an API mistake made in 1992.

So dwarf_next_cu_header_e() now returns the compilation-unit DIE as well as header data and dwarf_siblingof_c() is not needed except to traverse sibling DIEs. (the compilation-unit DIE by definition has no siblings).

Changes were required to support Mach-O (Apple) universal binaries, which were not readable by earlier versions of the library.

We have new library functions dwarf_init_path_a(), dwarf_init_path_dl_a(), and dwarf_get_universalbinary_count().

The first two allow a caller to specify which (numbering from zero) object file to report on by adding a new argument dw_universalnumber. Passing zero as the dw_universalnumber argument is always safe.

The third lets callers retrieve the number being used.

These new calls do not replace anything so existing code will work fine.

Applying the previously existing calls dwarf_init_path() dwarf_init_path_dl() to a Mach-O universal binary works, but the library will return data on the first (index zero) as a default since there is no dw_universalnumber argument possible.

For improved performance in reading Fde data when iterating though all usable pc values we add dwarf_get_fde_info_for_all_regs3_b(), which returns the next pc value with actual frame data. We retain dwarf_get_fde_info_for_all_regs3() so existing code need not change.

Changes 0.7.0 to 0.8.0

v0.8.0 released 2023-09-20

New functions dwarf_get_fde_info_for_reg3_c(), dwarf_get_fde_info_for_cfa_reg3_c() are defined. The advantage of the new versions is they correctly type the dw_offset argument return value as Dwarf_Signed instead of the earlier and incorrect type Dwarf_Unsigned.

The original functions dwarf_get_fde_info_for_reg3_b() and dwarf_get_fde_info_for_cfa_reg3_b() continue to exist and work for compatibility with the previous release.

For all open() calls for which the O_CLOEXEC flag exists we now add that flag to the open() call.

Vulnerabilities involving reading corrupt object files (created by fuzzing) have been fixed: DW202308-001 (ossfuzz 59576), DW202307-001 (ossfuzz 60506), DW202306-011 (ossfuzz 59950), DW202306-009 (ossfuzz 59755), DW202306-006 (ossfuzz 59727), DW202306-005 (ossfuzz 59717), DW202306-004 (ossfuzz 59695), DW202306-002 (ossfuzz 59519), DW202306-001 (ossfuzz 59597). DW202305-010 (ossfuzz 59478). DW202305-009 (ossfuzz 56451). DW202305-008 (ossfuzz 56451), DW202305-007 (ossfuzz 56474), DW202305-006 (ossfuzz 56472), DW202305-005 (ossfuzz 56462), DW202305-004 (ossfuzz 56446).

Changes 0.6.0 to 0.7.0

v0.7.0 released 2023-05-20

Elf section counts can exceed 16 bits (on linux see **man 5 elf**) so some function prototype members of struct **Dwarf_Obj_Access_Methods_a_s** changed. Specifically, om_get_section_info() om_load_section(), and om_↩
relocate_a_section() now pass section indexes as Dwarf_Unsigned instead of Dwarf_Half. Without this change executables/objects with more than 64K sections cannot be read by *libdwarf*. This is unlikely to affect your code since for most users *libdwarf* takes care of this and dwarfdump is aware of this change.

Two functions have been removed from libdwarf.h and the library: dwarf_dnames_abbrev_by_code() and dwarf_↩
dnames_abbrev_form_by_index().

dwarf_dnames_abbrev_by_code() is slow and pointless. Use either dwarf_dnames_name() or dwarf_dnames_abbrevtable() instead, depending on what you want to accomplish.

dwarf_dnames_abbrev_form_by_index() is not needed, was difficult to call due to argument list requirements, and never worked.

Changes 0.5.0 to 0.6.0

v0.6.0 released 2023-02-20 The dealloc required by dwarf_offset_list() was wrong. The call could crash *libdwarf* on systems with 32bit pointers. The new and proper dealloc (for all pointer sizes) is dwarf_dealloc(dbg,offsetlistptr,↩
DW_DLA_UARRAY);

A memory leak from dwarf_load_loclists() and dwarf_load_rnglists() is fixed and the libdwarf-regressiontests error that hid the leak has also been fixed.

A **compatibility** change affects callers of dwarf_dietype_offset(), which on success returns the offset of the target of the DW_AT_type attribute (if such exists in the Dwarf_Die). Added a pointer argument so the function can (when appropriate) return a FALSE argument indicating the offset refers to DWARF4 .debug_types section, rather than TRUE value when .debug_info is the section the offset refers to. If anyone was using this function it would fail badly (while pretending success) with a DWARF4 DW_FORM_ref_sig8 on a DW_AT_type attribute from the Dwarf_↩ Die argument. One will likely encounter DWARF4 content so a single correct function seemed necessary. New regression tests will ensure this will continue to work.

A **compatibility** change affects callers of dwarf_get_pubtypes(). If an application reads .debug_pubtypes there is a **compatibility break**. Such applications must be recompiled with latest *libdwarf*, change Dwarf_Type declarations to use Dwarf_Global, and can only use the latest *libdwarf*. We are correcting a 1993 library design mistake that created extra work and documentation for library users and inflated the *libdwarf* API and documentation for no good reason.

The changes are: the data type Dwarf_Type disappears as do dwarf_pubtypename() dwarf_pubtype_die_offset(), dwarf_pubtype_cu_offset(), dwarf_pubtype_name_offsets() and dwarf_pubtypes_dealloc(). Instead the type is Dwarf_Global, the type and functions used for dwarf_get_globals(). The existing read/dealloc functions for Dwarf↩ _Global apply to pubtypes data too.

No one should be referring to the 1990s SGI/IRIX sections .debug_weaknames, .debug_funcnames, .debug_↩ varnames, or .debug_typenames as they are not emitted by any compiler except from SGI/IRIX/MIPS in that period. There is (revised) support in *libdwarf* to read these sections, but we will not mention details here.

Any use of DW_FORM_strx3 or DW_FORM_addrx3 in DWARF would, in 0.5.0 and earlier, result in *libdwarf* reporting erroneous data. A copy-paste error in libdwarf/dwarf_util.c was noticed and fixed 24 January 2023 for 0.6.0. Bug **DW202301-001**.

Changes 0.4.2 to 0.5.0

v0.5.0 released 2022-11-22 The handling of the .debug_abbrev data in *libdwarf* is now more cpu-efficient (measurably faster) so access to DIEs and attribute lists is faster. The changes are library-internal so are not visible in the API.

Corrects CU and TU indexes in the .debug_names (fast access) section to be zero-based. The code for that section was previously unusable as it did not follow the DWARF5 documentation.

dwarf_get_globals() now returns a list of Dwarf_Global names and DIE offsets whether such are defined in the .debug_names or .debug_pubnames section or both. Previously it only read .debug_pubnames.

A new function, dwarf_global_tag_number(), returns the DW_TAG of any Dwarf_Global that was derived from the .debug_names section.

Three new functions enable printing of the .debug_addr table. dwarf_debug_addr_table(), dwarf_debug_addr_by_index(), and dwarf_dealloc_debug_addr_table(). Actual use of the table(s) in .debug_addr is handled for you when an attribute invoking such is encountered (see DW_FORM_addrx, DW_FORM_addrx1 etc).

Added doc/libdwarf.dox to the distribution (left out by accident earlier).

Changes 0.4.1 to 0.4.2

0.4.2 released 2022-09-13. No API changes. No API additions. Corrected a bug in dwarf_tsearchhash.c where a delete request was accidentally assumed in all hash tree searches. It was invisible to *libdwarf* uses. Vulnerabilities DW202207-001 and DW202208-001 were fixed so error conditions when reading fuzzed object files can no longer crash *libdwarf* (the crash was possible but not certain before the fixes). In this release we believe neither *libdwarf* nor dwarfdump leak memory even when there are malloc failures. Any GNU debuglink or build-id section contents were not being properly freed (if malloced, meaning a compressed section) until 9 September 2022.

It is now possible to run the build sanity tests in all three build mechanisms (configure,cmake,meson) on linux, Macos, FreeBSD, and Mingw msys2 (windows). *libdwarf* README.md (or README) and README.cmake document how to do builds for each supported platform and build mechanism.

Changes 0.4.0 to 0.4.1

Reading a carefully corrupted DIE with form DW_FORM_ref_sig8 could result in reading memory outside any section, possibly leading to a segmentation violation or other crash. Fixed.

See also

`https://www.prevanders.net/dwarfbug.xml` DW202206-001

Reading a carefully corrupted .debug_pubnames/.debug_pubtypes could lead to reading memory outside the section being read, possibly leading to a segmentation violation or other crash. Fixed.

See also

`https://www.prevanders.net/dwarfbug.xml` DW202205-001

libdwarf accepts DW_AT_entry_pc in a compilation unit DIE as a base address for location lists (though it will prefer DW_AT_low_pc if present, per DWARF3). A particular compiler emits DW_AT_entry_pc in a DWARF2 object, requiring this change.

libdwarf adds dwarf_suppress_debuglink_crc() so that library callers can suppress crc calculations. (useful to save the time of crc when building and testing the same thing(s) over and over; it just loses a little checking.) Additionally, *libdwarf* now properly handles objects with only GNU debug-id or only GNU debuglink.

dwarfdump adds --show-args, an option to print its arguments and version. Without that new option the version and arguments are not shown. The output of -v (--version) is a little more complete.

dwarfdump adds --suppress-debuglink-crc, an option to avoid crc calculations when rebuilding and rerunning tests depending on GNU .note.gnu.buildid or .gnu_debuglink sections. The help text and the dwarfdump.1 man page are more specific documenting --suppress-debuglink-crc and --no-follow-debuglink

Changes 0.3.4 to 0.4.0

Removed the unused Dwarf_Error argument from dwarf_return_empty_pubnames() as the function can only return DW_DLV_OK. dwarf_xu_header_free() renamed to dwarf_dealloc_xu_header(). dwarf_gdbindex_free() renamed to dwarf_dealloc_gdbindex(). dwarf_loc_head_c_dealloc renamed to dwarf_dealloc_loc_head_c().

dwarf_get_location_op_value_d() renamed to dwarf_get_location_op_value_c(), and 3 pointless arguments removed. The dwarf_get_location_op_value_d version and the three arguments were added for DWARF5 in libdwarf-20210528 but the change was a mistake. Now reverted to the previous version.

The .debug_names section interfaces have changed. Added dwarf_dnames_offsets() to provide details of facts useful in problems reading the section. dwarf_dnames_name() now does work and the interface was changed to make it easier to use.

Changes 0.3.3 to 0.3.4

Replaced the groff -mm based libdwarf.pdf with a libdwarf.pdf generated by doxygen and latex.

Added support for the meson build system.

Updated an include in libdwarfp source files. Improved doxygen documentation of *libdwarf*. Now 'make check -j8' and the like works correctly. Fixed a bug where reading a PE (Windows) object could fail for certain section virtual size values. Added initializers to two uninitialized local variables in dwarfdump source so a compiler warning cannot not kill a –enable-wall build.

Added src/bin/dwarfexample/showsectiongroups.c so it is easy to see what groups are present in an object without all the other dwarfdump output.

Changes 20210528 to 0.3.3 (28 January 2022)

There were major revisions in going from date versioning to Semantic Versioning. Many functions were deleted and various functions changed their list of arguments. Many many filenames changed. Include lists were simplified. Far too much changed to list here.

Chapter 2

JIT and special case DWARF

html 2

2.1 Reading DWARF not in an object file

If the DWARF you work with is in standard object files (Elf, PE, MacOS) then you can ignore this section entirely. All that this section describes is used, but it's already done for you in functions in the library:

See also

dwarf_init_path dwarf_init_path_dl

dwarf_init_b and

dwarf_finish .

This section describes how to use calls

See also

dwarf_object_init_b

dwarf_object_finish .

These functions are useful if someone is doing just-in-time compilation, and someone working on the code wants to debug this on-the-fly code in a situation where nothing can be written to disc, but DWARF can be constructed in memory.

For a simple example of this with DWARF in local arrays

See also

Demonstrating reading DWARF without a file.

But the *libdwarf* feature can be useful in a variety of circumstances.

For example, the DWARF data were kept in simple files of bytes on the internet. Or on the local net. Or if files can be written locally each section could be kept in a simple stream of bytes in the local file system.

Another example is a non-standard file system, or file format, with the intent of obfuscating the file or the DWARF.

For this to work the code generator must generate standard DWARF.

Overall the idea is a simple one: You write a small handful of functions and supply function pointers and code implementing the functions. These are part of your application or library, not part of *libdwarf*. Your code accesses the data in whatever way applies and you write code that provides the interfaces so standard *libdwarf* can access your DWARF content.

You set up a little bit of data with that code (described below) and then you have essentially written the dwarf_↩ init_path equivalent and you can access compilation units, line tables etc and the standard *libdwarf* function calls simply work.

Data you need to create involves the following types. What follows describes how to fill them in and how to make them work for you.

```
typedef struct Dwarf_Obj_Access_Interface_a_s
    Dwarf_Obj_Access_Interface_a;
struct Dwarf_Obj_Access_Interface_a_s {
    void                             *ai_object;
    const Dwarf_Obj_Access_Methods_a *ai_methods;
};

typedef struct Dwarf_Obj_Access_Methods_a_s
    Dwarf_Obj_Access_Methods_a
struct Dwarf_Obj_Access_Methods_a_s {
    int     (*om_get_section_info)(void* obj,
        Dwarf_Half                    section_index,
        Dwarf_Obj_Access_Section_a* return_section,
        int                         * error);
    Dwarf_Small      (*om_get_byte_order)(void* obj);
    Dwarf_Small      (*om_get_length_size)(void* obj);
    Dwarf_Small      (*om_get_pointer_size)(void* obj);
    Dwarf_Unsigned   (*om_get_filesize)(void* obj);
    Dwarf_Unsigned   (*om_get_section_count)(void* obj);
    int              (*om_load_section)(void* obj,
        Dwarf_Half    section_index,
        Dwarf_Small** return_data,
        int         * error);
    int              (*om_relocate_a_section)(void* obj,
        Dwarf_Half  section_index,
        Dwarf_Debug dbg,
        int        *error);
};

typedef struct Dwarf_Obj_Access_Section_a_s
    Dwarf_Obj_Access_Section_a
struct Dwarf_Obj_Access_Section_a_s {
    const char*    as_name;
    Dwarf_Unsigned as_type;
    Dwarf_Unsigned as_flags;
    Dwarf_Addr     as_addr;
    Dwarf_Unsigned as_offset;
    Dwarf_Unsigned as_size;
    Dwarf_Unsigned as_link;
    Dwarf_Unsigned as_info;
    Dwarf_Unsigned as_addralign;
    Dwarf_Unsigned as_entrysize;
};
```

2.1.1 Describing the Interface

struct struct Dwarf_Obj_Access_Interface_a_s

Your code must create and fill in this struct's two pointer members. Libdwarf needs these to access your DWARF data. You pass a pointer to this filled-in struct to **dwarf_object_init_b**. When it is time to conclude all access to the created Dwarf_Debug call **dwarf_object_finish** . Any allocations you made in setting these things up you must then free after calling **dwarf_object_finish** .

ai_object

Allocate a local struct (*libdwarf* will not touch this struct and will not know anything of its contents). You will need one of these for each Dwarf_Debug you open. Put a pointer to this into ai_object. Then fill in all the data you need to access information you will pass back via the ai_methods functions. In the description of the methods functions described later here, this pointer is named **obj** .

ai_methods

Usually you allocate a static structure and fill it in with function pointers (to functions you write). Then put a pointer to the static structure into this field.

2.1.2 Describing A Section

Dwarf_Obj_Access_Section_a:

The set of fields here is a set that is sufficient to describe a single object section to *libdwarf*. Your implementation of a **om_get_section_info** must simply fill in a few fields (leaving most zero) for *libdwarf* for the section indexed. The fields here are standard Elf, and for most you can just fill in the value zero. For section index zero as_name should be set to an empty string (see below about section index numbers).

as_name: Here you set a section name via the pointer. The section names must be names as defined in the DWARF standard, so if such do not appear in your data you have to create the strings yourself.

as_type: Just fill in zero.

as_flags: Just fill in zero.

as_addr: Fill in the address, in local memory, where the bytes of the section are.

as_offset: Just fill in zero.

as_size: Fill in the size, in bytes, of the section you are telling *libdwarf* about.

as_link: Just fill in zero.

as_info: Just fill in zero.

as_addralign:Just fill in zero.

as_entrysize: Just fill in one.

2.1.3 Function Pointers

struct Dwarf_Obj_Access_Methods_a_s:

The functions *libdwarf* needs to access object data are declared here. Usually the struct is statically defined and the function pointers are set at compile time. You must implement these functions based on your knowledge of how the actual data is represented and where to get it.

Each has a first-parameter of **obj** which is a struct you define to hold data you need to implement this set of functions. You refer to it When *libdwarf* calls your set of functions (these described now) it passes the ai_object pointer you provided to these functions as **obj** parameter .

This is the final part of your work for *libdwarf*. In the source file with your code you will be allocating data, making a provision for an array (real or conceptual) for per-section data, and returning values *libdwarf* needs. Note that the section array should include an index zero with all zero field values. That means interesting fields start with index one. This special case of index zero Elf is required and matches the standard Elf object format.

Notice that the **error** argument, where applicable, is an int∗ . Error codes passed back are DW_DLE codes and **dwarf_errmsg_by_number** may be used (by your code) to get the standard error string for that error.

om_get_section_info

```
Get address, size, and name info about a section.

Parameters
obj            -  Your data
section_index  - Zero-based index.
return_section - Pointer to a structure in which
    section info will be placed.   Caller must
    provide a valid pointer to a structure area.
    The structure's contents will be overwritten
    by the call to get_section_info.
error          - A pointer to an integer in which an error
    code may be stored.

Return
DW_DLV_OK       - Everything ok.
DW_DLV_ERROR    - Error occurred. Use 'error' to determine the
    @e libdwarf defined error.
DW_DLV_NO_ENTRY - No such section.
```

om_get_byte_order

This retrieves data you put into your **ai_object** struct that you filled out.

```
Get from your @b ai_object whether the object
file represented by this interface is big-endian
(DW_END_big) or little endian (DW_END_little).

Parameters
obj  -  Your data

Return
Endianness of object, DW_END_big or DW_END_little.
```

om_get_length_size

This retrieves data you put into your **ai_object** struct that you filled out.

```
Get the size of a length field in the underlying object file.
@e libdwarf currently supports * 4 and 8 byte sizes, but may
support larger in the future.
Perhaps the return type should be an enumeration?

Parameters
obj  -  Your data

Return
Size of length. Cannot fail.
```

om_get_pointer_size

This retrieves data you put into your **ai_object** struct that you filled out.

```
Get the size of a pointer field in the underlying object file.
```

```
@e libdwarf currently supports  4 and 8 byte sizes.
Perhaps the return type should be an enumeration?

Return
Size of pointer. Cannot fail.  */
```

om_get_filesize

This retrieves data you put into your **ai_object** struct that you filled out.

```
Parameters
obj  -  Your data

Return
Must return a value at least as large as any section @e libdwarf
might read.  Returns a value that is a sanity check on
offsets @e libdwarf reads for this DWARF set.  It need not be
a tight bound.
```

om_get_section_count

This retrieves data you put into your **ai_object** struct that you filled out.

```
Get the number of sections in the object file, including
the index zero section with no content.

Parameters
obj  -  Your data

Return
Number of sections.
```

om_load_section

This retrieves data you put into your **ai_object** struct that you filled out.

Get a pointer to an array of bytes that are the section content.

```
Get a pointer to an array of bytes that
represent the section.

Parameters
obj            -  Your data
section_index - Zero-based section index.
return_data   - Place the address of this section
    content into  *return_data .
error          - Pointer to an integer for returning
    libdwarf-defined error numbers.

Return
DW_DLV_OK       - No error.
DW_DLV_ERROR    - Error. Use 'error' to indicate
    a libdwarf-defined error number.
DW_DLV_NO_ENTRY - No such section.  */
```

om_relocate_a_section

```
Leave this pointer NULL.
If relocations are required it is probably simpler
for you do to them yourself n your
implementation of @b om_load_section .
Any relocations this function pointer
is to use must be in standard Elf
relocation (32 or 64 bit) form and must be
in an appropriately named Elf relocation section.

Parameters
obj  -  Your data
section_index - Zero-based index of the
    section to be relocated.
error - Pointer to an integer for returning libdwarf-defined
    error numbers.

Return
DW_DLV_OK - No error.
DW_DLV_ERROR - Error. Use 'error' to indicate
    a libdwarf-defined
    error number.
DW_DLV_NO_ENTRY - No such section.
```

Chapter 3

dwarf.h

dwarf.h contains all the identifiers such as DW_TAG_compile_unit etc from the various versions of the DWARF Standard beginning with DWARF2 and containing all later Dwarf Standard identifiers.

In addition, it contains all user-defined identifiers that we have been able to find.

All identifiers here are C defines with the prefix "DW_" .

Chapter 4

libdwarf.h

libdwarf.h contains all the type declarations and function function declarations needed to use the library. It is essential that coders include dwarf.h before including libdwarf.h.

All identifiers here in the public namespace begin with DW_ or Dwarf_ or dwarf_ . All function argument names declared here begin with dw_ .

Chapter 5

checkexamples.c

checkexamples.c contains what user code should be. Hence the code typed in checkexamples.c is PUBLIC DOMAIN and may be copied, used, and altered without any restrictions.

checkexamples.c need not be compiled routinely nor should it ever be executed.

To verify syntatic correctness compile in the libdwarf-code/doc directory with:

```
cc -c -Wall -O0 -Wpointer-arith  \
-Wdeclaration-after-statement \
-Wextra -Wcomment -Wformat -Wpedantic -Wuninitialized \
-Wno-long-long -Wshadow -Wbad-function-cast \
-Wmissing-parameter-type -Wnested-externs \
-I../src/lib/libdwarf checkexamples.c
```

Chapter 6

Topic Index

6.1 Topics

Here is a list of all topics with brief descriptions:

Chapter 7

Class Index

7.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 8

File Index

8.1 File List

Here is a list of all documented files with brief descriptions:

Chapter 9

Topic Documentation

9.1 Basic Library Datatypes Group

Typedefs

- typedef unsigned long long Dwarf_Unsigned
- typedef signed long long Dwarf_Signed
- typedef unsigned long long Dwarf_Off
- typedef unsigned long long Dwarf_Addr
- typedef int Dwarf_Bool
- typedef unsigned short Dwarf_Half
- typedef unsigned char Dwarf_Small
- typedef void ∗ Dwarf_Ptr

9.1.1 Detailed Description

9.1.2 Typedef Documentation

9.1.2.1 Dwarf_Addr

```
Dwarf_Addr
```

Used when a data item is a an address represented in DWARF. 64 bits. Must be as large as the largest object address size.

9.1.2.2 Dwarf_Bool

```
Dwarf_Bool
```

A TRUE(non-zero)/FALSE(zero) data item.

9.1.2.3 Dwarf_Half

`Dwarf_Half`

Many libdwarf values (attribute codes, for example) are defined by the standard to be 16 bits, and this datatype reflects that (the type must be at least 16 bits wide).

9.1.2.4 Dwarf_Off

`Dwarf_Off`

Used for offsets. It should be same size as Dwarf_Unsigned.

9.1.2.5 Dwarf_Ptr

`Dwarf_Ptr`

A generic pointer type. It uses void ∗ so it cannot be added-to or subtracted-from.

9.1.2.6 Dwarf_Signed

`Dwarf_Signed`

The basic signed data type. Intended to be a signed 64bit value.

9.1.2.7 Dwarf_Small

`Dwarf_Small`

Used for small unsigned integers and used as Dwarf_Small∗ for pointers and it supports pointer addition and subtraction conveniently.

9.1.2.8 Dwarf_Unsigned

`Dwarf_Unsigned`

The basic unsigned data type. Intended to be an unsigned 64bit value.

9.2 Enumerators with various purposes

Enumerations

- enum Dwarf_Ranges_Entry_Type { **DW_RANGES_ENTRY** , **DW_RANGES_ADDRESS_SELECTION** , **DW_RANGES_END** }
- enum Dwarf_Form_Class {
  DW_FORM_CLASS_UNKNOWN = 0 , **DW_FORM_CLASS_ADDRESS** = 1 , **DW_FORM_CLASS_BLOCK** = 2 , **DW_FORM_CLASS_CONSTANT** =3 ,
  DW_FORM_CLASS_EXPRLOC = 4 , **DW_FORM_CLASS_FLAG** = 5 , **DW_FORM_CLASS_LINEPTR** = 6 , **DW_FORM_CLASS_LOCLISTPTR** =7 ,
  DW_FORM_CLASS_MACPTR = 8 , **DW_FORM_CLASS_RANGELISTPTR** =9 , **DW_FORM_CLASS_↩ REFERENCE** =10 , **DW_FORM_CLASS_STRING** = 11 ,
  DW_FORM_CLASS_FRAMEPTR = 12 , **DW_FORM_CLASS_MACROPTR** = 13 , **DW_FORM_CLASS_↩ ADDRPTR** = 14 , **DW_FORM_CLASS_LOCLIST** = 15 ,
  DW_FORM_CLASS_LOCLISTSPTR =16 , **DW_FORM_CLASS_RNGLIST** =17 , **DW_FORM_CLASS_↩ RNGLISTSPTR** =18 , **DW_FORM_CLASS_STROFFSETSPTR** =19 }

9.2.1 Detailed Description

9.2.2 Enumeration Type Documentation

9.2.2.1 Dwarf_Form_Class

```
enum Dwarf_Form_Class
```

The dwarf specification separates FORMs into different classes. To do the separation properly requires 4 pieces of data as of DWARF4 (thus the function arguments listed here). The DWARF4 specification class definition suffices to describe all DWARF versions. See section 7.5.4, Attribute Encodings. A return of DW_FORM_CLASS_UNKNOWN means the library could not properly figure out what form-class it is.

DW_FORM_CLASS_FRAMEPTR is MIPS/IRIX only, and refers to the DW_AT_MIPS_fde attribute (a reference to the .debug_frame section).

DWARF5: DW_FORM_CLASS_LOCLISTSPTR is like DW_FORM_CLASS_LOCLIST except that LOCLISTSPTR is always a section offset, never an index, and LOCLISTSPTR is only referenced by DW_AT_loclists_base. Note DW_FORM_CLASS_LOCLISTSPTR spelling to distinguish from DW_FORM_CLASS_LOCLISTPTR.

DWARF5: DW_FORM_CLASS_RNGLISTSPTR is like DW_FORM_CLASS_RNGLIST except that RNGLISTSPTR is always a section offset, never an index. DW_FORM_CLASS_RNGLISTSPTR is only referenced by DW_AT_↩
rnglists_base.

9.2.2.2 Dwarf_Ranges_Entry_Type

```
enum Dwarf_Ranges_Entry_Type
```

The dwr_addr1/addr2 data is either pair of offsets of a base pc address (DW_RANGES_ENTRY) or a base pc address (dwr_addr2 in DW_RANGES_ADDRESS_SELECTION) or both are zero(end of list, DW_RANGES_END) or both non-zero but identical (means an empty range, DW_RANGES_ENTRY). These are for use with DWARF 2,3,4.

DW_RANGES_ADDRESS_SELECTION should have been spelled DW_RANGES_BASE_ADDRESS. but it is not worth changing as it is widely used.

The DW_RANGES_ENTRY values are raw pc offset data recorded in the section, not addresses.

See also

Example getting .debug_ranges data

Dwarf_Ranges∗ apply to DWARF2,3, and 4. Not to DWARF5 (the data is different and in a new DWARF5 section).

9.3 Defined and Opaque Structs

Classes

- struct Dwarf_Form_Data16_s
- struct Dwarf_Sig8_s
- struct Dwarf_Block_s
- struct Dwarf_Printf_Callback_Info_s
- struct Dwarf_Cmdline_Options_s
- struct Dwarf_Ranges_s
- struct Dwarf_Regtable_Entry3_s
- struct Dwarf_Regtable3_s
- struct Dwarf_Macro_Details_s
- struct Dwarf_Obj_Access_Section_a_s
- struct Dwarf_Obj_Access_Methods_a_s
- struct Dwarf_Obj_Access_Interface_a_s
- struct Dwarf_Debug_Fission_Per_CU_s

Typedefs

- typedef struct Dwarf_Form_Data16_s Dwarf_Form_Data16
- typedef struct Dwarf_Sig8_s Dwarf_Sig8
- typedef struct Dwarf_Block_s Dwarf_Block
- typedef struct Dwarf_Locdesc_c_s ∗ Dwarf_Locdesc_c
- typedef struct Dwarf_Loc_Head_c_s ∗ Dwarf_Loc_Head_c
- typedef struct Dwarf_Gnu_Index_Head_s ∗ Dwarf_Gnu_Index_Head
- typedef struct Dwarf_Dsc_Head_s ∗ Dwarf_Dsc_Head
- typedef struct Dwarf_Frame_Instr_Head_s ∗ Dwarf_Frame_Instr_Head
- typedef void(∗ dwarf_printf_callback_function_type) (void ∗dw_user_pointer, const char ∗dw_linecontent)
- typedef struct Dwarf_Cmdline_Options_s **Dwarf_Cmdline_Options**
- typedef struct Dwarf_Str_Offsets_Table_s ∗ Dwarf_Str_Offsets_Table
- typedef struct Dwarf_Ranges_s Dwarf_Ranges
- typedef struct Dwarf_Regtable_Entry3_s Dwarf_Regtable_Entry3
- typedef struct Dwarf_Regtable3_s Dwarf_Regtable3
- typedef struct Dwarf_Error_s ∗ Dwarf_Error
- typedef struct Dwarf_Debug_s ∗ Dwarf_Debug
- typedef struct Dwarf_Section_s ∗ Dwarf_Section
- typedef struct Dwarf_Die_s ∗ Dwarf_Die
- typedef struct Dwarf_Debug_Addr_Table_s ∗ Dwarf_Debug_Addr_Table
- typedef struct Dwarf_Line_s ∗ Dwarf_Line
- typedef struct Dwarf_Global_s ∗ Dwarf_Global
- typedef struct Dwarf_Type_s ∗ Dwarf_Type
- typedef struct Dwarf_Func_s ∗ Dwarf_Func
- typedef struct Dwarf_Var_s ∗ Dwarf_Var
- typedef struct Dwarf_Weak_s ∗ Dwarf_Weak
- typedef struct Dwarf_Attribute_s ∗ Dwarf_Attribute
- typedef struct Dwarf_Abbrev_s ∗ Dwarf_Abbrev
- typedef struct Dwarf_Fde_s ∗ Dwarf_Fde
- typedef struct Dwarf_Cie_s ∗ Dwarf_Cie
- typedef struct Dwarf_Arange_s ∗ Dwarf_Arange
- typedef struct Dwarf_Gdbindex_s ∗ Dwarf_Gdbindex
- typedef struct Dwarf_Xu_Index_Header_s ∗ Dwarf_Xu_Index_Header
- typedef struct Dwarf_Line_Context_s ∗ Dwarf_Line_Context
- typedef struct Dwarf_Macro_Context_s ∗ Dwarf_Macro_Context
- typedef struct Dwarf_Dnames_Head_s ∗ Dwarf_Dnames_Head
- typedef void(∗ Dwarf_Handler) (Dwarf_Error dw_error, Dwarf_Ptr dw_errarg)
- typedef struct Dwarf_Macro_Details_s Dwarf_Macro_Details
- typedef struct Dwarf_Debug_Fission_Per_CU_s Dwarf_Debug_Fission_Per_CU
- typedef struct Dwarf_Obj_Access_Interface_a_s Dwarf_Obj_Access_Interface_a
- typedef struct Dwarf_Obj_Access_Methods_a_s Dwarf_Obj_Access_Methods_a
- typedef struct Dwarf_Obj_Access_Section_a_s Dwarf_Obj_Access_Section_a
- typedef struct Dwarf_Rnglists_Head_s ∗ Dwarf_Rnglists_Head

Enumerations

- enum Dwarf_Sec_Alloc_Pref { **Dwarf_Alloc_None** =0 , **Dwarf_Alloc_Malloc** =1 , **Dwarf_Alloc_Mmap** =2 }

9.3.1 Detailed Description

9.3.2 Typedef Documentation

9.3.2.1 Dwarf_Abbrev

`Dwarf_Abbrev`

Used to reference a Dwarf_Abbrev. Usually Dwarf_Abbrev are fully handled inside the library so one rarely needs to declare the type.

9.3.2.2 Dwarf_Arange

`Dwarf_Arange`

Used to reference a code address range in a section such as .debug_info.

9.3.2.3 Dwarf_Attribute

`Dwarf_Attribute`

Used to reference a Dwarf_Die attribute

9.3.2.4 Dwarf_Block

`Dwarf_Block`

Used to hold uninterpreted blocks of data. bl_data refers to on an uninterpreted block of data Used with certain location information functions, a frame expression function, expanded frame instructions, and DW_FORM_block functions.

See also

dwarf_formblock

Documenting Form_Block

9.3.2.5 Dwarf_Cie

`Dwarf_Cie`

Used to reference .debug_frame or .eh_frame CIE.

9.3.2.6 Dwarf_Debug

`Dwarf_Debug`

An open Dwarf_Debug points to data that libdwarf maintains to support libdwarf calls.

9.3.2.7 Dwarf_Debug_Addr_Table

```
Dwarf_Debug_Addr_Table
```

Used to reference a table in section .debug_addr

9.3.2.8 Dwarf_Debug_Fission_Per_CU

```
Dwarf_Debug_Fission_Per_CU
```

A handy short name for a Dwarf_Debug_Fission_Per_CU_s struct.

9.3.2.9 Dwarf_Die

```
Dwarf_Die
```

Used to reference a DWARF Debugging Information Entry.

9.3.2.10 Dwarf_Dnames_Head

```
Dwarf_Dnames_Head
```

Used as the general reference to the DWARF5 .debug_names section.

9.3.2.11 Dwarf_Dsc_Head

```
Dwarf_Dsc_Head
```

Access to DW_AT_discr_list array of discriminant values.

9.3.2.12 Dwarf_Error

```
Dwarf_Error
Dwarf_Error error = 0;
dres = dwarf_siblingof_c(in_die,&return_sib, &error);
```

&error is used in calls to return error details when the call returns DW_DLV_ERROR.

9.3.2.13 Dwarf_Fde

```
Dwarf_Fde
```

Used to reference .debug_frame or .eh_frame FDE.

9.3.2.14 Dwarf_Form_Data16

`Dwarf_Form_Data16`

a container for a DW_FORM_data16 data item. We have no integer types suitable so this special struct is used instead. It is up to consumers/producers to deal with the contents.

9.3.2.15 Dwarf_Frame_Instr_Head

`Dwarf_Frame_Instr_Head`

The basis for access to DWARF frame instructions (FDE or CIE) in full detail.

9.3.2.16 Dwarf_Func

`Dwarf_Func`

An SGI extension type which is no longer used at all. As of release 0.6.0 use Dwarf_Global instead.

9.3.2.17 Dwarf_Gdbindex

`Dwarf_Gdbindex`

Used to reference .gdb_index section data which is a fast-access section by and for gdb.

9.3.2.18 Dwarf_Global

`Dwarf_Global`

Used to reference a reference to an entry in the .debug_pubnames section.

9.3.2.19 Dwarf_Gnu_Index_Head

`Dwarf_Gnu_Index_Head`

A pointer to a struct Dwarf_Gnu_Index_Head_s for sections .debug_gnu_pubtypes or .debug_gnu_pubnames. These are not standard DWARF, and can appear with gcc -gdwarf-5

9.3.2.20 Dwarf_Handler

`Dwarf_Handler`

Used in rare cases (mainly tiny programs) with dwarf_init_path() etc initialization calls to provide a pointer to a generic-error-handler function you write.

9.3.2.21 Dwarf_Line

`Dwarf_Line`

Used to reference a line reference from the .debug_line section.

9.3.2.22 Dwarf_Line_Context

`Dwarf_Line_Context`

Used as the general reference line data (.debug_line).

9.3.2.23 Dwarf_Loc_Head_c

`Dwarf_Loc_Head_c`

provides access to any sort of location description for DWARF2,3,4, or 5.

9.3.2.24 Dwarf_Locdesc_c

`Dwarf_Locdesc_c`

Provides access to Dwarf_Locdesc_c, a single location description

9.3.2.25 Dwarf_Macro_Context

`Dwarf_Macro_Context`

Used as the general reference to DWARF5 .debug_macro data.

9.3.2.26 Dwarf_Macro_Details

`Dwarf_Macro_Details`

A handy short name for a Dwarf_Macro_Details_S struct.

9.3.2.27 Dwarf_Obj_Access_Interface_a

`Dwarf_Obj_Access_Interface_a`

Used for access to and setting up special data allowing access to DWARF even with no object files present

9.3.2.28 Dwarf_Obj_Access_Methods_a

`Dwarf_Obj_Access_Methods_a`

Used for access to and setting up special data allowing access to DWARF even with no object files present

9.3.2.29 Dwarf_Obj_Access_Section_a

`Dwarf_Obj_Access_Section_a`

Used for access to and setting up special data allowing access to DWARF even with no object files present. The fields match up with Elf section headers, but for non-Elf many of the fields can be set to zero.

9.3.2.30 dwarf_printf_callback_function_type

`dwarf_printf_callback_function_type`

Used as a function pointer to a user-written callback function. This provides a detailed content of line table data.

The default contents of the callback data are all zero bytes. So no callbacks involving this data will be done.

See dwarf_register_printf_callback()

Parameters

dw_user_pointer	Passes your callback a pointer to space you allocated as an identifier of some kind in calling dwarf_register_printf_callback..
dw_linecontent	Passes your callback null-terminated string with one line of detailed line table content.

9.3.2.31 Dwarf_Ranges

`Dwarf_Ranges`

Details of of non-contiguous address ranges of DIEs for DWARF2, DWARF3, and DWARF4. Sufficient for older dwarf.

dwr_addr1 and dwr_addr2 in the struct are offsets from a base address in the CU involved. To calculate actual range pc addresses see the example:

See also

Example getting .debug_ranges data

9.3.2.32 Dwarf_Regtable3

`Dwarf_Regtable3`

This structs provides a way for applications to select the number of frame registers and to select names for them.

rt3_rules and rt3_reg_table_size must be filled in before calling libdwarf. Filled in with a pointer to an array (pointer and array set up by the calling application) of rt3_reg_table_size Dwarf_Regtable_Entry3_s structs. libdwarf does not allocate or deallocate space for the rules, you must do so. libdwarf will initialize the contents rules array, you do not need to do so (though if you choose to initialize the array somehow that is ok: libdwarf will overwrite your initializations with its own).

Note that this definition can only deal correctly with register table size that fits in a 16 bit unsigned value.

9.3.2.33 Dwarf_Regtable_Entry3

Dwarf_Regtable_Entry3

For each index i (naming a hardware register with dwarf number i) the following is true and defines the value of that register:

```
If dw_regnum is Register DW_FRAME_UNDEFINED_VAL
    it is not DWARF register number but
    a place holder indicating the register
    has no defined value.
If dw_regnum is Register DW_FRAME_SAME_VAL
    it  is not DWARF register number but
    a place holder indicating the register has the same
    value in the previous frame.

    DW_FRAME_UNDEFINED_VAL, DW_FRAME_SAME_VAL and
    DW_FRAME_CFA_COL are only present at libdwarf runtime.
    Never on disk.
    DW_FRAME_* Values present on disk are in dwarf.h
    Because DW_FRAME_SAME_VAL and DW_FRAME_UNDEFINED_VAL
    and DW_FRAME_CFA_COL are definable at runtime
    consider the names symbolic in this comment,
    not absolute.

Otherwise: the register number is a DWARF register number
    (see ABI documents for how this translates to hardware/
    software register numbers in the machine hardware)
    and the following applies:

In a cfa-defining entry (rt3_cfa_rule) the regnum is the
CFA 'register number'. Which is some 'normal' register,
not DW_FRAME_CFA_COL, nor DW_FRAME_SAME_VAL, nor
DW_FRAME_UNDEFINED_VAL.

If dw_value_type == DW_EXPR_OFFSET (the only
possible case for dwarf2):
    If dw_offset_relevant is non-zero, then
        the value is stored at at the address
        CFA+N where N (dw_offset) is a signed offset,
        (not unsigned) and must be cast to Dwarf_Signed
        before use.
        dw_regnum is the cfa register rule which means
        one ignores dw_regnum and uses the CFA appropriately.
        Rule: Offset(N)
    If dw_offset_relevant is zero, then the
        value of the register
        is the value of (DWARF) register number dw_regnum.
        Rule: register(R)
If dw_value_type  == DW_EXPR_VAL_OFFSET
    the  value of this register is CFA +N where
    N (dw_offset) is a signed offset (not unsigned)
    and must be cast to Dwarf_Signed before use.
    dw_regnum is the cfa register rule which means
    one ignores dw_regnum and uses the CFA appropriately.
    Rule: val_offset(N)
If dw_value_type  == DW_EXPR_EXPRESSION
    The value of the register is the value at the address
    computed by evaluating the DWARF expression E.
    Rule: expression(E)
    The expression E byte stream is pointed to by
    block.bl_data.
    The expression length in bytes is given by
    block.bl_len.
If dw_value_type  == DW_EXPR_VAL_EXPRESSION
    The value of the register is the value
    computed by evaluating the DWARF expression E.
    Rule: val_expression(E)
    The expression E byte stream is pointed to
    by block.bl_data.
    The expression length in bytes is given by
    block.bl_len.
Other values of dw_value_type are an error.

Note that this definition can only deal correctly
with register numbers that fit in a 16 bit
unsigned value.  Removing this
restriction would force an incompatible
change to several functions in the libdwarf API.
```

9.3.2.34 Dwarf_Rnglists_Head

`Dwarf_Rnglists_Head`

Used for access to a set of DWARF5 debug_rnglists entries.

9.3.2.35 Dwarf_Section

`Dwarf_Section`

An open Dwarf_Section points to data that libdwarf maintains to record object section data.

9.3.2.36 Dwarf_Sig8

`Dwarf_Sig8`

Used for signatures where ever they appear. It is not a string, it is 8 bytes of a signature one would use to find a type unit.

See also

dwarf_formsig8

9.3.2.37 Dwarf_Str_Offsets_Table

`Dwarf_Str_Offsets_Table`

Provides an access to the .debug_str_offsets section independently of other DWARF sections. Mainly of use in examining the .debug_str_offsets section content for problems.

9.3.2.38 Dwarf_Type

`Dwarf_Type`

Before release 0.6.0 used to reference a reference to an entry in the .debug_pubtypes section (as well as the SGI-only extension .debug_types). However, we use Dwarf_Global instead now.

9.3.2.39 Dwarf_Var

`Dwarf_Var`

An SGI extension type which is no longer used at all. As of release 0.6.0 use Dwarf_Global instead.

9.3.2.40 Dwarf_Weak

`Dwarf_Weak`

An SGI extension type which is no longer used at all. As of release 0.6.0 use Dwarf_Global instead.

9.3.2.41 Dwarf_Xu_Index_Header

`Dwarf_Xu_Index_Header`

Used to reference .debug_cu_index or .debug_tu_index sections in a split-dwarf package file.

9.3.3 Enumeration Type Documentation

9.3.3.1 Dwarf_Sec_Alloc_Pref

`enum Dwarf_Sec_Alloc_Pref`

Since

{0.12.0}

This is part of the allowance of mmap for loading sections of an object file.

The option of using mmap() only applies to Elf object files in this release.

See also

dwarf_set_load_preference()

9.4 Default stack frame macros

Macros

- #define **DW_DLX_NO_EH_OFFSET** (-1LL)
- #define **DW_DLX_EH_OFFSET_UNAVAILABLE** (-2LL)
- #define **DW_CIE_AUGMENTER_STRING_V0** "z"
- #define **DW_REG_TABLE_SIZE** DW_FRAME_LAST_REG_NUM
- #define **DW_FRAME_REG_INITIAL_VALUE** DW_FRAME_SAME_VAL
- #define **DW_EXPR_OFFSET** 0 /∗ offset is from CFA reg ∗/
- #define **DW_EXPR_VAL_OFFSET** 1
- #define **DW_EXPR_EXPRESSION** 2
- #define **DW_EXPR_VAL_EXPRESSION** 3

9.4.1 Detailed Description

9.5 DW_DLA alloc/dealloc typename&number

Macros

- #define **DW_DLA_STRING** 0x01 /∗ char∗ ∗/
- #define **DW_DLA_LOC** 0x02 /∗ Dwarf_Loc ∗/
- #define **DW_DLA_LOCDESC** 0x03 /∗ Dwarf_Locdesc ∗/
- #define **DW_DLA_ELLIST** 0x04 /∗ Dwarf_Ellist (not used)∗/
- #define **DW_DLA_BOUNDS** 0x05 /∗ Dwarf_Bounds (not used) ∗/
- #define **DW_DLA_BLOCK** 0x06 /∗ Dwarf_Block ∗/
- #define **DW_DLA_DEBUG** 0x07 /∗ Dwarf_Debug ∗/
- #define **DW_DLA_DIE** 0x08 /∗ Dwarf_Die ∗/
- #define **DW_DLA_LINE** 0x09 /∗ Dwarf_Line ∗/
- #define **DW_DLA_ATTR** 0x0a /∗ Dwarf_Attribute ∗/
- #define **DW_DLA_TYPE** 0x0b /∗ Dwarf_Type (not used) ∗/
- #define **DW_DLA_SUBSCR** 0x0c /∗ Dwarf_Subscr (not used) ∗/
- #define **DW_DLA_GLOBAL** 0x0d /∗ Dwarf_Global ∗/
- #define **DW_DLA_ERROR** 0x0e /∗ Dwarf_Error ∗/
- #define **DW_DLA_LIST** 0x0f /∗ a list ∗/
- #define **DW_DLA_LINEBUF** 0x10 /∗ Dwarf_Line∗ (not used) ∗/
- #define **DW_DLA_ARANGE** 0x11 /∗ Dwarf_Arange ∗/
- #define **DW_DLA_ABBREV** 0x12 /∗ Dwarf_Abbrev ∗/
- #define **DW_DLA_FRAME_INSTR_HEAD** 0x13 /∗ Dwarf_Frame_Instr_Head ∗/
- #define **DW_DLA_CIE** 0x14 /∗ Dwarf_Cie ∗/
- #define **DW_DLA_FDE** 0x15 /∗ Dwarf_Fde ∗/
- #define **DW_DLA_LOC_BLOCK** 0x16 /∗ Dwarf_Loc ∗/
- #define **DW_DLA_FRAME_OP** 0x17 /∗ Dwarf_Frame_Op (not used) ∗/
- #define **DW_DLA_FUNC** 0x18 /∗ Dwarf_Func ∗/
- #define **DW_DLA_UARRAY** 0x19 /∗ Array of Dwarf_Off:Jan2023 ∗/
- #define **DW_DLA_VAR** 0x1a /∗ Dwarf_Var ∗/
- #define **DW_DLA_WEAK** 0x1b /∗ Dwarf_Weak ∗/
- #define **DW_DLA_ADDR** 0x1c /∗ Dwarf_Addr sized entries ∗/
- #define **DW_DLA_RANGES** 0x1d /∗ Dwarf_Ranges ∗/
- #define **DW_DLA_GNU_INDEX_HEAD** 0x35
- #define **DW_DLA_RNGLISTS_HEAD** 0x36 /∗ .debug_rnglists DW5 ∗/
- #define **DW_DLA_GDBINDEX** 0x37 /∗ Dwarf_Gdbindex ∗/
- #define **DW_DLA_XU_INDEX** 0x38 /∗ Dwarf_Xu_Index_Header ∗/
- #define **DW_DLA_LOC_BLOCK_C** 0x39 /∗ Dwarf_Loc_c∗/
- #define **DW_DLA_LOCDESC_C** 0x3a /∗ Dwarf_Locdesc_c ∗/
- #define **DW_DLA_LOC_HEAD_C** 0x3b /∗ Dwarf_Loc_Head_c ∗/
- #define **DW_DLA_MACRO_CONTEXT** 0x3c /∗ Dwarf_Macro_Context ∗/
- #define **DW_DLA_DSC_HEAD** 0x3e /∗ Dwarf_Dsc_Head ∗/
- #define **DW_DLA_DNAMES_HEAD** 0x3f /∗ Dwarf_Dnames_Head ∗/
- #define **DW_DLA_STR_OFFSETS** 0x40
- #define **DW_DLA_DEBUG_ADDR** 0x41

9.5.1 Detailed Description

These identify the various allocate/dealloc types. The allocation happens within libdwarf, and the deallocation is usually done by user code.

9.6 DW_DLE Dwarf_Error numbers

Macros

- #define **DW_DLE_NE** 0 /∗ no error ∗/
- #define **DW_DLE_VMM** 1 /∗ dwarf format/library version mismatch ∗/
- #define **DW_DLE_MAP** 2 /∗ memory map failure ∗/
- #define **DW_DLE_LEE** 3 /∗ libelf error ∗/
- #define **DW_DLE_NDS** 4 /∗ no debug section ∗/
- #define **DW_DLE_NLS** 5 /∗ no line section ∗/
- #define **DW_DLE_ID** 6 /∗ invalid descriptor for query ∗/
- #define **DW_DLE_IOF** 7 /∗ I/O failure ∗/
- #define **DW_DLE_MAF** 8 /∗ memory allocation failure ∗/
- #define **DW_DLE_IA** 9 /∗ invalid argument ∗/
- #define **DW_DLE_MDE** 10 /∗ mangled debugging entry ∗/
- #define **DW_DLE_MLE** 11 /∗ mangled line number entry ∗/
- #define **DW_DLE_FNO** 12 /∗ file not open ∗/
- #define **DW_DLE_FNR** 13 /∗ file not a regular file ∗/
- #define **DW_DLE_FWA** 14 /∗ file open with wrong access ∗/
- #define **DW_DLE_NOB** 15 /∗ not an object file ∗/
- #define **DW_DLE_MOF** 16 /∗ mangled object file header ∗/
- #define **DW_DLE_EOLL** 17 /∗ end of location list entries ∗/
- #define **DW_DLE_NOLL** 18 /∗ no location list section ∗/
- #define **DW_DLE_BADOFF** 19 /∗ Invalid offset ∗/
- #define **DW_DLE_EOS** 20 /∗ end of section ∗/
- #define **DW_DLE_ATRUNC** 21 /∗ abbreviations section appears truncated∗/
- #define **DW_DLE_BADBITC** 22 /∗ Address size passed to dwarf bad,∗/
- #define **DW_DLE_DBG_ALLOC** 23
- #define **DW_DLE_FSTAT_ERROR** 24
- #define **DW_DLE_FSTAT_MODE_ERROR** 25
- #define **DW_DLE_INIT_ACCESS_WRONG** 26
- #define **DW_DLE_ELF_BEGIN_ERROR** 27
- #define **DW_DLE_ELF_GETEHDR_ERROR** 28
- #define **DW_DLE_ELF_GETSHDR_ERROR** 29
- #define **DW_DLE_ELF_STRPTR_ERROR** 30
- #define **DW_DLE_DEBUG_INFO_DUPLICATE** 31
- #define **DW_DLE_DEBUG_INFO_NULL** 32
- #define **DW_DLE_DEBUG_ABBREV_DUPLICATE** 33
- #define **DW_DLE_DEBUG_ABBREV_NULL** 34
- #define **DW_DLE_DEBUG_ARANGES_DUPLICATE** 35
- #define **DW_DLE_DEBUG_ARANGES_NULL** 36
- #define **DW_DLE_DEBUG_LINE_DUPLICATE** 37
- #define **DW_DLE_DEBUG_LINE_NULL** 38
- #define **DW_DLE_DEBUG_LOC_DUPLICATE** 39
- #define **DW_DLE_DEBUG_LOC_NULL** 40
- #define **DW_DLE_DEBUG_MACINFO_DUPLICATE** 41
- #define **DW_DLE_DEBUG_MACINFO_NULL** 42
- #define **DW_DLE_DEBUG_PUBNAMES_DUPLICATE** 43
- #define **DW_DLE_DEBUG_PUBNAMES_NULL** 44
- #define **DW_DLE_DEBUG_STR_DUPLICATE** 45
- #define **DW_DLE_DEBUG_STR_NULL** 46
- #define **DW_DLE_CU_LENGTH_ERROR** 47
- #define **DW_DLE_VERSION_STAMP_ERROR** 48
- #define **DW_DLE_ABBREV_OFFSET_ERROR** 49

- #define **DW_DLE_ADDRESS_SIZE_ERROR** 50
- #define **DW_DLE_DEBUG_INFO_PTR_NULL** 51
- #define **DW_DLE_DIE_NULL** 52
- #define **DW_DLE_STRING_OFFSET_BAD** 53
- #define **DW_DLE_DEBUG_LINE_LENGTH_BAD** 54
- #define **DW_DLE_LINE_PROLOG_LENGTH_BAD** 55
- #define **DW_DLE_LINE_NUM_OPERANDS_BAD** 56
- #define **DW_DLE_LINE_SET_ADDR_ERROR** 57
- #define **DW_DLE_LINE_EXT_OPCODE_BAD** 58
- #define **DW_DLE_DWARF_LINE_NULL** 59
- #define **DW_DLE_INCL_DIR_NUM_BAD** 60
- #define **DW_DLE_LINE_FILE_NUM_BAD** 61
- #define **DW_DLE_ALLOC_FAIL** 62
- #define **DW_DLE_NO_CALLBACK_FUNC** 63
- #define **DW_DLE_SECT_ALLOC** 64
- #define **DW_DLE_FILE_ENTRY_ALLOC** 65
- #define **DW_DLE_LINE_ALLOC** 66
- #define **DW_DLE_FPGM_ALLOC** 67
- #define **DW_DLE_INCDIR_ALLOC** 68
- #define **DW_DLE_STRING_ALLOC** 69
- #define **DW_DLE_CHUNK_ALLOC** 70
- #define **DW_DLE_BYTEOFF_ERR** 71
- #define **DW_DLE_CIE_ALLOC** 72
- #define **DW_DLE_FDE_ALLOC** 73
- #define **DW_DLE_REGNO_OVFL** 74
- #define **DW_DLE_CIE_OFFS_ALLOC** 75
- #define **DW_DLE_WRONG_ADDRESS** 76
- #define **DW_DLE_EXTRA_NEIGHBORS** 77
- #define **DW_DLE_WRONG_TAG** 78
- #define **DW_DLE_DIE_ALLOC** 79
- #define **DW_DLE_PARENT_EXISTS** 80
- #define **DW_DLE_DBG_NULL** 81
- #define **DW_DLE_DEBUGLINE_ERROR** 82
- #define **DW_DLE_DEBUGFRAME_ERROR** 83
- #define **DW_DLE_DEBUGINFO_ERROR** 84
- #define **DW_DLE_ATTR_ALLOC** 85
- #define **DW_DLE_ABBREV_ALLOC** 86
- #define **DW_DLE_OFFSET_UFLW** 87
- #define **DW_DLE_ELF_SECT_ERR** 88
- #define **DW_DLE_DEBUG_FRAME_LENGTH_BAD** 89
- #define **DW_DLE_FRAME_VERSION_BAD** 90
- #define **DW_DLE_CIE_RET_ADDR_REG_ERROR** 91
- #define **DW_DLE_FDE_NULL** 92
- #define **DW_DLE_FDE_DBG_NULL** 93
- #define **DW_DLE_CIE_NULL** 94
- #define **DW_DLE_CIE_DBG_NULL** 95
- #define **DW_DLE_FRAME_TABLE_COL_BAD** 96
- #define **DW_DLE_PC_NOT_IN_FDE_RANGE** 97
- #define **DW_DLE_CIE_INSTR_EXEC_ERROR** 98
- #define **DW_DLE_FRAME_INSTR_EXEC_ERROR** 99
- #define **DW_DLE_FDE_PTR_NULL** 100
- #define **DW_DLE_RET_OP_LIST_NULL** 101
- #define **DW_DLE_LINE_CONTEXT_NULL** 102
- #define **DW_DLE_DBG_NO_CU_CONTEXT** 103
- #define **DW_DLE_DIE_NO_CU_CONTEXT** 104

- #define **DW_DLE_FIRST_DIE_NOT_CU** 105
- #define **DW_DLE_NEXT_DIE_PTR_NULL** 106
- #define **DW_DLE_DEBUG_FRAME_DUPLICATE** 107
- #define **DW_DLE_DEBUG_FRAME_NULL** 108
- #define **DW_DLE_ABBREV_DECODE_ERROR** 109
- #define **DW_DLE_DWARF_ABBREV_NULL** 110
- #define **DW_DLE_ATTR_NULL** 111
- #define **DW_DLE_DIE_BAD** 112
- #define **DW_DLE_DIE_ABBREV_BAD** 113
- #define **DW_DLE_ATTR_FORM_BAD** 114
- #define **DW_DLE_ATTR_NO_CU_CONTEXT** 115
- #define **DW_DLE_ATTR_FORM_SIZE_BAD** 116
- #define **DW_DLE_ATTR_DBG_NULL** 117
- #define **DW_DLE_BAD_REF_FORM** 118
- #define **DW_DLE_ATTR_FORM_OFFSET_BAD** 119
- #define **DW_DLE_LINE_OFFSET_BAD** 120
- #define **DW_DLE_DEBUG_STR_OFFSET_BAD** 121
- #define **DW_DLE_STRING_PTR_NULL** 122
- #define **DW_DLE_PUBNAMES_VERSION_ERROR** 123
- #define **DW_DLE_PUBNAMES_LENGTH_BAD** 124
- #define **DW_DLE_GLOBAL_NULL** 125
- #define **DW_DLE_GLOBAL_CONTEXT_NULL** 126
- #define **DW_DLE_DIR_INDEX_BAD** 127
- #define **DW_DLE_LOC_EXPR_BAD** 128
- #define **DW_DLE_DIE_LOC_EXPR_BAD** 129
- #define **DW_DLE_ADDR_ALLOC** 130
- #define **DW_DLE_OFFSET_BAD** 131
- #define **DW_DLE_MAKE_CU_CONTEXT_FAIL** 132
- #define **DW_DLE_REL_ALLOC** 133
- #define **DW_DLE_ARANGE_OFFSET_BAD** 134
- #define **DW_DLE_SEGMENT_SIZE_BAD** 135
- #define **DW_DLE_ARANGE_LENGTH_BAD** 136
- #define **DW_DLE_ARANGE_DECODE_ERROR** 137
- #define **DW_DLE_ARANGES_NULL** 138
- #define **DW_DLE_ARANGE_NULL** 139
- #define **DW_DLE_NO_FILE_NAME** 140
- #define **DW_DLE_NO_COMP_DIR** 141
- #define **DW_DLE_CU_ADDRESS_SIZE_BAD** 142
- #define **DW_DLE_INPUT_ATTR_BAD** 143
- #define **DW_DLE_EXPR_NULL** 144
- #define **DW_DLE_BAD_EXPR_OPCODE** 145
- #define **DW_DLE_EXPR_LENGTH_BAD** 146
- #define **DW_DLE_MULTIPLE_RELOC_IN_EXPR** 147
- #define **DW_DLE_ELF_GETIDENT_ERROR** 148
- #define **DW_DLE_NO_AT_MIPS_FDE** 149
- #define **DW_DLE_NO_CIE_FOR_FDE** 150
- #define **DW_DLE_DIE_ABBREV_LIST_NULL** 151
- #define **DW_DLE_DEBUG_FUNCNAMES_DUPLICATE** 152
- #define **DW_DLE_DEBUG_FUNCNAMES_NULL** 153
- #define **DW_DLE_DEBUG_FUNCNAMES_VERSION_ERROR** 154
- #define **DW_DLE_DEBUG_FUNCNAMES_LENGTH_BAD** 155
- #define **DW_DLE_FUNC_NULL** 156
- #define **DW_DLE_FUNC_CONTEXT_NULL** 157
- #define **DW_DLE_DEBUG_TYPENAMES_DUPLICATE** 158
- #define **DW_DLE_DEBUG_TYPENAMES_NULL** 159

- #define **DW_DLE_DEBUG_TYPENAMES_VERSION_ERROR** 160
- #define **DW_DLE_DEBUG_TYPENAMES_LENGTH_BAD** 161
- #define **DW_DLE_TYPE_NULL** 162
- #define **DW_DLE_TYPE_CONTEXT_NULL** 163
- #define **DW_DLE_DEBUG_VARNAMES_DUPLICATE** 164
- #define **DW_DLE_DEBUG_VARNAMES_NULL** 165
- #define **DW_DLE_DEBUG_VARNAMES_VERSION_ERROR** 166
- #define **DW_DLE_DEBUG_VARNAMES_LENGTH_BAD** 167
- #define **DW_DLE_VAR_NULL** 168
- #define **DW_DLE_VAR_CONTEXT_NULL** 169
- #define **DW_DLE_DEBUG_WEAKNAMES_DUPLICATE** 170
- #define **DW_DLE_DEBUG_WEAKNAMES_NULL** 171
- #define **DW_DLE_DEBUG_WEAKNAMES_VERSION_ERROR** 172
- #define **DW_DLE_DEBUG_WEAKNAMES_LENGTH_BAD** 173
- #define **DW_DLE_WEAK_NULL** 174
- #define **DW_DLE_WEAK_CONTEXT_NULL** 175
- #define **DW_DLE_LOCDESC_COUNT_WRONG** 176
- #define **DW_DLE_MACINFO_STRING_NULL** 177
- #define **DW_DLE_MACINFO_STRING_EMPTY** 178
- #define **DW_DLE_MACINFO_INTERNAL_ERROR_SPACE** 179
- #define **DW_DLE_MACINFO_MALLOC_FAIL** 180
- #define **DW_DLE_DEBUGMACINFO_ERROR** 181
- #define **DW_DLE_DEBUG_MACRO_LENGTH_BAD** 182
- #define **DW_DLE_DEBUG_MACRO_MAX_BAD** 183
- #define **DW_DLE_DEBUG_MACRO_INTERNAL_ERR** 184
- #define **DW_DLE_DEBUG_MACRO_MALLOC_SPACE** 185
- #define **DW_DLE_DEBUG_MACRO_INCONSISTENT** 186
- #define **DW_DLE_DF_NO_CIE_AUGMENTATION** 187
- #define **DW_DLE_DF_REG_NUM_TOO_HIGH** 188
- #define **DW_DLE_DF_MAKE_INSTR_NO_INIT** 189
- #define **DW_DLE_DF_NEW_LOC_LESS_OLD_LOC** 190
- #define **DW_DLE_DF_POP_EMPTY_STACK** 191
- #define **DW_DLE_DF_ALLOC_FAIL** 192
- #define **DW_DLE_DF_FRAME_DECODING_ERROR** 193
- #define **DW_DLE_DEBUG_LOC_SECTION_SHORT** 194
- #define **DW_DLE_FRAME_AUGMENTATION_UNKNOWN** 195
- #define **DW_DLE_PUBTYPE_CONTEXT** 196 /∗ Unused. ∗/
- #define **DW_DLE_DEBUG_PUBTYPES_LENGTH_BAD** 197
- #define **DW_DLE_DEBUG_PUBTYPES_VERSION_ERROR** 198
- #define **DW_DLE_DEBUG_PUBTYPES_DUPLICATE** 199
- #define **DW_DLE_FRAME_CIE_DECODE_ERROR** 200
- #define **DW_DLE_FRAME_REGISTER_UNREPRESENTABLE** 201
- #define **DW_DLE_FRAME_REGISTER_COUNT_MISMATCH** 202
- #define **DW_DLE_LINK_LOOP** 203
- #define **DW_DLE_STRP_OFFSET_BAD** 204
- #define **DW_DLE_DEBUG_RANGES_DUPLICATE** 205
- #define **DW_DLE_DEBUG_RANGES_OFFSET_BAD** 206
- #define **DW_DLE_DEBUG_RANGES_MISSING_END** 207
- #define **DW_DLE_DEBUG_RANGES_OUT_OF_MEM** 208
- #define **DW_DLE_DEBUG_SYMTAB_ERR** 209
- #define **DW_DLE_DEBUG_STRTAB_ERR** 210
- #define **DW_DLE_RELOC_MISMATCH_INDEX** 211
- #define **DW_DLE_RELOC_MISMATCH_RELOC_INDEX** 212
- #define **DW_DLE_RELOC_MISMATCH_STRTAB_INDEX** 213
- #define **DW_DLE_RELOC_SECTION_MISMATCH** 214

- #define **DW_DLE_RELOC_SECTION_MISSING_INDEX** 215
- #define **DW_DLE_RELOC_SECTION_LENGTH_ODD** 216
- #define **DW_DLE_RELOC_SECTION_PTR_NULL** 217
- #define **DW_DLE_RELOC_SECTION_MALLOC_FAIL** 218
- #define **DW_DLE_NO_ELF64_SUPPORT** 219
- #define **DW_DLE_MISSING_ELF64_SUPPORT** 220
- #define **DW_DLE_ORPHAN_FDE** 221
- #define **DW_DLE_DUPLICATE_INST_BLOCK** 222
- #define **DW_DLE_BAD_REF_SIG8_FORM** 223
- #define **DW_DLE_ATTR_EXPRLOC_FORM_BAD** 224
- #define **DW_DLE_FORM_SEC_OFFSET_LENGTH_BAD** 225
- #define **DW_DLE_NOT_REF_FORM** 226
- #define **DW_DLE_DEBUG_FRAME_LENGTH_NOT_MULTIPLE** 227
- #define **DW_DLE_REF_SIG8_NOT_HANDLED** 228
- #define **DW_DLE_DEBUG_FRAME_POSSIBLE_ADDRESS_BOTCH** 229
- #define **DW_DLE_LOC_BAD_TERMINATION** 230
- #define **DW_DLE_SYMTAB_SECTION_LENGTH_ODD** 231
- #define **DW_DLE_RELOC_SECTION_SYMBOL_INDEX_BAD** 232
- #define **DW_DLE_RELOC_SECTION_RELOC_TARGET_SIZE_UNKNOWN** 233
- #define **DW_DLE_SYMTAB_SECTION_ENTRYSIZE_ZERO** 234
- #define **DW_DLE_LINE_NUMBER_HEADER_ERROR** 235
- #define **DW_DLE_DEBUG_TYPES_NULL** 236
- #define **DW_DLE_DEBUG_TYPES_DUPLICATE** 237
- #define **DW_DLE_DEBUG_TYPES_ONLY_DWARF4** 238
- #define **DW_DLE_DEBUG_TYPEOFFSET_BAD** 239
- #define **DW_DLE_GNU_OPCODE_ERROR** 240
- #define **DW_DLE_DEBUGPUBTYPES_ERROR** 241
- #define **DW_DLE_AT_FIXUP_NULL** 242
- #define **DW_DLE_AT_FIXUP_DUP** 243
- #define **DW_DLE_BAD_ABINAME** 244
- #define **DW_DLE_TOO_MANY_DEBUG** 245
- #define **DW_DLE_DEBUG_STR_OFFSETS_DUPLICATE** 246
- #define **DW_DLE_SECTION_DUPLICATION** 247
- #define **DW_DLE_SECTION_ERROR** 248
- #define **DW_DLE_DEBUG_ADDR_DUPLICATE** 249
- #define **DW_DLE_DEBUG_CU_UNAVAILABLE_FOR_FORM** 250
- #define **DW_DLE_DEBUG_FORM_HANDLING_INCOMPLETE** 251
- #define **DW_DLE_NEXT_DIE_PAST_END** 252
- #define **DW_DLE_NEXT_DIE_WRONG_FORM** 253
- #define **DW_DLE_NEXT_DIE_NO_ABBREV_LIST** 254
- #define **DW_DLE_NESTED_FORM_INDIRECT_ERROR** 255
- #define **DW_DLE_CU_DIE_NO_ABBREV_LIST** 256
- #define **DW_DLE_MISSING_NEEDED_DEBUG_ADDR_SECTION** 257
- #define **DW_DLE_ATTR_FORM_NOT_ADDR_INDEX** 258
- #define **DW_DLE_ATTR_FORM_NOT_STR_INDEX** 259
- #define **DW_DLE_DUPLICATE_GDB_INDEX** 260
- #define **DW_DLE_ERRONEOUS_GDB_INDEX_SECTION** 261
- #define **DW_DLE_GDB_INDEX_COUNT_ERROR** 262
- #define **DW_DLE_GDB_INDEX_COUNT_ADDR_ERROR** 263
- #define **DW_DLE_GDB_INDEX_INDEX_ERROR** 264
- #define **DW_DLE_GDB_INDEX_CUVEC_ERROR** 265
- #define **DW_DLE_DUPLICATE_CU_INDEX** 266
- #define **DW_DLE_DUPLICATE_TU_INDEX** 267
- #define **DW_DLE_XU_TYPE_ARG_ERROR** 268
- #define **DW_DLE_XU_IMPOSSIBLE_ERROR** 269

- #define **DW_DLE_XU_NAME_COL_ERROR** 270
- #define **DW_DLE_XU_HASH_ROW_ERROR** 271
- #define **DW_DLE_XU_HASH_INDEX_ERROR** 272
- #define **DW_DLE_FAILSAFE_ERRVAL** 273
- #define **DW_DLE_ARANGE_ERROR** 274
- #define **DW_DLE_PUBNAMES_ERROR** 275
- #define **DW_DLE_FUNCNAMES_ERROR** 276
- #define **DW_DLE_TYPENAMES_ERROR** 277
- #define **DW_DLE_VARNAMES_ERROR** 278
- #define **DW_DLE_WEAKNAMES_ERROR** 279
- #define **DW_DLE_RELOCS_ERROR** 280
- #define **DW_DLE_ATTR_OUTSIDE_SECTION** 281
- #define **DW_DLE_FISSION_INDEX_WRONG** 282
- #define **DW_DLE_FISSION_VERSION_ERROR** 283
- #define **DW_DLE_NEXT_DIE_LOW_ERROR** 284
- #define **DW_DLE_CU_UT_TYPE_ERROR** 285
- #define **DW_DLE_NO_SUCH_SIGNATURE_FOUND** 286
- #define **DW_DLE_SIGNATURE_SECTION_NUMBER_WRONG** 287
- #define **DW_DLE_ATTR_FORM_NOT_DATA8** 288
- #define **DW_DLE_SIG_TYPE_WRONG_STRING** 289
- #define **DW_DLE_MISSING_REQUIRED_TU_OFFSET_HASH** 290
- #define **DW_DLE_MISSING_REQUIRED_CU_OFFSET_HASH** 291
- #define **DW_DLE_DWP_MISSING_DWO_ID** 292
- #define **DW_DLE_DWP_SIBLING_ERROR** 293
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- #define **DW_DLE_NO_TIED_SIG_AVAILABLE** 302
- #define **DW_DLE_STRING_NOT_TERMINATED** 303
- #define **DW_DLE_BAD_LINE_TABLE_OPERATION** 304
- #define **DW_DLE_LINE_CONTEXT_BOTCH** 305
- #define **DW_DLE_LINE_CONTEXT_INDEX_WRONG** 306
- #define **DW_DLE_NO_TIED_STRING_AVAILABLE** 307
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- #define **DW_DLE_CU_TYPE_MISSING** 309
- #define **DW_DLE_LLE_CODE_UNKNOWN** 310
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- #define **DW_DLE_INTERFACE_NOT_SUPPORTED** 313
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- #define **DW_DLE_ZDEBUG_INPUT_FORMAT_ODD** 315
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- #define **DW_DLE_ZLIB_DATA_ERROR** 317
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- #define **DW_DLE_BAD_MACRO_INDEX** 323
- #define **DW_DLE_MACRO_OP_UNHANDLED** 324

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- #define **DW_DLE_DEBUG_RNGLISTS_DUPLICATE** 359
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- #define **DW_DLE_FORM_STRING_BAD_STRING** 361
- #define **DW_DLE_AUGMENTATION_STRING_OFF_END** 362
- #define **DW_DLE_STRING_OFF_END_PUBNAMES_LIKE** 363
- #define **DW_DLE_LINE_STRING_BAD** 364
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- #define **DW_DLE_MACRO_STRING_BAD** 366
- #define **DW_DLE_MACINFO_STRING_BAD** 367
- #define **DW_DLE_ZLIB_UNCOMPRESS_ERROR** 368
- #define **DW_DLE_IMPROPER_DWO_ID** 369
- #define **DW_DLE_GROUPNUMBER_ERROR** 370
- #define **DW_DLE_ADDRESS_SIZE_ZERO** 371
- #define **DW_DLE_DEBUG_NAMES_HEADER_ERROR** 372
- #define **DW_DLE_DEBUG_NAMES_AUG_STRING_ERROR** 373
- #define **DW_DLE_DEBUG_NAMES_PAD_NON_ZERO** 374
- #define **DW_DLE_DEBUG_NAMES_OFF_END** 375
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- #define **DW_DLE_DEBUG_NAMES_NULL_POINTER** 378
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- #define **DW_DLE_DEBUG_NAMES_UNHANDLED_FORM** 381
- #define **DW_DLE_LNCT_CODE_UNKNOWN** 382
- #define **DW_DLE_LNCT_FORM_CODE_NOT_HANDLED** 383
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- #define **DW_DLE_UNIT_TYPE_NOT_HANDLED** 386
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- #define **DW_DLE_GROUP_MAP_DUPLICATE** 388
- #define **DW_DLE_GROUP_COUNT_ERROR** 389
- #define **DW_DLE_GROUP_INTERNAL_ERROR** 390
- #define **DW_DLE_GROUP_LOAD_ERROR** 391
- #define **DW_DLE_GROUP_LOAD_READ_ERROR** 392
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- #define **DW_DLE_ABBREV_MISSING** 394
- #define **DW_DLE_NO_TAG_FOR_DIE** 395
- #define **DW_DLE_LOWPC_WRONG_CLASS** 396
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- #define **DW_DLE_OFFSET_SIZE** 415
- #define **DW_DLE_MACH_O_SEGOFFSET_BAD** 416
- #define **DW_DLE_FILE_OFFSET_BAD** 417
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- #define **DW_DLE_ELF_ENDIAN_BAD** 421
- #define **DW_DLE_ELF_VERSION_BAD** 422
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- #define **DW_DLE_BAD_TYPE_SIZE** 425
- #define **DW_DLE_PE_SIZE_SMALL** 426
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- #define **DW_DLE_PRODUCER_CODE_NOT_AVAILABLE** 431
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- #define **DW_DLE_RETURN_EMPTY_PUBNAMES_ERROR** 434

- #define **DW_DLE_SECTION_SIZE_ERROR** 435
- #define **DW_DLE_INTERNAL_NULL_POINTER** 436
- #define **DW_DLE_SECTION_STRING_OFFSET_BAD** 437
- #define **DW_DLE_SECTION_INDEX_BAD** 438
- #define **DW_DLE_INTEGER_TOO_SMALL** 439
- #define **DW_DLE_ELF_SECTION_LINK_ERROR** 440
- #define **DW_DLE_ELF_SECTION_GROUP_ERROR** 441
- #define **DW_DLE_ELF_SECTION_COUNT_MISMATCH** 442
- #define **DW_DLE_ELF_STRING_SECTION_MISSING** 443
- #define **DW_DLE_SEEK_OFF_END** 444
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- #define **DW_DLE_ELF_SECTION_ERROR** 446
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- #define **DW_DLE_RNGLISTS_ERROR** 468
- #define **DW_DLE_LOCLISTS_ERROR** 469
- #define **DW_DLE_SECTION_SIZE_OR_OFFSET_LARGE** 470
- #define **DW_DLE_GDBINDEX_STRING_ERROR** 471
- #define **DW_DLE_GNU_PUBNAMES_ERROR** 472
- #define **DW_DLE_GNU_PUBTYPES_ERROR** 473
- #define **DW_DLE_DUPLICATE_GNU_DEBUG_PUBNAMES** 474
- #define **DW_DLE_DUPLICATE_GNU_DEBUG_PUBTYPES** 475
- #define **DW_DLE_DEBUG_SUP_STRING_ERROR** 476
- #define **DW_DLE_DEBUG_SUP_ERROR** 477
- #define **DW_DLE_LOCATION_ERROR** 478
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- #define **DW_DLE_SIGNATURE_MISMATCH** 480
- #define **DW_DLE_MACRO_VERSION_ERROR** 481
- #define **DW_DLE_NEGATIVE_SIZE** 482
- #define **DW_DLE_UDATA_VALUE_NEGATIVE** 483
- #define **DW_DLE_DEBUG_NAMES_ERROR** 484
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- #define **DW_DLE_MACHO_CORRUPT_HEADER** 486
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- #define **DW_DLE_MACHO_CORRUPT_SECTIONDETAILS** 488
- #define **DW_DLE_RELOCATION_SECTION_SIZE_ERROR** 489

- #define **DW_DLE_SYMBOL_SECTION_SIZE_ERROR** 490
- #define **DW_DLE_PE_SECTION_SIZE_ERROR** 491
- #define **DW_DLE_DEBUG_ADDR_ERROR** 492
- #define **DW_DLE_NO_SECT_STRINGS** 493
- #define **DW_DLE_TOO_FEW_SECTIONS** 494
- #define **DW_DLE_BUILD_ID_DESCRIPTION_SIZE** 495
- #define **DW_DLE_BAD_SECTION_FLAGS** 496
- #define **DW_DLE_IMPROPER_SECTION_ZERO** 497
- #define **DW_DLE_INVALID_NULL_ARGUMENT** 498
- #define **DW_DLE_LINE_INDEX_WRONG** 499
- #define **DW_DLE_LINE_COUNT_WRONG** 500
- #define **DW_DLE_ARITHMETIC_OVERFLOW** 501
- #define **DW_DLE_UNIVERSAL_BINARY_ERROR** 502
- #define **DW_DLE_UNIV_BIN_OFFSET_SIZE_ERROR** 503
- #define **DW_DLE_PE_SECTION_SIZE_HEURISTIC_FAIL** 504
- #define **DW_DLE_LLE_ERROR** 505
- #define **DW_DLE_RLE_ERROR** 506
- #define **DW_DLE_MACHO_SEGMENT_COUNT_HEURISTIC_FAIL** 507
- #define **DW_DLE_DUPLICATE_NOTE_GNU_BUILD_ID** 508
- #define **DW_DLE_SYSCONF_VALUE_UNUSABLE** 509
- #define DW_DLE_LAST 509
- #define **DW_DLE_LO_USER** 0x10000

9.6.1 Detailed Description

These identify the various error codes that have been used. Not all of them are still use. We do not recycle obsolete codes into new uses. The codes 1 through 22 are historic and it is unlikely they are used anywhere in the library.

9.6.2 Macro Definition Documentation

9.6.2.1 DW_DLE_LAST

```
#define DW_DLE_LAST 509
```

Note

DW_DLE_LAST MUST EQUAL LAST ERROR NUMBER

9.7 Libdwarf Initialization Functions

Functions

- DW_API int dwarf_init_path (const char ∗dw_path, char ∗dw_true_path_out_buffer, unsigned int dw_true_path_bufferlen, unsigned int dw_groupnumber, Dwarf_Handler dw_errhand, Dwarf_Ptr dw_errarg, Dwarf_Debug ∗dw_dbg, Dwarf_Error ∗dw_error)

  Initialization based on path, the most common initialization.
- DW_API int dwarf_init_path_a (const char ∗dw_path, char ∗dw_true_path_out_buffer, unsigned int dw_true_path_bufferlen, unsigned int dw_groupnumber, unsigned int dw_universalnumber, Dwarf_Handler dw_errhand, Dwarf_Ptr dw_errarg, Dwarf_Debug ∗dw_dbg, Dwarf_Error ∗dw_error)

Initialization based on path.

- DW_API int dwarf_init_path_dl (const char ∗dw_path, char ∗dw_true_path_out_buffer, unsigned int dw↩_true_path_bufferlen, unsigned int dw_groupnumber, Dwarf_Handler dw_errhand, Dwarf_Ptr dw_errarg, Dwarf_Debug ∗dw_dbg, char ∗∗dw_dl_path_array, unsigned int dw_dl_path_array_size, unsigned char ∗dw_dl_path_source, Dwarf_Error ∗dw_error)

  Initialization following GNU debuglink section data.
- DW_API int dwarf_init_path_dl_a (const char ∗dw_path, char ∗dw_true_path_out_buffer, unsigned int dw_↩true_path_bufferlen, unsigned int dw_groupnumber, unsigned int dw_universalnumber, Dwarf_Handler dw↩_errhand, Dwarf_Ptr dw_errarg, Dwarf_Debug ∗dw_dbg, char ∗∗dw_dl_path_array, unsigned int dw_dl_↩path_array_size, unsigned char ∗dw_dl_path_source, Dwarf_Error ∗dw_error)

  Initialization based on path with debuglink.
- DW_API int dwarf_init_b (int dw_fd, unsigned int dw_groupnumber, Dwarf_Handler dw_errhand, Dwarf_Ptr dw_errarg, Dwarf_Debug ∗dw_dbg, Dwarf_Error ∗dw_error)

  Initialization based on Unix/Linux (etc) fd.
- DW_API int dwarf_finish (Dwarf_Debug dw_dbg)

  Close the initialized dw_dbg and free all data libdwarf has for this dw_dbg.
- DW_API int dwarf_object_init_b (Dwarf_Obj_Access_Interface_a ∗dw_obj, Dwarf_Handler dw_errhand, Dwarf_Ptr dw_errarg, unsigned int dw_groupnumber, Dwarf_Debug ∗dw_dbg, Dwarf_Error ∗dw_error)

  Used to access DWARF information in memory or in an object format unknown to libdwarf.
- DW_API int dwarf_object_finish (Dwarf_Debug dw_dbg)

  Used to close the object_init dw_dbg.
- DW_API int dwarf_set_tied_dbg (Dwarf_Debug dw_split_dbg, Dwarf_Debug dw_tied_dbg, Dwarf_Error ∗dw_error)

  Use with split dwarf.
- DW_API int dwarf_get_tied_dbg (Dwarf_Debug dw_dbg, Dwarf_Debug ∗dw_tieddbg_out, Dwarf_Error ∗dw↩_error)

  Use with split dwarf.

9.7.1 Detailed Description

9.7.2 Initialization And Finish Operations

Opening and closing libdwarf on object files.

9.7.3 Function Documentation

9.7.3.1 dwarf_finish()

```
DW_API int dwarf_finish (
            Dwarf_Debug dw_dbg )
```

Close the initialized dw_dbg and free all data libdwarf has for this dw_dbg.

Parameters

dw_dbg	Close the dbg.

Returns

May return DW_DLV_ERROR if something is very wrong: no further information is available.. May return DW_DLV_NO_ENTRY but no further information is available. Normally returns DW_DLV_OK.

There is nothing the caller can do with the return value except report it somehow. Most callers ignore the return value.

9.7.3.2 dwarf_get_tied_dbg()

```
DW_API int dwarf_get_tied_dbg (
            Dwarf_Debug dw_dbg,
            Dwarf_Debug * dw_tieddbg_out,
            Dwarf_Error * dw_error )
```

Use with split dwarf.

Given a main Dwarf_Debug this returns the tied Dwarf_Debug if there is one or else returns null(0).

Before v0.11.0 it was not defined what this returned if the tied-Dwarf_Debug was passed in, but it would have returned null(0) in that case. Unlikely anyone uses this call as callers had the tied and base dbg when calling dwarf_set_tied_dbg().

Parameters

dw_dbg	Pass in a non-null Dwarf_Debug which is either a main-Dwarf_Debug or a tied-Dwarf_Debug.
dw_tieddbg_out	On success returns the applicable tied-Dwarf_Debug through the pointer. If dw_dbg is a tied-Dwarf_Debug the function returns null(0) through the poiner. If there is no tied-Dwarf_Debug (meaning there is just a main-Dwarf_Debug) the function returns null (0) through the pointer.
dw_error	If the dw_dbg is invalid or damaged then the function returns DW_DLV_ERROR and dw_error is set to point to the error details.

Returns

DW_DLV_OK or DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY.

9.7.3.3 dwarf_init_b()

```
DW_API int dwarf_init_b (
            int dw_fd,
            unsigned int dw_groupnumber,
            Dwarf_Handler dw_errhand,
            Dwarf_Ptr dw_errarg,
            Dwarf_Debug * dw_dbg,
            Dwarf_Error * dw_error )
```

Initialization based on Unix/Linux (etc) fd.

In case DW_DLV_ERROR returned be sure to call dwarf_dealloc_error even though the returned Dwarf_Debug is NULL.

Parameters

dw_fd	An open Unix/Linux/etc fd on the object file.
dw_groupnumber	The value passed in should be DW_GROUPNUMBER_ANY unless one wishes to other than a standard group.
dw_errhand	Pass in NULL unless one wishes libdwarf to call this error handling function (which you must write) instead of passing meaningful values to the dw_error argument.
dw_errarg	If dw_errorhand is non-null, then this value (a pointer or integer that means something to you) is passed to the dw_errhand function in case that is helpful to you.
dw_dbg	On success, ∗dw_dbg is set to a pointer to a new Dwarf_Debug structure to be used in calls to libdwarf functions.
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

9.7.3.4 dwarf_init_path()

```
DW_API int dwarf_init_path (
            const char * dw_path,
            char * dw_true_path_out_buffer,
            unsigned int dw_true_path_bufferlen,
            unsigned int dw_groupnumber,
            Dwarf_Handler dw_errhand,
            Dwarf_Ptr dw_errarg,
            Dwarf_Debug * dw_dbg,
            Dwarf_Error * dw_error )
```

Initialization based on path, the most common initialization.

On a Mach-O universal binary this function can only return information about the first (zero index) object in the universal binary.

Parameters

dw_path	Pass in the path to the object file to open.
dw_true_path_out_buffer	Pass in NULL or the name of a string buffer (The buffer should be initialized with an initial NUL byte) The returned string will be null-terminated. The path actually used is copied to true_path_out. If true_path_buffer len is zero or true_path_out_buffer is zero then the Special Macos processing will not occur, nor will the GNU_debuglink processing occur. In case GNU debuglink data was followed or Macos dSYM applies the true_path_out will not match path and the initial byte will be non-null. The value put in true_path_out is the actual file name.
dw_true_path_bufferlen	Pass in the length in bytes of the buffer.
dw_groupnumber	The value passed in should be DW_GROUPNUMBER_ANY unless one wishes to other than a standard group.
dw_errhand	Pass in NULL unless one wishes libdwarf to call this error handling function (which you must write) instead of passing meaningful values to the dw_error argument.
dw_errarg	If dw_errorhand is non-null, then this value (a pointer or integer that means something to you) is passed to the dw_errhand function in case that is helpful to you.
dw_dbg	On success, ∗dw_dbg is set to a pointer to a new Dwarf_Debug structure to be used in calls to libdwarf functions.
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

Details on separate DWARF object access

See also

dwarf_init_path_dl dwarf_init_b

Using dwarf_init_path()

9.7.3.5 dwarf_init_path_a()

```
DW_API int dwarf_init_path_a (
             const char * dw_path,
             char * dw_true_path_out_buffer,
             unsigned int dw_true_path_bufferlen,
             unsigned int dw_groupnumber,
             unsigned int dw_universalnumber,
             Dwarf_Handler dw_errhand,
             Dwarf_Ptr dw_errarg,
             Dwarf_Debug * dw_dbg,
             Dwarf_Error * dw_error )
```

Initialization based on path.

This identical to dwarf_init_path() except that it adds a new argument, dw_universalnumber, with which you can specify which object in a Mach-O universal binary you wish to open.

It is always safe and appropriate to pass zero as the dw_universalnumber. Elf and PE and (non-universal) Mach-O object files ignore the value of dw_universalnumber.

9.7.3.6 dwarf_init_path_dl()

```
DW_API int dwarf_init_path_dl (
             const char * dw_path,
             char * dw_true_path_out_buffer,
             unsigned int dw_true_path_bufferlen,
             unsigned int dw_groupnumber,
             Dwarf_Handler dw_errhand,
             Dwarf_Ptr dw_errarg,
             Dwarf_Debug * dw_dbg,
             char ** dw_dl_path_array,
             unsigned int dw_dl_path_array_size,
             unsigned char * dw_dl_path_source,
             Dwarf_Error * dw_error )
```

Initialization following GNU debuglink section data.

Sets the true-path with DWARF if there is appropriate debuglink data available.

In case DW_DLV_ERROR returned be sure to call dwarf_dealloc_error even though the returned Dwarf_Debug is NULL.

Parameters

dw_path	Pass in the path to the object file to open.
dw_true_path_out_buffer	Pass in NULL or the name of a string buffer.
dw_true_path_bufferlen	Pass in the length in bytes of the buffer.
dw_groupnumber	The value passed in should be DW_GROUPNUMBER_ANY unless one wishes to other than a standard group.
dw_errhand	Pass in NULL, normally. If non-null one wishes libdwarf to call this error handling function (which you must write) instead of passing meaningful values to the dw_error argument.
dw_errarg	Pass in NULL, normally. If dw_errorhand is non-null, then this value (a pointer or integer that means something to you) is passed to the dw_errhand function in case that is helpful to you.
dw_dbg	On success, ∗dw_dbg is set to a pointer to a new Dwarf_Debug structure to be used in calls to libdwarf functions.
dw_dl_path_array	debuglink processing allows a user-specified set of file paths and this argument allows one to specify these. Pass in a pointer to array of pointers to strings which you, the caller, have filled in. The strings should be alternate paths (see the GNU debuglink documentation.)
dw_dl_path_array_size	Specify the size of the dw_dl_path_array.
dw_dl_path_source	returns DW_PATHSOURCE_basic or other such value so the caller can know how the true-path was resolved.
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

Details on separate DWARF object access

See also

Using dwarf_init_path_dl()

9.7.3.7 dwarf_init_path_dl_a()

```
DW_API int dwarf_init_path_dl_a (
             const char * dw_path,
             char * dw_true_path_out_buffer,
             unsigned int dw_true_path_bufferlen,
             unsigned int dw_groupnumber,
             unsigned int dw_universalnumber,
             Dwarf_Handler dw_errhand,
             Dwarf_Ptr dw_errarg,
             Dwarf_Debug * dw_dbg,
             char ** dw_dl_path_array,
             unsigned int dw_dl_path_array_size,
             unsigned char * dw_dl_path_source,
             Dwarf_Error * dw_error )
```

Initialization based on path with debuglink.

This identical to dwarf_init_path_dl() except that it adds a new argument, dw_universalnumber, with which you can specify which object in a Mach-O universal binary you wish to open.

It is always safe and appropriate to pass zero as the dw_universalnumber. Elf and PE and (non-universal) Mach-O object files ignore the value of dw_universalnumber.

Mach-O objects do not contain or use debuglink data.

9.7.3.8 dwarf_object_finish()

```
DW_API int dwarf_object_finish (
            Dwarf_Debug dw_dbg )
```

Used to close the object_init dw_dbg.

Close the dw_dbg opened by dwarf_object_init_b().

Parameters

dw_dbg	Must be an open Dwarf_Debug opened by dwarf_object_init_b(). The init call dw_obj data is not freed by the call to dwarf_object_finish.

Returns

The return value DW_DLV_OK etc is useless, one could possibly report it somehow. Callers usually ignore the return value.

9.7.3.9 dwarf_object_init_b()

```
DW_API int dwarf_object_init_b (
            Dwarf_Obj_Access_Interface_a * dw_obj,
            Dwarf_Handler dw_errhand,
            Dwarf_Ptr dw_errarg,
            unsigned int dw_groupnumber,
            Dwarf_Debug * dw_dbg,
            Dwarf_Error * dw_error )
```

Used to access DWARF information in memory or in an object format unknown to libdwarf.

In case DW_DLV_ERROR returned be sure to call dwarf_dealloc_error even though the returned Dwarf_Debug is NULL.

See also

Demonstrating reading DWARF without a file.

and

See also

dw_noobject Reading DWARF not in object file

Parameters

dw_obj	A data structure filled out by the caller so libdwarf can access DWARF data not in a supported object file format.
dw_errhand	Pass in NULL normally.
dw_errarg	Pass in NULL normally.
dw_groupnumber	The value passed in should be DW_GROUPNUMBER_ANY unless one wishes to other than a standard group (quite unlikely for this interface).
dw_dbg	On success, *dw_dbg is set to a pointer to a new Dwarf_Debug structure to be used in calls to libdwarf functions.
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.7.3.10 dwarf_set_tied_dbg()

```
DW_API int dwarf_set_tied_dbg (
            Dwarf_Debug dw_split_dbg,
            Dwarf_Debug dw_tied_dbg,
            Dwarf_Error * dw_error )
```

Use with split dwarf.

In libdwarf usage the object file being reported on [a] is opened with dwarf_init_path() or the like. If that object file [a] is a split-dwarf object then important data needed to report all of what is in the object file [a] needs an open Dwarf_Debug on the base object file [b] (usually the base executable object). Here we call that executable object file [b] the *tied* object.

See DWARF5 Appendix F.

Parameters

dw_split_dbg	Pass in an open dbg, on a split-dwarf object file with (normally) lots of DWARF but no executable code.
dw_tied_dbg	Pass in an open dbg on an executable (we call it a *tied* dbg here) which has minimal DWARF (to save space in the executable).
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

See also

Attaching a tied dbg

Detaching a tied dbg

9.8 Compilation Unit (CU) Access

Functions

- DW_API int dwarf_next_cu_header_e (Dwarf_Debug dw_dbg, Dwarf_Bool dw_is_info, Dwarf_Die ∗dw_cu←_die, Dwarf_Unsigned ∗dw_cu_header_length, Dwarf_Half ∗dw_version_stamp, Dwarf_Off ∗dw_abbrev←_offset, Dwarf_Half ∗dw_address_size, Dwarf_Half ∗dw_length_size, Dwarf_Half ∗dw_extension_size, Dwarf_Sig8 ∗dw_type_signature, Dwarf_Unsigned ∗dw_typeoffset, Dwarf_Unsigned ∗dw_next_cu_header←_offset, Dwarf_Half ∗dw_header_cu_type, Dwarf_Error ∗dw_error)

  Return information on the next CU header(e).
- DW_API int dwarf_next_cu_header_d (Dwarf_Debug dw_dbg, Dwarf_Bool dw_is_info, Dwarf_Unsigned ∗dw_cu_header_length, Dwarf_Half ∗dw_version_stamp, Dwarf_Off ∗dw_abbrev_offset, Dwarf_Half ∗dw←_address_size, Dwarf_Half ∗dw_length_size, Dwarf_Half ∗dw_extension_size, Dwarf_Sig8 ∗dw_type←_signature, Dwarf_Unsigned ∗dw_typeoffset, Dwarf_Unsigned ∗dw_next_cu_header_offset, Dwarf_Half ∗dw_header_cu_type, Dwarf_Error ∗dw_error)

Return information on the next CU header(d)

- DW_API int dwarf_siblingof_c (Dwarf_Die dw_die, Dwarf_Die ∗dw_return_siblingdie, Dwarf_Error ∗dw_error)

  Return the next sibling DIE.
- DW_API int dwarf_siblingof_b (Dwarf_Debug dw_dbg, Dwarf_Die dw_die, Dwarf_Bool dw_is_info, Dwarf_Die ∗dw_return_siblingdie, Dwarf_Error ∗dw_error)

  Return the first DIE or the next sibling DIE.
- DW_API int dwarf_cu_header_basics (Dwarf_Die dw_die, Dwarf_Half ∗dw_version, Dwarf_Bool ∗dw_is_info, Dwarf_Bool ∗dw_is_dwo, Dwarf_Half ∗dw_offset_size, Dwarf_Half ∗dw_address_size, Dwarf_Half ∗dw_←extension_size, Dwarf_Sig8 ∗∗dw_signature, Dwarf_Off ∗dw_offset_of_length, Dwarf_Unsigned ∗dw_total←_byte_length, Dwarf_Error ∗dw_error)

  Return some CU-relative facts.
- DW_API int dwarf_child (Dwarf_Die dw_die, Dwarf_Die ∗dw_return_childdie, Dwarf_Error ∗dw_error)

  Return the child DIE, if any. The child may be the first of a list of sibling DIEs.
- DW_API void dwarf_dealloc_die (Dwarf_Die dw_die)

  Deallocate (free) a DIE.
- DW_API int dwarf_die_from_hash_signature (Dwarf_Debug dw_dbg, Dwarf_Sig8 ∗dw_hash_sig, const char ∗dw_sig_type, Dwarf_Die ∗dw_returned_CU_die, Dwarf_Error ∗dw_error)

  Return a CU DIE given a has signature.
- DW_API int dwarf_offdie_b (Dwarf_Debug dw_dbg, Dwarf_Off dw_offset, Dwarf_Bool dw_is_info, Dwarf_Die ∗dw_return_die, Dwarf_Error ∗dw_error)

  Return DIE given global (not CU-relative) offset.
- DW_API int dwarf_find_die_given_sig8 (Dwarf_Debug dw_dbg, Dwarf_Sig8 ∗dw_ref, Dwarf_Die ∗dw_die_←out, Dwarf_Bool ∗dw_is_info, Dwarf_Error ∗dw_error)

  Return a DIE given a Dwarf_Sig8 hash.
- DW_API Dwarf_Bool dwarf_get_die_infotypes_flag (Dwarf_Die dw_die)

  Return the is_info flag.

9.8.1 Detailed Description

9.8.2 Function Documentation

9.8.2.1 dwarf_child()

```
DW_API int dwarf_child (
            Dwarf_Die dw_die,
            Dwarf_Die ∗ dw_return_childdie,
            Dwarf_Error ∗ dw_error )
```

Return the child DIE, if any. The child may be the first of a list of sibling DIEs.

Parameters

dw_die	We will return the first child of this DIE.
dw_return_childdie	Returns the first child through the pointer. For subsequent dies siblings of the first, use dwarf_siblingof_c().
dw_error	The usual Dwarf_Error∗.

Returns

Returns DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if dw_die has no children.

See also

Using dwarf_child()

9.8.2.2 dwarf_cu_header_basics()

```
DW_API int dwarf_cu_header_basics (
             Dwarf_Die dw_die,
             Dwarf_Half * dw_version,
             Dwarf_Bool * dw_is_info,
             Dwarf_Bool * dw_is_dwo,
             Dwarf_Half * dw_offset_size,
             Dwarf_Half * dw_address_size,
             Dwarf_Half * dw_extension_size,
             Dwarf_Sig8 ** dw_signature,
             Dwarf_Off * dw_offset_of_length,
             Dwarf_Unsigned * dw_total_byte_length,
             Dwarf_Error * dw_error )
```

Return some CU-relative facts.

Any Dwarf_Die will work. The values returned through the pointers are about the CU for a DIE

Parameters

dw_die	Some open Dwarf_Die.
dw_version	Returns the DWARF version: 2,3,4, or 5
dw_is_info	Returns non-zero if the CU is .debug_info. Returns zero if the CU is .debug_types (DWARF4).
dw_is_dwo	Returns ton-zero if the CU is a dwo/dwp object and zero if it is a standard object.
dw_offset_size	Returns offset size, 4 and 8 are possible.
dw_address_size	Almost always returns 4 or 8. Could be 2 in unusual circumstances.
dw_extension_size	The sum of dw_offset_size and dw_extension_size are the count of the initial bytes of the CU. Standard lengths are 4 and 12. For 1990's SGI objects the length could be 8.
dw_signature	Returns a pointer to an 8 byte signature.
dw_offset_of_length	Returns the section offset of the initial byte of the CU.
dw_total_byte_length	Returns the total length of the CU including the length field and the content of the CU.
dw_error	The usual Dwarf_Error∗.

Returns

Returns DW_DLV_OK etc.

9.8.2.3 dwarf_dealloc_die()

```
DW_API void dwarf_dealloc_die (
             Dwarf_Die dw_die )
```

Deallocate (free) a DIE.

Parameters

dw_die	Frees (deallocs) memory associated with this Dwarf_Die.

DIEs not freed explicitly will be freed by dwarf_finish().

9.8.2.4 dwarf_die_from_hash_signature()

```
DW_API int dwarf_die_from_hash_signature (
            Dwarf_Debug dw_dbg,
            Dwarf_Sig8 * dw_hash_sig,
            const char * dw_sig_type,
            Dwarf_Die * dw_returned_CU_die,
            Dwarf_Error * dw_error )
```

Return a CU DIE given a has signature.

Parameters

dw_dbg	
dw_hash_sig	A pointer to an 8 byte signature to be looked up. in .debug_names.
dw_sig_type	Valid type requests are "cu" and "tu"
dw_returned_CU_die	Returns the found CU DIE if one is found.
dw_error	The usual Dwarf_Error∗.

Returns

DW_DLV_OK means dw_returned_CU_die was set. DW_DLV_NO_ENTRY means the signature could not be found.

9.8.2.5 dwarf_find_die_given_sig8()

```
DW_API int dwarf_find_die_given_sig8 (
            Dwarf_Debug dw_dbg,
            Dwarf_Sig8 * dw_ref,
            Dwarf_Die * dw_die_out,
            Dwarf_Bool * dw_is_info,
            Dwarf_Error * dw_error )
```

Return a DIE given a Dwarf_Sig8 hash.

Returns DIE and is_info flag if it finds the hash signature of a DIE. Often will be the CU DIE of DW_UT_split_type or DW_UT_type CU.

Parameters

dw_dbg	The applicable Dwarf_Debug
dw_ref	A pointer to a Dwarf_Sig8 struct whose content defines what is being searched for.
dw_die_out	If found, this returns the found DIE itself.
dw_is_info	If found, this returns section (.debug_is_info or .debug_is_types).
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.8.2.6 dwarf_get_die_infotypes_flag()

```
DW_API Dwarf_Bool dwarf_get_die_infotypes_flag (
            Dwarf_Die dw_die )
```

Return the is_info flag.

So client software knows if a DIE is in debug_info or (DWARF4-only) debug_types.

Parameters

dw_die	The DIE being queried.

Returns

If non-zero the flag means the DIE is in .debug_info. Otherwise it means the DIE is in .debug_types.

9.8.2.7 dwarf_next_cu_header_d()

```
DW_API int dwarf_next_cu_header_d (
            Dwarf_Debug dw_dbg,
            Dwarf_Bool dw_is_info,
            Dwarf_Unsigned * dw_cu_header_length,
            Dwarf_Half * dw_version_stamp,
            Dwarf_Off * dw_abbrev_offset,
            Dwarf_Half * dw_address_size,
            Dwarf_Half * dw_length_size,
            Dwarf_Half * dw_extension_size,
            Dwarf_Sig8 * dw_type_signature,
            Dwarf_Unsigned * dw_typeoffset,
            Dwarf_Unsigned * dw_next_cu_header_offset,
            Dwarf_Half * dw_header_cu_type,
            Dwarf_Error * dw_error )
```

Return information on the next CU header(d)

This is the version to use for linking against libdwarf v0.8.0 and earlier (and it also works for later versions).

This version will eventually be deprecated.

The library keeps track of where it is in the object file and it knows where to find 'next'.

In order to read the DIE tree of the CU this records information in the dw_dbg data and after a successful call to dwarf_next_cu_header_d() only an immediate call to dwarf_siblingof_b(dw_dbg,NULL,dw_is_info, &cu_die,...) is guaranteed to return the correct DIE (a Compilation Unit DIE).

Avoid any call to libdwarf between a successful call to dwarf_next_cu_header_d() and dwarf_siblingof_b(dw_dbg,↩ NULL,dw_is_info, &cu_die,...) to ensure the intended and correct Dwarf_Die is returned.

See also

Example walking CUs(d)

All arguments are the same as dwarf_next_cu_header_e() except that there is no dw_cu_die argument here.

9.8.2.8 dwarf_next_cu_header_e()

```
DW_API int dwarf_next_cu_header_e (
            Dwarf_Debug dw_dbg,
            Dwarf_Bool dw_is_info,
            Dwarf_Die * dw_cu_die,
            Dwarf_Unsigned * dw_cu_header_length,
            Dwarf_Half * dw_version_stamp,
            Dwarf_Off * dw_abbrev_offset,
            Dwarf_Half * dw_address_size,
            Dwarf_Half * dw_length_size,
            Dwarf_Half * dw_extension_size,
            Dwarf_Sig8 * dw_type_signature,
            Dwarf_Unsigned * dw_typeoffset,
            Dwarf_Unsigned * dw_next_cu_header_offset,
            Dwarf_Half * dw_header_cu_type,
            Dwarf_Error * dw_error )
```

Return information on the next CU header(e).

New in v0.9.0 November 2023.

The library keeps track of where it is in the object file and it knows where to find 'next'.

It returns the CU_DIE pointer through dw_cu_die;

dwarf_next_cu_header_e() is preferred over dwarf_next_cu_header_d() as the latter requires a second (immediate) step to access the CU-DIE of the CU.

With the CU-DIE returned by dwarf_next_cu_header_e() one calls dwarf_child() first (the CU-DIE has no siblings) and then one calls dwarf_siblingof_c() and dwarf_child() appropriately to descend the tree of DIEs.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_is_info	Pass in TRUE if reading through .debug_info Pass in FALSE if reading through DWARF4 .debug_types.
dw_cu_die	Pass in a pointer to a Dwarf_Die. the call sets the passed-in pointer to be a Compilation Unit Die for use with dwarf_child() or any other call requiring a Dwarf_Die argument.
dw_cu_header_length	Returns the length of the just-read CU header.
dw_version_stamp	Returns the version number (2 to 5) of the CU header just read.
dw_abbrev_offset	Returns the .debug_abbrev offset from the the CU header just read.
dw_address_size	Returns the address size specified for this CU, usually either 4 or 8.
dw_length_size	Returns the offset size (the length of the size field from the header) specified for this CU, either 4 or 4.
dw_extension_size	If the section is standard 64bit DWARF then this value is 4. Else the value is zero.
dw_type_signature	If the CU is DW_UT_skeleton DW_UT_split_compile, DW_UT_split_type or DW_UT_type this is the type signature from the CU_header compiled into this field.
dw_typeoffset	For DW_UT_split_type or DW_UT_type this is the type offset from the CU header.
dw_next_cu_header_offset	The offset in the section of the next CU (unless there is a compiler bug this is rarely of interest).
dw_header_cu_type	Returns DW_UT_compile, or other DW_UT value.
dw_error	In case return is DW_DLV_ERROR dw_error is set to point to the error details.

Returns

Returns DW_DLV_OK on success. Returns DW_DLV_NO_ENTRY if all CUs have been read.

See also

Example walking CUs(e)

9.8.2.9 dwarf_offdie_b()

```
DW_API int dwarf_offdie_b (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_offset,
            Dwarf_Bool dw_is_info,
            Dwarf_Die * dw_return_die,
            Dwarf_Error * dw_error )
```

Return DIE given global (not CU-relative) offset.

This works whether or not the target section has had dwarf_next_cu_header_d() applied, the CU the offset exists in has been seen at all, or the target offset is one libdwarf has seen before.

Parameters

dw_dbg	The applicable Dwarf_Debug
dw_offset	The global offset of the DIE in the appropriate section.
dw_is_info	Pass TRUE if the target is .debug_info. Pass FALSE if the target is .debug_types.
dw_return_die	On success this returns a DIE pointer to the found DIE.
dw_error	The usual Dwarf_Error∗.

Returns

DW_DLV_OK means dw_returned_die was found DW_DLV_NO_ENTRY is only possible if the offset is to a null DIE, and that is very unusual. Otherwise expect DW_DLV_ERROR.

See also

Using dwarf_offdie_b()

9.8.2.10 dwarf_siblingof_b()

```
DW_API int dwarf_siblingof_b (
            Dwarf_Debug dw_dbg,
            Dwarf_Die dw_die,
            Dwarf_Bool dw_is_info,
            Dwarf_Die * dw_return_siblingdie,
            Dwarf_Error * dw_error )
```

Return the first DIE or the next sibling DIE.

This function follows dwarf_next_cu_header_d() to return the CU-DIE that dwarf_next_cu_header_d() implies but does not reveal.

Aside from the special case required use of dwarf_siblingof_b() immediately following dwarf_next_cu_header_d(), dwarf_siblingof_c() is the faster function.

This function will eventually be deprecated.

Parameters

dw_dbg	The Dwarf_Debug one is operating on.
dw_die	Immediately after calling dwarf_next_cu_header_d pass in NULL to retrieve the CU DIE. Or pass in a known DIE and this will retrieve the next sibling in the chain.
dw_is_info	Pass TRUE or FALSE to match the applicable dwarf_next_cu_header_d call.
dw_return_siblingdie	The DIE returned through the pointer.
dw_error	The usual error information, if any.

Returns

Returns DW_DLV_OK etc.

See also

example4

dwarf_get_die_infotypes

9.8.2.11 dwarf_siblingof_c()

```
DW_API int dwarf_siblingof_c (
            Dwarf_Die dw_die,
            Dwarf_Die * dw_return_siblingdie,
            Dwarf_Error * dw_error )
```

Return the next sibling DIE.

Parameters

dw_die	Pass in a known DIE and this will retrieve the next sibling in the chain.
dw_return_siblingdie	The DIE returned through the pointer.
dw_error	The usual error information, if any.

Returns

Returns DW_DLV_OK etc.

See also

example4

dwarf_get_die_infotypes

9.9 Debugging Information Entry (DIE) content

Functions

- DW_API int dwarf_die_abbrev_global_offset (Dwarf_Die dw_die, Dwarf_Off ∗dw_abbrev_offset, Dwarf_Unsigned ∗dw_abbrev_count, Dwarf_Error ∗dw_error)

  Return the abbrev section offset of a DIE's abbrevs.
- DW_API int dwarf_tag (Dwarf_Die dw_die, Dwarf_Half ∗dw_return_tag, Dwarf_Error ∗dw_error)

  Get TAG value of DIE.
- DW_API int dwarf_dieoffset (Dwarf_Die dw_die, Dwarf_Off ∗dw_return_offset, Dwarf_Error ∗dw_error)

  Return the global section offset of the DIE.
- DW_API int dwarf_debug_addr_index_to_addr (Dwarf_Die dw_die, Dwarf_Unsigned dw_index, Dwarf_Addr ∗dw_return_addr, Dwarf_Error ∗dw_error)

  Extract address given address index. DWARF5.
- DW_API Dwarf_Bool dwarf_addr_form_is_indexed (int dw_form)

  Informs if a DW_FORM is an indexed form.
- DW_API int dwarf_CU_dieoffset_given_die (Dwarf_Die dw_die, Dwarf_Off ∗dw_return_offset, Dwarf_Error ∗dw_error)

  Return the CU DIE offset given any DIE.
- DW_API int dwarf_get_cu_die_offset_given_cu_header_offset_b (Dwarf_Debug dw_dbg, Dwarf_Off dw_in↩ _cu_header_offset, Dwarf_Bool dw_is_info, Dwarf_Off ∗dw_out_cu_die_offset, Dwarf_Error ∗dw_error)

  Return the CU DIE section offset given CU header offset.
- DW_API int dwarf_die_CU_offset (Dwarf_Die dw_die, Dwarf_Off ∗dw_return_offset, Dwarf_Error ∗dw_error)

  returns the CU relative offset of the DIE.
- DW_API int dwarf_die_CU_offset_range (Dwarf_Die dw_die, Dwarf_Off ∗dw_return_CU_header_offset, Dwarf_Off ∗dw_return_CU_length_bytes, Dwarf_Error ∗dw_error)

  Return the offset length of the entire CU of a DIE.
- DW_API int dwarf_attr (Dwarf_Die dw_die, Dwarf_Half dw_attrnum, Dwarf_Attribute ∗dw_returned_attr, Dwarf_Error ∗dw_error)

  Given DIE and attribute number return a Dwarf_attribute.
- DW_API int dwarf_die_text (Dwarf_Die dw_die, Dwarf_Half dw_attrnum, char ∗∗dw_ret_name, Dwarf_Error ∗dw_error)

  Given DIE and attribute number return a string.
- DW_API int dwarf_diename (Dwarf_Die dw_die, char ∗∗dw_diename, Dwarf_Error ∗dw_error)

  Return the string from a DW_AT_name attribute.
- DW_API Dwarf_Unsigned dwarf_die_abbrev_code (Dwarf_Die dw_die)

  Return the DIE abbrev code.
- DW_API int dwarf_die_abbrev_children_flag (Dwarf_Die dw_die, Dwarf_Half ∗dw_ab_has_child)

  Return TRUE if the DIE has children.
- DW_API int dwarf_validate_die_sibling (Dwarf_Die dw_sibling, Dwarf_Off ∗dw_offset)

  Validate a sibling DIE.
- DW_API int dwarf_hasattr (Dwarf_Die dw_die, Dwarf_Half dw_attrnum, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_error)

  Tells whether a DIE has a particular attribute.
- DW_API int dwarf_offset_list (Dwarf_Debug dw_dbg, Dwarf_Off dw_offset, Dwarf_Bool dw_is_info, Dwarf_Off ∗∗dw_offbuf, Dwarf_Unsigned ∗dw_offcount, Dwarf_Error ∗dw_error)

  Return an array of DIE children offsets.
- DW_API int dwarf_get_die_address_size (Dwarf_Die dw_die, Dwarf_Half ∗dw_addr_size, Dwarf_Error ∗dw↩ _error)

  Get the address size applying to a DIE.
- DW_API int dwarf_die_offsets (Dwarf_Die dw_die, Dwarf_Off ∗dw_global_offset, Dwarf_Off ∗dw_local_↩ offset, Dwarf_Error ∗dw_error)

Return section and CU-local offsets of a DIE.

- DW_API int dwarf_get_version_of_die (Dwarf_Die dw_die, Dwarf_Half ∗dw_version, Dwarf_Half ∗dw_↩ offset_size)

  Get the version and offset size.
- DW_API int dwarf_lowpc (Dwarf_Die dw_die, Dwarf_Addr ∗dw_returned_addr, Dwarf_Error ∗dw_error)

  Return the DW_AT_low_pc value.
- DW_API int dwarf_highpc_b (Dwarf_Die dw_die, Dwarf_Addr ∗dw_return_addr, Dwarf_Half ∗dw_return_↩ form, enum Dwarf_Form_Class ∗dw_return_class, Dwarf_Error ∗dw_error)

  Return the DW_AT_hipc address value.
- DW_API int dwarf_dietype_offset (Dwarf_Die dw_die, Dwarf_Off ∗dw_return_offset, Dwarf_Bool ∗dw_is_info, Dwarf_Error ∗dw_error)

  Return the offset from the DW_AT_type attribute.
- DW_API int dwarf_bytesize (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_returned_size, Dwarf_Error ∗dw_↩ error)

  Return the value of the attribute DW_AT_byte_size.
- DW_API int dwarf_bitsize (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_returned_size, Dwarf_Error ∗dw_error)

  Return the value of the attribute DW_AT_bitsize.
- DW_API int dwarf_bitoffset (Dwarf_Die dw_die, Dwarf_Half ∗dw_attrnum, Dwarf_Unsigned ∗dw_returned↩ _offset, Dwarf_Error ∗dw_error)

  Return the bit offset attribute of a DIE.
- DW_API int dwarf_srclang (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_returned_lang, Dwarf_Error ∗dw_error)

  Return the value of the DW_AT_language attribute.
- DW_API int dwarf_srclanglname (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_returned_lname, Dwarf_Error ∗dw_error)

  Return the value of the DW_AT_language_name attribute.
- DW_API int dwarf_srclanglname_version (Dwarf_Die dw_die, const char ∗dw_returned_verstring, Dwarf_Error ∗dw_error)

  Return the value of the DW_AT_language_version attribute.
- DW_API int dwarf_language_version_data (Dwarf_Unsigned dw_lname_name, int ∗dw_default_lower_↩ bound, const char ∗∗dw_version_string)

  Return values associated with DW_AT_language_name.
- DW_API int **dwarf_language_version_string** (Dwarf_Unsigned dw_lname_name, int ∗dw_default_lower↩ _bound, const char ∗∗dw_version_string)
- DW_API int dwarf_lvn_name_direct (Dwarf_Unsigned dw_lv_lang, Dwarf_Unsigned dw_lv_ver, const char ∗∗dw_ret_version_name, const char ∗∗dw_ret_version_scheme)

  Return language version name.
- DW_API int dwarf_lvn_name (Dwarf_Die dw_die, const char ∗∗dw_ret_version_name, const char ∗∗dw_↩ ret_version_scheme)

  Return values associated with DW_AT_language_version.
- DW_API int dwarf_lvn_table_entry (Dwarf_Unsigned dw_lvn_index, Dwarf_Unsigned ∗dw_lvn_language_↩ name, Dwarf_Unsigned ∗dw_lvn_language_version, const char ∗∗dw_lvn_language_version_scheme, const char ∗∗dw_lvn_language_version_name)

  Return values from the DWARF6 language version standard.
- DW_API int dwarf_arrayorder (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_returned_order, Dwarf_Error ∗dw↩ _error)

  Return the value of the DW_AT_ordering attribute.

9.9.1 Detailed Description

This is the main interface to attributes of a DIE.

9.9.2 Function Documentation

9.9.2.1 dwarf_addr_form_is_indexed()

```
DW_API Dwarf_Bool dwarf_addr_form_is_indexed (
             int dw_form )
```

Informs if a DW_FORM is an indexed form.

Reading a CU DIE with DW_AT_low_pc an indexed value can be problematic as several different FORMs are indexed. Some in DWARF5 others being extensions to DWARF4 and DWARF5. Indexed forms interact with DW↩_AT_addr_base in a DIE making this a very relevant distinction.

9.9.2.2 dwarf_arrayorder()

```
DW_API int dwarf_arrayorder (
             Dwarf_Die dw_die,
             Dwarf_Unsigned * dw_returned_order,
             Dwarf_Error * dw_error )
```

Return the value of the DW_AT_ordering attribute.

Parameters

dw_die	The DIE of interest.
dw_returned_order	On success returns the ordering value. For example DW_ORD_row_major
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.3 dwarf_attr()

```
DW_API int dwarf_attr (
             Dwarf_Die dw_die,
             Dwarf_Half dw_attrnum,
             Dwarf_Attribute * dw_returned_attr,
             Dwarf_Error * dw_error )
```

Given DIE and attribute number return a Dwarf_attribute.

Returns DW_DLV_NO_ENTRY if the DIE has no attribute dw_attrnum.

Parameters

dw_die	The DIE of interest.
dw_attrnum	An attribute number, for example DW_AT_name.
dw_returned_attr	On success a Dwarf_Attribute pointer is returned and it should eventually be deallocated.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.4 dwarf_bitoffset()

```
DW_API int dwarf_bitoffset (
            Dwarf_Die dw_die,
            Dwarf_Half * dw_attrnum,
            Dwarf_Unsigned * dw_returned_offset,
            Dwarf_Error * dw_error )
```

Return the bit offset attribute of a DIE.

If the attribute is DW_AT_data_bit_offset (DWARF4, DWARF5) the returned bit offset has one meaning. If the attribute is DW_AT_bit_offset (DWARF2, DWARF3) the meaning is quite different.

Parameters

dw_die	The DIE of interest.
dw_attrnum	If successful, returns the number of the attribute (DW_AT_data_bit_offset or DW_AT_bit_offset)
dw_returned_offset	If successful, returns the bit offset value.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.5 dwarf_bitsize()

```
DW_API int dwarf_bitsize (
            Dwarf_Die dw_die,
            Dwarf_Unsigned * dw_returned_size,
            Dwarf_Error * dw_error )
```

Return the value of the attribute DW_AT_bitsize.

Parameters

dw_die	The DIE of interest.
dw_returned_size	If successful, returns the size through the pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.6 dwarf_bytesize()

```
DW_API int dwarf_bytesize (
            Dwarf_Die dw_die,
            Dwarf_Unsigned * dw_returned_size,
            Dwarf_Error * dw_error )
```

Return the value of the attribute DW_AT_byte_size.

Parameters

dw_die	The DIE of interest.
dw_returned_size	If successful, returns the size through the pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.7 dwarf_CU_dieoffset_given_die()

```
DW_API int dwarf_CU_dieoffset_given_die (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

Return the CU DIE offset given any DIE.

Returns the global debug_info section offset of the CU DIE in the CU containing the given_die (the passed in DIE can be any DIE).

This does not identify whether the section is .debug_info or .debug_types, use dwarf_get_die_infotypes_flag() to determine the section.

See also

dwarf_get_cu_die_offset_given_cu_header_offset_b

Using dwarf_offset_given_die()

Parameters

dw_die	The DIE being queried.
dw_return_offset	Returns the section offset of the CU DIE for dw_die.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.8 dwarf_debug_addr_index_to_addr()

```
DW_API int dwarf_debug_addr_index_to_addr (
            Dwarf_Die dw_die,
            Dwarf_Unsigned dw_index,
            Dwarf_Addr * dw_return_addr,
            Dwarf_Error * dw_error )
```

Extract address given address index. DWARF5.

Useful for checking for compiler/linker errors in the creation of DWARF5.

Parameters

dw_die	The DIE of interest
dw_index	An index into .debug_addr. This will look first for .debug_addr in the dbg object DIE and if not there will look in the tied object if that is available.
dw_return_addr	On success the address is returned through the pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.9 dwarf_die_abbrev_children_flag()

```
DW_API int dwarf_die_abbrev_children_flag (
            Dwarf_Die dw_die,
            Dwarf_Half * dw_ab_has_child )
```

Return TRUE if the DIE has children.

Parameters

dw_die	A valid DIE pointer (not NULL).
dw_ab_has_child	Sets TRUE though the pointer if the DIE has children. Otherwise sets FALSE.

Returns

Returns TRUE if the DIE has a child DIE. Else returns FALSE.

9.9.2.10 dwarf_die_abbrev_code()

```
DW_API Dwarf_Unsigned dwarf_die_abbrev_code (
            Dwarf_Die dw_die )
```

Return the DIE abbrev code.

The Abbrev code for a DIE is a positive integer assigned by the compiler within a particular CU. For .debug_names abbreviations the situation is conceptually similar. The code values are arbitrary but compilers are motivated to make them small so the object size is as small as possible.

Returns the abbrev code of the die. Cannot fail.

Parameters

dw_die	The DIE of interest.

Returns

The abbrev code. of the DIE.

9.9.2.11 dwarf_die_abbrev_global_offset()

```
DW_API int dwarf_die_abbrev_global_offset (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_abbrev_offset,
            Dwarf_Unsigned * dw_abbrev_count,
            Dwarf_Error * dw_error )
```

Return the abbrev section offset of a DIE's abbrevs.

So we can associate a DIE's abbreviations with the contents the abbreviations section. Useful for detailed printing and analysis of abbreviations.

Parameters

dw_die	The DIE of interest
dw_abbrev_offset	On success is set to the global offset in the .debug_abbrev section of the abbreviations for the DIE.
dw_abbrev_count	On success is set to the count of abbreviations in the .debug_abbrev section of the abbreviations for the DIE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.12 dwarf_die_CU_offset()

```
DW_API int dwarf_die_CU_offset (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

returns the CU relative offset of the DIE.

See also

dwarf_CU_dieoffset_given_die

This does not identify whether the section is .debug_info or .debug_types, use dwarf_get_die_infotypes_flag() to determine the section.

Parameters

dw_die	The DIE being queried.
dw_return_offset	Returns the CU relative offset of this DIE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.13 dwarf_die_CU_offset_range()

```
DW_API int dwarf_die_CU_offset_range (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_CU_header_offset,
            Dwarf_Off * dw_return_CU_length_bytes,
            Dwarf_Error * dw_error )
```

Return the offset length of the entire CU of a DIE.

This does not identify whether the section is .debug_info or .debug_types, use dwarf_get_die_infotypes_flag() to determine the section.

Parameters

dw_die	The DIE being queried.
dw_return_CU_header_offset	On success returns the section offset of the CU this DIE is in.
dw_return_CU_length_bytes	On success returns the CU length of the CU this DIE is in, including the CU length, header, and all DIEs.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.14 dwarf_die_offsets()

```
DW_API int dwarf_die_offsets (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_global_offset,
            Dwarf_Off * dw_local_offset,
            Dwarf_Error * dw_error )
```

Return section and CU-local offsets of a DIE.

This does not identify whether the section is .debug_info or .debug_types, use dwarf_get_die_infotypes_flag() to determine the section.

Parameters

dw_die	The DIE of interest.
dw_global_offset	On success returns the offset of the DIE in its section.
dw_local_offset	On success returns the offset of the DIE within its CU.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.15 dwarf_die_text()

```
DW_API int dwarf_die_text (
             Dwarf_Die dw_die,
             Dwarf_Half dw_attrnum,
             char ** dw_ret_name,
             Dwarf_Error * dw_error )
```

Given DIE and attribute number return a string.

Returns DW_DLV_NO_ENTRY if the DIE has no attribute dw_attrnum.

Parameters

dw_die	The DIE of interest.
dw_attrnum	An attribute number, for example DW_AT_name.
dw_ret_name	On success a pointer to the string is returned. Do not free the string. Many attributes allow various forms that directly or indirectly contain strings and this returns the string.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.16 dwarf_diename()

```
DW_API int dwarf_diename (
             Dwarf_Die dw_die,
             char ** dw_diename,
             Dwarf_Error * dw_error )
```

Return the string from a DW_AT_name attribute.

Returns DW_DLV_NO_ENTRY if the DIE has no attribute DW_AT_name

Parameters

dw_die	The DIE of interest.
dw_diename	On success a pointer to the string is returned. Do not free the string. Various forms directly or indirectly contain strings and this follows all of them to their string.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.17 dwarf_dieoffset()

```
DW_API int dwarf_dieoffset (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

Return the global section offset of the DIE.

Parameters

dw_die	The DIE of interest
dw_return_offset	On success the offset refers to the section of the DIE itself, which may be .debug_offset or .debug_types.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.18 dwarf_dietype_offset()

```
DW_API int dwarf_dietype_offset (
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_offset,
            Dwarf_Bool * dw_is_info,
            Dwarf_Error * dw_error )
```

Return the offset from the DW_AT_type attribute.

The offset returned is is a global offset from the DW_AT_type of the DIE passed in. If this CU is DWARF4 the offset could be in .debug_types, otherwise it is in .debug_info Check the section of the DIE to know which it is, dwarf_cu_header_basics() will return that.

Added pointer argument to return the section the offset applies to. December 2022.

Parameters

dw_die	The DIE of interest.
dw_return_offset	If successful, returns the offset through the pointer.
dw_is_info	If successful, set to TRUE if the dw_return_offset is in .debug_info and FALSE if the dw_return_offset is in .debug_types.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.19 dwarf_get_cu_die_offset_given_cu_header_offset_b()

```
DW_API int dwarf_get_cu_die_offset_given_cu_header_offset_b (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_in_cu_header_offset,
            Dwarf_Bool dw_is_info,
            Dwarf_Off * dw_out_cu_die_offset,
            Dwarf_Error * dw_error )
```

Return the CU DIE section offset given CU header offset.

Returns the CU DIE global offset if one knows the CU header global offset.

See also

dwarf_CU_dieoffset_given_die

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_in_cu_header_offset	The CU header offset.
dw_is_info	If TRUE the CU header offset is in .debug_info. Otherwise the CU header offset is in .debug_types.
dw_out_cu_die_offset	The CU DIE offset returned through this pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.20 dwarf_get_die_address_size()

```
DW_API int dwarf_get_die_address_size (
            Dwarf_Die dw_die,
            Dwarf_Half * dw_addr_size,
            Dwarf_Error * dw_error )
```

Get the address size applying to a DIE.

Parameters

dw_die	The DIE of interest.
dw_addr_size	On success, returns the address size that applies to dw_die. Normally 4 or 8.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.21 dwarf_get_version_of_die()

```
DW_API int dwarf_get_version_of_die (
            Dwarf_Die dw_die,
            Dwarf_Half * dw_version,
            Dwarf_Half * dw_offset_size )
```

Get the version and offset size.

The values returned apply to the CU this DIE belongs to. This is useful as preparation for calling dwarf_get_form↩ _class

Parameters

dw_die	The DIE of interest.
dw_version	Returns the version of the CU this DIE is contained in. Standard version numbers are 2 through 5.
dw_offset_size	Returns the offset_size (4 or 8) of the CU this DIE is contained in.

Returns

On success, returns DW_DLV_OK. If dw_die is null or its contents are corrupted retuns DW_DLV_ERROR and there is nothing useful returned. Never returns DW_DLV_NO_ENTRY.

9.9.2.22 dwarf_hasattr()

```
DW_API int dwarf_hasattr (
            Dwarf_Die dw_die,
            Dwarf_Half dw_attrnum,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Tells whether a DIE has a particular attribute.

Parameters

dw_die	The DIE of interest.
dw_attrnum	The attribute number we are asking about, DW_AT_name for example.
dw_returned_bool	On success is set TRUE if dw_die has dw_attrnum and FALSE otherwise.
dw_error	The usual error detail return pointer.

Returns

Never returns DW_DLV_NO_ENTRY. Returns DW_DLV_OK unless there is an error, in which case it returns DW_DLV_ERROR and sets dw_error to the error details.

9.9.2.23 dwarf_highpc_b()

```
DW_API int dwarf_highpc_b (
             Dwarf_Die dw_die,
             Dwarf_Addr * dw_return_addr,
             Dwarf_Half * dw_return_form,
             enum Dwarf_Form_Class * dw_return_class,
             Dwarf_Error * dw_error )
```

Return the DW_AT_hipc address value.

This is accessing the DW_AT_high_pc attribute. Calculating the high pc involves elements which we don't describe here, but which are shown in the example. See the DWARF5 standard.

See also

Reading high pc from a DIE.

Parameters

dw_die	The DIE of interest.
dw_return_addr	On success returns the high-pc address for this DIE. If the high-pc is a not DW_FORM_addr and is a non-indexed constant form one must add the value of the DW_AT_low_pc to this to get the true high-pc value as the value returned is an unsigned offset of the associated low-pc value.
dw_return_form	On success returns the actual FORM for this attribute. Needed for certain cases to calculate the true dw_return_addr;
dw_return_class	On success returns the FORM CLASS for this attribute. Needed for certain cases to calculate the true dw_return_addr;
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.24 dwarf_language_version_data()

```
DW_API int dwarf_language_version_data (
             Dwarf_Unsigned dw_lname_name,
             int * dw_default_lower_bound,
             const char ** dw_version_string )
```

Return values associated with DW_AT_language_name.

Returns the value of a the default-lower-bound and a string defining the interpretation of the DWARF6 version from the DW_AT_language_version attribute. Replaces dwarf_language_version_string().

Parameters

dw_lname_name	Pass in a DW_LNAME value, for example DW_LNAME_C (0x0003).
dw_default_lower_bound.	On success returns the language code (normally only found on a CU DIE). For example DW_LNAME_C has a default lower bound of zero (0) that will be returned through the pointer.

Parameters

dw_version_scheme	On success, return the version scheme, For DW_LNAME_C the string returned through the pointer would by "YYYYMM". If there is no version scheme defined, return a NULL through the pointer. Never dealloc or free() the string returned through dw_version_scheme as it is a static constant string.

Returns

Returns DW_DLV_OK or the dw_lang_name is unknown, returns DW_DLV_NO_ENTRY. Never returns DW↩_DLV_ERROR;

9.9.2.25 dwarf_lowpc()

```
DW_API int dwarf_lowpc (
            Dwarf_Die dw_die,
            Dwarf_Addr * dw_returned_addr,
            Dwarf_Error * dw_error )
```

Return the DW_AT_low_pc value.

Parameters

dw_die	The DIE of interest.
dw_returned_addr	On success returns, through the pointer, the address DW_AT_low_pc defines.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.26 dwarf_lvn_name()

```
DW_API int dwarf_lvn_name (
            Dwarf_Die dw_die,
            const char ** dw_ret_version_name,
            const char ** dw_ret_version_scheme )
```

Return values associated with DW_AT_language_version.

New in version 2.2.0 July 2025

Given any valid DIE for a Compilation Unit returns the value of a the CU_DIE name of the DWARF6 DW_AT_↩language_version as a string, as "C++98" for example. And the string defining the format of the language version, for example 'YYYYMM" if DW_LNAME_C. Never free or dealloc the returned string, it is static memory @param dw_die Pass in any valid open Dwarf_Die for the compilation unit of interest. @param dw_reg_version_name On success returns the language version name string through the pointer. Never dealloc or free the string, it points to static memory. @param dw_ret_version_scheme On success, return the version scheme, For DW_LNAME_C the string returned through the pointer would by "YYYYMM". If there is no version scheme defined, return a NULL through the pointer. Never dealloc or free() the string returned through dw_version_scheme as it is a static constant string.

Returns

Returns DW_DLV_OK or the dw_lang_name is unknown, returns DW_DLV_NO_ENTRY. Never returns DW↩
_DLV_ERROR;

9.9.2.27 dwarf_lvn_name_direct()

```
DW_API int dwarf_lvn_name_direct (
            Dwarf_Unsigned dw_lv_lang,
            Dwarf_Unsigned dw_lv_ver,
            const char ** dw_ret_version_name,
            const char ** dw_ret_version_scheme )
```

Return language version name.

New in version 2.2.0 July 2025

Returns the value of a the name of the DWARF6 DW_AT_language_version as a string, as "C++98" for example. And the string defining the format of the language version, for example 'YYYYMM" if DW_LNAME_C. Never free or dealloc the returned string, it is static memory @param dw_lv_lang Pass in a DW_LNAME value, for example DW↩
_LNAME_C (0x0003). @param Pass in the language version, for example 201103 (meeaning C++ 11). @param dw_ret_version_name On success, return the name of the version, "C++11" for example. Never free or dealloc the string. @param dw_reg_version_scheme On success, returns For DW_LNAME_C the string returned through the pointer would be "YYYYMM". If there is no version scheme defined, return a NULL through the pointer. Never dealloc or free() the string returned through dw_version_scheme as it is a static constant string.

Returns

Returns DW_DLV_OK or the dw_lang_name is unknown, returns DW_DLV_NO_ENTRY. Never returns DW↩
_DLV_ERROR;

9.9.2.28 dwarf_lvn_table_entry()

```
DW_API int dwarf_lvn_table_entry (
            Dwarf_Unsigned dw_lvn_index,
            Dwarf_Unsigned * dw_lvn_language_name,
            Dwarf_Unsigned * dw_lvn_language_version,
            const char ** dw_lvn_language_version_scheme,
            const char ** dw_lvn_language_version_name )
```

Return values from the DWARF6 language version standard.

New in version 2.2.0 July 2025

Primarily used by dwarfdump. This enables access to the instances of DWARF6 language version table known to this version of libdwarf. None of the strings returned through pointers should be dealloc-d or free-d, they are static strings.

Parameters

dw_lvn_index	To see all table entries, pass in the index of a table entry, beginning with 0, and call again with subsequent numbers untill the function returns DW_DLV_NO_ENTRY (meaning there are no more entries). The index has no intrinsic meaning.

Parameters

dw_lvn_language_name	On success, the function returns the language name through the pointer. For example, a value like DW_LNAME_C.
dw_lvn_language_version	On success, the function returns the language version through the pointer. For example a number such as for C: 199901.
dw_lvn_language_version_scheme	On success, the function returns a pointer to a string identifying the format of the language version through the pointer. For example "YYYYMM" for C.
dw_lvn_language_version_name	On success, the function returns a pointer to a string for C. identifying the name of the language version through the pointer. For example: "C99".

Returns

9.9.2.29 dwarf_offset_list()

```
DW_API int dwarf_offset_list (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_offset,
            Dwarf_Bool dw_is_info,
            Dwarf_Off ** dw_offbuf,
            Dwarf_Unsigned * dw_offcount,
            Dwarf_Error * dw_error )
```

Return an array of DIE children offsets.

Given a DIE section offset and dw_is_info, returns an array of DIE global [section] offsets of the children of DIE.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_offset	A DIE offset.
dw_is_info	If TRUE says to use the offset in .debug_info. Else use the offset in .debug_types.
dw_offbuf	A pointer to an array of children DIE global [section] offsets is returned through the pointer.
dw_offcount	The number of elements in dw_offbuf. If the DIE has no children it could be zero, in which case dw_offbuf and dw_offcount are not touched.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. DW_DLV_NO_ENTRY means there are no children of the DIE, hence no list of child offsets.

On successful return, use dwarf_dealloc(dbg, dw_offbuf, DW_DLA_UARRAY); to dealloc the allocated space.

See also

Using dwarf_offset_list()

9.9.2.30 dwarf_srclang()

```
DW_API int dwarf_srclang (
            Dwarf_Die dw_die,
            Dwarf_Unsigned * dw_returned_lang,
            Dwarf_Error * dw_error )
```

Return the value of the DW_AT_language attribute.

Returns DWARF5 DW_LANG language name. The DW_LANG value returned lets one access the LANG name as a string with dwarf_get_LANG_name()

To access DW_LNAME names (in DWARF5 or later) see dwarf_srclanglname(). To get the DW_LNAME as a string, call dwarf_get_LNAME_name().

DWARF5 and earlier

The DIE should be a CU DIE.

Parameters

dw_die	The DIE of interest.
dw_returned_lang	On success returns the language code (normally only found on a CU DIE). For example DW_LANG_C (0x0002).
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.31 dwarf_srclanglname()

```
DW_API int dwarf_srclanglname (
            Dwarf_Die dw_die,
            Dwarf_Unsigned * dw_returned_lname,
            Dwarf_Error * dw_error )
```

Return the value of the DW_AT_language_name attribute.

New in v2.1.0 July 2025.

Returns a DWARF6 DW_AT language_name name. The DW_LNAME value returned lets one access the LNAME name as a string with dwarf_get_LNAME_name() Also see dwarf_language_version_data() for valued based on DW_LNAME names.

To access DW_LANG names (in DWARF5 or earlier) see dwarf_srclang().

Parameters

dw_die	The DIE of interest, normally a CU_DIE.
dw_returned_lname	On success returns the language name (code) (normally only found on a CU DIE). For example DW_LNAME_C (0x0003).
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.32 dwarf_srclanglname_version()

```
DW_API int dwarf_srclanglname_version (
            Dwarf_Die dw_die,
            const char * dw_returned_verstring,
            Dwarf_Error * dw_error )
```

Return the value of the DW_AT_language_version attribute.

New in v2.1.0 July 2025.

Finds the DW_AT_language_version of the DIE if one is present.

The DIE should be a CU DIE.

Parameters

dw_die	The DIE of interest.
dw_returned	verstring On success returns the language verion string from a DW_AT_language_version attributes (normally only found on a CU DIE). For example DW_LNAME_C would return a pointer to "YYYYMM" Never free or dealloc the string returned through dw_returned_verstring, it is in static memory.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.33 dwarf_tag()

```
DW_API int dwarf_tag (
            Dwarf_Die dw_die,
            Dwarf_Half * dw_return_tag,
            Dwarf_Error * dw_error )
```

Get TAG value of DIE.

Parameters

dw_die	The DIE of interest
dw_return_tag	On success, set to the DW_TAG value of the DIE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.9.2.34 dwarf_validate_die_sibling()

```
DW_API int dwarf_validate_die_sibling (
            Dwarf_Die dw_sibling,
            Dwarf_Off * dw_offset )
```

Validate a sibling DIE.

This is used by dwarfdump (when dwarfdump is checking for valid DWARF) to try to catch a corrupt DIE tree.

This does not identify whether the section is .debug_info or .debug_types, use dwarf_get_die_infotypes_flag() to determine the section.

See also

using dwarf_validate_die_sibling

Parameters

dw_sibling	Pass in a DIE returned by dwarf_siblingof_b().
dw_offset	Set to zero through the pointer.

Returns

Returns DW_DLV_OK if the sibling is at an appropriate place in the section. Otherwise it returns DW_DLV_↩ ERROR indicating the DIE tree is corrupt.

9.10 DIE Attribute and Attribute-Form Details

Functions

- DW_API int dwarf_attrlist (Dwarf_Die dw_die, Dwarf_Attribute ∗∗dw_attrbuf, Dwarf_Signed ∗dw_attrcount, Dwarf_Error ∗dw_error)

  Gets the full list of attributes.
- DW_API int dwarf_hasform (Dwarf_Attribute dw_attr, Dwarf_Half dw_form, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_error)

  Sets TRUE if a Dwarf_Attribute has the indicated FORM.
- DW_API int dwarf_whatform (Dwarf_Attribute dw_attr, Dwarf_Half ∗dw_returned_final_form, Dwarf_Error ∗dw_error)

  Return the form of the Dwarf_Attribute.
- DW_API int dwarf_whatform_direct (Dwarf_Attribute dw_attr, Dwarf_Half ∗dw_returned_initial_form, Dwarf_Error ∗dw_error)

  Return the initial form of the Dwarf_Attribute.
- DW_API int dwarf_whatattr (Dwarf_Attribute dw_attr, Dwarf_Half ∗dw_returned_attrnum, Dwarf_Error ∗dw↩ _error)

  Return the attribute number of the Dwarf_Attribute.
- DW_API int dwarf_formref (Dwarf_Attribute dw_attr, Dwarf_Off ∗dw_return_offset, Dwarf_Bool ∗dw_is_info, Dwarf_Error ∗dw_error)

  Retrieve the CU-relative offset of a reference.
- DW_API int dwarf_global_formref_b (Dwarf_Attribute dw_attr, Dwarf_Off ∗dw_return_offset, Dwarf_Bool ∗dw_offset_is_info, Dwarf_Error ∗dw_error)

Return the section-relative offset of a Dwarf_Attribute.

- DW_API int dwarf_global_formref (Dwarf_Attribute dw_attr, Dwarf_Off ∗dw_return_offset, Dwarf_Error ∗dw←_error)

  Same as dwarf_global_formref_b except...
- DW_API int dwarf_formsig8 (Dwarf_Attribute dw_attr, Dwarf_Sig8 ∗dw_returned_sig_bytes, Dwarf_Error ∗dw_error)

  Return an 8 byte reference form for DW_FORM_ref_sig8.
- DW_API int dwarf_formsig8_const (Dwarf_Attribute dw_attr, Dwarf_Sig8 ∗dw_returned_sig_bytes, Dwarf_Error ∗dw_error)

  Return an 8 byte reference form for DW_FORM_data8.
- DW_API int dwarf_formaddr (Dwarf_Attribute dw_attr, Dwarf_Addr ∗dw_returned_addr, Dwarf_Error ∗dw_←error)

  Return the address when the attribute has form address.
- DW_API int dwarf_get_debug_addr_index (Dwarf_Attribute dw_attr, Dwarf_Unsigned ∗dw_return_index, Dwarf_Error ∗dw_error)

  Get the addr index of a Dwarf_Attribute.
- DW_API int dwarf_formflag (Dwarf_Attribute dw_attr, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_←error)

  Return the flag value of a flag form.
- DW_API int dwarf_formudata (Dwarf_Attribute dw_attr, Dwarf_Unsigned ∗dw_returned_val, Dwarf_Error ∗dw_error)

  Return an unsigned value.
- DW_API int dwarf_formsdata (Dwarf_Attribute dw_attr, Dwarf_Signed ∗dw_returned_val, Dwarf_Error ∗dw←_error)

  Return a signed value.
- DW_API int dwarf_formdata16 (Dwarf_Attribute dw_attr, Dwarf_Form_Data16 ∗dw_returned_val, Dwarf_Error ∗dw_error)

  Return a 16 byte Dwarf_Form_Data16 value.
- DW_API int dwarf_formblock (Dwarf_Attribute dw_attr, Dwarf_Block ∗∗dw_returned_block, Dwarf_Error ∗dw_error)

  Return an allocated filled-in Form_Block.
- DW_API int dwarf_formstring (Dwarf_Attribute dw_attr, char ∗∗dw_returned_string, Dwarf_Error ∗dw_error)

  Return a pointer to a string.
- DW_API int dwarf_get_debug_str_index (Dwarf_Attribute dw_attr, Dwarf_Unsigned ∗dw_return_index, Dwarf_Error ∗dw_error)

  Return a string index.
- DW_API int dwarf_formexprloc (Dwarf_Attribute dw_attr, Dwarf_Unsigned ∗dw_return_exprlen, Dwarf_Ptr ∗dw_block_ptr, Dwarf_Error ∗dw_error)

  Return a pointer-to and length-of a block of data.
- DW_API enum Dwarf_Form_Class dwarf_get_form_class (Dwarf_Half dw_version, Dwarf_Half dw_attrnum, Dwarf_Half dw_offset_size, Dwarf_Half dw_form)

  Return the FORM_CLASS applicable. Four pieces of information are necessary to get the correct FORM_CLASS.
- DW_API int dwarf_attr_offset (Dwarf_Die dw_die, Dwarf_Attribute dw_attr, Dwarf_Off ∗dw_return_offset, Dwarf_Error ∗dw_error)

  Return the offset of an attribute in its section.
- DW_API int dwarf_uncompress_integer_block_a (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_input_←length_in_bytes, void ∗dw_input_block, Dwarf_Unsigned ∗dw_value_count, Dwarf_Signed ∗∗dw_value_←array, Dwarf_Error ∗dw_error)

  Uncompress a block of sleb numbers It's not much of a compression so not much of an uncompression. Developed by Sun Microsystems and it is unclear if it was ever used.
- DW_API void dwarf_dealloc_uncompressed_block (Dwarf_Debug dw_dbg, void ∗dw_value_array)

  Dealloc what dwarf_uncompress_integer_block_a allocated.

- DW_API int dwarf_convert_to_global_offset (Dwarf_Attribute dw_attr, Dwarf_Off dw_offset, Dwarf_Off ∗dw↩_return_offset, Dwarf_Error ∗dw_error)

  Convert local offset to global offset.
- DW_API void dwarf_dealloc_attribute (Dwarf_Attribute dw_attr)

  Dealloc a Dwarf_Attribute When this call returns the dw_attr is a stale pointer.
- DW_API int dwarf_discr_list (Dwarf_Debug dw_dbg, Dwarf_Small ∗dw_blockpointer, Dwarf_Unsigned dw↩_blocklen, Dwarf_Dsc_Head ∗dw_dsc_head_out, Dwarf_Unsigned ∗dw_dsc_array_length_out, Dwarf_Error ∗dw_error)

  Return an array of discriminant values.
- DW_API int dwarf_discr_entry_u (Dwarf_Dsc_Head dw_dsc, Dwarf_Unsigned dw_entrynum, Dwarf_Half ∗dw_out_type, Dwarf_Unsigned ∗dw_out_discr_low, Dwarf_Unsigned ∗dw_out_discr_high, Dwarf_Error ∗dw_error)

  Access a single unsigned discriminant list entry.
- DW_API int dwarf_discr_entry_s (Dwarf_Dsc_Head dw_dsc, Dwarf_Unsigned dw_entrynum, Dwarf_Half ∗dw_out_type, Dwarf_Signed ∗dw_out_discr_low, Dwarf_Signed ∗dw_out_discr_high, Dwarf_Error ∗dw↩_error)

  Access to a single signed discriminant list entry.

9.10.1 Detailed Description

Access to the details of DIEs

9.10.2 Function Documentation

9.10.2.1 dwarf_attr_offset()

```
DW_API int dwarf_attr_offset (
            Dwarf_Die dw_die,
            Dwarf_Attribute dw_attr,
            Dwarf_Off ∗ dw_return_offset,
            Dwarf_Error ∗ dw_error )
```

Return the offset of an attribute in its section.

Parameters

dw_die	The DIE of interest.
dw_attr	A Dwarf_Attribute of interest in this DIE
dw_return_offset	The offset is in .debug_info if the DIE is there. The offset is in .debug_types if the DIE is there.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. DW_DLV_NO_ENTRY is impossible.

9.10.2.2 dwarf_attrlist()

```
DW_API int dwarf_attrlist (
            Dwarf_Die dw_die,
            Dwarf_Attribute ** dw_attrbuf,
            Dwarf_Signed * dw_attrcount,
            Dwarf_Error * dw_error )
```

Gets the full list of attributes.

Parameters

dw_die	The DIE from which to pull attributes.
dw_attrbuf	The pointer is set to point to an array of Dwarf_Attribute (pointers to attribute data). This array must eventually be deallocated.
dw_attrcount	The number of entries in the array of pointers. There is no null-pointer to terminate the list, use this count.
dw_error	A place to return error details.

Returns

If it returns DW_DLV_ERROR and dw_error is non-null it creates an Dwarf_Error and places it in this argument. Usually returns DW_DLV_OK.

See also

Using dwarf_attrlist()

Using dwarf_attrlist()

9.10.2.3 dwarf_convert_to_global_offset()

```
DW_API int dwarf_convert_to_global_offset (
            Dwarf_Attribute dw_attr,
            Dwarf_Off dw_offset,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

Convert local offset to global offset.

Uses the DW_FORM of the attribute to determine if the dw_offset is local, and if so, adds the CU base offset to adjust dw_offset.

Parameters

dw_attr	The attribute the local offset was extracted from.
dw_offset	The global offset of the attribute.
dw_return_offset	The returned section (global) offset.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Returns DW_DLV_ERROR if the dw_attr form is not an offset form (for example, DW_FORM_ref_udata).

9.10.2.4 dwarf_dealloc_attribute()

```
DW_API void dwarf_dealloc_attribute (
            Dwarf_Attribute dw_attr )
```

Dealloc a Dwarf_Attribute When this call returns the dw_attr is a stale pointer.

Parameters

dw_attr	The attribute to dealloc.

9.10.2.5 dwarf_dealloc_uncompressed_block()

```
DW_API void dwarf_dealloc_uncompressed_block (
            Dwarf_Debug dw_dbg,
            void * dw_value_array )
```

Dealloc what dwarf_uncompress_integer_block_a allocated.

Parameters

dw_dbg	The Dwarf_Debug of interest
dw_value_array	The array was called an array of Dwarf_Signed. We dealloc all of it without needing dw_value_count.

9.10.2.6 dwarf_discr_entry_s()

```
DW_API int dwarf_discr_entry_s (
            Dwarf_Dsc_Head dw_dsc,
            Dwarf_Unsigned dw_entrynum,
            Dwarf_Half * dw_out_type,
            Dwarf_Signed * dw_out_discr_low,
            Dwarf_Signed * dw_out_discr_high,
            Dwarf_Error * dw_error )
```

Access to a single signed discriminant list entry.

The same as dwarf_discr_entry_u except here the values are signed.

9.10.2.7 dwarf_discr_entry_u()

```
DW_API int dwarf_discr_entry_u (
            Dwarf_Dsc_Head dw_dsc,
            Dwarf_Unsigned dw_entrynum,
            Dwarf_Half * dw_out_type,
            Dwarf_Unsigned * dw_out_discr_low,
            Dwarf_Unsigned * dw_out_discr_high,
            Dwarf_Error * dw_error )
```

Access a single unsigned discriminant list entry.

It is up to the caller to know whether the discriminant values are signed or unsigned (therefore to know whether this or dwarf_discr_entry_s. should be called)

Parameters

dw_dsc	The Dwarf_Dsc_Head applicable.
dw_entrynum	Valid values are zero to dw_dsc_array_length_out-1
dw_out_type	On success is set to either DW_DSC_label or DW_DSC_range through the pointer.
dw_out_discr_low	On success set to the lowest in this discriminant range
dw_out_discr_high	On success set to the highest in this discriminant range
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.10.2.8 dwarf_discr_list()

```
DW_API int dwarf_discr_list (
            Dwarf_Debug dw_dbg,
            Dwarf_Small * dw_blockpointer,
            Dwarf_Unsigned dw_blocklen,
            Dwarf_Dsc_Head * dw_dsc_head_out,
            Dwarf_Unsigned * dw_dsc_array_length_out,
            Dwarf_Error * dw_error )
```

Return an array of discriminant values.

This applies if a DW_TAG_variant has one of the DW_FORM_block forms.

See also

dwarf_formblock

For an example of use and dealloc:

See also

Using dwarf_discr_list()

Parameters

dw_dbg	The applicable Dwarf_Debug
dw_blockpointer	The bl_data value from a Dwarf_Block.
dw_blocklen	The bl_len value from a Dwarf_Block.
dw_dsc_head_out	On success returns a pointer to an array of discriminant values in an opaque struct.
dw_dsc_array_length_out	On success returns the number of entries in the dw_dsc_head_out array.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.10.2.9 dwarf_formaddr()

```
DW_API int dwarf_formaddr (
            Dwarf_Attribute dw_attr,
            Dwarf_Addr * dw_returned_addr,
            Dwarf_Error * dw_error )
```

Return the address when the attribute has form address.

There are several address forms, some of them indexed.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_addr	On success this set through the pointer to the address in the attribute.
dw_error	A place to return error details.

Returns

On success returns DW_DLV_OK sets dw_returned_addr . If attribute is passed in NULL or the attribute is badly broken or the address cannot be retrieved the call returns DW_DLV_ERROR. Never returns DW_DLV↩ _NO_ENTRY.

9.10.2.10 dwarf_formblock()

```
DW_API int dwarf_formblock (
            Dwarf_Attribute dw_attr,
            Dwarf_Block ** dw_returned_block,
            Dwarf_Error * dw_error )
```

Return an allocated filled-in Form_Block.

It is an error if the DW_FORM in the attribute is not a block form. DW_FORM_block2 is an example of a block form.

See also

Dwarf_Block

Using dwarf_discr_list()

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_block	Allocates a Dwarf_Block and returns a pointer to the filled-in block.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.11 dwarf_formdata16()

```
DW_API int dwarf_formdata16 (
             Dwarf_Attribute dw_attr,
             Dwarf_Form_Data16 * dw_returned_val,
             Dwarf_Error * dw_error )
```

Return a 16 byte Dwarf_Form_Data16 value.

We just store the bytes in a struct, we have no 16 byte integer type. It is an error if the FORM is not DW_FORM_↩ data16

See also

Dwarf_Form_Data16

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_val	Copies the 16 byte value into the pointed to area.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.12 dwarf_formexprloc()

```
DW_API int dwarf_formexprloc (
             Dwarf_Attribute dw_attr,
             Dwarf_Unsigned * dw_return_exprlen,
             Dwarf_Ptr * dw_block_ptr,
             Dwarf_Error * dw_error )
```

Return a pointer-to and length-of a block of data.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_return_exprlen	Returns the length in bytes of the block if it succeeds.
dw_block_ptr	Returns a pointer to the first byte of the block of data if it succeeds.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. If the attribute form is not DW_FORM_exprloc it returns DW_DLV_ERROR and sets dw_error to point to the error details.

9.10.2.13 dwarf_formflag()

```
DW_API int dwarf_formflag (
            Dwarf_Attribute dw_attr,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Return the flag value of a flag form.

It is an error if the FORM is not a flag form.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_bool	Returns either TRUE or FALSE through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.14 dwarf_formref()

```
DW_API int dwarf_formref (
            Dwarf_Attribute dw_attr,
            Dwarf_Off * dw_return_offset,
            Dwarf_Bool * dw_is_info,
            Dwarf_Error * dw_error )
```

Retrieve the CU-relative offset of a reference.

The DW_FORM of the attribute must be one of a small set of local reference forms: DW_FORM_ref<n> or DW↩
_FORM_udata.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_return_offset	Returns the CU-relative offset through the pointer.
dw_is_info	Returns a flag through the pointer. TRUE if the offset is in .debug_info, FALSE if it is in .debug_types
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_returned_attrnum If attribute is passed in NULL or the attribute is badly broken or the FORM of this attribute is not one of the small set of local references the call returns DW_DLV↩
_ERROR. Never returns DW_DLV_NO_ENTRY;

9.10.2.15 dwarf_formsdata()

```
DW_API int dwarf_formsdata (
            Dwarf_Attribute dw_attr,
            Dwarf_Signed * dw_returned_val,
            Dwarf_Error * dw_error )
```

Return a signed value.

The form must be a signed integral type. It is an error otherwise.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_val	On success returns the signed value through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.16 dwarf_formsig8()

```
DW_API int dwarf_formsig8 (
            Dwarf_Attribute dw_attr,
            Dwarf_Sig8 * dw_returned_sig_bytes,
            Dwarf_Error * dw_error )
```

Return an 8 byte reference form for DW_FORM_ref_sig8.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_sig_bytes	On success returns DW_DLV_OK and copies the 8 bytes into dw_returned_sig_bytes.
dw_error	A place to return error details.

Returns

On success returns DW_DLV_OK and copies the 8 bytes into dw_returned_sig_bytes. If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. If the dw_attr has a form other than DW_FORM_ref_sig8 the function returns DW_DLV_NO_ENTRY

9.10.2.17 dwarf_formsig8_const()

```
DW_API int dwarf_formsig8_const (
            Dwarf_Attribute dw_attr,
            Dwarf_Sig8 * dw_returned_sig_bytes,
            Dwarf_Error * dw_error )
```

Return an 8 byte reference form for DW_FORM_data8.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_sig_bytes	On success Returns DW_DLV_OK and copies the 8 bytes into dw_returned_sig_bytes.
dw_error	A place to return error details.

Returns

On success returns DW_DLV_OK and copies the 8 bytes into dw_returned_sig_bytes. If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. If the dw_attr has a form other than DW_FORM_data8 the function returns DW_DLV_NO_ENTRY

9.10.2.18 dwarf_formstring()

```
DW_API int dwarf_formstring (
            Dwarf_Attribute dw_attr,
            char ** dw_returned_string,
            Dwarf_Error * dw_error )
```

Return a pointer to a string.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_string	On success puts a pointer to a string existing in an appropriate DWARF section into dw_returned_string. Never free() or dealloc the returned string.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.10.2.19 dwarf_formudata()

```
DW_API int dwarf_formudata (
            Dwarf_Attribute dw_attr,
            Dwarf_Unsigned * dw_returned_val,
            Dwarf_Error * dw_error )
```

Return an unsigned value.

The form can be an unsigned or signed integral type but if it is a signed type the value must be non-negative. It is an error otherwise.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_val	On success returns the unsigned value through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.20 dwarf_get_debug_addr_index()

```
DW_API int dwarf_get_debug_addr_index (
             Dwarf_Attribute dw_attr,
             Dwarf_Unsigned * dw_return_index,
             Dwarf_Error * dw_error )
```

Get the addr index of a Dwarf_Attribute.

So a consumer can get the index when the object with the actual .debug_addr section is elsewhere (Debug Fission). Or if the caller just wants the index. Only call it when you know it should does have an index address FORM such as DW_FORM_addrx1 or one of the GNU address index forms.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_return_index	If successful it returns the index through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. Never returns DW_DLV_NO_ENTRY.

9.10.2.21 dwarf_get_debug_str_index()

```
DW_API int dwarf_get_debug_str_index (
             Dwarf_Attribute dw_attr,
             Dwarf_Unsigned * dw_return_index,
             Dwarf_Error * dw_error )
```

Return a string index.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_return_index	If the form is a string index form (for example DW_FORM_strx) the string index value is returned via the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. If the attribute form is not one of the string index forms it returns DW_DLV_↩ ERROR and sets dw_error to point to the error details.

9.10.2.22 dwarf_get_form_class()

```
DW_API enum Dwarf_Form_Class dwarf_get_form_class (
            Dwarf_Half dw_version,
            Dwarf_Half dw_attrnum,
            Dwarf_Half dw_offset_size,
            Dwarf_Half dw_form )
```

Return the FORM_CLASS applicable. Four pieces of information are necessary to get the correct FORM_CLASS.

Parameters

dw_version	The CU's DWARF version. Standard numbers are 2,3,4, or 5.
dw_attrnum	For example DW_AT_name
dw_offset_size	The offset size applicable to the compilation unit relevant to the attribute and form.
dw_form	The FORM number, for example DW_FORM_data4

Returns

Returns a form class, for example DW_FORM_CLASS_CONSTANT. The FORM_CLASS names are mentioned (for example as 'address' in Table 2.3 of DWARF5) but are not assigned formal names & numbers in the standard.

9.10.2.23 dwarf_global_formref()

```
DW_API int dwarf_global_formref (
            Dwarf_Attribute dw_attr,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

Same as dwarf_global_formref_b except...

See also

dwarf_global_formref_b

This is the same, except there is no dw_offset_is_info pointer so in the case of DWARF4 and DW_FORM_ref_sig8 it is not possible to determine which section the offset applies to!

9.10.2.24 dwarf_global_formref_b()

```
DW_API int dwarf_global_formref_b (
            Dwarf_Attribute dw_attr,
            Dwarf_Off * dw_return_offset,
            Dwarf_Bool * dw_offset_is_info,
            Dwarf_Error * dw_error )
```

Return the section-relative offset of a Dwarf_Attribute.

The target section of the returned offset can be in various sections depending on the FORM. Only a DW_FORM↩ _ref_sig8 can change the returned offset of a .debug_info DIE via a lookup into .debug_types by changing dw_↩ offset_is_info to FALSE (DWARF4).

The caller must determine the target section from the FORM.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_return_offset	Returns the CU-relative offset through the pointer.
dw_offset_is_info	For references to DIEs this informs whether the target DIE (the target the offset refers to) is in .debug_info or .debug_types. For non-DIE targets this field is not meaningful. Refer to the attribute FORM to determine the target section of the offset.
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_return_offset and dw_offset_is_info. If attribute is passed in NULL or the attribute is badly broken or the FORM of this attribute is not one of the many reference types the call returns DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY;

9.10.2.25 dwarf_hasform()

```
DW_API int dwarf_hasform (
            Dwarf_Attribute dw_attr,
            Dwarf_Half dw_form,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Sets TRUE if a Dwarf_Attribute has the indicated FORM.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_form	The DW_FORM you are asking about, DW_FORM_strp for example.
dw_returned_bool	The pointer passed in must be a valid non-null pointer to a Dwarf_Bool. On success, sets the value to TRUE or FALSE.
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_returned_bool. If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY;

9.10.2.26 dwarf_uncompress_integer_block_a()

```
DW_API int dwarf_uncompress_integer_block_a (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_input_length_in_bytes,
            void * dw_input_block,
            Dwarf_Unsigned * dw_value_count,
            Dwarf_Signed ** dw_value_array,
            Dwarf_Error * dw_error )
```

Uncompress a block of sleb numbers It's not much of a compression so not much of an uncompression. Developed by Sun Microsystems and it is unclear if it was ever used.

See also

dwarf_dealloc_uncompressed_block

9.10.2.27 dwarf_whatattr()

```
DW_API int dwarf_whatattr (
            Dwarf_Attribute dw_attr,
            Dwarf_Half * dw_returned_attrnum,
            Dwarf_Error * dw_error )
```

Return the attribute number of the Dwarf_Attribute.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_attrnum	The attribute number of the attribute is returned through the pointer. For example, DW_AT_name
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_returned_attrnum If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY;

9.10.2.28 dwarf_whatform()

```
DW_API int dwarf_whatform (
            Dwarf_Attribute dw_attr,
            Dwarf_Half * dw_returned_final_form,
            Dwarf_Error * dw_error )
```

Return the form of the Dwarf_Attribute.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_final_form	The form of the item is returned through the pointer. If the base form is DW_FORM_indirect the function resolves the final form and returns that final form.
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_returned_final_form If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY;

9.10.2.29 dwarf_whatform_direct()

```
DW_API int dwarf_whatform_direct (
            Dwarf_Attribute dw_attr,
            Dwarf_Half * dw_returned_initial_form,
            Dwarf_Error * dw_error )
```

Return the initial form of the Dwarf_Attribute.

Parameters

dw_attr	The Dwarf_Attribute of interest.
dw_returned_initial_form	The form of the item is returned through the pointer. If the base form is DW_FORM_indirect the value set is DW_FORM_indirect.
dw_error	A place to return error details.

Returns

Returns DW_DLV_OK and sets dw_returned_initial_form. If attribute is passed in NULL or the attribute is badly broken the call returns DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY;

9.11 Line Table For a CU

Functions

- DW_API int dwarf_srcfiles (Dwarf_Die dw_cu_die, char ∗∗∗dw_srcfiles, Dwarf_Signed ∗dw_filecount, Dwarf_Error ∗dw_error)

  The list of source files from the line table header.
- DW_API int dwarf_srclines_b (Dwarf_Die dw_cudie, Dwarf_Unsigned ∗dw_version_out, Dwarf_Small ∗dw↩_table_count, Dwarf_Line_Context ∗dw_linecontext, Dwarf_Error ∗dw_error)

  Initialize Dwarf_Line_Context for line table access.
- DW_API int dwarf_srclines_from_linecontext (Dwarf_Line_Context dw_linecontext, Dwarf_Line ∗∗dw_linebuf, Dwarf_Signed ∗dw_linecount, Dwarf_Error ∗dw_error)

  Access source lines from line context.
- DW_API int dwarf_srclines_two_level_from_linecontext (Dwarf_Line_Context dw_context, Dwarf_Line ∗∗dw_linebuf, Dwarf_Signed ∗dw_linecount, Dwarf_Line ∗∗dw_linebuf_actuals, Dwarf_Signed ∗dw_↩linecount_actuals, Dwarf_Error ∗dw_error)

  Returns line table counts and data.
- DW_API void dwarf_srclines_dealloc_b (Dwarf_Line_Context dw_context)

  Dealloc the memory allocated by dwarf_srclines_b.
- DW_API int dwarf_srclines_table_offset (Dwarf_Line_Context dw_context, Dwarf_Unsigned ∗dw_offset, Dwarf_Error ∗dw_error)

  Return the srclines table offset.
- DW_API int dwarf_srclines_comp_dir (Dwarf_Line_Context dw_context, const char ∗∗dw_compilation_↩directory, Dwarf_Error ∗dw_error)

  Compilation Directory name for the CU.
- DW_API int dwarf_srclines_subprog_count (Dwarf_Line_Context dw_context, Dwarf_Signed ∗dw_count, Dwarf_Error ∗dw_error)

  Subprog count: Part of the two-level line table extension.
- DW_API int dwarf_srclines_subprog_data (Dwarf_Line_Context dw_context, Dwarf_Signed dw_index, const char ∗∗dw_name, Dwarf_Unsigned ∗dw_decl_file, Dwarf_Unsigned ∗dw_decl_line, Dwarf_Error ∗dw_error)

  Retrieve data from the line table subprog array.
- DW_API int dwarf_srclines_files_indexes (Dwarf_Line_Context dw_context, Dwarf_Signed ∗dw_baseindex, Dwarf_Signed ∗dw_count, Dwarf_Signed ∗dw_endindex, Dwarf_Error ∗dw_error)

Return values easing indexing line table file numbers. Count is the real count of files array entries. Since DWARF 2,3,4 are zero origin indexes and DWARF5 and later are one origin, this function replaces dwarf_srclines_files_count().

- DW_API int dwarf_srclines_files_data_b (Dwarf_Line_Context dw_context, Dwarf_Signed dw_index_↩ in, const char ∗∗dw_name, Dwarf_Unsigned ∗dw_directory_index, Dwarf_Unsigned ∗dw_last_mod_time, Dwarf_Unsigned ∗dw_file_length, Dwarf_Form_Data16 ∗∗dw_md5ptr, Dwarf_Error ∗dw_error)

  Access data for each line table file.
- DW_API int dwarf_srclines_include_dir_count (Dwarf_Line_Context dw_line_context, Dwarf_Signed ∗dw_↩ count, Dwarf_Error ∗dw_error)

  Return the number of include directories in the Line Table.
- DW_API int dwarf_srclines_include_dir_data (Dwarf_Line_Context dw_line_context, Dwarf_Signed dw_↩ index, const char ∗∗dw_name, Dwarf_Error ∗dw_error)

  Return the include directories in the Line Table.
- DW_API int dwarf_srclines_version (Dwarf_Line_Context dw_line_context, Dwarf_Unsigned ∗dw_version, Dwarf_Small ∗dw_table_count, Dwarf_Error ∗dw_error)

  The DWARF version number of this compile-unit.
- DW_API int dwarf_linebeginstatement (Dwarf_Line dw_line, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_error)

  Read Line beginstatement register.
- DW_API int dwarf_lineendsequence (Dwarf_Line dw_line, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_error)

  Read Line endsequence register flag.
- DW_API int dwarf_lineno (Dwarf_Line dw_line, Dwarf_Unsigned ∗dw_returned_linenum, Dwarf_Error ∗dw↩ _error)

  Read Line line register.
- DW_API int dwarf_line_srcfileno (Dwarf_Line dw_line, Dwarf_Unsigned ∗dw_returned_filenum, Dwarf_Error ∗dw_error)

  Read Line file register.
- DW_API int dwarf_line_is_addr_set (Dwarf_Line dw_line, Dwarf_Bool ∗dw_is_addr_set, Dwarf_Error ∗dw↩ _error)

  Is the Dwarf_Line address from DW_LNS_set_address? This is not a line register, but it is a flag set by the library in each Dwarf_Line, and it is derived from reading the line table.
- DW_API int dwarf_lineaddr (Dwarf_Line dw_line, Dwarf_Addr ∗dw_returned_addr, Dwarf_Error ∗dw_error)

  Return the address of the Dwarf_Line.
- DW_API int dwarf_lineoff_b (Dwarf_Line dw_line, Dwarf_Unsigned ∗dw_returned_lineoffset, Dwarf_Error ∗dw_error)

  Return a column number through the pointer.
- DW_API int dwarf_linesrc (Dwarf_Line dw_line, char ∗∗dw_returned_name, Dwarf_Error ∗dw_error)

  Return the file name applicable to the Dwarf_Line.
- DW_API int dwarf_lineblock (Dwarf_Line dw_line, Dwarf_Bool ∗dw_returned_bool, Dwarf_Error ∗dw_error)

  Return the basic_block line register.
- DW_API int dwarf_prologue_end_etc (Dwarf_Line dw_line, Dwarf_Bool ∗dw_prologue_end, Dwarf_Bool ∗dw_epilogue_begin, Dwarf_Unsigned ∗dw_isa, Dwarf_Unsigned ∗dw_discriminator, Dwarf_Error ∗dw_↩ error)

  Return various line table registers in one call.
- DW_API int **dwarf_linelogical** (Dwarf_Line dw_line, Dwarf_Unsigned ∗dw_returned_logical, Dwarf_Error ∗dw_error)

  Experimental Two-level logical Row Number Experimental two level line tables. Not explained here. When reading from an actuals table, dwarf_line_logical() returns the logical row number for the line.
- DW_API int **dwarf_linecontext** (Dwarf_Line dw_line, Dwarf_Unsigned ∗dw_returned_context, Dwarf_Error ∗dw_error)

  Experimental Two-level line tables call contexts Experimental two level line tables. Not explained here. When reading from a logicals table, dwarf_linecontext() returns the logical row number corresponding the the calling context for an inlined call.
- DW_API int **dwarf_line_subprogno** (Dwarf_Line, Dwarf_Unsigned ∗, Dwarf_Error ∗)

Two-level line tables get subprogram number Experimental two level line tables. Not explained here. When reading from a logicals table, dwarf_line_subprogno() returns the index in the subprograms table of the inlined subprogram. Currently this always returns zero through the pointer as the relevant field is never updated from the default of zero.

- DW_API int **dwarf_line_subprog** (Dwarf_Line, char ∗∗, char ∗∗, Dwarf_Unsigned ∗, Dwarf_Error ∗)

  Two-level line tables get subprog, file, line Experimental two level line tables. Not explained here. When reading from a logicals table, dwarf_line_subprog() returns the name of the inlined subprogram, its declaration filename, and its declaration line number, if available.

- DW_API int dwarf_check_lineheader_b (Dwarf_Die dw_cu_die, int ∗dw_errcount_out, Dwarf_Error ∗dw_↩ error)

  Access to detailed line table header issues.

- DW_API int dwarf_print_lines (Dwarf_Die dw_cu_die, Dwarf_Error ∗dw_error, int ∗dw_errorcount_out)

  Print line information in great detail.

- DW_API struct Dwarf_Printf_Callback_Info_s dwarf_register_printf_callback (Dwarf_Debug dw_dbg, struct Dwarf_Printf_Callback_Info_s ∗dw_callbackinfo)

  For line details this records callback details.

9.11.1 Detailed Description

Access to all the line table details.

9.11.2 Function Documentation

9.11.2.1 dwarf_check_lineheader_b()

```
DW_API int dwarf_check_lineheader_b (
            Dwarf_Die dw_cu_die,
            int * dw_errcount_out,
            Dwarf_Error * dw_error )
```

Access to detailed line table header issues.

Lets the caller get detailed messages about some compiler errors we detect. Calls back, the caller should do something with the messages (likely just print them). The lines passed back already have newlines.

See also

dwarf_check_lineheader(b)

Dwarf_Printf_Callback_Info_s

Parameters

dw_cu_die	The CU DIE of interest
dw_error	If DW_DLV_ERROR this shows one error encountered.
dw_errcount_out	Returns the count of detected errors through the pointer.

Returns

DW_DLV_OK etc.

9.11.2.2 dwarf_line_is_addr_set()

```
DW_API int dwarf_line_is_addr_set (
             Dwarf_Line dw_line,
             Dwarf_Bool * dw_is_addr_set,
             Dwarf_Error * dw_error )
```

Is the Dwarf_Line address from DW_LNS_set_address? This is not a line register, but it is a flag set by the library in each Dwarf_Line, and it is derived from reading the line table.

Parameters

dw_line	The Dwarf_Line of interest.
dw_is_addr_set	On success it sets the flag to TRUE or FALSE.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.3 dwarf_line_srcfileno()

```
DW_API int dwarf_line_srcfileno (
             Dwarf_Line dw_line,
             Dwarf_Unsigned * dw_returned_filenum,
             Dwarf_Error * dw_error )
```

Read Line file register.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_filenum	On success it sets the value to the file number from the Dwarf_Line file register
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.4 dwarf_lineaddr()

```
DW_API int dwarf_lineaddr (
             Dwarf_Line dw_line,
             Dwarf_Addr * dw_returned_addr,
             Dwarf_Error * dw_error )
```

Return the address of the Dwarf_Line.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_addr	On success it sets the value to the value of the address register in the Dwarf_Line.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.5 dwarf_linebeginstatement()

```
DW_API int dwarf_linebeginstatement (
            Dwarf_Line dw_line,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Read Line beginstatement register.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_bool	On success it sets the value TRUE (if the dw_line has the is_stmt register set) and FALSE if is_stmt is not set.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.6 dwarf_lineblock()

```
DW_API int dwarf_lineblock (
            Dwarf_Line dw_line,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Return the basic_block line register.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_bool	On success it sets the flag to TRUE or FALSE from the basic_block register in the line table.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.7 dwarf_lineendsequence()

```
DW_API int dwarf_lineendsequence (
            Dwarf_Line dw_line,
            Dwarf_Bool * dw_returned_bool,
            Dwarf_Error * dw_error )
```

Read Line endsequence register flag.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_bool	On success it sets the value TRUE (if the dw_line has the end_sequence register set) and FALSE if end_sequence is not set.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.8 dwarf_lineno()

```
DW_API int dwarf_lineno (
            Dwarf_Line dw_line,
            Dwarf_Unsigned * dw_returned_linenum,
            Dwarf_Error * dw_error )
```

Read Line line register.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_linenum	On success it sets the value to the line number from the Dwarf_Line line register
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.9 dwarf_lineoff_b()

```
DW_API int dwarf_lineoff_b (
            Dwarf_Line dw_line,
            Dwarf_Unsigned * dw_returned_lineoffset,
            Dwarf_Error * dw_error )
```

Return a column number through the pointer.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_lineoffset	On success it sets the value to the column register from the Dwarf_Line.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.10 dwarf_linesrc()

```
DW_API int dwarf_linesrc (
            Dwarf_Line dw_line,
            char ** dw_returned_name,
            Dwarf_Error * dw_error )
```

Return the file name applicable to the Dwarf_Line.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_returned_name	On success it reads the file register and finds constructs a file name from a directory and filename there and and returns a pointer to that string through the pointer. It is necessary to deallocthe returned string with `dwarf_dealloc(dbg, lsrc_filename, DW_DLA_STRING);` (Older versions of this function incorrectly said not to free() or dwarf_dealloc().)
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

See also

Using dwarf_srclines_b() and linecontext

9.11.2.11 dwarf_print_lines()

```
DW_API int dwarf_print_lines (
            Dwarf_Die dw_cu_die,
            Dwarf_Error * dw_error,
            int * dw_errorcount_out )
```

Print line information in great detail.

dwarf_print_lines lets the caller prints line information for a CU in great detail. Does not use printf. Instead it calls back to the application using a function pointer once per line-to-print. The lines passed back already have any needed newlines.

dwarfdump uses this function for verbose printing of line table data.

Failing to call the dwarf_register_printf_callback() function will prevent the lines from being passed back but such omission is not an error. The same function, but focused on checking for errors is dwarf_check_lineheader_b().

See also

Dwarf_Printf_Callback_Info_s

Parameters

dw_cu_die	The CU DIE of interest
dw_error	
dw_errorcount_out	

Returns

DW_DLV_OK etc.

9.11.2.12 dwarf_prologue_end_etc()

```
DW_API int dwarf_prologue_end_etc (
            Dwarf_Line dw_line,
            Dwarf_Bool * dw_prologue_end,
            Dwarf_Bool * dw_epilogue_begin,
            Dwarf_Unsigned * dw_isa,
            Dwarf_Unsigned * dw_discriminator,
            Dwarf_Error * dw_error )
```

Return various line table registers in one call.

Line Table Registers

Parameters

dw_line	The Dwarf_Line of interest.
dw_prologue_end	On success it sets the flag to TRUE or FALSE from the prologue_end register in the line table.
dw_epilogue_begin	On success it sets the flag to TRUE or FALSE from the epilogue_begin register in the line table.
dw_isa	On success it sets the value to the value of from the isa register in the line table.
dw_discriminator	On success it sets the value to the value of from the discriminator register in the line table.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.13 dwarf_register_printf_callback()

```
DW_API struct Dwarf_Printf_Callback_Info_s dwarf_register_printf_callback (
            Dwarf_Debug dw_dbg,
            struct Dwarf_Printf_Callback_Info_s * dw_callbackinfo )
```

For line details this records callback details.

Not usually needed. It is a way to check (while using the library) what callback data is in use or to update that callback data.

See also

Dwarf_Printf_Callback_Info_s

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_callbackinfo	If non-NULL pass in a pointer to your instance of struct Dwarf_Printf_Callback_Info_s with all the fields filled in.

Returns

If dw_callbackinfo NULL it returns a copy of the current Dwarf_Printf_Callback_Info_s for dw_dbg. Otherwise it returns the previous contents of the struct.

9.11.2.14 dwarf_srcfiles()

```
DW_API int dwarf_srcfiles (
            Dwarf_Die dw_cu_die,
            char *** dw_srcfiles,
            Dwarf_Signed * dw_filecount,
            Dwarf_Error * dw_error )
```

The list of source files from the line table header.

The array returned by this function applies to a single compilation unit (CU).

The returned array is indexed from 0 (zero) to dw_filecount-1 when the function returns DW_DLV_OK.

In referencing the array via a file-number from a **DW_AT_decl_file** or **DW_AT_call_file** attribute one needs to know if the CU is DWARF5 or not.

Line Table Version numbers match compilation unit version numbers except that an experimental line table with line table version 0xfe06 has sometimes been used with DWARF4.

For DWARF5:

The file-number from a **DW_AT_decl_file** or **DW_AT_call_file** is the proper index into the array of string pointers.

For DWARF2,3,4, including experimental line table version 0xfe06 and a file-number from a **DW_AT_decl_file** or **DW_AT_call_file**:

1. If the file-number is zero there is no file name to find.
2. Otherwise subtract one(1) from the file-number and use the new value as the index into the array of string pointers.

The name strings returned are each assembled in the following way by dwarf_srcfiles():

1. The file number denotes a name in the line table header.
2. If the name is not a full path (i.e. not starting with / in posix/linux/Macos) then prepend the appropriate directory string from the line table header.
3. If the name is still not a full path then prepend the content of the DW_AT_comp_dir attribute of the CU DIE.

To retrieve the line table version call dwarf_srclines_b() and dwarf_srclines_version().

See also

Using dwarf_srclines_b()

Parameters

dw_cu_die	The CU DIE in this CU.
dw_srcfiles	On success allocates an array of pointers to strings and for each such, computes the fullest path possible given the CU DIE data for each file name listed in the line table header.
dw_filecount	On success returns the number of entries in the array of pointers to strings. The number returned is non-negative.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds. If there is no .debug_line[.dwo] returns DW_DLV_NO_ENTRY.

See also

Using dwarf_srcfiles()

9.11.2.15 dwarf_srclines_b()

```
DW_API int dwarf_srclines_b (
            Dwarf_Die dw_cudie,
            Dwarf_Unsigned * dw_version_out,
            Dwarf_Small * dw_table_count,
            Dwarf_Line_Context * dw_linecontext,
            Dwarf_Error * dw_error )
```

Initialize Dwarf_Line_Context for line table access.

Returns Dwarf_Line_Context pointer, needed for access to line table data. Returns the line table version number (needed to use dwarf_srcfiles() properly).

See also

Using dwarf_srclines_b()
Using dwarf_srclines_b() and linecontext

Parameters

dw_cudie	The Compilation Unit (CU) DIE of interest.
dw_version_out	The DWARF Line Table version number (Standard: 2,3,4, or 5) Version 0xf006 is an experimental (two-level) line table.
dw_table_count	Zero or one means this is a normal DWARF line table. Two means this is an experimental two-level line table.
dw_linecontext	On success sets the pointer to point to an opaque structure usable for further queries.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.16 dwarf_srclines_comp_dir()

```
DW_API int dwarf_srclines_comp_dir (
            Dwarf_Line_Context dw_context,
            const char ** dw_compilation_directory,
            Dwarf_Error * dw_error )
```

Compilation Directory name for the CU.

Do not free() or dealloc the string, it is in a dwarf section.

Parameters

dw_context	The Line Context of interest.
dw_compilation_directory	On success returns a pointer to a string identifying the compilation directory of the CU.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.17 dwarf_srclines_dealloc_b()

```
DW_API void dwarf_srclines_dealloc_b (
            Dwarf_Line_Context dw_context )
```

Dealloc the memory allocated by dwarf_srclines_b.

The way to deallocate (free) a Dwarf_Line_Context

Parameters

dw_context	The context to be dealloced (freed). On return the pointer passed in is stale and calling applications should zero the pointer.

9.11.2.18 dwarf_srclines_files_data_b()

```
DW_API int dwarf_srclines_files_data_b (
             Dwarf_Line_Context dw_context,
             Dwarf_Signed dw_index_in,
             const char ** dw_name,
             Dwarf_Unsigned * dw_directory_index,
             Dwarf_Unsigned * dw_last_mod_time,
             Dwarf_Unsigned * dw_file_length,
             Dwarf_Form_Data16 ** dw_md5ptr,
             Dwarf_Error * dw_error )
```

Access data for each line table file.

Has the md5ptr field so cases where DW_LNCT_MD5 is present can return pointer to the MD5 value. With DWARF 5 index starts with 0. dwarf_srclines_files_indexes() makes indexing through the files easy.

See also

dwarf_srclines_files_indexes

Using dwarf_srclines_b()

Parameters

dw_context	The line context of interest.
dw_index_in	The entry of interest. Callers should index as dw_baseindex through dw_endindex-1.
dw_name	If dw_name non-null on success returns The file name in the line table header through the pointer.
dw_directory_index	If dw_directory_index non-null on success returns the directory number in the line table header through the pointer.
dw_last_mod_time	If dw_last_mod_time non-null on success returns the directory last modification date/time through the pointer.
dw_file_length	If dw_file_length non-null on success returns the file length recorded in the line table through the pointer.
dw_md5ptr	If dw_md5ptr non-null on success returns a pointer to the 16byte MD5 hash of the file through the pointer. If there is no md5 value present it returns 0 through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.19 dwarf_srclines_files_indexes()

```
DW_API int dwarf_srclines_files_indexes (
             Dwarf_Line_Context dw_context,
             Dwarf_Signed * dw_baseindex,
             Dwarf_Signed * dw_count,
             Dwarf_Signed * dw_endindex,
             Dwarf_Error * dw_error )
```

Return values easing indexing line table file numbers. Count is the real count of files array entries. Since DWARF 2,3,4 are zero origin indexes and DWARF5 and later are one origin, this function replaces dwarf_srclines_files_↩ count().

Parameters

dw_context	The line context of interest.
dw_baseindex	On success returns the base index of valid file indexes. With DWARF2,3,4 the value is 1. With DWARF5 the value is 0.
dw_count	On success returns the real count of entries.
dw_endindex	On success returns value such that callers should index as dw_baseindex through dw_endindex-1.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

See also

Using dwarf_srclines_b()

9.11.2.20 dwarf_srclines_from_linecontext()

```
DW_API int dwarf_srclines_from_linecontext (
             Dwarf_Line_Context dw_linecontext,
             Dwarf_Line ** dw_linebuf,
             Dwarf_Signed * dw_linecount,
             Dwarf_Error * dw_error )
```

Access source lines from line context.

Provides access to Dwarf_Line data from a Dwarf_Line_Context on a standard line table.

Parameters

dw_linecontext	The line context of interest.
dw_linebuf	On success returns an array of pointers to Dwarf_Line.
dw_linecount	On success returns the count of entries in dw_linebuf. If dw_linecount is returned as zero this is a line table with no lines.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.21 dwarf_srclines_include_dir_count()

```
DW_API int dwarf_srclines_include_dir_count (
             Dwarf_Line_Context dw_line_context,
             Dwarf_Signed * dw_count,
             Dwarf_Error * dw_error )
```

Return the number of include directories in the Line Table.

Parameters

dw_line_context	The line context of interest.
dw_count	On success returns the count of directories. How to use this depends on the line table version number.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

See also

dwarf_srclines_include_dir_data

9.11.2.22 dwarf_srclines_include_dir_data()

```
DW_API int dwarf_srclines_include_dir_data (
            Dwarf_Line_Context dw_line_context,
            Dwarf_Signed dw_index,
            const char ** dw_name,
            Dwarf_Error * dw_error )
```

Return the include directories in the Line Table.

Parameters

dw_line_context	The line context of interest.
dw_index	Pass in an index to the line context list of include directories. If the line table is version 2,3, or 4, the valid indexes are 1 through dw_count. If the line table is version 5 the valid indexes are 0 through dw_count-1.
dw_name	On success it returns a pointer to a directory name. Do not free/deallocate the string.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

See also

dwarf_srclines_include_dir_count

9.11.2.23 dwarf_srclines_subprog_count()

```
DW_API int dwarf_srclines_subprog_count (
            Dwarf_Line_Context dw_context,
            Dwarf_Signed * dw_count,
            Dwarf_Error * dw_error )
```

Subprog count: Part of the two-level line table extension.

A non-standard table. The actual meaning of subprog count left undefined here.

Parameters

dw_context	The Dwarf_Line_Context of interest.
dw_count	On success returns the two-level line table subprogram array size in this line context.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.24 dwarf_srclines_subprog_data()

```
DW_API int dwarf_srclines_subprog_data (
            Dwarf_Line_Context dw_context,
            Dwarf_Signed dw_index,
            const char ** dw_name,
            Dwarf_Unsigned * dw_decl_file,
            Dwarf_Unsigned * dw_decl_line,
            Dwarf_Error * dw_error )
```

Retrieve data from the line table subprog array.

A non-standard table. Not defined here.

Parameters

dw_context	The Dwarf_Line_Context of interest.
dw_index	The item to retrieve. Valid indexes are 1 through dw_count.
dw_name	On success returns a pointer to the subprog name.
dw_decl_file	On success returns a file number through the pointer.
dw_decl_line	On success returns a line number through the pointer.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.25 dwarf_srclines_table_offset()

```
DW_API int dwarf_srclines_table_offset (
            Dwarf_Line_Context dw_context,
            Dwarf_Unsigned * dw_offset,
            Dwarf_Error * dw_error )
```

Return the srclines table offset.

The offset is in the relevant .debug_line or .debug_line.dwo section (and in a split dwarf package file includes the base line table offset).

Parameters

dw_context	
dw_offset	On success returns the section offset of the dw_context.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.11.2.26 dwarf_srclines_two_level_from_linecontext()

```
DW_API int dwarf_srclines_two_level_from_linecontext (
            Dwarf_Line_Context dw_context,
            Dwarf_Line ** dw_linebuf,
            Dwarf_Signed * dw_linecount,
            Dwarf_Line ** dw_linebuf_actuals,
            Dwarf_Signed * dw_linecount_actuals,
            Dwarf_Error * dw_error )
```

Returns line table counts and data.

Works for DWARF2,3,4,5 and for experimental two-level line tables. A single level table will have ∗linebuf_actuals and ∗linecount_actuals set to 0.

Two-level line tables are non-standard and not documented further. For standard (one-level) tables, it will return the single table through dw_linebuf, and the value returned through dw_linecount_actuals will be 0.

People not using these two-level tables should dwarf_srclines_from_linecontext instead.

9.11.2.27 dwarf_srclines_version()

```
DW_API int dwarf_srclines_version (
            Dwarf_Line_Context dw_line_context,
            Dwarf_Unsigned * dw_version,
            Dwarf_Small * dw_table_count,
            Dwarf_Error * dw_error )
```

The DWARF version number of this compile-unit.

The .debug_lines[.dwo] table count informs about the line table version and the type of line table involved.

Meaning of the value returned via dw_table_count:

- 0 The table is a header with no lines.
- 1 The table is a standard line table.
- 2 The table is an experimental line table.

Parameters

dw_line_context	The Line Context of interest.
dw_version	On success, returns the line table version through the pointer.
dw_table_count	On success, returns the tablecount through the pointer. If the table count is zero the line table is a header with no lines. If the table count is 1 this is a standard line table. If the table count is this is an experimental two-level line table.
dw_error	The usual error pointer.

Returns

DW_DLV_OK if it succeeds.

9.12 Ranges: code addresses in DWARF3-4

Functions

- DW_API int dwarf_get_ranges_b (Dwarf_Debug dw_dbg, Dwarf_Off dw_rangesoffset, Dwarf_Die dw↩_die, Dwarf_Off ∗dw_return_realoffset, Dwarf_Ranges ∗∗dw_rangesbuf, Dwarf_Signed ∗dw_rangecount, Dwarf_Unsigned ∗dw_bytecount, Dwarf_Error ∗dw_error)

  Access to code ranges from a CU or just reading through the raw .debug_ranges section.
- DW_API void dwarf_dealloc_ranges (Dwarf_Debug dw_dbg, Dwarf_Ranges ∗dw_rangesbuf, Dwarf_Signed dw_rangecount)

  Dealloc the array dw_rangesbuf.
- DW_API int dwarf_get_ranges_baseaddress (Dwarf_Debug dw_dbg, Dwarf_Die dw_die, Dwarf_Bool ∗dw_known_base, Dwarf_Unsigned ∗dw_baseaddress, Dwarf_Bool ∗dw_at_ranges_offset_present, Dwarf_Unsigned ∗dw_at_ranges_offset, Dwarf_Error ∗dw_error)

  Find ranges base address.

9.12.1 Detailed Description

In DWARF3 and DWARF4 the DW_AT_ranges attribute provides an offset into the .debug_ranges section, which contains code address ranges.

See also

Dwarf_Ranges

DWARF3 and DWARF4. DW_AT_ranges with an unsigned constant FORM (DWARF3) or DW_FORM_sec_offset(↩DWARF4).

9.12.2 Function Documentation

9.12.2.1 dwarf_dealloc_ranges()

```
DW_API void dwarf_dealloc_ranges (
            Dwarf_Debug dw_dbg,
            Dwarf_Ranges ∗ dw_rangesbuf,
            Dwarf_Signed dw_rangecount )
```

Dealloc the array dw_rangesbuf.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_rangesbuf	The dw_rangesbuf pointer returned by dwarf_get_ranges_b
dw_rangecount	The dw_rangecount returned by dwarf_get_ranges_b

9.12.2.2 dwarf_get_ranges_b()

```
DW_API int dwarf_get_ranges_b (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_rangesoffset,
            Dwarf_Die dw_die,
            Dwarf_Off * dw_return_realoffset,
            Dwarf_Ranges ** dw_rangesbuf,
            Dwarf_Signed * dw_rangecount,
            Dwarf_Unsigned * dw_bytecount,
            Dwarf_Error * dw_error )
```

Access to code ranges from a CU or just reading through the raw .debug_ranges section.

Adds return of the dw_realoffset to accommodate DWARF4 GNU split-dwarf, where the ranges could be in the tieddbg (meaning the real executable, a.out, not in a dwp). DWARF4 split-dwarf is an extension, not standard DWARF4.

If printing all entries in the section pass in an initial dw_rangesoffset of zero and dw_die of NULL. Then increment dw_rangesoffset by dw_bytecount and call again to get the next batch of ranges. With a specific option dwarfdump can do this. This not a normal thing to do!

See also

Example getting .debug_ranges data

Parameters

dw_dbg	The Dwarf_Debug of interest
dw_rangesoffset	The offset to read from in the section.
dw_die	Pass in the DIE whose DW_AT_ranges brought us to ranges.
dw_return_realoffset	The actual offset in the section actually read. In a tieddbg dwp DWARF4 extension object the base offset is added to dw_rangesoffset and returned here.
dw_rangesbuf	A pointer to an array of structs is returned here. The struct contents are the raw values in the section.
dw_rangecount	The count of structs in the array is returned here.
dw_bytecount	The number of bytes in the .debug_ranges section applying to the returned array. This makes possible just marching through the section by offset.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.12.2.3 dwarf_get_ranges_baseaddress()

```
DW_API int dwarf_get_ranges_baseaddress (
            Dwarf_Debug dw_dbg,
            Dwarf_Die dw_die,
            Dwarf_Bool * dw_known_base,
            Dwarf_Unsigned * dw_baseaddress,
            Dwarf_Bool * dw_at_ranges_offset_present,
            Dwarf_Unsigned * dw_at_ranges_offset,
            Dwarf_Error * dw_error )
```

Find ranges base address.

The function allows callers to calculate actual address from .debug_ranges data in a simple and efficient way.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_die	Pass in any non-null valid Dwarf_Die to find the applicable .debug_ranges base address. The dw_die need not be a CU-DIE. A null dw_die is allowed.
dw_known_base	if dw_die is non-null and there is a known base address for the CU DIE that (a DW_at_low_pc in the CU DIE) dw_known_base will be set TRUE, Otherwise the value FALSE will be returned through dw_known_base.
dw_baseaddress	if dw_known_base is returned as TRUE then dw_baseaddress will be set with the correct pc value. Otherwise zero will be set through dw_baseaddress.
dw_at_ranges_offset_present	Set to 1 (TRUE) if the dw_die has the attribute DW_AT_ranges, otherwise set to zero (FALSE).
dw_at_ranges_offset	Set to the value of dw_die DW_AT_ranges attribute of dw_die if and only iff dw_at_ranges_offset_present was set to 1.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK or DW_DLV_ERROR. Never returns DW_DLV_NO_ENTRY.

9.13 Rnglists: code addresses in DWARF5

Functions

- DW_API int dwarf_rnglists_get_rle_head (Dwarf_Attribute dw_attr, Dwarf_Half dw_theform, Dwarf_Unsigned dw_index_or_offset_value, Dwarf_Rnglists_Head ∗dw_head_out, Dwarf_Unsigned ∗dw_count_of_entries↩_in_head, Dwarf_Unsigned ∗dw_global_offset_of_rle_set, Dwarf_Error ∗dw_error)

  Get Access to DWARF5 rnglists.
- DW_API int dwarf_get_rnglists_entry_fields_a (Dwarf_Rnglists_Head dw_head, Dwarf_Unsigned dw↩_entrynum, unsigned int ∗dw_entrylen, unsigned int ∗dw_rle_value_out, Dwarf_Unsigned ∗dw_raw1, Dwarf_Unsigned ∗dw_raw2, Dwarf_Bool ∗dw_debug_addr_unavailable, Dwarf_Unsigned ∗dw_cooked1, Dwarf_Unsigned ∗dw_cooked2, Dwarf_Error ∗dw_error)

  Access rnglist entry details.
- DW_API void dwarf_dealloc_rnglists_head (Dwarf_Rnglists_Head dw_head)

  Dealloc a Dwarf_Rnglists_Head.
- DW_API int dwarf_load_rnglists (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_rnglists_count, Dwarf_Error ∗dw_error)

Loads all .debug_rnglists headers.

- DW_API int dwarf_get_rnglist_offset_index_value (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_context↩_index, Dwarf_Unsigned dw_offsetentry_index, Dwarf_Unsigned ∗dw_offset_value_out, Dwarf_Unsigned ∗dw_global_offset_value_out, Dwarf_Error ∗dw_error)

  Retrieve the section offset of a rnglist.
- DW_API int dwarf_get_rnglist_head_basics (Dwarf_Rnglists_Head dw_head, Dwarf_Unsigned ∗dw↩_rle_count, Dwarf_Unsigned ∗dw_rnglists_version, Dwarf_Unsigned ∗dw_rnglists_index_returned, Dwarf_Unsigned ∗dw_bytes_total_in_rle, Dwarf_Half ∗dw_offset_size, Dwarf_Half ∗dw_address_↩size, Dwarf_Half ∗dw_segment_selector_size, Dwarf_Unsigned ∗dw_overall_offset_of_this_context, Dwarf_Unsigned ∗dw_total_length_of_this_context, Dwarf_Unsigned ∗dw_offset_table_offset, Dwarf_Unsigned ∗dw_offset_table_entrycount, Dwarf_Bool ∗dw_rnglists_base_present, Dwarf_Unsigned ∗dw_rnglists↩_base, Dwarf_Bool ∗dw_rnglists_base_address_present, Dwarf_Unsigned ∗dw_rnglists_base_address, Dwarf_Bool ∗dw_rnglists_debug_addr_base_present, Dwarf_Unsigned ∗dw_rnglists_debug_addr_base, Dwarf_Error ∗dw_error)

  Access to internal data on rangelists.
- DW_API int dwarf_get_rnglist_context_basics (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_index, Dwarf_Unsigned ∗dw_header_offset, Dwarf_Small ∗dw_offset_size, Dwarf_Small ∗dw_extension_size, unsigned int ∗dw_version, Dwarf_Small ∗dw_address_size, Dwarf_Small ∗dw_segment_selector_size, Dwarf_Unsigned ∗dw_offset_entry_count, Dwarf_Unsigned ∗dw_offset_of_offset_array, Dwarf_Unsigned ∗dw_offset_of_first_rangeentry, Dwarf_Unsigned ∗dw_offset_past_last_rangeentry, Dwarf_Error ∗dw_error)

  Access to rnglists header data.
- DW_API int dwarf_get_rnglist_rle (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_contextnumber, Dwarf_Unsigned dw_entry_offset, Dwarf_Unsigned dw_endoffset, unsigned int ∗dw_entrylen, unsigned int ∗dw_entry_kind, Dwarf_Unsigned ∗dw_entry_operand1, Dwarf_Unsigned ∗dw_entry_operand2, Dwarf_Error ∗dw_error)

  Access to raw rnglists range data.

9.13.1 Detailed Description

Used in DWARF5 to define valid address ranges for code.

DW_FORM_rnglistx or DW_AT_ranges with DW_FORM_sec_offset

9.13.2 Function Documentation

9.13.2.1 dwarf_dealloc_rnglists_head()

```
DW_API void dwarf_dealloc_rnglists_head (
            Dwarf_Rnglists_Head dw_head )
```

Dealloc a Dwarf_Rnglists_Head.

Parameters

dw_head	dealloc all the memory associated with dw_head. The caller should then immediately set the pointer to zero/NULL as it is stale.

9.13.2.2 dwarf_get_rnglist_context_basics()

```
DW_API int dwarf_get_rnglist_context_basics (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_index,
            Dwarf_Unsigned * dw_header_offset,
            Dwarf_Small * dw_offset_size,
            Dwarf_Small * dw_extension_size,
            unsigned int * dw_version,
            Dwarf_Small * dw_address_size,
            Dwarf_Small * dw_segment_selector_size,
            Dwarf_Unsigned * dw_offset_entry_count,
            Dwarf_Unsigned * dw_offset_of_offset_array,
            Dwarf_Unsigned * dw_offset_of_first_rangeentry,
            Dwarf_Unsigned * dw_offset_past_last_rangeentry,
            Dwarf_Error * dw_error )
```

Access to rnglists header data.

This returns, independent of any DIEs or CUs information on the .debug_rnglists headers present in the section.

We do not document the details here. See the DWARF5 standard.

Enables printing of details about the Range List Table Headers, one header per call. Index starting at 0. Returns DW_DLV_NO_ENTRY if index is too high for the table. A .debug_rnglists section may contain any number of Range List Table Headers with their details.

9.13.2.3 dwarf_get_rnglist_head_basics()

```
DW_API int dwarf_get_rnglist_head_basics (
             Dwarf_Rnglists_Head dw_head,
             Dwarf_Unsigned * dw_rle_count,
             Dwarf_Unsigned * dw_rnglists_version,
             Dwarf_Unsigned * dw_rnglists_index_returned,
             Dwarf_Unsigned * dw_bytes_total_in_rle,
             Dwarf_Half * dw_offset_size,
             Dwarf_Half * dw_address_size,
             Dwarf_Half * dw_segment_selector_size,
             Dwarf_Unsigned * dw_overall_offset_of_this_context,
             Dwarf_Unsigned * dw_total_length_of_this_context,
             Dwarf_Unsigned * dw_offset_table_offset,
             Dwarf_Unsigned * dw_offset_table_entrycount,
             Dwarf_Bool * dw_rnglists_base_present,
             Dwarf_Unsigned * dw_rnglists_base,
             Dwarf_Bool * dw_rnglists_base_address_present,
             Dwarf_Unsigned * dw_rnglists_base_address,
             Dwarf_Bool * dw_rnglists_debug_addr_base_present,
             Dwarf_Unsigned * dw_rnglists_debug_addr_base,
             Dwarf_Error * dw_error )
```

Access to internal data on rangelists.

Returns detailed data from a Dwarf_Rnglists_Head Since this is primarily internal data we don't describe the details of the returned fields here.

9.13.2.4 dwarf_get_rnglist_offset_index_value()

```
DW_API int dwarf_get_rnglist_offset_index_value (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_context_index,
            Dwarf_Unsigned dw_offsetentry_index,
            Dwarf_Unsigned * dw_offset_value_out,
            Dwarf_Unsigned * dw_global_offset_value_out,
            Dwarf_Error * dw_error )
```

Retrieve the section offset of a rnglist.

Can be used to access raw rnglist data. Not used by most callers. See DWARF5 Section 7.28 Range List Table Page 242

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_context_index	Begin this at zero.
dw_offsetentry_index	Begin this at zero.
dw_offset_value_out	On success returns the rangelist entry offset within the rangelist set.
dw_global_offset_value_out	On success returns the rangelist entry offset within rnglist section.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If there are no rnglists at all, or if one of the above index values is too high to be valid it returns DW_DLV_NO_ENTRY.

9.13.2.5 dwarf_get_rnglist_rle()

```
DW_API int dwarf_get_rnglist_rle (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_contextnumber,
            Dwarf_Unsigned dw_entry_offset,
            Dwarf_Unsigned dw_endoffset,
            unsigned int * dw_entrylen,
            unsigned int * dw_entry_kind,
            Dwarf_Unsigned * dw_entry_operand1,
            Dwarf_Unsigned * dw_entry_operand2,
            Dwarf_Error * dw_error )
```

Access to raw rnglists range data.

Describes the actual raw data recorded in a particular range entry.

We do not describe all these fields for now, the raw values are mostly useful for people debugging compiler-generated DWARF.

9.13.2.6 dwarf_get_rnglists_entry_fields_a()

```
DW_API int dwarf_get_rnglists_entry_fields_a (
            Dwarf_Rnglists_Head dw_head,
            Dwarf_Unsigned dw_entrynum,
            unsigned int * dw_entrylen,
            unsigned int * dw_rle_value_out,
            Dwarf_Unsigned * dw_raw1,
            Dwarf_Unsigned * dw_raw2,
            Dwarf_Bool * dw_debug_addr_unavailable,
            Dwarf_Unsigned * dw_cooked1,
            Dwarf_Unsigned * dw_cooked2,
            Dwarf_Error * dw_error )
```

Access rnglist entry details.

See also

Accessing rnglists section

Parameters

dw_head	The Dwarf_Rnglists_Head of interest.
dw_entrynum	Valid values are 0 through dw_count_of_entries_in_head-1.
dw_entrylen	On success returns the length in bytes of this individual entry.
dw_rle_value_out	On success returns the RLE value of the entry, such as DW_RLE_startx_endx. This determines which of dw_raw1 and dw_raw2 contain meaningful data.
dw_raw1	On success returns a value directly recorded in the rangelist entry if that applies to this rle.
dw_raw2	On success returns a value directly recorded in the rangelist entry if that applies to this rle.
dw_debug_addr_unavailable	On success returns a flag. If the .debug_addr section is required but absent or unavailable the flag is set to TRUE. Otherwise sets the flag FALSE.
dw_cooked1	On success returns (if appropriate) the dw_raw1 value turned into a valid address.
dw_cooked2	On success returns (if appropriate) the dw_raw2 value turned into a valid address. Ignore the value if dw_debug_addr_unavailable is set.
dw_error	The usual error detail return pointer. Ignore the value if dw_debug_addr_unavailable is set.

Returns

Returns DW_DLV_OK etc.

9.13.2.7 dwarf_load_rnglists()

```
DW_API int dwarf_load_rnglists (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned * dw_rnglists_count,
            Dwarf_Error * dw_error )
```

Loads all .debug_rnglists headers.

Loads all the rnglists headers and returns DW_DLV_NO_ENTRY if the section is missing or empty. Intended to be done quite early. It is automatically done if anything needing CU or DIE information is called, so it is not necessary for you to call this in any normal situation.

See also

Accessing accessing raw rnglist

Doing it more than once is never necessary or harmful. There is no deallocation call made visible, deallocation happens when dwarf_finish() is called.

Parameters

dw_dbg	
dw_rnglists_count	On success it returns the number of rnglists headers in the section through dw_rnglists_count.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If the section does not exist the function returns DW_DLV_OK.

9.13.2.8 dwarf_rnglists_get_rle_head()

```
DW_API int dwarf_rnglists_get_rle_head (
            Dwarf_Attribute dw_attr,
            Dwarf_Half dw_theform,
            Dwarf_Unsigned dw_index_or_offset_value,
            Dwarf_Rnglists_Head * dw_head_out,
            Dwarf_Unsigned * dw_count_of_entries_in_head,
            Dwarf_Unsigned * dw_global_offset_of_rle_set,
            Dwarf_Error * dw_error )
```

Get Access to DWARF5 rnglists.

Opens a Dwarf_Rnglists_Head to access a set of DWARF5 rangelists .debug_rnglists DW_FORM_sec_offset DW↩_FORM_rnglistx (DW_AT_ranges in DWARF5).

See also

Accessing rnglists section

Parameters

dw_attr	The attribute referring to .debug_rnglists
dw_theform	The form number, DW_FORM_sec_offset or DW_FORM_rnglistx.
dw_index_or_offset_value	If the form is an index, pass it here. If the form is an offset, pass that here.
dw_head_out	On success creates a record owning the rnglists data for this attribute.
dw_count_of_entries_in_head	On success this is set to the number of entry in the rnglists for this attribute.
dw_global_offset_of_rle_set	On success set to the global offset of the rnglists in the rnglists section.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.14 Locations of data: DWARF2-DWARF5

Macros

- #define **DW_LKIND_expression** 0 /∗ DWARF2,3,4,5 ∗/
- #define **DW_LKIND_loclist** 1 /∗ DWARF 2,3,4 ∗/
- #define **DW_LKIND_GNU_exp_list** 2 /∗ GNU DWARF4 .dwo extension ∗/
- #define **DW_LKIND_loclists** 5 /∗ DWARF5 loclists ∗/
- #define **DW_LKIND_unknown** 99

Functions

- DW_API int dwarf_get_loclist_c (Dwarf_Attribute dw_attr, Dwarf_Loc_Head_c ∗dw_loclist_head, Dwarf_Unsigned ∗dw_locentry_count, Dwarf_Error ∗dw_error)

  Location Lists and Expressions.
- DW_API int dwarf_get_loclist_head_kind (Dwarf_Loc_Head_c dw_loclist_head, unsigned int ∗dw_lkind, Dwarf_Error ∗dw_error)

  Know what kind of location data it is.
- DW_API int dwarf_get_locdesc_entry_d (Dwarf_Loc_Head_c dw_loclist_head, Dwarf_Unsigned dw_↩index, Dwarf_Small ∗dw_lle_value_out, Dwarf_Unsigned ∗dw_rawlowpc, Dwarf_Unsigned ∗dw_rawhipc, Dwarf_Bool ∗dw_debug_addr_unavailable, Dwarf_Addr ∗dw_lowpc_cooked, Dwarf_Addr ∗dw_hipc_cooked, Dwarf_Unsigned ∗dw_locexpr_op_count_out, Dwarf_Locdesc_c ∗dw_locentry_out, Dwarf_Small ∗dw_↩loclist_source_out, Dwarf_Unsigned ∗dw_expression_offset_out, Dwarf_Unsigned ∗dw_locdesc_offset_out, Dwarf_Error ∗dw_error)

  Retrieve the details(_d) of a location expression.
- DW_API int dwarf_get_locdesc_entry_e (Dwarf_Loc_Head_c dw_loclist_head, Dwarf_Unsigned dw_↩index, Dwarf_Small ∗dw_lle_value_out, Dwarf_Unsigned ∗dw_rawlowpc, Dwarf_Unsigned ∗dw_rawhipc, Dwarf_Bool ∗dw_debug_addr_unavailable, Dwarf_Addr ∗dw_lowpc_cooked, Dwarf_Addr ∗dw_hipc_cooked, Dwarf_Unsigned ∗dw_locexpr_op_count_out, Dwarf_Unsigned ∗dw_lle_bytecount, Dwarf_Locdesc_c ∗dw_locentry_out, Dwarf_Small ∗dw_loclist_source_out, Dwarf_Unsigned ∗dw_expression_offset_out, Dwarf_Unsigned ∗dw_locdesc_offset_out, Dwarf_Error ∗dw_error)

  Retrieve the details(_e) of a location expression.
- DW_API int dwarf_get_location_op_value_c (Dwarf_Locdesc_c dw_locdesc, Dwarf_Unsigned dw_↩index, Dwarf_Small ∗dw_operator_out, Dwarf_Unsigned ∗dw_operand1, Dwarf_Unsigned ∗dw_operand2, Dwarf_Unsigned ∗dw_operand3, Dwarf_Unsigned ∗dw_offset_for_branch, Dwarf_Error ∗dw_error)

  Get the raw values from a single location operation.
- DW_API int dwarf_loclist_from_expr_c (Dwarf_Debug dw_dbg, Dwarf_Ptr dw_expression_in, Dwarf_Unsigned dw_expression_length, Dwarf_Half dw_address_size, Dwarf_Half dw_offset_size, Dwarf_Half dw_dwarf_↩version, Dwarf_Loc_Head_c ∗dw_loc_head, Dwarf_Unsigned ∗dw_listlen, Dwarf_Error ∗dw_error)

  Generate a Dwarf_Loc_Head_c from an expression block.
- DW_API void dwarf_dealloc_loc_head_c (Dwarf_Loc_Head_c dw_head)

  Dealloc (free) all memory allocated for Dwarf_Loc_Head_c.
- DW_API int dwarf_load_loclists (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_loclists_count, Dwarf_Error ∗dw_error)

  Load Loclists.
- DW_API int dwarf_get_loclist_offset_index_value (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_context↩_index, Dwarf_Unsigned dw_offsetentry_index, Dwarf_Unsigned ∗dw_offset_value_out, Dwarf_Unsigned ∗dw_global_offset_value_out, Dwarf_Error ∗dw_error)

Return certain loclists offsets.

- DW_API int dwarf_get_loclist_head_basics (Dwarf_Loc_Head_c dw_head, Dwarf_Small ∗dw_lkind, Dwarf_Unsigned ∗dw_lle_count, Dwarf_Unsigned ∗dw_loclists_version, Dwarf_Unsigned ∗dw_loclists↩_index_returned, Dwarf_Unsigned ∗dw_bytes_total_in_rle, Dwarf_Half ∗dw_offset_size, Dwarf_Half ∗dw↩_address_size, Dwarf_Half ∗dw_segment_selector_size, Dwarf_Unsigned ∗dw_overall_offset_of_this↩_context, Dwarf_Unsigned ∗dw_total_length_of_this_context, Dwarf_Unsigned ∗dw_offset_table_offset, Dwarf_Unsigned ∗dw_offset_table_entrycount, Dwarf_Bool ∗dw_loclists_base_present, Dwarf_Unsigned ∗dw_loclists_base, Dwarf_Bool ∗dw_loclists_base_address_present, Dwarf_Unsigned ∗dw_loclists_base↩_address, Dwarf_Bool ∗dw_loclists_debug_addr_base_present, Dwarf_Unsigned ∗dw_loclists_debug_↩addr_base, Dwarf_Unsigned ∗dw_offset_this_lle_area, Dwarf_Error ∗dw_error)

  Return basic data about a loclists head.
- DW_API int dwarf_get_loclist_context_basics (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_index, Dwarf_Unsigned ∗dw_header_offset, Dwarf_Small ∗dw_offset_size, Dwarf_Small ∗dw_extension_size, unsigned int ∗dw_version, Dwarf_Small ∗dw_address_size, Dwarf_Small ∗dw_segment_selector_size, Dwarf_Unsigned ∗dw_offset_entry_count, Dwarf_Unsigned ∗dw_offset_of_offset_array, Dwarf_Unsigned ∗dw_offset_of_first_locentry, Dwarf_Unsigned ∗dw_offset_past_last_locentry, Dwarf_Error ∗dw_error)

  Return basic data about a loclists context.
- DW_API int dwarf_get_loclist_lle (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_contextnumber, Dwarf_Unsigned dw_entry_offset, Dwarf_Unsigned dw_endoffset, unsigned int ∗dw_entrylen, unsigned int ∗dw_entry_kind, Dwarf_Unsigned ∗dw_entry_operand1, Dwarf_Unsigned ∗dw_entry_operand2, Dwarf_Unsigned ∗dw_↩expr_ops_blocksize, Dwarf_Unsigned ∗dw_expr_ops_offset, Dwarf_Small ∗∗dw_expr_opsdata, Dwarf_Error ∗dw_error)

  Return basic data about a loclists context entry.

9.14.1 Detailed Description

9.14.2 Function Documentation

9.14.2.1 dwarf_dealloc_loc_head_c()

```
DW_API void dwarf_dealloc_loc_head_c (
            Dwarf_Loc_Head_c dw_head )
```

Dealloc (free) all memory allocated for Dwarf_Loc_Head_c.

Parameters

dw_head	A head pointer.

The caller should zero the passed-in pointer on return as it is stale at that point.

9.14.2.2 dwarf_get_location_op_value_c()

```
DW_API int dwarf_get_location_op_value_c (
            Dwarf_Locdesc_c dw_locdesc,
            Dwarf_Unsigned dw_index,
            Dwarf_Small * dw_operator_out,
            Dwarf_Unsigned * dw_operand1,
            Dwarf_Unsigned * dw_operand2,
            Dwarf_Unsigned * dw_operand3,
            Dwarf_Unsigned * dw_offset_for_branch,
            Dwarf_Error * dw_error )
```

Get the raw values from a single location operation.

Parameters

dw_locdesc	Pass in a valid Dwarf_Locdesc_c.
dw_index	Pass in the operator index. zero through dw_locexpr_op_count_out-1.
dw_operator_out	On success returns the DW_OP operator, such as DW_OP_plus .
dw_operand1	On success returns the value of the operand or zero.
dw_operand2	On success returns the value of the operand or zero.
dw_operand3	On success returns the value of the operand or zero.
dw_offset_for_branch	On success returns The byte offset of the operator within the entire expression. Useful for checking the correctness of operators that branch..
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.14.2.3 dwarf_get_locdesc_entry_d()

```
DW_API int dwarf_get_locdesc_entry_d (
            Dwarf_Loc_Head_c dw_loclist_head,
            Dwarf_Unsigned dw_index,
            Dwarf_Small * dw_lle_value_out,
            Dwarf_Unsigned * dw_rawlowpc,
            Dwarf_Unsigned * dw_rawhipc,
            Dwarf_Bool * dw_debug_addr_unavailable,
            Dwarf_Addr * dw_lowpc_cooked,
            Dwarf_Addr * dw_hipc_cooked,
            Dwarf_Unsigned * dw_locexpr_op_count_out,
            Dwarf_Locdesc_c * dw_locentry_out,
            Dwarf_Small * dw_loclist_source_out,
            Dwarf_Unsigned * dw_expression_offset_out,
            Dwarf_Unsigned * dw_locdesc_offset_out,
            Dwarf_Error * dw_error )
```

Retrieve the details(_d) of a location expression.

Cooked value means the addresses from the location description after base values applied, so they are actual addresses. debug_addr_unavailable non-zero means the record from a Split Dwarf skeleton unit could not be accessed from the .dwo section or dwp object so the cooked values could not be calculated.

Parameters

dw_loclist_head	A loclist head pointer.
dw_index	Pass in an index value less than dw_locentry_count .
dw_lle_value_out	On success returns the DW_LLE value applicable, such as DW_LLE_start_end .
dw_rawlowpc	On success returns the first operand in the expression (if the expression has an operand).

Parameters

dw_rawhipc	On success returns the second operand in the expression. (if the expression has a second operand).
dw_debug_addr_unavailable	On success returns FALSE if the data required to calculate dw_lowpc_cooked or dw_hipc_cooked was present or TRUE if some required data was missing (for example in split dwarf).
dw_lowpc_cooked	On success and if dw_debug_addr_unavailable FALSE returns the true low address.
dw_hipc_cooked	On success and if dw_debug_addr_unavailable FALSE returns the true high address.
dw_locexpr_op_count_out	On success returns the count of operations in the expression.
dw_locentry_out	On success returns a pointer to a specific location description.
dw_loclist_source_out	On success returns the applicable DW_LKIND value.
dw_expression_offset_out	On success returns the offset of the expression in the applicable section.
dw_locdesc_offset_out	On return sets the offset to the location description offset (if that is meaningful) or zero for simple location expressions.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.14.2.4 dwarf_get_locdesc_entry_e()

```
DW_API int dwarf_get_locdesc_entry_e (
            Dwarf_Loc_Head_c dw_loclist_head,
            Dwarf_Unsigned dw_index,
            Dwarf_Small * dw_lle_value_out,
            Dwarf_Unsigned * dw_rawlowpc,
            Dwarf_Unsigned * dw_rawhipc,
            Dwarf_Bool * dw_debug_addr_unavailable,
            Dwarf_Addr * dw_lowpc_cooked,
            Dwarf_Addr * dw_hipc_cooked,
            Dwarf_Unsigned * dw_locexpr_op_count_out,
            Dwarf_Unsigned * dw_lle_bytecount,
            Dwarf_Locdesc_c * dw_locentry_out,
            Dwarf_Small * dw_loclist_source_out,
            Dwarf_Unsigned * dw_expression_offset_out,
            Dwarf_Unsigned * dw_locdesc_offset_out,
            Dwarf_Error * dw_error )
```

Retrieve the details(_e) of a location expression.

Cooked value means the addresses from the location description after base values applied, so they are actual addresses. debug_addr_unavailable non-zero means the record from a Split Dwarf skeleton unit could not be accessed from the .dwo section or dwp object so the cooked values could not be calculated.

This is identical to dwarf_get_locdesc_entry_d except that it adds a pointer argument so the caller can know the size, in bytes, of the loclist DW_LLE operation itself.

It's used by dwarfdump but it is unlikely to be of interest to most callers..

9.14.2.5 dwarf_get_loclist_c()

```
DW_API int dwarf_get_loclist_c (
            Dwarf_Attribute dw_attr,
            Dwarf_Loc_Head_c * dw_loclist_head,
            Dwarf_Unsigned * dw_locentry_count,
            Dwarf_Error * dw_error )
```

Location Lists and Expressions.

This works on DWARF2 through DWARF5.

See also

Location/expression access

Parameters

dw_attr	The attribute must refer to a location expression or a location list, so must be DW_FORM_block, DW_FORM_exprloc, or a loclist reference form..
dw_loclist_head	On success returns a pointer to the created loclist head record.
dw_locentry_count	On success returns the count of records. For an expression it will be one.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.14.2.6 dwarf_get_loclist_context_basics()

```
DW_API int dwarf_get_loclist_context_basics (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_index,
            Dwarf_Unsigned * dw_header_offset,
            Dwarf_Small * dw_offset_size,
            Dwarf_Small * dw_extension_size,
            unsigned int * dw_version,
            Dwarf_Small * dw_address_size,
            Dwarf_Small * dw_segment_selector_size,
            Dwarf_Unsigned * dw_offset_entry_count,
            Dwarf_Unsigned * dw_offset_of_offset_array,
            Dwarf_Unsigned * dw_offset_of_first_locentry,
            Dwarf_Unsigned * dw_offset_past_last_locentry,
            Dwarf_Error * dw_error )
```

Return basic data about a loclists context.

Some of the same values as from dwarf_get_loclist_head_basics but here without any dependence on data derived from a CU context. Useful to print raw loclist data.

9.14.2.7 dwarf_get_loclist_head_basics()

```
DW_API int dwarf_get_loclist_head_basics (
            Dwarf_Loc_Head_c dw_head,
            Dwarf_Small * dw_lkind,
            Dwarf_Unsigned * dw_lle_count,
            Dwarf_Unsigned * dw_loclists_version,
            Dwarf_Unsigned * dw_loclists_index_returned,
            Dwarf_Unsigned * dw_bytes_total_in_rle,
            Dwarf_Half * dw_offset_size,
            Dwarf_Half * dw_address_size,
            Dwarf_Half * dw_segment_selector_size,
            Dwarf_Unsigned * dw_overall_offset_of_this_context,
            Dwarf_Unsigned * dw_total_length_of_this_context,
            Dwarf_Unsigned * dw_offset_table_offset,
            Dwarf_Unsigned * dw_offset_table_entrycount,
            Dwarf_Bool * dw_loclists_base_present,
            Dwarf_Unsigned * dw_loclists_base,
            Dwarf_Bool * dw_loclists_base_address_present,
            Dwarf_Unsigned * dw_loclists_base_address,
            Dwarf_Bool * dw_loclists_debug_addr_base_present,
            Dwarf_Unsigned * dw_loclists_debug_addr_base,
            Dwarf_Unsigned * dw_offset_this_lle_area,
            Dwarf_Error * dw_error )
```

Return basic data about a loclists head.

Used by dwarfdump to print basic data from the data generated to look at a specific loclist context as returned by dwarf_loclists_index_get_lle_head() or dwarf_loclists_offset_get_lle_head. Here we know there was a Dwarf↩_Attribute so additional things are known as compared to calling dwarf_get_loclist_context_basics See DWARF5 Section 7.20 Location List Table page 243.

9.14.2.8 dwarf_get_loclist_head_kind()

```
DW_API int dwarf_get_loclist_head_kind (
            Dwarf_Loc_Head_c dw_loclist_head,
            unsigned int * dw_lkind,
            Dwarf_Error * dw_error )
```

Know what kind of location data it is.

Parameters

dw_loclist_head	Pass in a loclist head pointer.
dw_lkind	On success returns the loclist kind through the pointer. For example DW_LKIND_expression.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.14.2.9 dwarf_get_loclist_lle()

```
DW_API int dwarf_get_loclist_lle (
                Dwarf_Debug dw_dbg,
                Dwarf_Unsigned dw_contextnumber,
                Dwarf_Unsigned dw_entry_offset,
                Dwarf_Unsigned dw_endoffset,
                unsigned int * dw_entrylen,
                unsigned int * dw_entry_kind,
                Dwarf_Unsigned * dw_entry_operand1,
                Dwarf_Unsigned * dw_entry_operand2,
                Dwarf_Unsigned * dw_expr_ops_blocksize,
                Dwarf_Unsigned * dw_expr_ops_offset,
                Dwarf_Small ** dw_expr_opsdata,
                Dwarf_Error * dw_error )
```

Return basic data about a loclists context entry.

Useful to print raw loclist data.

9.14.2.10 dwarf_get_loclist_offset_index_value()

```
DW_API int dwarf_get_loclist_offset_index_value (
                Dwarf_Debug dw_dbg,
                Dwarf_Unsigned dw_context_index,
                Dwarf_Unsigned dw_offsetentry_index,
                Dwarf_Unsigned * dw_offset_value_out,
                Dwarf_Unsigned * dw_global_offset_value_out,
                Dwarf_Error * dw_error )
```

Return certain loclists offsets.

Useful with the DWARF5 .debug_loclists section.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_context_index	Pass in the loclists context index.
dw_offsetentry_index	Pass in the offset array index.
dw_offset_value_out	On success returns the offset value at offset table[dw_offsetentry_index], an offset local to this context.
dw_global_offset_value_out	On success returns the same offset value but with the offset of the table added in to form a section offset.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If one of the indexes passed in is out of range it returns DW_DLV_NO_ENTRY.

9.14.2.11 dwarf_load_loclists()

```
DW_API int dwarf_load_loclists (
                Dwarf_Debug dw_dbg,
                Dwarf_Unsigned * dw_loclists_count,
                Dwarf_Error * dw_error )
```

Load Loclists.

This loads raw .debug_loclists (DWARF5). It is unlikely you have a reason to use this function. If CUs or DIES have been referenced in any way loading is already done. A duplicate loading attempt returns DW_DLV_OK immediately, returning dw_loclists_count filled in and does nothing else.

Doing it more than once is never necessary or harmful. There is no deallocation call made visible, deallocation happens when dwarf_finish() is called.

Parameters

dw_dbg	The applicable Dwarf_Debug.
dw_loclists_count	On success, returns the number of DWARF5 loclists contexts in the section, whether this is the first or a duplicate load.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK if it loaded successfully or if it is a duplicate load. If no .debug_loclists present returns DW_DLV_NO_ENTRY.

9.14.2.12 dwarf_loclist_from_expr_c()

```
DW_API int dwarf_loclist_from_expr_c (
            Dwarf_Debug dw_dbg,
            Dwarf_Ptr dw_expression_in,
            Dwarf_Unsigned dw_expression_length,
            Dwarf_Half dw_address_size,
            Dwarf_Half dw_offset_size,
            Dwarf_Half dw_dwarf_version,
            Dwarf_Loc_Head_c * dw_loc_head,
            Dwarf_Unsigned * dw_listlen,
            Dwarf_Error * dw_error )
```

Generate a Dwarf_Loc_Head_c from an expression block.

Useful if you have an expression block (from somewhere), do not have a Dwarf_Attribute available, and wish to deal with the expression.

See also

Reading a location expression

Parameters

dw_dbg	The applicable Dwarf_Debug
dw_expression_in	Pass in a pointer to the expression bytes.
dw_expression_length	Pass in the length, in bytes, of the expression.
dw_address_size	Pass in the applicable address_size.
dw_offset_size	Pass in the applicable offset size.
dw_dwarf_version	Pass in the applicable dwarf version.
dw_loc_head	On success returns a pointer to a dwarf location head record for use in getting to the details of the expression.
dw_listlen	On success, sets the listlen to one.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.15 .debug_addr access: DWARF5

Functions

- DW_API int dwarf_debug_addr_table (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_section_offset, Dwarf_Debug_Addr_Table ∗dw_table_header, Dwarf_Unsigned ∗dw_length, Dwarf_Half ∗dw_version, Dwarf_Small ∗dw_address_size, Dwarf_Unsigned ∗dw_at_addr_base, Dwarf_Unsigned ∗dw_entry_count, Dwarf_Unsigned ∗dw_next_table_offset, Dwarf_Error ∗dw_error)

  Return a .debug_addr table.
- DW_API int dwarf_debug_addr_by_index (Dwarf_Debug_Addr_Table dw_dat, Dwarf_Unsigned dw_entry_↩ index, Dwarf_Unsigned ∗dw_address, Dwarf_Error ∗dw_error)

  Return .debug_addr address given table index.
- DW_API void dwarf_dealloc_debug_addr_table (Dwarf_Debug_Addr_Table dw_dat)

  dealloc (free) a Dwarf_Attr_Table record.

9.15.1 Detailed Description

Reading just the .debug_addr section.

These functions solely useful for reading that section. It seems unlikely you would have a reason to call these. The functions getting attribute values use the section when appropriate without using these functions.

9.15.2 Function Documentation

9.15.2.1 dwarf_dealloc_debug_addr_table()

```
DW_API void dwarf_dealloc_debug_addr_table (
            Dwarf_Debug_Addr_Table dw_dat )
```

dealloc (free) a Dwarf_Attr_Table record.

Parameters

dw_dat	Pass in a valid Dwarf_Debug_Addr_Table pointer. Does nothing if the dw_dat field is NULL.

9.15.2.2 dwarf_debug_addr_by_index()

```
DW_API int dwarf_debug_addr_by_index (
            Dwarf_Debug_Addr_Table dw_dat,
            Dwarf_Unsigned dw_entry_index,
            Dwarf_Unsigned * dw_address,
            Dwarf_Error * dw_error )
```

Return .debug_addr address given table index.

Parameters

dw_dat	Pass in a Dwarf_Debug_Addr_Table pointer.
dw_entry_index	Pass in a Dwarf_Debug_Addr_Table index to an address. If out of the valid range 0 through dw_entry_count-1 the function returns DW_DLV_NO_ENTRY.
dw_address	Returns an address in the program through the pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If the dw_section_offset passed in is out of range it returns DW_DLV_NO_ENTRY. If it returns DW_DLV_ERROR only dw_error is set, dw_address is not set.

9.15.2.3 dwarf_debug_addr_table()

```
DW_API int dwarf_debug_addr_table (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_section_offset,
            Dwarf_Debug_Addr_Table * dw_table_header,
            Dwarf_Unsigned * dw_length,
            Dwarf_Half * dw_version,
            Dwarf_Small * dw_address_size,
            Dwarf_Unsigned * dw_at_addr_base,
            Dwarf_Unsigned * dw_entry_count,
            Dwarf_Unsigned * dw_next_table_offset,
            Dwarf_Error * dw_error )
```

Return a .debug_addr table.

Allocates and returns a pointer to a Dwarf_Debug_Addr_Table as well as the contents of the record.

Other than dw_debug and dw_error and dw_table_header a NULL passed in as a pointer argument means the return value will not be set through the pointer, so a caller can pass NULL for return values of no immediate interest.

It is only intended to enable printing of the simple DWARF5 .debug_addr section (by dwarfdump).

When emitting DWARF4, gcc may emit a GNU-specified .debug_addr format. If some CU has been opened then this call will work, but the single table will have all the entries for all CUs.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_section_offset	Pass in the section offset of a table header. Start with zero. If the passed-in offset is past the last byte of the table the function returns DW_DLV_NO_ENTRY.
dw_table_header	On success Returns a pointer to a Dwarf_Debug_Addr_Table for use with dwarf_get_attr_by_index().
dw_length	On success Returns the length in bytes of this contribution to .debug_addr from the table header, including the table length field and the array of addresses.
dw_version	On success returns the version number, which should be 5.
dw_address_size	On success returns the address size of the address entries in this table.
dw_at_addr_base	On success returns the value that will appear in some DW_AT_addr_base attribute.
dw_entry_count	On success returns the number of table entries in this table instance.
dw_next_table_offset	On success returns the offset of the next table in the section. Use the offset returned in the next call to this function.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If the dw_section_offset passed in is out of range it returns DW_DLV_NO_ENTRY. If it returns DW_DLV_ERROR only dw_error is set, none of the other return values are set through the pointers.

9.16 Macro Access: DWARF5

Functions

- DW_API int dwarf_get_macro_context (Dwarf_Die dw_die, Dwarf_Unsigned ∗dw_version_out, Dwarf_Macro_Context ∗dw_macro_context, Dwarf_Unsigned ∗dw_macro_unit_offset_out, Dwarf_Unsigned ∗dw_macro_ops_↩ count_out, Dwarf_Unsigned ∗dw_macro_ops_data_length_out, Dwarf_Error ∗dw_error)

  DWARF5 .debug_macro access via Dwarf_Die.
- DW_API int dwarf_get_macro_context_by_offset (Dwarf_Die dw_die, Dwarf_Unsigned dw_offset, Dwarf_Unsigned ∗dw_version_out, Dwarf_Macro_Context ∗dw_macro_context, Dwarf_Unsigned ∗dw_↩ macro_ops_count_out, Dwarf_Unsigned ∗dw_macro_ops_data_length, Dwarf_Error ∗dw_error)

  DWARF5 .debug_macro access via Dwarf_Die and an offset.
- DW_API int dwarf_macro_context_total_length (Dwarf_Macro_Context dw_context, Dwarf_Unsigned ∗dw↩ _mac_total_len, Dwarf_Error ∗dw_error)

  Return a macro context total length.
- DW_API void dwarf_dealloc_macro_context (Dwarf_Macro_Context dw_mc)

  Dealloc a macro context.
- DW_API int dwarf_macro_context_head (Dwarf_Macro_Context dw_mc, Dwarf_Half ∗dw_version, Dwarf_Unsigned ∗dw_mac_offset, Dwarf_Unsigned ∗dw_mac_len, Dwarf_Unsigned ∗dw_mac_header↩ _len, unsigned int ∗dw_flags, Dwarf_Bool ∗dw_has_line_offset, Dwarf_Unsigned ∗dw_line_offset, Dwarf_Bool ∗dw_has_offset_size_64, Dwarf_Bool ∗dw_has_operands_table, Dwarf_Half ∗dw_opcode↩ _count, Dwarf_Error ∗dw_error)

  Access the internal details of a Dwarf_Macro_Context.
- DW_API int dwarf_macro_operands_table (Dwarf_Macro_Context dw_mc, Dwarf_Half dw_index, Dwarf_Half ∗dw_opcode_number, Dwarf_Half ∗dw_operand_count, const Dwarf_Small ∗∗dw_operand_array, Dwarf_Error ∗dw_error)

  Access to the details of the opcode operands table.
- DW_API int dwarf_get_macro_op (Dwarf_Macro_Context dw_macro_context, Dwarf_Unsigned dw_op_↩ number, Dwarf_Unsigned ∗dw_op_start_section_offset, Dwarf_Half ∗dw_macro_operator, Dwarf_Half ∗dw↩ _forms_count, const Dwarf_Small ∗∗dw_formcode_array, Dwarf_Error ∗dw_error)

  Access macro operation details of a single operation.
- DW_API int dwarf_get_macro_defundef (Dwarf_Macro_Context dw_macro_context, Dwarf_Unsigned dw_↩ op_number, Dwarf_Unsigned ∗dw_line_number, Dwarf_Unsigned ∗dw_index, Dwarf_Unsigned ∗dw_offset, Dwarf_Half ∗dw_forms_count, const char ∗∗dw_macro_string, Dwarf_Error ∗dw_error)

  Get Macro defundef.
- DW_API int dwarf_get_macro_startend_file (Dwarf_Macro_Context dw_macro_context, Dwarf_Unsigned dw_op_number, Dwarf_Unsigned ∗dw_line_number, Dwarf_Unsigned ∗dw_name_index_to_line_tab, const char ∗∗dw_src_file_name, Dwarf_Error ∗dw_error)

  Get Macro start end.
- DW_API int dwarf_get_macro_import (Dwarf_Macro_Context dw_macro_context, Dwarf_Unsigned dw_op↩ _number, Dwarf_Unsigned ∗dw_target_offset, Dwarf_Error ∗dw_error)

  Get Macro import.

9.16.1 Detailed Description

Reading the .debug_macro section.

See also

Reading .debug_macro data (DWARF5) An example reading .debug_macro

9.16.2 Function Documentation

9.16.2.1 dwarf_dealloc_macro_context()

```
DW_API void dwarf_dealloc_macro_context (
            Dwarf_Macro_Context dw_mc )
```

Dealloc a macro context.

Parameters

dw_mc	A pointer to the macro context of interest. On return the caller should zero the pointer as the pointer is then stale.

9.16.2.2 dwarf_get_macro_context()

```
DW_API int dwarf_get_macro_context (
            Dwarf_Die dw_die,
            Dwarf_Unsigned * dw_version_out,
            Dwarf_Macro_Context * dw_macro_context,
            Dwarf_Unsigned * dw_macro_unit_offset_out,
            Dwarf_Unsigned * dw_macro_ops_count_out,
            Dwarf_Unsigned * dw_macro_ops_data_length_out,
            Dwarf_Error * dw_error )
```

DWARF5 .debug_macro access via Dwarf_Die.

See also

Reading .debug_macro data (DWARF5)

Parameters

dw_die	The CU DIE of interest.
dw_version_out	On success returns the macro context version (5)
dw_macro_context	On success returns a pointer to a macro context which allows access to the context content.
dw_macro_unit_offset_out	On success returns the offset of the macro context.
dw_macro_ops_count_out	On success returns the number of macro operations in the context.
dw_macro_ops_data_length_out	On success returns the length in bytes of the operations in the context.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If no .debug_macro section exists for the CU it returns DW_DLV_NO_ENTRY.

9.16.2.3 dwarf_get_macro_context_by_offset()

```
DW_API int dwarf_get_macro_context_by_offset (
            Dwarf_Die dw_die,
            Dwarf_Unsigned dw_offset,
            Dwarf_Unsigned * dw_version_out,
            Dwarf_Macro_Context * dw_macro_context,
            Dwarf_Unsigned * dw_macro_ops_count_out,
            Dwarf_Unsigned * dw_macro_ops_data_length,
            Dwarf_Error * dw_error )
```

DWARF5 .debug_macro access via Dwarf_Die and an offset.

Parameters

dw_die	The CU DIE of interest.
dw_offset	The offset in the section to begin reading.
dw_version_out	On success returns the macro context version (5)
dw_macro_context	On success returns a pointer to a macro context which allows access to the context content.
dw_macro_ops_count_out	On success returns the number of macro operations in the context.
dw_macro_ops_data_length	On success returns the length in bytes of the macro context, starting at the offset of the first byte of the context.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If no .debug_macro section exists for the CU it returns DW_DLV_NO_ENTRY. If the dw_offset is outside the section it returns DW_DLV_ERROR.

9.16.2.4 dwarf_get_macro_defundef()

```
DW_API int dwarf_get_macro_defundef (
            Dwarf_Macro_Context dw_macro_context,
            Dwarf_Unsigned dw_op_number,
            Dwarf_Unsigned * dw_line_number,
            Dwarf_Unsigned * dw_index,
            Dwarf_Unsigned * dw_offset,
            Dwarf_Half * dw_forms_count,
            const char ** dw_macro_string,
            Dwarf_Error * dw_error )
```

Get Macro defundef.

To extract the value portion of a macro define:

See also

dwarf_find_macro_value_start

Parameters

dw_macro_context	The macro context of interest.
dw_op_number	valid values are 0 through dw_macro_ops_count_out-1. The op number must be for a def/undef.
dw_line_number	The line number in the user source for this define/undef

Parameters

dw_index	On success if the macro is an strx form the value returned is the string index in the record, otherwise zero is returned.
dw_offset	On success if the macro is an strp or sup form the value returned is the string offset in the appropriate section, otherwise zero is returned.
dw_forms_count	On success the value 2 is returned.
dw_macro_string	On success a pointer to a null-terminated string is returned. Do not dealloc or free this string.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. It is an error if operator dw_op_number is not a DW_MACRO_define, DW↩_MACRO_undef, DW_MACRO_define_strp DW_MACRO_undef_strp, DW_MACRO_undef_sup, DW_↩MACRO_undef_sup, DW_MACRO_define_strx, or DW_MACRO_undef_strx,

9.16.2.5 dwarf_get_macro_import()

```
DW_API int dwarf_get_macro_import (
            Dwarf_Macro_Context dw_macro_context,
            Dwarf_Unsigned dw_op_number,
            Dwarf_Unsigned * dw_target_offset,
            Dwarf_Error * dw_error )
```

Get Macro import.

Parameters

dw_macro_context	The macro context of interest.
dw_op_number	Valid values are 0 through dw_macro_ops_count_out-1.
dw_target_offset	Returns the offset in the imported section.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. It is an error if the operator is not DW_MACRO_import or DW_MACRO_import_↩sup.

9.16.2.6 dwarf_get_macro_op()

```
DW_API int dwarf_get_macro_op (
            Dwarf_Macro_Context dw_macro_context,
            Dwarf_Unsigned dw_op_number,
            Dwarf_Unsigned * dw_op_start_section_offset,
            Dwarf_Half * dw_macro_operator,
            Dwarf_Half * dw_forms_count,
            const Dwarf_Small ** dw_formcode_array,
            Dwarf_Error * dw_error )
```

Access macro operation details of a single operation.

Useful for printing basic data about the operation.

Parameters

dw_macro_context	The macro context of interest.
dw_op_number	valid values are 0 through dw_macro_ops_count_out-1.
dw_op_start_section_offset	On success returns the section offset of this operator.
dw_macro_operator	On success returns the the macro operator itself, for example DW_MACRO_define.
dw_forms_count	On success returns the number of forms in the formcode array.
dw_formcode_array	On success returns a pointer to the formcode array of operand forms.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.16.2.7 dwarf_get_macro_startend_file()

```
DW_API int dwarf_get_macro_startend_file (
            Dwarf_Macro_Context dw_macro_context,
            Dwarf_Unsigned dw_op_number,
            Dwarf_Unsigned * dw_line_number,
            Dwarf_Unsigned * dw_name_index_to_line_tab,
            const char ** dw_src_file_name,
            Dwarf_Error * dw_error )
```

Get Macro start end.

Parameters

dw_macro_context	The macro context of interest.
dw_op_number	Valid values are 0 through dw_macro_ops_count_out-1. The op number must be for a start/end.
dw_line_number	If end_file nothing is returned here. If start_file on success returns the line number of the source line of the include directive.
dw_name_index_to_line_tab	If end_file nothing is returned here. If start_file on success returns the file name index in the line table file names table.
dw_src_file_name	If end_file nothing is returned here. If start_file on success returns a pointer to the null-terminated source file name. Do not free or dealloc this string.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. It is an error if the operator is not DW_MACRO_start_file or DW_MACRO_end_file.

9.16.2.8 dwarf_macro_context_head()

```
DW_API int dwarf_macro_context_head (
            Dwarf_Macro_Context dw_mc,
            Dwarf_Half * dw_version,
            Dwarf_Unsigned * dw_mac_offset,
            Dwarf_Unsigned * dw_mac_len,
            Dwarf_Unsigned * dw_mac_header_len,
            unsigned int * dw_flags,
            Dwarf_Bool * dw_has_line_offset,
            Dwarf_Unsigned * dw_line_offset,
            Dwarf_Bool * dw_has_offset_size_64,
            Dwarf_Bool * dw_has_operands_table,
            Dwarf_Half * dw_opcode_count,
            Dwarf_Error * dw_error )
```

Access the internal details of a Dwarf_Macro_Context.

Not described in detail here. See DWARF5 Standard Section 6.3.1 Macro Information Header page 166.

9.16.2.9 dwarf_macro_context_total_length()

```
DW_API int dwarf_macro_context_total_length (
            Dwarf_Macro_Context dw_context,
            Dwarf_Unsigned * dw_mac_total_len,
            Dwarf_Error * dw_error )
```

Return a macro context total length.

Parameters

dw_context	A pointer to the macro context of interest.
dw_mac_total_len	On success returns the length in bytes of the macro context.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.16.2.10 dwarf_macro_operands_table()

```
DW_API int dwarf_macro_operands_table (
            Dwarf_Macro_Context dw_mc,
            Dwarf_Half dw_index,
            Dwarf_Half * dw_opcode_number,
            Dwarf_Half * dw_operand_count,
            const Dwarf_Small ** dw_operand_array,
            Dwarf_Error * dw_error )
```

Access to the details of the opcode operands table.

Not of much interest to most libdwarf users.

Parameters

dw_mc	The macro context of interest.
dw_index	The opcode operands table index. 0 through dw_opcode_count-1.
dw_opcode_number	On success returns the opcode number in the table.
dw_operand_count	On success returns the number of forms for that dw_index.
dw_operand_array	On success returns the array of op operand forms
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.17 Macro Access: DWARF2-4

Functions

- DW_API char ∗ dwarf_find_macro_value_start (char ∗dw_macro_string)

  Return a pointer to the value part of a macro.
- DW_API int dwarf_get_macro_details (Dwarf_Debug dw_dbg, Dwarf_Off dw_macro_offset, Dwarf_Unsigned dw_maximum_count, Dwarf_Signed ∗dw_entry_count, Dwarf_Macro_Details ∗∗dw_details, Dwarf_Error ∗dw_error)

  Getting .debug_macinfo macro details.

9.17.1 Detailed Description

Reading the .debug_macinfo section.

The section is rarely used since it takes a lot of disk space. DWARF5 has much more compact macro data (in section .debug_macro).

For an example see

See also

Reading .debug_macinfo (DWARF2-4) An example reading .debug_macinfo

9.17.2 Function Documentation

9.17.2.1 dwarf_find_macro_value_start()

```
DW_API char * dwarf_find_macro_value_start (
             char * dw_macro_string )
```

Return a pointer to the value part of a macro.

This function Works for all versions, DWARF2-DWARF5

Parameters

dw_macro_string	The macro string passed in should be properly formatted with a name, a space, and then the value portion (whether a function-like macro or not function-like).

Returns

On success it returns a pointer to the value portion of the macro. On failure it returns a pointer to a NUL byte (so a zero-length string).

9.17.2.2 dwarf_get_macro_details()

```
DW_API int dwarf_get_macro_details (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_macro_offset,
            Dwarf_Unsigned dw_maximum_count,
            Dwarf_Signed * dw_entry_count,
            Dwarf_Macro_Details ** dw_details,
            Dwarf_Error * dw_error )
```

Getting .debug_macinfo macro details.

An example calling this function

See also

Reading .debug_macinfo (DWARF2-4)

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_macro_offset	The offset in the section you wish to start from.
dw_maximum_count	Pass in a count to ensure we will not allocate an excessive amount (guarding against a
dw_entry_count	On success returns a count of the macro operations in a CU macro set.
dw_details	On success returns a pointer to an array of struct DW_Macro_Details_s .
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18 Stack Frame Access

Functions

- DW_API int dwarf_get_fde_list (Dwarf_Debug dw_dbg, Dwarf_Cie **dw_cie_data, Dwarf_Signed *dw_cie↩_element_count, Dwarf_Fde **dw_fde_data, Dwarf_Signed *dw_fde_element_count, Dwarf_Error *dw_↩error)

  Get lists of .debug_frame FDEs and CIEs.
- DW_API int dwarf_get_fde_list_eh (Dwarf_Debug dw_dbg, Dwarf_Cie **dw_cie_data, Dwarf_Signed *dw↩_cie_element_count, Dwarf_Fde **dw_fde_data, Dwarf_Signed *dw_fde_element_count, Dwarf_Error *dw_error)

  Get lists of .eh_frame FDEs and CIEs.
- DW_API void dwarf_dealloc_fde_cie_list (Dwarf_Debug dw_dbg, Dwarf_Cie *dw_cie_data, Dwarf_Signed dw_cie_element_count, Dwarf_Fde *dw_fde_data, Dwarf_Signed dw_fde_element_count)

  Release storage associated with FDE and CIE arrays.
- DW_API int dwarf_get_fde_range (Dwarf_Fde dw_fde, Dwarf_Addr *dw_low_pc, Dwarf_Unsigned *dw_↩func_length, Dwarf_Small **dw_fde_bytes, Dwarf_Unsigned *dw_fde_byte_length, Dwarf_Off *dw_cie_↩offset, Dwarf_Signed *dw_cie_index, Dwarf_Off *dw_fde_offset, Dwarf_Error *dw_error)

  Return the FDE data for a single FDE.

- DW_API int dwarf_get_fde_exception_info (Dwarf_Fde dw_fde, Dwarf_Signed ∗dw_offset_into_exception↩ _tables, Dwarf_Error ∗dw_error)

  IRIX only access to C++ destructor tables.
- DW_API int dwarf_get_cie_of_fde (Dwarf_Fde dw_fde, Dwarf_Cie ∗dw_cie_returned, Dwarf_Error ∗dw_↩ error)

  Given FDE get CIE.
- DW_API int dwarf_get_cie_info_b (Dwarf_Cie dw_cie, Dwarf_Unsigned ∗dw_bytes_in_cie, Dwarf_Small ∗dw_version, char ∗∗dw_augmenter, Dwarf_Unsigned ∗dw_code_alignment_factor, Dwarf_Signed ∗dw↩ _data_alignment_factor, Dwarf_Half ∗dw_return_address_register_rule, Dwarf_Small ∗∗dw_initial_↩ instructions, Dwarf_Unsigned ∗dw_initial_instructions_length, Dwarf_Half ∗dw_offset_size, Dwarf_Error ∗dw_error)

  Given a CIE get access to its content.
- DW_API int dwarf_get_cie_index (Dwarf_Cie dw_cie, Dwarf_Signed ∗dw_index, Dwarf_Error ∗dw_error)

  Return CIE index given CIE.
- DW_API int dwarf_get_fde_instr_bytes (Dwarf_Fde dw_fde, Dwarf_Small ∗∗dw_outinstrs, Dwarf_Unsigned ∗dw_outlen, Dwarf_Error ∗dw_error)

  Return length and pointer to access frame instructions.
- DW_API int dwarf_get_fde_info_for_all_regs3_b (Dwarf_Fde dw_fde, Dwarf_Addr dw_pc_requested, Dwarf_Regtable3 ∗dw_reg_table, Dwarf_Addr ∗dw_row_pc, Dwarf_Bool ∗dw_has_more_rows, Dwarf_Addr ∗dw_subsequent_pc, Dwarf_Error ∗dw_error)

  Return information on frame registers at a given pc value.
- DW_API int dwarf_get_fde_info_for_all_regs3 (Dwarf_Fde dw_fde, Dwarf_Addr dw_pc_requested, Dwarf_Regtable3 ∗dw_reg_table, Dwarf_Addr ∗dw_row_pc, Dwarf_Error ∗dw_error)

  Return information on frame registers at a given pc value.
- DW_API int dwarf_get_fde_info_for_reg3_c (Dwarf_Fde dw_fde, Dwarf_Half dw_table_column, Dwarf_Addr dw_pc_requested, Dwarf_Small ∗dw_value_type, Dwarf_Unsigned ∗dw_offset_relevant, Dwarf_Unsigned ∗dw_register, Dwarf_Signed ∗dw_offset, Dwarf_Block ∗dw_block_content, Dwarf_Addr ∗dw_row_pc_out, Dwarf_Bool ∗dw_has_more_rows, Dwarf_Addr ∗dw_subsequent_pc, Dwarf_Error ∗dw_error)

  Return details about a particular pc and register.
- DW_API int dwarf_get_fde_info_for_reg3_b (Dwarf_Fde dw_fde, Dwarf_Half dw_table_column, Dwarf_Addr dw_pc_requested, Dwarf_Small ∗dw_value_type, Dwarf_Unsigned ∗dw_offset_relevant, Dwarf_Unsigned ∗dw_register, Dwarf_Unsigned ∗dw_offset, Dwarf_Block ∗dw_block_content, Dwarf_Addr ∗dw_row_pc_out, Dwarf_Bool ∗dw_has_more_rows, Dwarf_Addr ∗dw_subsequent_pc, Dwarf_Error ∗dw_error)

  Return details about a particular pc and register.
- DW_API int dwarf_get_fde_info_for_cfa_reg3_c (Dwarf_Fde dw_fde, Dwarf_Addr dw_pc_requested, Dwarf_Small ∗dw_value_type, Dwarf_Unsigned ∗dw_offset_relevant, Dwarf_Unsigned ∗dw_register, Dwarf_Signed ∗dw_offset, Dwarf_Block ∗dw_block, Dwarf_Addr ∗dw_row_pc_out, Dwarf_Bool ∗dw_↩ has_more_rows, Dwarf_Addr ∗dw_subsequent_pc, Dwarf_Error ∗dw_error)

  Get the value of the CFA for a particular pc value.
- DW_API int dwarf_get_fde_info_for_cfa_reg3_b (Dwarf_Fde dw_fde, Dwarf_Addr dw_pc_requested, Dwarf_Small ∗dw_value_type, Dwarf_Unsigned ∗dw_offset_relevant, Dwarf_Unsigned ∗dw_register, Dwarf_Unsigned ∗dw_offset, Dwarf_Block ∗dw_block, Dwarf_Addr ∗dw_row_pc_out, Dwarf_Bool ∗dw↩ _has_more_rows, Dwarf_Addr ∗dw_subsequent_pc, Dwarf_Error ∗dw_error)

  Get the value of the CFA for a particular pc value.
- DW_API int dwarf_get_fde_for_die (Dwarf_Debug dw_dbg, Dwarf_Die dw_subr_die, Dwarf_Fde ∗dw_↩ returned_fde, Dwarf_Error ∗dw_error)

  Get the fde given DW_AT_MIPS_fde in a DIE.
- DW_API int dwarf_get_fde_n (Dwarf_Fde ∗dw_fde_data, Dwarf_Unsigned dw_fde_index, Dwarf_Fde ∗dw↩ _returned_fde, Dwarf_Error ∗dw_error)

  Retrieve an FDE from an FDE table.
- DW_API int dwarf_get_fde_at_pc (Dwarf_Fde ∗dw_fde_data, Dwarf_Addr dw_pc_of_interest, Dwarf_Fde ∗dw_returned_fde, Dwarf_Addr ∗dw_lopc, Dwarf_Addr ∗dw_hipc, Dwarf_Error ∗dw_error)

  Retrieve an FDE given a pc.

- DW_API int dwarf_get_cie_augmentation_data (Dwarf_Cie dw_cie, Dwarf_Small ∗∗dw_augdata, Dwarf_Unsigned ∗dw_augdata_len, Dwarf_Error ∗dw_error)

  Return .eh_frame CIE augmentation data.
- DW_API int dwarf_get_fde_augmentation_data (Dwarf_Fde dw_fde, Dwarf_Small ∗∗dw_augdata, Dwarf_Unsigned ∗dw_augdata_len, Dwarf_Error ∗dw_error)

  Return .eh_frame FDE augmentation data.
- DW_API int dwarf_expand_frame_instructions (Dwarf_Cie dw_cie, Dwarf_Small ∗dw_instructionspointer, Dwarf_Unsigned dw_length_in_bytes, Dwarf_Frame_Instr_Head ∗dw_head, Dwarf_Unsigned ∗dw_instr_←count, Dwarf_Error ∗dw_error)

  Expands CIE or FDE instructions for detailed examination. Called for CIE initial instructions and FDE instructions. Call dwarf_get_fde_instr_bytes() or dwarf_get_cie_info_b() to get the initial instruction bytes and instructions byte count you wish to expand.
- DW_API int dwarf_get_frame_instruction (Dwarf_Frame_Instr_Head dw_head, Dwarf_Unsigned dw_←instr_index, Dwarf_Unsigned ∗dw_instr_offset_in_instrs, Dwarf_Small ∗dw_cfa_operation, const char ∗∗dw_fields_description, Dwarf_Unsigned ∗dw_u0, Dwarf_Unsigned ∗dw_u1, Dwarf_Signed ∗dw_s0, Dwarf_Signed ∗dw_s1, Dwarf_Unsigned ∗dw_code_alignment_factor, Dwarf_Signed ∗dw_data_alignment←_factor, Dwarf_Block ∗dw_expression_block, Dwarf_Error ∗dw_error)

  Return information about a single instruction Fields_description means a sequence of up to three letters including u,s,r,c,d,b, terminated by NUL byte. It is a string but we test individual bytes instead of using string compares. Do not free any of the returned values.
- DW_API int dwarf_get_frame_instruction_a (Dwarf_Frame_Instr_Head dw_, Dwarf_Unsigned dw_←instr_index, Dwarf_Unsigned ∗dw_instr_offset_in_instrs, Dwarf_Small ∗dw_cfa_operation, const char ∗∗dw_fields_description, Dwarf_Unsigned ∗dw_u0, Dwarf_Unsigned ∗dw_u1, Dwarf_Unsigned ∗dw_u2, Dwarf_Signed ∗dw_s0, Dwarf_Signed ∗dw_s1, Dwarf_Unsigned ∗dw_code_alignment_factor, Dwarf_Signed ∗dw_data_alignment_factor, Dwarf_Block ∗dw_expression_block, Dwarf_Error ∗dw_error)

  Expands CIE or FDE instructions for detailed examination. Called for CIE initial instructions and FDE instructions. This is the same as dwarf_get_frame_instruction() except that it adds a dw_u2 field which contains an address-space identifier if the letter `a` *appears in dw_fields_description. The dw_u2 field is non-standard and only applies to Heterogeneous Debugging frame instructions defined by LLVM (DW_CFA_LLVM_def_aspace_cfa and DW_CFA_←LLVM_def_aspace_cfa_sf)*
- DW_API void dwarf_dealloc_frame_instr_head (Dwarf_Frame_Instr_Head dw_head)

  Deallocates the frame instruction data in dw_head.
- DW_API int dwarf_fde_section_offset (Dwarf_Debug dw_dbg, Dwarf_Fde dw_in_fde, Dwarf_Off ∗dw_fde_off, Dwarf_Off ∗dw_cie_off, Dwarf_Error ∗dw_error)

  Return FDE and CIE offsets from debugging info.
- DW_API int dwarf_cie_section_offset (Dwarf_Debug dw_dbg, Dwarf_Cie dw_in_cie, Dwarf_Off ∗dw_cie_off, Dwarf_Error ∗dw_error)

  Use to print CIE offsets from debugging info.
- DW_API Dwarf_Half dwarf_set_frame_rule_table_size (Dwarf_Debug dw_dbg, Dwarf_Half dw_value)

  Frame Rule Table Size Invariants for setting frame registers .
- DW_API Dwarf_Half dwarf_set_frame_rule_initial_value (Dwarf_Debug dw_dbg, Dwarf_Half dw_value)

  Frame Rule Initial Value.
- DW_API Dwarf_Half dwarf_set_frame_cfa_value (Dwarf_Debug dw_dbg, Dwarf_Half dw_value)

  Frame CFA Column Invariants for setting frame registers .
- DW_API Dwarf_Half dwarf_set_frame_same_value (Dwarf_Debug dw_dbg, Dwarf_Half dw_value)

  Frame Same Value Default Invariants for setting frame registers .
- DW_API Dwarf_Half dwarf_set_frame_undefined_value (Dwarf_Debug dw_dbg, Dwarf_Half dw_value)

  Frame Undefined Value Default Invariants for setting frame registers .

9.18.1 Detailed Description

Use to access DWARF2-5 .debug_frame and GNU .eh_frame sections. Does not evaluate frame instructions, but provides detailed data so it is possible do that yourself.

9.18.2 Function Documentation

9.18.2.1 dwarf_cie_section_offset()

```
DW_API int dwarf_cie_section_offset (
            Dwarf_Debug dw_dbg,
            Dwarf_Cie dw_in_cie,
            Dwarf_Off * dw_cie_off,
            Dwarf_Error * dw_error )
```

Use to print CIE offsets from debugging info.

Parameters

dw_dbg	The Dwarf_Debug of interest
dw_in_cie	Pass in the CIE of interest.
dw_cie_off	On success returns the section offset of the CIE.
dw_error	Error return details

Returns

Returns DW_DLV_OK etc.

9.18.2.2 dwarf_dealloc_fde_cie_list()

```
DW_API void dwarf_dealloc_fde_cie_list (
            Dwarf_Debug dw_dbg,
            Dwarf_Cie * dw_cie_data,
            Dwarf_Signed dw_cie_element_count,
            Dwarf_Fde * dw_fde_data,
            Dwarf_Signed dw_fde_element_count )
```

Release storage associated with FDE and CIE arrays.

Applies to .eh_frame and .debug_frame lists.

Parameters

dw_dbg	The Dwarf_Debug used in the list setup.
dw_cie_data	As returned from the list setup call.
dw_cie_element_count	
dw_fde_data	As returned from the list setup call.
dw_fde_element_count	As returned from the list setup call.

On return the pointers passed in dw_cie_data and dw_fde_data should be zeroed by the caller as they are then stale pointers.

9.18.2.3 dwarf_dealloc_frame_instr_head()

```
DW_API void dwarf_dealloc_frame_instr_head (
            Dwarf_Frame_Instr_Head dw_head )
```

Deallocates the frame instruction data in dw_head.

Parameters

dw_head	A head pointer. Frees all data created by dwarf_expand_frame_instructions() and makes the head pointer stale. The caller should set to NULL.

9.18.2.4 dwarf_expand_frame_instructions()

```
DW_API int dwarf_expand_frame_instructions (
            Dwarf_Cie dw_cie,
            Dwarf_Small * dw_instructionspointer,
            Dwarf_Unsigned dw_length_in_bytes,
            Dwarf_Frame_Instr_Head * dw_head,
            Dwarf_Unsigned * dw_instr_count,
            Dwarf_Error * dw_error )
```

Expands CIE or FDE instructions for detailed examination. Called for CIE initial instructions and FDE instructions. Call dwarf_get_fde_instr_bytes() or dwarf_get_cie_info_b() to get the initial instruction bytes and instructions byte count you wish to expand.

Combined with dwarf_get_frame_instruction() or dwarf_get_frame_instruction_a() (the second is like the first but adds an argument for LLVM address space numbers) it enables detailed access to frame instruction fields for evaluation or printing.

Free allocated memory with dwarf_dealloc_frame_instr_head().

See also

Using dwarf_expand_frame_instructions

Parameters

dw_cie	The cie relevant to the instructions.
dw_instructionspointer	points to the instructions
dw_length_in_bytes	byte length of the instruction sequence.
dw_head	The address of an allocated dw_head
dw_instr_count	Returns the number of instructions in the byte stream
dw_error	Error return details

Returns

On success returns DW_DLV_OK

9.18.2.5 dwarf_fde_section_offset()

```
DW_API int dwarf_fde_section_offset (
            Dwarf_Debug dw_dbg,
            Dwarf_Fde dw_in_fde,
            Dwarf_Off * dw_fde_off,
            Dwarf_Off * dw_cie_off,
            Dwarf_Error * dw_error )
```

Return FDE and CIE offsets from debugging info.

Parameters

dw_dbg	The Dwarf_Debug of interest
dw_in_fde	Pass in the FDE of interest.
dw_fde_off	On success returns the section offset of the FDE.
dw_cie_off	On success returns the section offset of the CIE.
dw_error	Error return details

Returns

Returns DW_DLV_OK etc.

9.18.2.6 dwarf_get_cie_augmentation_data()

```
DW_API int dwarf_get_cie_augmentation_data (
            Dwarf_Cie dw_cie,
            Dwarf_Small ** dw_augdata,
            Dwarf_Unsigned * dw_augdata_len,
            Dwarf_Error * dw_error )
```

Return .eh_frame CIE augmentation data.

GNU .eh_frame CIE augmentation information. See Linux Standard Base Core Specification version 3.0 .

See also

https://gcc.gnu.org/legacy-ml/gcc/2003-12/msg01168.html

Parameters

dw_cie	The CIE of interest.
dw_augdata	On success returns a pointer to the augmentation data.
dw_augdata_len	On success returns the length in bytes of the augmentation data.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If the augmentation data length is zero it returns DW_DLV_NO_ENTRY.

9.18.2.7 dwarf_get_cie_index()

```
DW_API int dwarf_get_cie_index (
            Dwarf_Cie dw_cie,
            Dwarf_Signed * dw_index,
            Dwarf_Error * dw_error )
```

Return CIE index given CIE.

Parameters

dw_cie	Pass in the CIE of interest.
dw_index	On success, returns the index (the position of the CIE in the CIE pointer array).
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.8 dwarf_get_cie_info_b()

```
DW_API int dwarf_get_cie_info_b (
            Dwarf_Cie dw_cie,
            Dwarf_Unsigned * dw_bytes_in_cie,
            Dwarf_Small * dw_version,
            char ** dw_augmenter,
            Dwarf_Unsigned * dw_code_alignment_factor,
            Dwarf_Signed * dw_data_alignment_factor,
            Dwarf_Half * dw_return_address_register_rule,
            Dwarf_Small ** dw_initial_instructions,
            Dwarf_Unsigned * dw_initial_instructions_length,
            Dwarf_Half * dw_offset_size,
            Dwarf_Error * dw_error )
```

Given a CIE get access to its content.

Parameters

dw_cie	Pass in the CIE of interest.
dw_bytes_in_cie	On success, returns the length of the CIE in bytes.
dw_version	On success, returns the CIE version number.
dw_augmenter	On success, returns a pointer to the augmentation string (which could be the empty string).
dw_code_alignment_factor	On success, returns a the code_alignment_factor used to interpret CIE/FDE operations.
dw_data_alignment_factor	On success, returns a the data_alignment_factor used to interpret CIE/FDE operations.
dw_return_address_register_rule	On success, returns a register number of the return address register.
dw_initial_instructions	On success, returns a pointer to the bytes of initial_instructions in the CIE.
dw_initial_instructions_length	On success, returns the length in bytes of the initial_instructions.
dw_offset_size	On success, returns the offset_size within this CIE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.9 dwarf_get_cie_of_fde()

```
DW_API int dwarf_get_cie_of_fde (
            Dwarf_Fde dw_fde,
            Dwarf_Cie * dw_cie_returned,
            Dwarf_Error * dw_error )
```

Given FDE get CIE.

Parameters

dw_fde	The FDE of interest.
dw_cie_returned	On success returns a pointer to the applicable CIE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.10 dwarf_get_fde_at_pc()

```
DW_API int dwarf_get_fde_at_pc (
            Dwarf_Fde * dw_fde_data,
            Dwarf_Addr dw_pc_of_interest,
            Dwarf_Fde * dw_returned_fde,
            Dwarf_Addr * dw_lopc,
            Dwarf_Addr * dw_hipc,
            Dwarf_Error * dw_error )
```

Retrieve an FDE given a pc.

Using binary search this finds the FDE that contains this dw_pc_of_interest That works because libdwarf ensures the array of FDEs is sorted by the low-pc

See also

dwarf_get_fde_list

Parameters

dw_fde_data	Pass in a pointer an array of fde pointers.
dw_pc_of_interest	The pc value of interest.
dw_returned_fde	On success a pointer to the applicable FDE is set through the pointer.
dw_lopc	On success a pointer to the low pc in dw_returned_fde is set through the pointer.
dw_hipc	On success a pointer to the high pc (one past the actual last byte address) in dw_returned_fde is set through the pointer.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK if the dw_pc_of_interest found in some FDE in the array. If no FDE is found containing dw_pc_of_interest DW_DLV_NO_ENTRY is returned.

9.18.2.11 dwarf_get_fde_augmentation_data()

```
DW_API int dwarf_get_fde_augmentation_data (
            Dwarf_Fde dw_fde,
            Dwarf_Small ** dw_augdata,
            Dwarf_Unsigned * dw_augdata_len,
            Dwarf_Error * dw_error )
```

Return .eh_frame FDE augmentation data.

GNU .eh_frame FDE augmentation information. See Linux Standard Base Core Specification version 3.0 .

See also

https://gcc.gnu.org/legacy-ml/gcc/2003-12/msg01168.html

Parameters

dw_fde	The FDE of interest.
dw_augdata	On success returns a pointer to the augmentation data.
dw_augdata_len	On success returns the length in bytes of the augmentation data.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc. If the augmentation data length is zero it returns DW_DLV_NO_ENTRY.

9.18.2.12 dwarf_get_fde_exception_info()

```
DW_API int dwarf_get_fde_exception_info (
            Dwarf_Fde dw_fde,
            Dwarf_Signed * dw_offset_into_exception_tables,
            Dwarf_Error * dw_error )
```

IRIX only access to C++ destructor tables.

This applies only to IRIX C++ destructor information which was never documented and is unlikely to be of interest.

9.18.2.13 dwarf_get_fde_for_die()

```
DW_API int dwarf_get_fde_for_die (
            Dwarf_Debug dw_dbg,
            Dwarf_Die dw_subr_die,
            Dwarf_Fde * dw_returned_fde,
            Dwarf_Error * dw_error )
```

Get the fde given DW_AT_MIPS_fde in a DIE.

This is essentially useless as only SGI/MIPS compilers from the 1990's had DW_AT_MIPS_fde in DW_TAG_↩ subprogram DIEs and this relies on that attribute to work.

9.18.2.14 dwarf_get_fde_info_for_all_regs3()

```
DW_API int dwarf_get_fde_info_for_all_regs3 (
             Dwarf_Fde dw_fde,
             Dwarf_Addr dw_pc_requested,
             Dwarf_Regtable3 * dw_reg_table,
             Dwarf_Addr * dw_row_pc,
             Dwarf_Error * dw_error )
```

Return information on frame registers at a given pc value.

Identical to dwarf_get_fde_info_for_all_regs3_b() except that this doesn't output dw_has_more_rows and dw_↩ subsequent_pc.

If you need to iterate through all rows of the FDE, consider switching to dwarf_get_fde_info_for_all_regs3_b() as it is more efficient.

9.18.2.15 dwarf_get_fde_info_for_all_regs3_b()

```
DW_API int dwarf_get_fde_info_for_all_regs3_b (
             Dwarf_Fde dw_fde,
             Dwarf_Addr dw_pc_requested,
             Dwarf_Regtable3 * dw_reg_table,
             Dwarf_Addr * dw_row_pc,
             Dwarf_Bool * dw_has_more_rows,
             Dwarf_Addr * dw_subsequent_pc,
             Dwarf_Error * dw_error )
```

Return information on frame registers at a given pc value.

An FDE at a given pc (code address) This function is new in October 2023 version 0.9.0.

Parameters

dw_fde	Pass in the FDE of interest.
dw_pc_requested	Pass in a pc (code) address inside that FDE.
dw_reg_table	On success, returns a pointer to a struct given the frame state.
dw_row_pc	On success returns the address of the row of frame data which may be a few counts off of the pc requested.
dw_has_more_rows	On success returns FALSE if there are no more rows, otherwise returns TRUE.
dw_subsequent_pc	On success this returns the address of the next pc for which there is a register row, making access to all the rows in sequence much more efficient than just adding 1 to a pc value.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK if the dw_pc_requested is in the FDE passed in and there is some applicable row in the table.

9.18.2.16 dwarf_get_fde_info_for_cfa_reg3_b()

```
DW_API int dwarf_get_fde_info_for_cfa_reg3_b (
            Dwarf_Fde dw_fde,
            Dwarf_Addr dw_pc_requested,
            Dwarf_Small * dw_value_type,
            Dwarf_Unsigned * dw_offset_relevant,
            Dwarf_Unsigned * dw_register,
            Dwarf_Unsigned * dw_offset,
            Dwarf_Block * dw_block,
            Dwarf_Addr * dw_row_pc_out,
            Dwarf_Bool * dw_has_more_rows,
            Dwarf_Addr * dw_subsequent_pc,
            Dwarf_Error * dw_error )
```

Get the value of the CFA for a particular pc value.

See also

dwarf_get_fde_info_for_cfa_reg3_c

This is the earlier version that returns a dw_offset of type Dwarf_Unsigned, requiring you to cast to Dwarf_Signed to work with the value.

9.18.2.17 dwarf_get_fde_info_for_cfa_reg3_c()

```
DW_API int dwarf_get_fde_info_for_cfa_reg3_c (
            Dwarf_Fde dw_fde,
            Dwarf_Addr dw_pc_requested,
            Dwarf_Small * dw_value_type,
            Dwarf_Unsigned * dw_offset_relevant,
            Dwarf_Unsigned * dw_register,
            Dwarf_Signed * dw_offset,
            Dwarf_Block * dw_block,
            Dwarf_Addr * dw_row_pc_out,
            Dwarf_Bool * dw_has_more_rows,
            Dwarf_Addr * dw_subsequent_pc,
            Dwarf_Error * dw_error )
```

Get the value of the CFA for a particular pc value.

See also

dwarf_get_fde_info_for_reg3_c() has essentially the same return values as dwarf_get_fde_info_for_reg3_c but it refers to the CFA (which is not part of the register table) so this function has no table column argument.

New in September 2023, release 0.8.0. dwarf_get_fde_info_for_cfa_reg3_c() returns dw_offset as a signed type. dwarf_get_fde_info_for_cfa_reg3_b() returns dw_offset as an unsigned type, requiring the caller to cast to Dwarf↩_Signed before using the value. Both versions exist and operate properly.

If dw_value_type == DW_EXPR_EXPRESSION or DW_EXPR_VALUE_EXPRESSION dw_offset is not set and the caller must evaluate the expression, which usually depends on runtime frame data which cannot be calculated without a stack frame including register values (etc).

9.18.2.18 dwarf_get_fde_info_for_reg3_b()

```
DW_API int dwarf_get_fde_info_for_reg3_b (
             Dwarf_Fde dw_fde,
             Dwarf_Half dw_table_column,
             Dwarf_Addr dw_pc_requested,
             Dwarf_Small * dw_value_type,
             Dwarf_Unsigned * dw_offset_relevant,
             Dwarf_Unsigned * dw_register,
             Dwarf_Unsigned * dw_offset,
             Dwarf_Block * dw_block_content,
             Dwarf_Addr * dw_row_pc_out,
             Dwarf_Bool * dw_has_more_rows,
             Dwarf_Addr * dw_subsequent_pc,
             Dwarf_Error * dw_error )
```

Return details about a particular pc and register.

Identical to dwarf_get_fde_info_for_reg3_c() except that this returns dw_offset as a Dwarf_Unsigned, which was never appropriate, and required you to cast that value to Dwarf_Signed to use it properly..

Please switch to using dwarf_get_fde_info_for_reg3_c()

9.18.2.19 dwarf_get_fde_info_for_reg3_c()

```
DW_API int dwarf_get_fde_info_for_reg3_c (
             Dwarf_Fde dw_fde,
             Dwarf_Half dw_table_column,
             Dwarf_Addr dw_pc_requested,
             Dwarf_Small * dw_value_type,
             Dwarf_Unsigned * dw_offset_relevant,
             Dwarf_Unsigned * dw_register,
             Dwarf_Signed * dw_offset,
             Dwarf_Block * dw_block_content,
             Dwarf_Addr * dw_row_pc_out,
             Dwarf_Bool * dw_has_more_rows,
             Dwarf_Addr * dw_subsequent_pc,
             Dwarf_Error * dw_error )
```

Return details about a particular pc and register.

It is efficient to iterate across all table_columns (registers) using this function (dwarf_get_fde_info_for_reg3_c()). Or one could instead call dwarf_get_fde_info_for_all_regs3() and index into the table it fills in.

If dw_value_type == DW_EXPR_EXPRESSION or DW_EXPR_VALUE_EXPRESSION dw_offset is not set and the caller must evaluate the expression, which usually depends on runtime frame data which cannot be calculated without a stack frame including registers (etc).

dwarf_get_fde_info_for_reg3_c() is new in libdwarf 0.8.0. It corrects the incorrect type of the dw_offset argument in dwarf_get_fde_info_for_reg3_b(). Both versions operate correctly.

Parameters

dw_fde	Pass in the FDE of interest.
dw_table_column	Pass in the table_column, column numbers in the table are 0 through the number_of_registers-1.

Parameters

dw_pc_requested	Pass in the pc of interest within dw_fde.
dw_value_type	On success returns the value type, a DW_EXPR value. For example DW_EXPR_EXPRESSION
dw_offset_relevant	On success returns FALSE if the offset value is irrelevant, otherwise TRUE.
dw_register	On success returns a register number.
dw_offset	On success returns a signed register offset value when dw_value_type is DW_EXPR_OFFSET or DW_EXPER_VAL_OFFSET.
dw_block_content	On success returns a pointer to a block. For example, for DW_EXPR_EXPRESSION the block gives access to the expression bytes.
dw_row_pc_out	On success returns the address of the actual pc for this register at this pc.
dw_has_more_rows	On success returns FALSE if there are no more rows, otherwise returns TRUE.
dw_subsequent_pc	On success this returns the address of the next pc for which there is a register row, making access to all the rows in sequence much more efficient than just adding 1 to a pc value.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK if the dw_pc_requested is in the FDE passed in and there is a row for the pc in the table.

9.18.2.20 dwarf_get_fde_instr_bytes()

```
DW_API int dwarf_get_fde_instr_bytes (
             Dwarf_Fde dw_fde,
             Dwarf_Small ** dw_outinstrs,
             Dwarf_Unsigned * dw_outlen,
             Dwarf_Error * dw_error )
```

Return length and pointer to access frame instructions.

See also

dwarf_expand_frame_instructions

Using dwarf_expand_frame_instructions

Parameters

dw_fde	Pass in the FDE of interest.
dw_outinstrs	On success returns a pointer to the FDE instruction byte stream.
dw_outlen	On success returns the length of the dw_outinstrs byte stream.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.21 dwarf_get_fde_list()

```
DW_API int dwarf_get_fde_list (
            Dwarf_Debug dw_dbg,
            Dwarf_Cie ** dw_cie_data,
            Dwarf_Signed * dw_cie_element_count,
            Dwarf_Fde ** dw_fde_data,
            Dwarf_Signed * dw_fde_element_count,
            Dwarf_Error * dw_error )
```

Get lists of .debug_frame FDEs and CIEs.

See DWARF5 Section 6.4 Call Frame Information, page 171.

See also

Extracting fde, cie lists.

The FDE array returned through dw_fde_data is sorted low-to-high by the lowest-pc in each FDE.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_cie_data	On success returns a pointer to an array of pointers to CIE data.
dw_cie_element_count	On success returns a count of the number of elements in the dw_cie_data array.
dw_fde_data	On success returns a pointer to an array of pointers to FDE data.
dw_fde_element_count	On success returns a count of the number of elements in the dw_fde_data array. On success
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.22 dwarf_get_fde_list_eh()

```
DW_API int dwarf_get_fde_list_eh (
            Dwarf_Debug dw_dbg,
            Dwarf_Cie ** dw_cie_data,
            Dwarf_Signed * dw_cie_element_count,
            Dwarf_Fde ** dw_fde_data,
            Dwarf_Signed * dw_fde_element_count,
            Dwarf_Error * dw_error )
```

Get lists of .eh_frame FDEs and CIEs.

The arguments are identical to the previous function, the difference is the section read. The GNU-defined .eh_frame section is very similar to .debug_frame but has unique features that matter when following a stack trace.

See also

dwarf_get_fde_list

9.18.2.23 dwarf_get_fde_n()

```
DW_API int dwarf_get_fde_n (
            Dwarf_Fde * dw_fde_data,
            Dwarf_Unsigned dw_fde_index,
            Dwarf_Fde * dw_returned_fde,
            Dwarf_Error * dw_error )
```

Retrieve an FDE from an FDE table.

This is just like indexing into the FDE array but with extra checking of the pointer and index.

See also

dwarf_get_fde_list

9.18.2.24 dwarf_get_fde_range()

```
DW_API int dwarf_get_fde_range (
            Dwarf_Fde dw_fde,
            Dwarf_Addr * dw_low_pc,
            Dwarf_Unsigned * dw_func_length,
            Dwarf_Small ** dw_fde_bytes,
            Dwarf_Unsigned * dw_fde_byte_length,
            Dwarf_Off * dw_cie_offset,
            Dwarf_Signed * dw_cie_index,
            Dwarf_Off * dw_fde_offset,
            Dwarf_Error * dw_error )
```

Return the FDE data for a single FDE.

Parameters

dw_fde	The FDE of interest.
dw_low_pc	On success returns the low pc value for the function involved.
dw_func_length	On success returns the length of the function code in bytes.
dw_fde_bytes	On success returns a pointer to the bytes of the FDE.
dw_fde_byte_length	On success returns the length of the dw_fde_bytes area.
dw_cie_offset	On success returns the section offset of the associated CIE.
dw_cie_index	On success returns the CIE index of the associated CIE.
dw_fde_offset	On success returns the section offset of this FDE.
dw_error	The usual error detail return pointer.

Returns

Returns DW_DLV_OK etc.

9.18.2.25 dwarf_get_frame_instruction()

```
DW_API int dwarf_get_frame_instruction (
            Dwarf_Frame_Instr_Head dw_head,
            Dwarf_Unsigned dw_instr_index,
            Dwarf_Unsigned * dw_instr_offset_in_instrs,
            Dwarf_Small * dw_cfa_operation,
            const char ** dw_fields_description,
            Dwarf_Unsigned * dw_u0,
            Dwarf_Unsigned * dw_u1,
            Dwarf_Signed * dw_s0,
            Dwarf_Signed * dw_s1,
            Dwarf_Unsigned * dw_code_alignment_factor,
            Dwarf_Signed * dw_data_alignment_factor,
            Dwarf_Block * dw_expression_block,
            Dwarf_Error * dw_error )
```

Return information about a single instruction Fields_description means a sequence of up to three letters including u,s,r,c,d,b, terminated by NUL byte. It is a string but we test individual bytes instead of using string compares. Do not free any of the returned values.

See also

Using dwarf_expand_frame_instructions

Parameters

dw_head	A head record
dw_instr_index	index 0 < i < instr_count
dw_instr_offset_in_instrs	Returns the byte offset of this instruction within instructions.
dw_cfa_operation	Returns a DW_CFA opcode.
dw_fields_description	Returns a string. Do not free.
dw_u0	May be set to an unsigned value
dw_u1	May be set to an unsigned value
dw_s0	May be set to a signed value
dw_s1	May be set to a signed value
dw_code_alignment_factor	May be set by the call
dw_data_alignment_factor	May be set by the call
dw_expression_block	Pass in a pointer to a block
dw_error	If DW_DLV_ERROR and the argument is non-NULL, returns details about the error.

Returns

On success returns DW_DLV_OK If there is no such instruction with that index it returns DW_DLV_NO_ENTRY On error it returns DW_DLV_ERROR and if dw_error is NULL it pushes back a pointer to a Dwarf_Error to the caller.

Frame expressions have a variety of formats and content. The dw_fields parameter is set to a pointer to a short string with some set of the letters s,u,r,d,c,b,a which enables determining exactly which values the call sets. Some examples: A `s` in fields[0] means s0 is a signed number.

A `b` somewhere in fields means the expression block passed in has been filled in.

A `r` in fields[1] means u1 is set to a register number.

A `d` in fields means data_alignment_factor is set

A `c` in fields means code_alignment_factor is set

An `a` in fields means an LLVM address space value and only exists if calling dwarf_get_frame_instruction_a().

The possible frame instruction formats are:
```
"" "b" "r" "rb" "rr" "rsd" "rsda" "ru" "rua" "rud"
"sd" "u" "uc"
```

are the possible frame instruction formats.

9.18.2.26 dwarf_get_frame_instruction_a()

```
DW_API int dwarf_get_frame_instruction_a (
            Dwarf_Frame_Instr_Head dw_,
            Dwarf_Unsigned dw_instr_index,
            Dwarf_Unsigned * dw_instr_offset_in_instrs,
            Dwarf_Small * dw_cfa_operation,
            const char ** dw_fields_description,
            Dwarf_Unsigned * dw_u0,
            Dwarf_Unsigned * dw_u1,
            Dwarf_Unsigned * dw_u2,
            Dwarf_Signed * dw_s0,
            Dwarf_Signed * dw_s1,
            Dwarf_Unsigned * dw_code_alignment_factor,
            Dwarf_Signed * dw_data_alignment_factor,
            Dwarf_Block * dw_expression_block,
            Dwarf_Error * dw_error )
```

Expands CIE or FDE instructions for detailed examination. Called for CIE initial instructions and FDE instructions. This is the same as dwarf_get_frame_instruction() except that it adds a dw_u2 field which contains an address-space identifier if the letter `a` appears in dw_fields_description. The dw_u2 field is non-standard and only applies to Heterogeneous Debugging frame instructions defined by LLVM (DW_CFA_LLVM_def_aspace_cfa and DW_CFA↩ _LLVM_def_aspace_cfa_sf)

Where multiplication is called for (via dw_code_alignment_factor or dw_data_alignment_factor) to produce an offset there is no need to check for overflow as libdwarf has already verified there is no overflow.

The return values are the same except here we have: an `a` in fields[2] or fields[3] means dw_u2 is an address-space identifier for the LLVM CFA instruction.

9.18.2.27 dwarf_set_frame_cfa_value()

```
DW_API Dwarf_Half dwarf_set_frame_cfa_value (
            Dwarf_Debug dw_dbg,
            Dwarf_Half dw_value )
```

Frame CFA Column Invariants for setting frame registers .

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Pass in the value to record for the library to use.

Returns

Returns the previous value.

9.18.2.28 dwarf_set_frame_rule_initial_value()

```
DW_API Dwarf_Half dwarf_set_frame_rule_initial_value (
            Dwarf_Debug dw_dbg,
            Dwarf_Half dw_value )
```

Frame Rule Initial Value.

Invariants for setting frame registers

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Pass in the value to record for the library to use.

Returns

Returns the previous value.

9.18.2.29 dwarf_set_frame_rule_table_size()

```
DW_API Dwarf_Half dwarf_set_frame_rule_table_size (
            Dwarf_Debug dw_dbg,
            Dwarf_Half dw_value )
```

Frame Rule Table Size Invariants for setting frame registers .

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Pass in the value to record for the library to use.

Returns

Returns the previous value.

9.18.2.30 dwarf_set_frame_same_value()

```
DW_API Dwarf_Half dwarf_set_frame_same_value (
            Dwarf_Debug dw_dbg,
            Dwarf_Half dw_value )
```

Frame Same Value Default Invariants for setting frame registers .

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Pass in the value to record for the library to use.

Returns

Returns the previous value.

9.18.2.31 dwarf_set_frame_undefined_value()

```
DW_API Dwarf_Half dwarf_set_frame_undefined_value (
            Dwarf_Debug dw_dbg,
            Dwarf_Half dw_value )
```

Frame Undefined Value Default Invariants for setting frame registers .

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Pass in the value to record for the library to use.

Returns

Returns the previous value.

9.19 Abbreviations Section Details

Functions

- DW_API int dwarf_get_abbrev (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_offset, Dwarf_Abbrev ∗dw_↩ returned_abbrev, Dwarf_Unsigned ∗dw_length, Dwarf_Unsigned ∗dw_attr_count, Dwarf_Error ∗dw_error)

  Reading Abbreviation Data.
- DW_API int dwarf_get_abbrev_tag (Dwarf_Abbrev dw_abbrev, Dwarf_Half ∗dw_return_tag_number, Dwarf_Error ∗dw_error)

  Get abbreviation tag.
- DW_API int dwarf_get_abbrev_code (Dwarf_Abbrev dw_abbrev, Dwarf_Unsigned ∗dw_return_code_number, Dwarf_Error ∗dw_error)

  Get Abbreviation Code.
- DW_API int dwarf_get_abbrev_children_flag (Dwarf_Abbrev dw_abbrev, Dwarf_Signed ∗dw_return_flag, Dwarf_Error ∗dw_error)

  Get Abbrev Children Flag.
- DW_API int dwarf_get_abbrev_entry_b (Dwarf_Abbrev dw_abbrev, Dwarf_Unsigned dw_indx, Dwarf_Bool dw_filter_outliers, Dwarf_Unsigned ∗dw_returned_attr_num, Dwarf_Unsigned ∗dw_returned_form, Dwarf_Signed ∗dw_returned_implicit_const, Dwarf_Off ∗dw_offset, Dwarf_Error ∗dw_error)

  Get Abbrev Entry Details.

9.19.1 Detailed Description

Allows reading section .debug_abbrev independently of CUs or DIEs. Normally not done (libdwarf uses it as necessary to access DWARF DIEs and DWARF attributes) unless one is interested in the content of the section.

About Reading Independently.

9.19.2 Function Documentation

9.19.2.1 dwarf_get_abbrev()

```
DW_API int dwarf_get_abbrev (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_offset,
            Dwarf_Abbrev * dw_returned_abbrev,
            Dwarf_Unsigned * dw_length,
            Dwarf_Unsigned * dw_attr_count,
            Dwarf_Error * dw_error )
```

Reading Abbreviation Data.

Normally you never need to call these functions. Calls that involve DIEs do all this for you behind the scenes in the library.

This reads the data for a single abbrev code starting at dw_offset. Essentially, opening access to an abbreviation entry.

When libdwarf itself reads abbreviations to access DIEs the offset comes from the Compilation Unit Header debug↩ _abbrev_offset field.

See also

dwarf_next_cu_header_d

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_offset	Pass in the offset where a Debug_Abbrev starts.
dw_returned_abbrev	On success, sets a pointer to a Dwarf_Abbrev through the pointer to allow further access.
dw_length	On success, returns the length of the entire abbreviation block (bytes), useful to calculate the next offset if reading the section independently of any compilation unit.
dw_attr_count	On success, returns the number of attributes in this abbreviation entry.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. If the abbreviation is a single zero byte it is a null abbreviation. DW_↩ DLV_OK is returned.

Close the abbrev by calling dwarf_dealloc(dbg,∗dw_returned_abbrev, DW_DLA_ABBREV)

9.19.2.2 dwarf_get_abbrev_children_flag()

```
DW_API int dwarf_get_abbrev_children_flag (
            Dwarf_Abbrev dw_abbrev,
            Dwarf_Signed * dw_return_flag,
            Dwarf_Error * dw_error )
```

Get Abbrev Children Flag.

Parameters

dw_abbrev	The Dwarf_Abbrev of interest.
dw_return_flag	On success returns the flag TRUE (greater than zero) if the DIE referencing the abbreviation has children, else returns FALSE (zero).
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.19.2.3 dwarf_get_abbrev_code()

```
DW_API int dwarf_get_abbrev_code (
            Dwarf_Abbrev dw_abbrev,
            Dwarf_Unsigned * dw_return_code_number,
            Dwarf_Error * dw_error )
```

Get Abbreviation Code.

Parameters

dw_abbrev	The Dwarf_Abbrev of interest.
dw_return_code_number	Returns the code for this abbreviation, a number assigned to the abbreviation and unique within the applicable CU.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.19.2.4 dwarf_get_abbrev_entry_b()

```
DW_API int dwarf_get_abbrev_entry_b (
            Dwarf_Abbrev dw_abbrev,
            Dwarf_Unsigned dw_indx,
            Dwarf_Bool dw_filter_outliers,
            Dwarf_Unsigned * dw_returned_attr_num,
            Dwarf_Unsigned * dw_returned_form,
            Dwarf_Signed * dw_returned_implicit_const,
            Dwarf_Off * dw_offset,
            Dwarf_Error * dw_error )
```

Get Abbrev Entry Details.

Most will will call with filter_outliers non-zero.

Parameters

dw_abbrev	The Dwarf_Abbrev of interest.
dw_indx	Valid dw_index values are 0 through dw_attr_count-1
dw_filter_outliers	Pass non-zero (TRUE) so the function will check for unreasonable abbreviation content and return DW_DLV_ERROR if such found. If zero (FALSE) passed in even a nonsensical attribute number and/or unknown DW_FORM are allowed (used by dwarfdump to report the issue(s)).
dw_returned_attr_num	On success returns the attribute number, such as DW_AT_name
dw_returned_form	On success returns the attribute FORM, such as DW_FORM_udata
dw_returned_implicit_const	On success, if the dw_returned_form is DW_FORM_implicit_const then dw_returned_implicit_const is the implicit const value, but if not implicit const the return value is zero..
dw_offset	On success returns the offset of the start of this attr/form pair in the abbreviation section.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. If the abbreviation code for this Dwarf_Abbrev is 0 it is a null abbreviation, the dw_indx is ignored, and the function returns DW_DLV_NO_ENTRY.

9.19.2.5 dwarf_get_abbrev_tag()

```
DW_API int dwarf_get_abbrev_tag (
            Dwarf_Abbrev dw_abbrev,
            Dwarf_Half * dw_return_tag_number,
            Dwarf_Error * dw_error )
```

Get abbreviation tag.

Parameters

dw_abbrev	The Dwarf_Abbrev of interest.
dw_return_tag_number	Returns the tag value, for example DW_TAG_compile_unit.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.20 String Section .debug_str Details

Functions

- DW_API int dwarf_get_str (Dwarf_Debug dw_dbg, Dwarf_Off dw_offset, char ∗∗dw_string, Dwarf_Signed ∗dw_strlen_of_string, Dwarf_Error ∗dw_error)

  Reading From a String Section.

9.20.1 Detailed Description

Shows just the section content in detail

9.20.2 Function Documentation

9.20.2.1 dwarf_get_str()

```
DW_API int dwarf_get_str (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_offset,
            char ** dw_string,
            Dwarf_Signed * dw_strlen_of_string,
            Dwarf_Error * dw_error )
```

Reading From a String Section.

Reading The String Section

Parameters

dw_dbg	The Dwarf_Debug whose .debug_str section we want to access.
dw_offset	Pass in a string offset. Start at 0, and for the next call pass in dw_offset plus dw_strlen_of_string plus 1.
dw_string	The caller must pass in a valid pointer to a char ∗. On success returns a pointer to a string from offset dw_offset. Never dealloc or free this string.
dw_strlen_of_string	The caller must pass in a valid pointer to a Dwarf_Signed.

On success returns the strlen() of the string.

Parameters

dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. If there is no such section it returns DW_DLV_NO_ENTRY. If the dw↩ _offset is greater than the section size, or dw_string passed in is NULL or dw_strlen_of_string is NULL the function returns DW_DLV_ERROR.

9.21 Str_Offsets section details

Functions

- DW_API int dwarf_open_str_offsets_table_access (Dwarf_Debug dw_dbg, Dwarf_Str_Offsets_Table ∗dw_↩ table_data, Dwarf_Error ∗dw_error)

  Creates access to a .debug_str_offsets table.
- DW_API int dwarf_close_str_offsets_table_access (Dwarf_Str_Offsets_Table dw_table_data, Dwarf_Error ∗dw_error)

  Close str_offsets access, free table_data.
- DW_API int dwarf_next_str_offsets_table (Dwarf_Str_Offsets_Table dw_table_data, Dwarf_Unsigned ∗dw↩ _unit_length, Dwarf_Unsigned ∗dw_unit_length_offset, Dwarf_Unsigned ∗dw_table_start_offset, Dwarf_Half ∗dw_entry_size, Dwarf_Half ∗dw_version, Dwarf_Half ∗dw_padding, Dwarf_Unsigned ∗dw_table_value_↩ count, Dwarf_Error ∗dw_error)

  Iterate through the offsets tables.
- DW_API int dwarf_str_offsets_value_by_index (Dwarf_Str_Offsets_Table dw_table_data, Dwarf_Unsigned dw_index_to_entry, Dwarf_Unsigned ∗dw_entry_value, Dwarf_Error ∗dw_error)

  Access to an individual str offsets table entry.
- DW_API int dwarf_str_offsets_statistics (Dwarf_Str_Offsets_Table dw_table_data, Dwarf_Unsigned ∗dw_↩ wasted_byte_count, Dwarf_Unsigned ∗dw_table_count, Dwarf_Error ∗dw_error)

  Reports final wasted-bytes count.

9.21.1 Detailed Description

Shows just the section content in detail. Most library users will never call these, as references to this is handled by the code accessing some Dwarf_Attribute. Reading The Str_Offsets

9.21.2 Function Documentation

9.21.2.1 dwarf_close_str_offsets_table_access()

```
DW_API int dwarf_close_str_offsets_table_access (
            Dwarf_Str_Offsets_Table dw_table_data,
            Dwarf_Error * dw_error )
```

Close str_offsets access, free table_data.

See also

Reading string offsets section data

Parameters

dw_table_data	
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK etc. If there is no .debug_str_offsets section it returns DW_DLV_NO_ENTRY If it returns DW↩_DLV_ERROR there is nothing you can do except report the error and, optionally, call dwarf_dealloc_error to dealloc the error content (and then set the dw_error to NULL as after the dealloc the pointer is stale)..

9.21.2.2 dwarf_next_str_offsets_table()

```
DW_API int dwarf_next_str_offsets_table (
            Dwarf_Str_Offsets_Table dw_table_data,
            Dwarf_Unsigned * dw_unit_length,
            Dwarf_Unsigned * dw_unit_length_offset,
            Dwarf_Unsigned * dw_table_start_offset,
            Dwarf_Half * dw_entry_size,
            Dwarf_Half * dw_version,
            Dwarf_Half * dw_padding,
            Dwarf_Unsigned * dw_table_value_count,
            Dwarf_Error * dw_error )
```

Iterate through the offsets tables.

See also

Reading string offsets section data

Access to the tables starts at offset zero. The library progresses through the next table automatically, keeping track internally to know where it is.

Parameters

dw_table_data	Pass in an open Dwarf_Str_Offsets_Table.
dw_unit_length	On success returns a table unit_length field
dw_unit_length_offset	On success returns the section offset of the unit_length field.
dw_table_start_offset	On success returns the section offset of the array of table entries.
dw_entry_size	On success returns the entry size (4 or 8)
dw_version	On success returns the value in the version field 5.
dw_padding	On success returns the zero value in the padding field.
dw_table_value_count	On success returns the number of table entries, each of size dw_entry_size, in the table.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK Returns DW_DLV_NO_ENTRY if there are no more entries.

9.21.2.3 dwarf_open_str_offsets_table_access()

```
DW_API int dwarf_open_str_offsets_table_access (
            Dwarf_Debug dw_dbg,
            Dwarf_Str_Offsets_Table * dw_table_data,
            Dwarf_Error * dw_error )
```

Creates access to a .debug_str_offsets table.

See also

Reading string offsets section data

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest.
dw_table_data	On success returns a pointer to an opaque structure for use in further calls.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK etc. If there is no .debug_str_offsets section it returns DW_DLV_NO_ENTRY

9.21.2.4 dwarf_str_offsets_statistics()

```
DW_API int dwarf_str_offsets_statistics (
            Dwarf_Str_Offsets_Table dw_table_data,
            Dwarf_Unsigned * dw_wasted_byte_count,
            Dwarf_Unsigned * dw_table_count,
            Dwarf_Error * dw_error )
```

Reports final wasted-bytes count.

Reports the number of tables seen so far. Not very interesting.

Parameters

dw_table_data	Pass in the open table pointer.
dw_wasted_byte_count	Always returns 0 at present.
dw_table_count	On success returns the total number of tables seen so far in the section.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

9.21.2.5 dwarf_str_offsets_value_by_index()

```
DW_API int dwarf_str_offsets_value_by_index (
            Dwarf_Str_Offsets_Table dw_table_data,
            Dwarf_Unsigned dw_index_to_entry,
            Dwarf_Unsigned * dw_entry_value,
            Dwarf_Error * dw_error )
```

Access to an individual str offsets table entry.

See also

Reading string offsets section data

Parameters

dw_table_data	Pass in the open table pointer.
dw_index_to_entry	Pass in the entry number, 0 through dw_table_value_count-1 for the active table
dw_entry_value	On success returns the value in that table entry, an offset into a string table.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK Returns DW_DLV_ERROR if dw_index_to_entry is out of the correct range.

9.22 Dwarf_Error Functions

Functions

- DW_API Dwarf_Unsigned dwarf_errno (Dwarf_Error dw_error)

  What DW_DLE code does the error have?
- DW_API char * dwarf_errmsg (Dwarf_Error dw_error)

  What message string is in the error?
- DW_API char * dwarf_errmsg_by_number (Dwarf_Unsigned dw_errornum)

  What message string is associated with the error number.
- DW_API void dwarf_error_creation (Dwarf_Debug dw_dbg, Dwarf_Error *dw_error, char *dw_errmsg)

  Creating an error. This is very rarely helpful. It lets the library user create a Dwarf_Error and associate any string with that error. Your code could then return DW_DLV_ERROR to your caller when your intent is to let your caller clean up whatever seems wrong.
- DW_API void dwarf_dealloc_error (Dwarf_Debug dw_dbg, Dwarf_Error dw_error)

  Free (dealloc) an Dwarf_Error something created.

9.22.1 Detailed Description

These functions aid in understanding handling.

9.22.2 Function Documentation

9.22.2.1 dwarf_dealloc_error()

```
DW_API void dwarf_dealloc_error (
            Dwarf_Debug dw_dbg,
            Dwarf_Error dw_error )
```

Free (dealloc) an Dwarf_Error something created.

Parameters

dw_dbg	The relevant Dwarf_Debug pointer.
dw_error	A pointer to a Dwarf_Error. The pointer is then stale so you should immediately zero that pointer passed in.

9.22.2.2 dwarf_errmsg()

```
DW_API char * dwarf_errmsg (
            Dwarf_Error dw_error )
```

What message string is in the error?

Parameters

dw_error	The dw_error should be non-null and a valid Dwarf_Error.

Returns

A string with a message related to the error.

9.22.2.3 dwarf_errmsg_by_number()

```
DW_API char * dwarf_errmsg_by_number (
            Dwarf_Unsigned dw_errornum )
```

What message string is associated with the error number.

Parameters

dw_errornum	The dw_error should be an integer from the DW_DLE set. For example, DW_DLE_DIE_NULL.

Returns

The generic string describing that error number.

9.22.2.4 dwarf_errno()

```
DW_API Dwarf_Unsigned dwarf_errno (
            Dwarf_Error dw_error )
```

What DW_DLE code does the error have?

Parameters

dw_error	The dw_error should be non-null and a valid Dwarf_Error.

Returns

A DW_DLE value of some kind. For example: DW_DLE_DIE_NULL.

9.22.2.5 dwarf_error_creation()

```
DW_API void dwarf_error_creation (
            Dwarf_Debug dw_dbg,
            Dwarf_Error * dw_error,
            char * dw_errmsg )
```

Creating an error. This is very rarely helpful. It lets the library user create a Dwarf_Error and associate any string with that error. Your code could then return DW_DLV_ERROR to your caller when your intent is to let your caller clean up whatever seems wrong.

Parameters

dw_dbg	The relevant Dwarf_Debug.
dw_error	a Dwarf_Error is returned through this pointer.
dw_errmsg	The message string you provide.

9.23 Generic dwarf_dealloc Function

Functions

- DW_API void dwarf_dealloc (Dwarf_Debug dw_dbg, void ∗dw_space, Dwarf_Unsigned dw_type)

  The generic dealloc (free) function. It requires you know the correct DW_DLA value to pass in, and in a few cases such is not provided. The functions doing allocations tell you which dealloc to use.

9.23.1 Detailed Description

Works for most dealloc needed.

For easier to use versions see the following

See also

dwarf_dealloc_attribute

dwarf_dealloc_die

dwarf_dealloc_dnames

dwarf_dealloc_error

dwarf_dealloc_fde_cie_list

dwarf_dealloc_frame_instr_head

dwarf_dealloc_macro_context

dwarf_dealloc_ranges

dwarf_dealloc_rnglists_head

dwarf_dealloc_uncompressed_block

dwarf_globals_dealloc

dwarf_gnu_index_dealloc

dwarf_loc_head_c_dealloc

dwarf_srclines_dealloc_b

9.23.2 Function Documentation

9.23.2.1 dwarf_dealloc()

```
DW_API void dwarf_dealloc (
             Dwarf_Debug dw_dbg,
             void * dw_space,
             Dwarf_Unsigned dw_type )
```

The generic dealloc (free) function. It requires you know the correct DW_DLA value to pass in, and in a few cases such is not provided. The functions doing allocations tell you which dealloc to use.

Parameters

dw_dbg	Must be a valid open Dwarf_Debug. and must be the dw_dbg that the error was created on. If it is not the dealloc will do nothing.
dw_space	Must be an address returned directly by a libdwarf call that the call specifies as requiring dealloc/free. If it is not a segfault or address fault is possible.
dw_type	Must be a correct naming of the DW_DLA type. If it is not the dealloc will do nothing.

9.24 Access to Section .debug_sup

Functions

- DW_API int dwarf_get_debug_sup (Dwarf_Debug dw_dbg, Dwarf_Half *dw_version, Dwarf_Small *dw_is↩_supplementary, char **dw_filename, Dwarf_Unsigned *dw_checksum_len, Dwarf_Small **dw_checksum, Dwarf_Error *dw_error)

  Return basic .debug_sup section header data.

9.24.1 Detailed Description

9.24.2 Function Documentation

9.24.2.1 dwarf_get_debug_sup()

```
DW_API int dwarf_get_debug_sup (
             Dwarf_Debug dw_dbg,
             Dwarf_Half * dw_version,
             Dwarf_Small * dw_is_supplementary,
             char ** dw_filename,
             Dwarf_Unsigned * dw_checksum_len,
             Dwarf_Small ** dw_checksum,
             Dwarf_Error * dw_error )
```

Return basic .debug_sup section header data.

This returns basic data from the header of a .debug_sup section. See DWARF5 Section 7.3.6, "DWARF Supplementary Object Files"

Other sections present should be normal DWARF5, so normal libdwarf calls should work. We have no existing examples on hand, so it is hard to know what really works.

If there is no such section it returns DW_DLV_NO_ENTRY.

9.25 Fast Access to .debug_names DWARF5

Functions

- DW_API int dwarf_dnames_header (Dwarf_Debug dw_dbg, Dwarf_Off dw_starting_offset, Dwarf_Dnames_Head ∗dw_dn, Dwarf_Off ∗dw_offset_of_next_table, Dwarf_Error ∗dw_error)

  Open access to a .debug_names table.
- DW_API void dwarf_dealloc_dnames (Dwarf_Dnames_Head dw_dn)

  Frees all the malloc data associated with dw_dn.
- DW_API int dwarf_dnames_abbrevtable (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned dw_index, Dwarf_Unsigned ∗dw_abbrev_offset, Dwarf_Unsigned ∗dw_abbrev_code, Dwarf_Unsigned ∗dw_←abbrev_tag, Dwarf_Unsigned dw_array_size, Dwarf_Half ∗dw_idxattr_array, Dwarf_Half ∗dw_form_array, Dwarf_Unsigned ∗dw_idxattr_count)

  Access to the abbrevs table content.
- DW_API int dwarf_dnames_sizes (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned ∗dw_comp_unit←_count, Dwarf_Unsigned ∗dw_local_type_unit_count, Dwarf_Unsigned ∗dw_foreign_type_unit_count, Dwarf_Unsigned ∗dw_bucket_count, Dwarf_Unsigned ∗dw_name_count, Dwarf_Unsigned ∗dw_abbrev←_table_size, Dwarf_Unsigned ∗dw_entry_pool_size, Dwarf_Unsigned ∗dw_augmentation_string_size, char ∗∗dw_augmentation_string, Dwarf_Unsigned ∗dw_section_size, Dwarf_Half ∗dw_table_version, Dwarf_Half ∗dw_offset_size, Dwarf_Error ∗dw_error)

  Sizes and counts from the debug names table.
- DW_API int dwarf_dnames_offsets (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned ∗dw_header_←offset, Dwarf_Unsigned ∗dw_cu_table_offset, Dwarf_Unsigned ∗dw_tu_local_offset, Dwarf_Unsigned ∗dw_foreign_tu_offset, Dwarf_Unsigned ∗dw_bucket_offset, Dwarf_Unsigned ∗dw_hashes_offset, Dwarf_Unsigned ∗dw_stringoffsets_offset, Dwarf_Unsigned ∗dw_entryoffsets_offset, Dwarf_Unsigned ∗dw_abbrev_table_offset, Dwarf_Unsigned ∗dw_entry_pool_offset, Dwarf_Error ∗dw_error)

  Offsets from the debug names table.
- DW_API int dwarf_dnames_cu_table (Dwarf_Dnames_Head dw_dn, const char ∗dw_type, Dwarf_Unsigned dw_index_number, Dwarf_Unsigned ∗dw_offset, Dwarf_Sig8 ∗dw_sig, Dwarf_Error ∗dw_error)

  Each debug names cu list entry one at a time.
- DW_API int dwarf_dnames_bucket (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned dw_bucket_number, Dwarf_Unsigned ∗dw_index, Dwarf_Unsigned ∗dw_indexcount, Dwarf_Error ∗dw_error)

  Access to bucket contents.
- DW_API int dwarf_dnames_name (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned dw_name_index, Dwarf_Unsigned ∗dw_bucket_number, Dwarf_Unsigned ∗dw_hash_value, Dwarf_Unsigned ∗dw_offset_to←_debug_str, char ∗∗dw_ptrtostr, Dwarf_Unsigned ∗dw_offset_in_entrypool, Dwarf_Unsigned ∗dw_abbrev←_number, Dwarf_Half ∗dw_abbrev_tag, Dwarf_Unsigned dw_array_size, Dwarf_Half ∗dw_idxattr_array, Dwarf_Half ∗dw_form_array, Dwarf_Unsigned ∗dw_idxattr_count, Dwarf_Error ∗dw_error)

  Retrieve a name table entry.
- DW_API int dwarf_dnames_entrypool (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned dw_offset_in_←entrypool, Dwarf_Unsigned ∗dw_abbrev_code, Dwarf_Half ∗dw_tag, Dwarf_Unsigned ∗dw_value_count, Dwarf_Unsigned ∗dw_index_of_abbrev, Dwarf_Unsigned ∗dw_offset_of_initial_value, Dwarf_Error ∗dw_←error)

  Return a the set of values from an entrypool entry.
- DW_API int dwarf_dnames_entrypool_values (Dwarf_Dnames_Head dw_dn, Dwarf_Unsigned dw_←index_of_abbrev, Dwarf_Unsigned dw_offset_in_entrypool_of_values, Dwarf_Unsigned dw_arrays_←length, Dwarf_Half ∗dw_array_idx_number, Dwarf_Half ∗dw_array_form, Dwarf_Unsigned ∗dw_array_of_←offsets, Dwarf_Sig8 ∗dw_array_of_signatures, Dwarf_Bool ∗dw_single_cu, Dwarf_Unsigned ∗dw_cu_offset, Dwarf_Unsigned ∗dw_offset_of_next_entrypool, Dwarf_Error ∗dw_error)

  Return the value set defined by this entry.

9.25.1 Detailed Description

The section is new in DWARF5 and supersedes .debug_pubnames and .debug_pubtypes in DWARF2, DWARF3, and DWARF4.

The functions provide a detailed reporting of the content and structure of the table (so one can build one's own search table) but they are not particularly helpful for searching.

A new function (more than one?) would be needed for convenient searching.

9.25.2 Function Documentation

9.25.2.1 dwarf_dealloc_dnames()

```
DW_API void dwarf_dealloc_dnames (
             Dwarf_Dnames_Head dw_dn )
```

Frees all the malloc data associated with dw_dn.

Parameters

dw_dn	A Dwarf_Dnames_Head pointer. Callers should zero the pointer passed in as soon as possible after this returns as the pointer is then stale.

9.25.2.2 dwarf_dnames_abbrevtable()

```
DW_API int dwarf_dnames_abbrevtable (
             Dwarf_Dnames_Head dw_dn,
             Dwarf_Unsigned dw_index,
             Dwarf_Unsigned * dw_abbrev_offset,
             Dwarf_Unsigned * dw_abbrev_code,
             Dwarf_Unsigned * dw_abbrev_tag,
             Dwarf_Unsigned dw_array_size,
             Dwarf_Half * dw_idxattr_array,
             Dwarf_Half * dw_form_array,
             Dwarf_Unsigned * dw_idxattr_count )
```

Access to the abbrevs table content.

Of interest mainly to debugging issues with compilers or debuggers.

Parameters

dw_dn	A Dwarf_Dnames_Head pointer.
dw_index	An index (starting at zero) into a table constructed of abbrev data. These indexes are derived from abbrev data and are not in the abbrev data itself.
dw_abbrev_offset	Returns the offset of the abbrev table entry for this names table entry.
dw_abbrev_code	Returns the abbrev code for the abbrev at offset dw_abbrev_offset.
dw_abbrev_tag	Returns the tag for the abbrev at offset dw_abbrev_offset.
dw_array_size	The size you allocated in each of the following two arrays.

Parameters

dw_idxattr_array	Pass in an array you allocated where the function returns and array of index attributes (DW_IDX) for this dw_abbrev_code. The last attribute code in the array is zero.
dw_form_array	Pass in an array you allocated where the function returns and array of forms for this dw_abbrev_code (paralled to dw_idxattr_array). The last form code in the array is zero.
dw_idxattr_count	Returns the actual idxattribute/form count (including the terminating 0,0 pair. If the array_size passed in is less than this value the array returned is incomplete. Array entries needed. Might be larger than dw_array_size, meaning not all entries could be returned in your arrays.

Returns

Returns DW_DLV_OK on success. If the offset does not refer to a known part of the abbrev table it returns DW_DLV_NO_ENTRY. Never returns DW_DLV_ERROR.

9.25.2.3 dwarf_dnames_bucket()

```
DW_API int dwarf_dnames_bucket (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned dw_bucket_number,
            Dwarf_Unsigned * dw_index,
            Dwarf_Unsigned * dw_indexcount,
            Dwarf_Error * dw_error )
```

Access to bucket contents.

Parameters

dw_dn	The Dwarf_Dnames_Head of interest.
dw_bucket_number	Pass in a bucket number Bucket numbers start at 0.
dw_index	On success returns the index of the appropriate name entry. Name entry indexes start at one, a zero index means the bucket is unused.
dw_indexcount	On success returns the number of name entries in the bucket.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. An out of range dw_index_number gets a return if DW_DLV_NO_ENTRY

9.25.2.4 dwarf_dnames_cu_table()

```
DW_API int dwarf_dnames_cu_table (
            Dwarf_Dnames_Head dw_dn,
            const char * dw_type,
            Dwarf_Unsigned dw_index_number,
            Dwarf_Unsigned * dw_offset,
            Dwarf_Sig8 * dw_sig,
            Dwarf_Error * dw_error )
```

Each debug names cu list entry one at a time.

Indexes to the cu/tu/ tables start at 0.

Some values in dw_offset are actually offsets, such as for DW_IDX_die_offset. DW_IDX_compile_unit and DW_↩
IDX_type_unit are indexes into the table specified by dw_type and are returned through dw_offset field;

Parameters

dw_dn	The table of interest.
dw_type	Pass in the type, "cu" or "tu"
dw_index_number	For "cu" index range is 0 through K-1 For "tu" index range is 0 through T+F-1
dw_offset	Zero if it cannot be determined. (check the return value!).
dw_sig	the Dwarf_Sig8 is filled in with a signature if the TU index is T through T+F-1
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.25.2.5 dwarf_dnames_entrypool()

```
DW_API int dwarf_dnames_entrypool (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned dw_offset_in_entrypool,
            Dwarf_Unsigned * dw_abbrev_code,
            Dwarf_Half * dw_tag,
            Dwarf_Unsigned * dw_value_count,
            Dwarf_Unsigned * dw_index_of_abbrev,
            Dwarf_Unsigned * dw_offset_of_initial_value,
            Dwarf_Error * dw_error )
```

Return a the set of values from an entrypool entry.

Returns the basic data about an entrypool record and enables correct calling of dwarf_dnames_entrypool_values (see below). The two-stage approach makes it simple for callers to prepare for the number of values that will be returned by dwarf_dnames_entrypool_values()

Parameters

dw_dn	Pass in the debug names table of interest.
dw_offset_in_entrypool	The record offset (in the entry pool table) of the first record of IDX attributes. Starts at zero.
dw_abbrev_code	On success returns the abbrev code of the idx attributes for the pool entry.
dw_tag	On success returns the TAG of the DIE referred to by this entrypool entry.
dw_value_count	On success returns the number of distinct values imply by this entry.
dw_index_of_abbrev	On success returns the index of the abbrev index/form pairs in the abbreviation table.
dw_offset_of_initial_value	On success returns the entry pool offset of the sequence of bytes containing values, such as a CU index or a DIE offset.
dw_error	The usual error detail record

Returns

DW_DLV_OK is returned if the specified name entry exists. DW_DLV_NO_ENTRY is returned if the specified offset is outside the size of the table. DW_DLV_ERROR is returned in case of an internal error or corrupt section content.

9.25.2.6 dwarf_dnames_entrypool_values()

```
DW_API int dwarf_dnames_entrypool_values (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned dw_index_of_abbrev,
            Dwarf_Unsigned dw_offset_in_entrypool_of_values,
            Dwarf_Unsigned dw_arrays_length,
            Dwarf_Half * dw_array_idx_number,
            Dwarf_Half * dw_array_form,
            Dwarf_Unsigned * dw_array_of_offsets,
            Dwarf_Sig8 * dw_array_of_signatures,
            Dwarf_Bool * dw_single_cu,
            Dwarf_Unsigned * dw_cu_offset,
            Dwarf_Unsigned * dw_offset_of_next_entrypool,
            Dwarf_Error * dw_error )
```

Return the value set defined by this entry.

Call here after calling dwarf_dnames_entrypool to provide data to call this function correctly.

This retrieves the index attribute values that identify a names table name.

The caller allocates a set of arrays and the function fills them in. If dw_array_idx_number[n] is DW_IDX_type_hash then dw_array_of_signatures[n] contains the hash. For other IDX values dw_array_of_offsets[n] contains the value being returned.

Parameters

dw_dn	Pass in the debug names table of interest.
dw_index_of_abbrev	Pass in the abbreviation index.
dw_offset_in_entrypool_of_values	Pass in the offset of the values returned by dw_offset_of_initial_value above.
dw_arrays_length	Pass in the array length of each of the following four fields. The dw_value_count returned above is what you need to use.
dw_array_idx_number	Create an array of Dwarf_Half values, dw_arrays_length long, and pass a pointer to the first entry here.
dw_array_form	Create an array of Dwarf_Half values, dw_arrays_length long, and pass a pointer to the first entry here.
dw_array_of_offsets	Create an array of Dwarf_Unsigned values, dw_arrays_length long, and pass a pointer to the first entry here.
dw_array_of_signatures	Create an array of Dwarf_Sig8 structs, dw_arrays_length long, and pass a pointer to the first entry here.
dw_offset_of_next_entrypool	On success returns the offset of the next entrypool. A value here is usable in the next call to dwarf_dnames_entrypool.
dw_single_cu	On success, if it is a single-cu name table there is likely no DW_IDX_compile_unit. So we return TRUE via this flag in such a case.
dw_cu_offset	On success, for a single-cu name table with no DW_IDX_compile_unit this is set to the CU offset from that single CU-table entry.
dw_error	The usual error detail record

Returns

DW_DLV_OK is returned if the specified name entry exists. DW_DLV_NO_ENTRY is returned if the specified offset is outside the size of the table. DW_DLV_ERROR is returned in case of an internal error or corrupt section content.

9.25.2.7 dwarf_dnames_header()

```
DW_API int dwarf_dnames_header (
            Dwarf_Debug dw_dbg,
            Dwarf_Off dw_starting_offset,
            Dwarf_Dnames_Head * dw_dn,
            Dwarf_Off * dw_offset_of_next_table,
            Dwarf_Error * dw_error )
```

Open access to a .debug_names table.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_starting_offset	Read this section starting at offset zero.
dw_dn	On success returns a pointer to a set of data allowing access to the table.
dw_offset_of_next_table	On success returns Offset just past the end of the the opened table.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. If there is no such table or if dw_starting_offset is past the end of the section it returns DW_DLV_NO_ENTRY.

9.25.2.8 dwarf_dnames_name()

```
DW_API int dwarf_dnames_name (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned dw_name_index,
            Dwarf_Unsigned * dw_bucket_number,
            Dwarf_Unsigned * dw_hash_value,
            Dwarf_Unsigned * dw_offset_to_debug_str,
            char ** dw_ptrtostr,
            Dwarf_Unsigned * dw_offset_in_entrypool,
            Dwarf_Unsigned * dw_abbrev_number,
            Dwarf_Half * dw_abbrev_tag,
            Dwarf_Unsigned dw_array_size,
            Dwarf_Half * dw_idxattr_array,
            Dwarf_Half * dw_form_array,
            Dwarf_Unsigned * dw_idxattr_count,
            Dwarf_Error * dw_error )
```

Retrieve a name table entry.

Retrieve the name and other data from a single name table entry.

Parameters

dw_dn	The table of interest.
dw_name_index	Pass in the desired index, start at one.
dw_bucket_number	On success returns a bucket number, zero if no buckets present.
dw_hash_value	The hash value, all zeros if no hashes present
dw_offset_to_debug_str	The offset to the .debug_str section string.
dw_ptrtostr	if dw_ptrtostr non-null returns a pointer to the applicable string here.
dw_offset_in_entrypool	Returns the offset in the entrypool
dw_abbrev_number	Returned from entrypool.
dw_abbrev_tag	Returned from entrypool abbrev data.
dw_array_size	Size of array you provide to hold DW_IDX index attribute and form numbers. Possibly 10 suffices for practical purposes.
dw_idxattr_array	Array space you provide, for idx attribute numbers (function will initialize it). The final entry in the array will be 0.
dw_form_array	Array you provide, for form numbers (function will initialize it). The final entry in the array will be 0.
dw_idxattr_count	Array entries needed. Might be larger than dw_array_size, meaning not all entries could be returned in your array.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. If the index passed in is outside the valid range returns DW_DLV_NO_↩ ENTRY.

9.25.2.9 dwarf_dnames_offsets()

```
DW_API int dwarf_dnames_offsets (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned * dw_header_offset,
            Dwarf_Unsigned * dw_cu_table_offset,
            Dwarf_Unsigned * dw_tu_local_offset,
            Dwarf_Unsigned * dw_foreign_tu_offset,
            Dwarf_Unsigned * dw_bucket_offset,
            Dwarf_Unsigned * dw_hashes_offset,
            Dwarf_Unsigned * dw_stringoffsets_offset,
            Dwarf_Unsigned * dw_entryoffsets_offset,
            Dwarf_Unsigned * dw_abbrev_table_offset,
            Dwarf_Unsigned * dw_entry_pool_offset,
            Dwarf_Error * dw_error )
```

Offsets from the debug names table.

We do not describe these returned values, which refer to the .debug_names section.

The header offset is a section offset. The rest are offsets from the header.

See DWARF5 section 6.1.1 "Lookup By Name"

9.25.2.10 dwarf_dnames_sizes()

```
DW_API int dwarf_dnames_sizes (
            Dwarf_Dnames_Head dw_dn,
            Dwarf_Unsigned * dw_comp_unit_count,
            Dwarf_Unsigned * dw_local_type_unit_count,
            Dwarf_Unsigned * dw_foreign_type_unit_count,
            Dwarf_Unsigned * dw_bucket_count,
            Dwarf_Unsigned * dw_name_count,
            Dwarf_Unsigned * dw_abbrev_table_size,
            Dwarf_Unsigned * dw_entry_pool_size,
            Dwarf_Unsigned * dw_augmentation_string_size,
            char ** dw_augmentation_string,
            Dwarf_Unsigned * dw_section_size,
            Dwarf_Half * dw_table_version,
            Dwarf_Half * dw_offset_size,
            Dwarf_Error * dw_error )
```

Sizes and counts from the debug names table.

We do not describe these returned values. Other than for dw_dn and dw_error passing pointers you do not care about as NULL is fine. Of course no value can be returned through those passed as NULL.

Any program referencing a names table will need at least a few of these values.

See DWARF5 section 6.1.1 "Lookup By Name" particularly the graph page 139. dw_comp_unit_count is K(k), dw_local_type_unit_count is T(t), and dw_foreign_type_unit_count is F(f).

9.26 Fast Access to a CU given a code address

Functions

- DW_API int dwarf_get_aranges (Dwarf_Debug dw_dbg, Dwarf_Arange **dw_aranges, Dwarf_Signed *dw←_arange_count, Dwarf_Error *dw_error)

  Get access to CUs given code addresses.
- DW_API int dwarf_get_arange (Dwarf_Arange *dw_aranges, Dwarf_Unsigned dw_arange_count, Dwarf_Addr dw_address, Dwarf_Arange *dw_returned_arange, Dwarf_Error *dw_error)

  Find a range given a code address.
- DW_API int dwarf_get_cu_die_offset (Dwarf_Arange dw_arange, Dwarf_Off *dw_return_offset, Dwarf_Error *dw_error)

  Given an arange return its CU DIE offset.
- DW_API int dwarf_get_arange_cu_header_offset (Dwarf_Arange dw_arange, Dwarf_Off *dw_return_cu_←header_offset, Dwarf_Error *dw_error)

  Given an arange return its CU header offset.
- DW_API int dwarf_get_arange_info_b (Dwarf_Arange dw_arange, Dwarf_Unsigned *dw_segment, Dwarf_Unsigned *dw_segment_entry_size, Dwarf_Addr *dw_start, Dwarf_Unsigned *dw_length, Dwarf_Off *dw_cu_die_offset, Dwarf_Error *dw_error)

  Get the data in an arange entry.

9.26.1 Detailed Description

9.26.2 Function Documentation

9.26.2.1 dwarf_get_arange()

```
DW_API int dwarf_get_arange (
            Dwarf_Arange * dw_aranges,
            Dwarf_Unsigned dw_arange_count,
            Dwarf_Addr dw_address,
            Dwarf_Arange * dw_returned_arange,
            Dwarf_Error * dw_error )
```

Find a range given a code address.

Parameters

dw_aranges	Pass in a pointer to the first entry in the aranges array of pointers.
dw_arange_count	Pass in the dw_arange_count, the count for the array.
dw_address	Pass in the code address of interest.
dw_returned_arange	On success, returns the particular arange that holds that address.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if there is no such code address present in the section.

9.26.2.2 dwarf_get_arange_cu_header_offset()

```
DW_API int dwarf_get_arange_cu_header_offset (
            Dwarf_Arange dw_arange,
            Dwarf_Off * dw_return_cu_header_offset,
            Dwarf_Error * dw_error )
```

Given an arange return its CU header offset.

Parameters

dw_arange	The specific arange of interest.
dw_return_cu_header_offset	The CU header offset (in .debug_info) applicable to this arange.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.26.2.3 dwarf_get_arange_info_b()

```
DW_API int dwarf_get_arange_info_b (
            Dwarf_Arange dw_arange,
            Dwarf_Unsigned * dw_segment,
            Dwarf_Unsigned * dw_segment_entry_size,
            Dwarf_Addr * dw_start,
            Dwarf_Unsigned * dw_length,
            Dwarf_Off * dw_cu_die_offset,
            Dwarf_Error * dw_error )
```

Get the data in an arange entry.

Parameters

dw_arange	The specific arange of interest.
dw_segment	On success and if segment_entry_size is non-zero this returns the segment number from the arange.
dw_segment_entry_size	On success returns the segment entry size from the arange.
dw_start	On success returns the low address this arange refers to.
dw_length	On success returns the length, in bytes of the code area this arange refers to.
dw_cu_die_offset	On success returns the .debug_info section offset the arange refers to.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.26.2.4 dwarf_get_aranges()

```
DW_API int dwarf_get_aranges (
            Dwarf_Debug dw_dbg,
            Dwarf_Arange ** dw_aranges,
            Dwarf_Signed * dw_arange_count,
            Dwarf_Error * dw_error )
```

Get access to CUs given code addresses.

This intended as a fast-access to tie code addresses to CU dies. The data is in the .debug_aranges section. which may appear in DWARF2,3,4, or DWARF5.

See also

Reading an aranges section

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_aranges	On success returns a pointer to an array of Dwarf_Arange pointers.
dw_arange_count	On success returns a count of the length of the array.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if there is no such section.

9.26.2.5 dwarf_get_cu_die_offset()

```
DW_API int dwarf_get_cu_die_offset (
            Dwarf_Arange dw_arange,
            Dwarf_Off * dw_return_offset,
            Dwarf_Error * dw_error )
```

Given an arange return its CU DIE offset.

Parameters

dw_arange	The specific arange of interest.
dw_return_offset	The CU DIE offset (in .debug_info) applicable to this arange..
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.27 Fast Access to .debug_pubnames and more.

Macros

- #define **DW_GL_GLOBALS** 0 /∗ .debug_pubnames and .debug_names ∗/
- #define **DW_GL_PUBTYPES** 1 /∗ .debug_pubtypes ∗/
- #define **DW_GL_FUNCS** 2 /∗ .debug_funcnames ∗/
- #define **DW_GL_TYPES** 3 /∗ .debug_typenames ∗/
- #define **DW_GL_VARS** 4 /∗ .debug_varnames ∗/
- #define **DW_GL_WEAKS** 5 /∗ .debug_weaknames ∗/

Functions

- DW_API int dwarf_get_globals (Dwarf_Debug dw_dbg, Dwarf_Global ∗∗dw_globals, Dwarf_Signed ∗dw_number_of_globals, Dwarf_Error ∗dw_error)

  Global name space operations, .debug_pubnames access.
- DW_API int dwarf_get_pubtypes (Dwarf_Debug dw_dbg, Dwarf_Global ∗∗dw_pubtypes, Dwarf_Signed ∗dw_number_of_pubtypes, Dwarf_Error ∗dw_error)

  Global debug_types access.
- DW_API int dwarf_globals_by_type (Dwarf_Debug dw_dbg, int dw_requested_section, Dwarf_Global ∗∗dw_contents, Dwarf_Signed ∗dw_count, Dwarf_Error ∗dw_error)

  Allocate Any Fast Access DWARF2-DWARF4.
- DW_API void dwarf_globals_dealloc (Dwarf_Debug dw_dbg, Dwarf_Global ∗dw_global_like, Dwarf_Signed dw_count)

  Dealloc the Dwarf_Global data.
- DW_API int dwarf_globname (Dwarf_Global dw_global, char ∗∗dw_returned_name, Dwarf_Error ∗dw_error)

Return the name of a global-like data item.

- DW_API int dwarf_global_die_offset (Dwarf_Global dw_global, Dwarf_Off ∗dw_die_offset, Dwarf_Error ∗dw_error)

  Return the DIE offset of a global data item.
- DW_API int dwarf_global_cu_offset (Dwarf_Global dw_global, Dwarf_Off ∗dw_cu_header_offset, Dwarf_Error ∗dw_error)

  Return the CU header data of a global data item.
- DW_API int dwarf_global_name_offsets (Dwarf_Global dw_global, char ∗∗dw_returned_name, Dwarf_Off ∗dw_die_offset, Dwarf_Off ∗dw_cu_die_offset, Dwarf_Error ∗dw_error)

  Return the name and offsets of a global entry.
- DW_API Dwarf_Half dwarf_global_tag_number (Dwarf_Global dw_global)

  Return the DW_TAG number of a global entry.
- DW_API int dwarf_get_globals_header (Dwarf_Global dw_global, int ∗dw_category, Dwarf_Off ∗dw_offset←_pub_header, Dwarf_Unsigned ∗dw_length_size, Dwarf_Unsigned ∗dw_length_pub, Dwarf_Unsigned ∗dw←_version, Dwarf_Unsigned ∗dw_header_info_offset, Dwarf_Unsigned ∗dw_info_length, Dwarf_Error ∗dw_←error)

  For more complete globals printing.
- DW_API int dwarf_return_empty_pubnames (Dwarf_Debug dw_dbg, int dw_flag)

  A flag for dwarfdump on pubnames, pubtypes etc.

9.27.1 Detailed Description

Pubnames and Pubtypes overview

These functions each read one of a set of sections designed for fast access by name, but they are not always emitted as they each have somewhat limited and inflexible capabilities. So you may not see many of these.

All have the same set of functions with a name reflecting the specific object section involved. Only the first, of type Dwarf_Global, is documented here in full detail as the others do the same jobs just each for their applicable object section..

9.27.2 Function Documentation

9.27.2.1 dwarf_get_globals()

```
DW_API int dwarf_get_globals (
             Dwarf_Debug dw_dbg,
             Dwarf_Global ** dw_globals,
             Dwarf_Signed * dw_number_of_globals,
             Dwarf_Error * dw_error )
```

Global name space operations, .debug_pubnames access.

This accesses .debug_pubnames and .debug_names sections. Section .debug_pubnames is defined in DWARF2, DWARF3, and DWARF4. Section .debug_names is defined in DWARF5 and contains lots of information, but only the part of the wealth of information that this interface allows can be retrieved here. See dwarf_dnames_header() for access to all. debug_names data.

The code here, as of 0.4.3, September 3 2022, returns data from either section.

See also

Using dwarf_get_globals()

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_globals	On success returns an array of pointers to opaque structs..
dw_number_of_globals	On success returns the number of entries in the array.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if the section is not present.

9.27.2.2 dwarf_get_globals_header()

```
DW_API int dwarf_get_globals_header (
            Dwarf_Global dw_global,
            int * dw_category,
            Dwarf_Off * dw_offset_pub_header,
            Dwarf_Unsigned * dw_length_size,
            Dwarf_Unsigned * dw_length_pub,
            Dwarf_Unsigned * dw_version,
            Dwarf_Unsigned * dw_header_info_offset,
            Dwarf_Unsigned * dw_info_length,
            Dwarf_Error * dw_error )
```

For more complete globals printing.

For each CU represented in .debug_pubnames, etc, there is a .debug_pubnames header. For any given Dwarf←
_Global this returns the content of the applicable header. This does not include header information from any .debug_names headers.

The function declaration changed at version 0.6.0.

9.27.2.3 dwarf_get_pubtypes()

```
DW_API int dwarf_get_pubtypes (
            Dwarf_Debug dw_dbg,
            Dwarf_Global ** dw_pubtypes,
            Dwarf_Signed * dw_number_of_pubtypes,
            Dwarf_Error * dw_error )
```

Global debug_types access.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_pubtypes	On success returns an array of pointers to opaque structs..
dw_number_of_pubtypes	On success returns the number of entries in the array.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if the section is not present.

Same function name as 0.5.0 and earlier, but the data type changes to Dwarf_Global

dwarf_get_pubtypes() is an alternate name for dwarf_globals_by_type(..,DW_GL_PUBTYPES,..).

9.27.2.4 dwarf_global_cu_offset()

```
DW_API int dwarf_global_cu_offset (
            Dwarf_Global dw_global,
            Dwarf_Off * dw_cu_header_offset,
            Dwarf_Error * dw_error )
```

Return the CU header data of a global data item.

A CU header offset is rarely useful.

Parameters

dw_global	The Dwarf_Global of interest.
dw_cu_header_offset	On success a the section-global offset of a CU header is returned.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.27.2.5 dwarf_global_die_offset()

```
DW_API int dwarf_global_die_offset (
            Dwarf_Global dw_global,
            Dwarf_Off * dw_die_offset,
            Dwarf_Error * dw_error )
```

Return the DIE offset of a global data item.

Parameters

dw_global	The Dwarf_Global of interest.
dw_die_offset	On success a the section-global DIE offset of a data item is returned.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.27.2.6 dwarf_global_name_offsets()

```
DW_API int dwarf_global_name_offsets (
            Dwarf_Global dw_global,
            char ** dw_returned_name,
            Dwarf_Off * dw_die_offset,
            Dwarf_Off * dw_cu_die_offset,
            Dwarf_Error * dw_error )
```

Return the name and offsets of a global entry.

Parameters

dw_global	The Dwarf_Global of interest.
dw_returned_name	On success a pointer to the name (a null-terminated string) is returned.
dw_die_offset	On success a the section-global DIE offset of the global with the name.
dw_cu_die_offset	On success a the section-global offset of the relevant CU DIE is returned.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.27.2.7 dwarf_global_tag_number()

```
DW_API Dwarf_Half dwarf_global_tag_number (
            Dwarf_Global dw_global )
```

Return the DW_TAG number of a global entry.

Parameters

dw_global	The Dwarf_Global of interest.

Returns

If the Dwarf_Global refers to a global from the .debug_names section the return value is the DW_TAG for the DIE in the global entry, for example DW_TAG_subprogram. In case of error or if the section for this global was not .debug_names zero is returned.

9.27.2.8 dwarf_globals_by_type()

```
DW_API int dwarf_globals_by_type (
            Dwarf_Debug dw_dbg,
            int dw_requested_section,
            Dwarf_Global ** dw_contents,
            Dwarf_Signed * dw_count,
            Dwarf_Error * dw_error )
```

Allocate Any Fast Access DWARF2-DWARF4.

This interface new in 0.6.0. Simplfies access by replace dwarf_get_pubtypes, dwarf_get_funcs, dwarf_get_types, dwarfget_vars, and dwarf_get_weaks with a single set of types.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_requested_section	Pass in one of the values DW_GL_GLOBALS through DW_GL_WEAKS to select the section to extract data from.
dw_contents	On success returns an array of pointers to opaque structs.
dw_count	On success returns the number of entries in the array.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if the section is not present.

9.27.2.9 dwarf_globals_dealloc()

```
DW_API void dwarf_globals_dealloc (
            Dwarf_Debug dw_dbg,
            Dwarf_Global * dw_global_like,
            Dwarf_Signed dw_count )
```

Dealloc the Dwarf_Global data.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_global_like	The array of globals/types/etc data to dealloc (free).
dw_count	The number of entries in the array.

9.27.2.10 dwarf_globname()

```
DW_API int dwarf_globname (
            Dwarf_Global dw_global,
            char ** dw_returned_name,
            Dwarf_Error * dw_error )
```

Return the name of a global-like data item.

Parameters

dw_global	The Dwarf_Global of interest.
dw_returned_name	On success a pointer to the name (a null-terminated string) is returned.
dw_error	On error dw_error is set to point to the error details.

Returns

The usual value: DW_DLV_OK etc.

9.27.2.11 dwarf_return_empty_pubnames()

```
DW_API int dwarf_return_empty_pubnames (
            Dwarf_Debug dw_dbg,
            int dw_flag )
```

A flag for dwarfdump on pubnames, pubtypes etc.

Sets a flag in the dbg. Always returns DW_DLV_OK. Applies to all the sections of this kind: pubnames, pubtypes, funcs, typenames,vars, weaks. Ensures empty content (meaning no offset/name tuples, but with a header) for a CU shows up rather than being suppressed.

Primarily useful if one wants to note any pointless header data in the section.

Pubnames and Pubtypes overview

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_flag	Must be the value one.

Returns

Returns DW_DLV_OK. Always.

9.28 Fast Access to GNU .debug_gnu_pubnames

Functions

- DW_API int dwarf_get_gnu_index_head (Dwarf_Debug dw_dbg, Dwarf_Bool dw_which_section, Dwarf_Gnu_Index_Head ∗dw_head, Dwarf_Unsigned ∗dw_index_block_count_out, Dwarf_Error ∗dw_↩ error)

  Access to .debug_gnu_pubnames or .debug_gnu_pubtypes.
- DW_API void dwarf_gnu_index_dealloc (Dwarf_Gnu_Index_Head dw_head)

  Free resources of .debug_gnu_pubnames .debug_gnu_pubtypes.
- DW_API int dwarf_get_gnu_index_block (Dwarf_Gnu_Index_Head dw_head, Dwarf_Unsigned dw_number, Dwarf_Unsigned ∗dw_block_length, Dwarf_Half ∗dw_version, Dwarf_Unsigned ∗dw_offset_into_debug↩ _info, Dwarf_Unsigned ∗dw_size_of_debug_info_area, Dwarf_Unsigned ∗dw_count_of_index_entries, Dwarf_Error ∗dw_error)

  Access a particular block.
- DW_API int dwarf_get_gnu_index_block_entry (Dwarf_Gnu_Index_Head dw_head, Dwarf_Unsigned dw↩ _blocknumber, Dwarf_Unsigned dw_entrynumber, Dwarf_Unsigned ∗dw_offset_in_debug_info, const char ∗∗dw_name_string, unsigned char ∗dw_flagbyte, unsigned char ∗dw_staticorglobal, unsigned char ∗dw_↩ typeofentry, Dwarf_Error ∗dw_error)

  Access a particular entry of a block.

9.28.1 Detailed Description

Section .debug_gnu_pubnames or .debug_gnu_pubtypes.

This is a section created for and used by the GNU gdb debugger to access DWARF information.

Not part of standard DWARF.

9.28.2 Function Documentation

9.28.2.1 dwarf_get_gnu_index_block()

```
DW_API int dwarf_get_gnu_index_block (
            Dwarf_Gnu_Index_Head dw_head,
            Dwarf_Unsigned dw_number,
            Dwarf_Unsigned * dw_block_length,
            Dwarf_Half * dw_version,
            Dwarf_Unsigned * dw_offset_into_debug_info,
            Dwarf_Unsigned * dw_size_of_debug_info_area,
            Dwarf_Unsigned * dw_count_of_index_entries,
            Dwarf_Error * dw_error )
```

Access a particular block.

Parameters

dw_head	Pass in the Dwarf_Gnu_Index_head interest.
dw_number	Pass in the block number of the block of interest. 0 through dw_index_block_count_out-1.
dw_block_length	On success set to the length of the data in this block, in bytes.
dw_version	On success set to the version number of the block.
dw_offset_into_debug_info	On success set to the offset, in .debug_info, of the data for this block. The returned offset may be outside the bounds of the actual .debug_info section, such a possibility does not cause the function to return DW_DLV_ERROR.
dw_size_of_debug_info_area	On success set to the size in bytes, in .debug_info, of the area this block refers to. The returned dw_ dw_size_of_debug_info_are plus dw_offset_into_debug_info may be outside the bounds of the actual .debug_info section, such a possibility does not cause the function to return DW_DLV_ERROR. Use dwarf_get_section_max_offsets_d() to learn the size of .debug_info and optionally other sections as well.
dw_count_of_index_entries	On success set to the count of index entries in this particular block number.
dw_error	On error dw_error is set to point to the error details.

Returns

Returns DW_DLV_OK, DW_DLV_NO_ENTRY (if the section does not exist or is empty), or, in case of an error reading the section, DW_DLV_ERROR.

9.28.2.2 dwarf_get_gnu_index_block_entry()

```
DW_API int dwarf_get_gnu_index_block_entry (
            Dwarf_Gnu_Index_Head dw_head,
            Dwarf_Unsigned dw_blocknumber,
            Dwarf_Unsigned dw_entrynumber,
            Dwarf_Unsigned * dw_offset_in_debug_info,
            const char ** dw_name_string,
            unsigned char * dw_flagbyte,
            unsigned char * dw_staticorglobal,
            unsigned char * dw_typeofentry,
            Dwarf_Error * dw_error )
```

Access a particular entry of a block.

Access to a single entry in a block.

Parameters

dw_head	Pass in the Dwarf_Gnu_Index_head interest.
dw_blocknumber	Pass in the block number of the block of interest. 0 through dw_index_block_count_out-1.
dw_entrynumber	Pass in the entry number of the entry of interest. 0 through dw_count_of_index_entries-1.
dw_offset_in_debug_info	On success set to the offset in .debug_info relevant to this entry.
dw_name_string	On success set to the size in bytes, in .debug_info, of the area this block refersto.
dw_flagbyte	On success set to the entry flag byte content.
dw_staticorglobal	On success set to the entry static/global letter.
dw_typeofentry	On success set to the type of entry.
dw_error	On error dw_error is set to point to the error details.

Returns

Returns DW_DLV_OK, DW_DLV_NO_ENTRY (if the section does not exist or is empty), or, in case of an error reading the section, DW_DLV_ERROR.

9.28.2.3 dwarf_get_gnu_index_head()

```
DW_API int dwarf_get_gnu_index_head (
            Dwarf_Debug dw_dbg,
            Dwarf_Bool dw_which_section,
            Dwarf_Gnu_Index_Head * dw_head,
            Dwarf_Unsigned * dw_index_block_count_out,
            Dwarf_Error * dw_error )
```

Access to .debug_gnu_pubnames or .debug_gnu_pubtypes.

Call this to get access.

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest.
dw_which_section	Pass in TRUE to access .debug_gnu_pubnames. Pass in FALSE to access .debug_gnu_typenames.
dw_head	On success, set to a pointer to a head record allowing access to all the content of the section.
dw_index_block_count_out	On success, set to a count of the number of blocks of data available.
dw_error	

Returns

Returns DW_DLV_OK, DW_DLV_NO_ENTRY (if the section does not exist or is empty), or, in case of an error reading the section, DW_DLV_ERROR.

9.28.2.4 dwarf_gnu_index_dealloc()

```
DW_API void dwarf_gnu_index_dealloc (
            Dwarf_Gnu_Index_Head dw_head )
```

Free resources of .debug_gnu_pubnames .debug_gnu_pubtypes.

Call this to deallocate all memory used by dw_head.

Parameters

dw_head	Pass in the Dwarf_Gnu_Index_head whose data is to be deallocated.

9.29 Fast Access to Gdb Index

Functions

- DW_API int dwarf_gdbindex_header (Dwarf_Debug dw_dbg, Dwarf_Gdbindex ∗dw_gdbindexptr, Dwarf_Unsigned ∗dw_version, Dwarf_Unsigned ∗dw_cu_list_offset, Dwarf_Unsigned ∗dw_types_←cu_list_offset, Dwarf_Unsigned ∗dw_address_area_offset, Dwarf_Unsigned ∗dw_symbol_table_offset, Dwarf_Unsigned ∗dw_constant_pool_offset, Dwarf_Unsigned ∗dw_section_size, const char ∗∗dw_section←_name, Dwarf_Error ∗dw_error)

  Open access to the .gdb_index section.
- DW_API void dwarf_dealloc_gdbindex (Dwarf_Gdbindex dw_gdbindexptr)

  Free (dealloc) all allocated Dwarf_Gdbindex memory It should named dwarf_dealloc_gdbindex.
- DW_API int dwarf_gdbindex_culist_array (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned ∗dw_list_←length, Dwarf_Error ∗dw_error)

  Return the culist array length.
- DW_API int dwarf_gdbindex_culist_entry (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_←entryindex, Dwarf_Unsigned ∗dw_cu_offset, Dwarf_Unsigned ∗dw_cu_length, Dwarf_Error ∗dw_error)

  For a CU entry in the list return the offset and length.
- DW_API int dwarf_gdbindex_types_culist_array (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned ∗dw_←types_list_length, Dwarf_Error ∗dw_error)

  Return the types culist array length.
- DW_API int dwarf_gdbindex_types_culist_entry (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_←types_entryindex, Dwarf_Unsigned ∗dw_cu_offset, Dwarf_Unsigned ∗dw_tu_offset, Dwarf_Unsigned ∗dw←_type_signature, Dwarf_Error ∗dw_error)

  For a types CU entry in the list returns the offset and length.
- DW_API int dwarf_gdbindex_addressarea (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned ∗dw_←addressarea_list_length, Dwarf_Error ∗dw_error)

  Get access to gdbindex address area.
- DW_API int dwarf_gdbindex_addressarea_entry (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw←_entryindex, Dwarf_Unsigned ∗dw_low_address, Dwarf_Unsigned ∗dw_high_address, Dwarf_Unsigned ∗dw_cu_index, Dwarf_Error ∗dw_error)

  Get an address area value.
- DW_API int dwarf_gdbindex_symboltable_array (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned ∗dw_←symtab_list_length, Dwarf_Error ∗dw_error)

  Get access to the symboltable array.
- DW_API int dwarf_gdbindex_symboltable_entry (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_←entryindex, Dwarf_Unsigned ∗dw_string_offset, Dwarf_Unsigned ∗dw_cu_vector_offset, Dwarf_Error ∗dw←_error)

  Access individual symtab entry.
- DW_API int dwarf_gdbindex_cuvector_length (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_←cuvector_offset, Dwarf_Unsigned ∗dw_innercount, Dwarf_Error ∗dw_error)

  Get access to a cuvector.

- DW_API int dwarf_gdbindex_cuvector_inner_attributes (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_cuvector_offset_in, Dwarf_Unsigned dw_innerindex, Dwarf_Unsigned ∗dw_field_value, Dwarf_Error ∗dw_error)

  Get access to a cuvector.
- DW_API int dwarf_gdbindex_cuvector_instance_expand_value (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_field_value, Dwarf_Unsigned ∗dw_cu_index, Dwarf_Unsigned ∗dw_symbol_kind, Dwarf_Unsigned ∗dw_is_static, Dwarf_Error ∗dw_error)

  Expand the bit fields in a cuvector entry.
- DW_API int dwarf_gdbindex_string_by_offset (Dwarf_Gdbindex dw_gdbindexptr, Dwarf_Unsigned dw_↩ stringoffset, const char ∗∗dw_string_ptr, Dwarf_Error ∗dw_error)

  Retrieve a symbol name from the index data.

9.29.1 Detailed Description

Section .gdb_index

This is a section created for and used by the GNU gdb debugger to access DWARF information.

Not part of standard DWARF.

See also

`https://sourceware.org/gdb/onlinedocs/gdb/Index-Section-Format.html#↩ Index-Section-Format`

Version 8 built by gdb, so type entries are ok as is. Version 7 built by the 'gold' linker and type index entries for a CU must be derived otherwise, the type index is not correct... Earlier versions cannot be read correctly by the functions here.

The functions here make it possible to print the section content in detail, there is no search function here.

9.29.2 Function Documentation

9.29.2.1 dwarf_dealloc_gdbindex()

```
DW_API void dwarf_dealloc_gdbindex (
            Dwarf_Gdbindex dw_gdbindexptr )
```

Free (dealloc) all allocated Dwarf_Gdbindex memory It should named dwarf_dealloc_gdbindex.

Parameters

dw_gdbindexptr	Pass in a valid dw_gdbindexptr and on return assign zero to dw_gdbindexptr as it is stale.

9.29.2.2 dwarf_gdbindex_addressarea()

```
DW_API int dwarf_gdbindex_addressarea (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned * dw_addressarea_list_length,
            Dwarf_Error * dw_error )
```

Get access to gdbindex address area.

See also

Reading gdbindex addressarea

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_addressarea_list_length	On success returns the number of entries in the addressarea.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.3 dwarf_gdbindex_addressarea_entry()

```
DW_API int dwarf_gdbindex_addressarea_entry (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_entryindex,
            Dwarf_Unsigned * dw_low_address,
            Dwarf_Unsigned * dw_high_address,
            Dwarf_Unsigned * dw_cu_index,
            Dwarf_Error * dw_error )
```

Get an address area value.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_entryindex	Pass in an index, 0 through dw_addressarea_list_length-1. addressarea.
dw_low_address	On success returns the low address for the entry.
dw_high_address	On success returns the high address for the entry.
dw_cu_index	On success returns the index to the cu for the entry.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.4 dwarf_gdbindex_culist_array()

```
DW_API int dwarf_gdbindex_culist_array (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned * dw_list_length,
            Dwarf_Error * dw_error )
```

Return the culist array length.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_list_length	On success returns the array length of the cu list.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.5 dwarf_gdbindex_culist_entry()

```
DW_API int dwarf_gdbindex_culist_entry (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_entryindex,
            Dwarf_Unsigned * dw_cu_offset,
            Dwarf_Unsigned * dw_cu_length,
            Dwarf_Error * dw_error )
```

For a CU entry in the list return the offset and length.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_entryindex	Pass in a number from 0 through dw_list_length-1. If dw_entryindex is too large for the array the function returns DW_DLV_NO_ENTRY.
dw_cu_offset	On success returns the CU offset for this list entry.
dw_cu_length	On success returns the CU length(in bytes) for this list entry.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.6 dwarf_gdbindex_cuvector_inner_attributes()

```
DW_API int dwarf_gdbindex_cuvector_inner_attributes (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_cuvector_offset_in,
            Dwarf_Unsigned dw_innerindex,
            Dwarf_Unsigned * dw_field_value,
            Dwarf_Error * dw_error )
```

Get access to a cuvector.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_cuvector_offset↩ _in	Pass in the value of dw_cuvector_offset
dw_innerindex	Pass in the index of the CU vector in, from 0 through dw_innercount-1.
dw_field_value	On success returns a field of bits. To expand the bits call dwarf_gdbindex_cuvector_instance_expand_value.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.7 dwarf_gdbindex_cuvector_instance_expand_value()

```
DW_API int dwarf_gdbindex_cuvector_instance_expand_value (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_field_value,
            Dwarf_Unsigned * dw_cu_index,
            Dwarf_Unsigned * dw_symbol_kind,
            Dwarf_Unsigned * dw_is_static,
            Dwarf_Error * dw_error )
```

Expand the bit fields in a cuvector entry.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_field_value	Pass in the dw_field_value returned by dwarf_gdbindex_cuvector_inner_attributes.
dw_cu_index	On success returns the CU index from the dw_field_value
dw_symbol_kind	On success returns the symbol kind (see the sourceware page. Kinds are TYPE, VARIABLE, or FUNCTION.
dw_is_static	On success returns non-zero if the entry is a static symbol (file-local, as in C or C++), otherwise it returns non-zero and the symbol is global.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.8 dwarf_gdbindex_cuvector_length()

```
DW_API int dwarf_gdbindex_cuvector_length (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_cuvector_offset,
            Dwarf_Unsigned * dw_innercount,
            Dwarf_Error * dw_error )
```

Get access to a cuvector.

See also

Reading the gdbindex symbol table

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_cuvector_offset	Pass in the offset, dw_cu_vector_offset.
dw_innercount	On success returns the number of CUs in the cuvector instance array.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.9 dwarf_gdbindex_header()

```
DW_API int dwarf_gdbindex_header (
             Dwarf_Debug dw_dbg,
             Dwarf_Gdbindex * dw_gdbindexptr,
             Dwarf_Unsigned * dw_version,
             Dwarf_Unsigned * dw_cu_list_offset,
             Dwarf_Unsigned * dw_types_cu_list_offset,
             Dwarf_Unsigned * dw_address_area_offset,
             Dwarf_Unsigned * dw_symbol_table_offset,
             Dwarf_Unsigned * dw_constant_pool_offset,
             Dwarf_Unsigned * dw_section_size,
             const char ** dw_section_name,
             Dwarf_Error * dw_error )
```

Open access to the .gdb_index section.

The section is a single table one thinks.

See also

Reading gdbindex data

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_gdbindexptr	On success returns a pointer to make access to table details possible.
dw_version	On success returns the table version.
dw_cu_list_offset	On success returns the offset of the cu_list in the section.
dw_types_cu_list_offset	On success returns the offset of the types cu_list in the section.
dw_address_area_offset	On success returns the area pool offset.
dw_symbol_table_offset	On success returns the symbol table offset.
dw_constant_pool_offset	On success returns the constant pool offset.
dw_section_size	On success returns section size.
dw_section_name	On success returns section name.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if the section is absent.

9.29.2.10 dwarf_gdbindex_string_by_offset()

```
DW_API int dwarf_gdbindex_string_by_offset (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_stringoffset,
            const char ** dw_string_ptr,
            Dwarf_Error * dw_error )
```

Retrieve a symbol name from the index data.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_stringoffset	Pass in the string offset returned by dwarf_gdbindex_symboltable_entry
dw_string_ptr	On success returns a a pointer to the null-terminated string.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.11 dwarf_gdbindex_symboltable_array()

```
DW_API int dwarf_gdbindex_symboltable_array (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned * dw_symtab_list_length,
            Dwarf_Error * dw_error )
```

Get access to the symboltable array.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_symtab_list_length	On success returns the number of entries in the symbol table
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.12 dwarf_gdbindex_symboltable_entry()

```
DW_API int dwarf_gdbindex_symboltable_entry (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_entryindex,
            Dwarf_Unsigned * dw_string_offset,
            Dwarf_Unsigned * dw_cu_vector_offset,
            Dwarf_Error * dw_error )
```

Access individual symtab entry.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_entryindex	Pass in a valid index in the range 0 through dw_symtab_list_length-1 If the value is greater than dw_symtab_list_length-1 the function returns DW_DLV_NO_ENTRY;
dw_string_offset	On success returns the string offset in the appropriate string section.
dw_cu_vector_offset	On success returns the CU vector offset.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.13 dwarf_gdbindex_types_culist_array()

```
DW_API int dwarf_gdbindex_types_culist_array (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned * dw_types_list_length,
            Dwarf_Error * dw_error )
```

Return the types culist array length.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_types_list_length	On success returns the array length of the types cu list.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.29.2.14 dwarf_gdbindex_types_culist_entry()

```
DW_API int dwarf_gdbindex_types_culist_entry (
            Dwarf_Gdbindex dw_gdbindexptr,
            Dwarf_Unsigned dw_types_entryindex,
            Dwarf_Unsigned * dw_cu_offset,
            Dwarf_Unsigned * dw_tu_offset,
            Dwarf_Unsigned * dw_type_signature,
            Dwarf_Error * dw_error )
```

For a types CU entry in the list returns the offset and length.

Parameters

dw_gdbindexptr	Pass in the Dwarf_Gdbindex pointer of interest.
dw_types_entryindex	Pass in a number from 0 through dw_list_length-1. If the value is greater than dw_list_length-1 the function returns DW_DLV_NO_ENTRY.
dw_cu_offset	On success returns the types CU offset for this list entry.
dw_tu_offset	On success returns the tu offset for this list entry.
dw_type_signature	On success returns the type unit offset for this entry if the type has a signature.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.30 Fast Access to Split Dwarf (Debug Fission)

Functions

- DW_API int dwarf_get_xu_index_header (Dwarf_Debug dw_dbg, const char ∗dw_section_type, Dwarf_Xu_Index_Header ∗dw_xuhdr, Dwarf_Unsigned ∗dw_version_number, Dwarf_Unsigned ∗dw_section_count, Dwarf_Unsigned ∗dw_units_count, Dwarf_Unsigned ∗dw_hash_slots_count, const char ∗∗dw_sect_name, Dwarf_Error ∗dw_error)

  Access a .debug_cu_index or dw_tu_index section.
- DW_API void dwarf_dealloc_xu_header (Dwarf_Xu_Index_Header dw_xuhdr)

  Dealloc (free) memory associated with dw_xuhdr.
- DW_API int dwarf_get_xu_index_section_type (Dwarf_Xu_Index_Header dw_xuhdr, const char ∗∗dw_←typename, const char ∗∗dw_sectionname, Dwarf_Error ∗dw_error)

  Return basic information about a Dwarf_Xu_Index_Header.
- DW_API int dwarf_get_xu_hash_entry (Dwarf_Xu_Index_Header dw_xuhdr, Dwarf_Unsigned dw_index, Dwarf_Sig8 ∗dw_hash_value, Dwarf_Unsigned ∗dw_index_to_sections, Dwarf_Error ∗dw_error)

  Get a Hash Entry.
- DW_API int dwarf_get_xu_section_names (Dwarf_Xu_Index_Header dw_xuhdr, Dwarf_Unsigned dw_←column_index, Dwarf_Unsigned ∗dw_SECT_number, const char ∗∗dw_SECT_name, Dwarf_Error ∗dw_←error)

  get DW_SECT value for a column.
- DW_API int dwarf_get_xu_section_offset (Dwarf_Xu_Index_Header dw_xuhdr, Dwarf_Unsigned dw_row_←index, Dwarf_Unsigned dw_column_index, Dwarf_Unsigned ∗dw_sec_offset, Dwarf_Unsigned ∗dw_sec_←size, Dwarf_Error ∗dw_error)

  Get row data (section data) for a row and column.
- DW_API int dwarf_get_debugfission_for_die (Dwarf_Die dw_die, Dwarf_Debug_Fission_Per_CU ∗dw_←percu_out, Dwarf_Error ∗dw_error)

  Get debugfission data for a Dwarf_Die.
- DW_API int dwarf_get_debugfission_for_key (Dwarf_Debug dw_dbg, Dwarf_Sig8 ∗dw_hash_sig, const char ∗dw_cu_type, Dwarf_Debug_Fission_Per_CU ∗dw_percu_out, Dwarf_Error ∗dw_error)

  Given a hash signature find per-cu Fission data.

9.30.1 Detailed Description

9.30.2 Function Documentation

9.30.2.1 dwarf_dealloc_xu_header()

```
DW_API void dwarf_dealloc_xu_header (
            Dwarf_Xu_Index_Header dw_xuhdr )
```

Dealloc (free) memory associated with dw_xuhdr.

Should be named dwarf_dealloc_xuhdr instead.

Parameters

dw_xuhdr	Dealloc (free) all associated memory. The caller should zero the passed in value on return as it is then a stale value.

9.30.2.2 dwarf_get_debugfission_for_die()

```
DW_API int dwarf_get_debugfission_for_die (
            Dwarf_Die dw_die,
            Dwarf_Debug_Fission_Per_CU * dw_percu_out,
            Dwarf_Error * dw_error )
```

Get debugfission data for a Dwarf_Die.

For any Dwarf_Die in a compilation unit, return the debug fission table data through dw_percu_out. Usually applications will pass in the CU die. Calling code should zero all of the struct Dwarf_Debug_Fission_Per_CU_s before calling this. If there is no debugfission data this returns DW_DLV_NO_ENTRY (only .dwp objects have debugfission data)

Parameters

dw_die	Pass in a Dwarf_Die pointer, Usually pass in a CU DIE pointer.
dw_percu_out	Pass in a pointer to a zeroed structure. On success the function fills in the structure.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.30.2.3 dwarf_get_debugfission_for_key()

```
DW_API int dwarf_get_debugfission_for_key (
            Dwarf_Debug dw_dbg,
            Dwarf_Sig8 * dw_hash_sig,
            const char * dw_cu_type,
            Dwarf_Debug_Fission_Per_CU * dw_percu_out,
            Dwarf_Error * dw_error )
```

Given a hash signature find per-cu Fission data.

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest.
dw_hash_sig	Pass in a pointer to a Dwarf_Sig8 containing a hash value of interest.
dw_cu_type	Pass in the type, a string. Either "cu" or "tu".
dw_percu_out	Pass in a pointer to a zeroed structure. On success the function fills in the structure.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.30.2.4 dwarf_get_xu_hash_entry()

```
DW_API int dwarf_get_xu_hash_entry (
            Dwarf_Xu_Index_Header dw_xuhdr,
            Dwarf_Unsigned dw_index,
            Dwarf_Sig8 * dw_hash_value,
            Dwarf_Unsigned * dw_index_to_sections,
            Dwarf_Error * dw_error )
```

Get a Hash Entry.

See also

examplez/x

Parameters

dw_xuhdr	Pass in an open header pointer.
dw_index	Pass in the index of the entry you wish. Valid index values are 0 through **S-1**. If the dw_index passed in is outside the valid range the functionj
dw_hash_value	Pass in a pointer to a Dwarf_Sig8. On success the hash struct is filled in with the 8 byte hash value.
dw_index_to_sections	On success returns the offset/size table index for this hash entry.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK on success. If the dw_index passed in is outside the valid range the function it returns DW_DLV_NO_ENTRY (before version 0.7.0 it returned DW_DLV_ERROR, though nothing mentioned that). In case of error it returns DW_DLV_ERROR. If dw_error is non-null returns error details through dw_error (the usual error behavior).

9.30.2.5 dwarf_get_xu_index_header()

```
DW_API int dwarf_get_xu_index_header (
            Dwarf_Debug dw_dbg,
            const char * dw_section_type,
            Dwarf_Xu_Index_Header * dw_xuhdr,
            Dwarf_Unsigned * dw_version_number,
            Dwarf_Unsigned * dw_section_count,
            Dwarf_Unsigned * dw_units_count,
            Dwarf_Unsigned * dw_hash_slots_count,
            const char ** dw_sect_name,
            Dwarf_Error * dw_error )
```

Access a .debug_cu_index or dw_tu_index section.

These sections are in a DWARF5 package file, a file normally named with the .dwo or .dwp extension.. See DWARF5 section 7.3.5.3 Format of the CU and TU Index Sections.

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest
dw_section_type	Pass in a pointer to either "cu" or "tu".
dw_xuhdr	On success, returns a pointer usable in further calls.
dw_version_number	On success returns five.
dw_section_count	On success returns the number of entries in the table of section counts. Referred to as **N**.
dw_units_count	On success returns the number of compilation units or type units in the index. Referred to as **U**.
dw_hash_slots_count	On success returns the number of slots in the hash table. Referred to as **S**.
dw_sect_name	On success returns a pointer to the name of the section. Do not free/dealloc the returned pointer.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc. Returns DW_DLV_NO_ENTRY if the section requested is not present.

9.30.2.6 dwarf_get_xu_index_section_type()

```
DW_API int dwarf_get_xu_index_section_type (
                Dwarf_Xu_Index_Header dw_xuhdr,
                const char ** dw_typename,
                const char ** dw_sectionname,
                Dwarf_Error * dw_error )
```

Return basic information about a Dwarf_Xu_Index_Header.

Parameters

dw_xuhdr	Pass in an open header pointer.
dw_typename	On success returns a pointer to the immutable string "tu" or "cu". Do not free.
dw_sectionname	On success returns a pointer to the section name in the object file. Do not free.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.30.2.7 dwarf_get_xu_section_names()

```
DW_API int dwarf_get_xu_section_names (
             Dwarf_Xu_Index_Header dw_xuhdr,
             Dwarf_Unsigned dw_column_index,
             Dwarf_Unsigned * dw_SECT_number,
             const char ** dw_SECT_name,
             Dwarf_Error * dw_error )
```

get DW_SECT value for a column.

See also

Reading Split Dwarf (Debug Fission) data

Parameters

dw_xuhdr	Pass in an open header pointer.
dw_column_index	The section names are in row zero of the table so we do not mention the row number at all. Pass in the column of the entry you wish. Valid dw_column_index values are 0 through **N-1**.
dw_SECT_number	On success returns DW_SECT_INFO or other section id as appears in dw_column_index.
dw_SECT_name	On success returns a pointer to the string with the section name.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.30.2.8 dwarf_get_xu_section_offset()

```
DW_API int dwarf_get_xu_section_offset (
             Dwarf_Xu_Index_Header dw_xuhdr,
             Dwarf_Unsigned dw_row_index,
             Dwarf_Unsigned dw_column_index,
             Dwarf_Unsigned * dw_sec_offset,
             Dwarf_Unsigned * dw_sec_size,
             Dwarf_Error * dw_error )
```

Get row data (section data) for a row and column.

The section offset represents a base offset for the section the row data refers to. DWARF6 Section 7.3.5.3 page 193.

Parameters

dw_xuhdr	Pass in an open header pointer.
dw_row_index	Pass in a row number , 1 through **U**
dw_column_index	Pass in a column number , 0 through **N-1**
dw_sec_offset	On success returns the section offset of the section whose name dwarf_get_xu_section_names returns.
dw_sec_size	On success returns the section size of the section whose name dwarf_get_xu_section_names returns. If the returned section size is zero then this column makes no contribution to the dwp object file and the dw_sec_size and dw_sec_offset shoul be ignored.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.31 Access GNU .gnu_debuglink, build-id.

Functions

- DW_API int dwarf_gnu_debuglink (Dwarf_Debug dw_dbg, char ∗∗dw_debuglink_path_returned, unsigned char ∗∗dw_crc_returned, char ∗∗dw_debuglink_fullpath_returned, unsigned int ∗dw_debuglink_path_↩ length_returned, unsigned int ∗dw_buildid_type_returned, char ∗∗dw_buildid_owner_name_returned, unsigned char ∗∗dw_buildid_returned, unsigned int ∗dw_buildid_length_returned, char ∗∗∗dw_paths_returned, unsigned int ∗dw_paths_length_returned, Dwarf_Error ∗dw_error)

  Find a separated DWARF object file.
- DW_API int dwarf_suppress_debuglink_crc (int dw_suppress)

  Suppressing crc calculations.
- DW_API int dwarf_add_debuglink_global_path (Dwarf_Debug dw_dbg, const char ∗dw_pathname, Dwarf_Error ∗dw_error)

  Adding debuglink global paths.
- DW_API int dwarf_crc32 (Dwarf_Debug dw_dbg, unsigned char ∗dw_crcbuf, Dwarf_Error ∗dw_error)

  Crc32 used for debuglink crc calculation.
- DW_API unsigned int dwarf_basic_crc32 (const unsigned char ∗dw_buf, unsigned long dw_len, unsigned int dw_init)

  Public interface to the real crc calculation.

9.31.1 Detailed Description

When DWARF sections are in a different object than the executable or a normal shared object. The special GNU section provides a way to name the object file with DWARF.

libdwarf will attempt to use this data to find the object file with DWARF.

Has nothing to do with split-dwarf/debug-fission.

9.31.2 Function Documentation

9.31.2.1 dwarf_add_debuglink_global_path()

```
DW_API int dwarf_add_debuglink_global_path (
            Dwarf_Debug dw_dbg,
            const char * dw_pathname,
            Dwarf_Error * dw_error )
```

Adding debuglink global paths.

Used inside src/bin/dwarfexample/dwdebuglink.c so we can show all that is going on. The following has the explanation for how debuglink and global paths interact:

See also

https://sourceware.org/gdb/onlinedocs/gdb/Separate-Debug-Files.html

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest.
dw_pathname	Pass in a pathname to add to the list of global paths used by debuglink.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.31.2.2 dwarf_basic_crc32()

```
DW_API unsigned int dwarf_basic_crc32 (
            const unsigned char * dw_buf,
            unsigned long dw_len,
            unsigned int dw_init )
```

Public interface to the real crc calculation.

It is unlikely this is useful. The calculation will not produce a return matching that of Linux/Macos if the compiler implements unsigned int or signed int as 16 bits long.

The caller must guarantee that dw_buf is non-null and pointing to dw_len bytes of readable memory. If dw_buf is NULL then 0 is immediately returned and there is no indication of error.

Parameters

dw_buf	Pass in a pointer to some bytes on which the crc calculation as done in debuglink is to be done.
dw_len	Pass in the length in bytes of dw_buf.
dw_init	Pass in the initial 32 bit value, zero is the right choice.

Returns

Returns an int (assumed 32 bits int!) with the calculated crc.

9.31.2.3 dwarf_crc32()

```
DW_API int dwarf_crc32 (
            Dwarf_Debug dw_dbg,
            unsigned char * dw_crcbuf,
            Dwarf_Error * dw_error )
```

Crc32 used for debuglink crc calculation.

Caller passes pointer to array of 4 unsigned char provided by the caller and if this returns DW_DLV_OK that array is filled in.

Callers must guarantee dw_crcbuf points to at least 4 bytes of writable memory. Passing in a null dw_crcbug results in an immediate return of DW_DLV_NO_ENTRY and the pointer is not used.

Parameters

dw_dbg	Pass in an open dw_dbg. When you attempted to open it, and it succeeded then pass the it via the Dwarf_Debug The function reads the file into memory and performs a crc calculation.
dw_crcbuf	Pass in a pointer to a 4 byte area to hold the returned crc, on success the function puts the 4 bytes there.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.31.2.4 dwarf_gnu_debuglink()

```
DW_API int dwarf_gnu_debuglink (
            Dwarf_Debug dw_dbg,
            char ** dw_debuglink_path_returned,
            unsigned char ** dw_crc_returned,
            char ** dw_debuglink_fullpath_returned,
            unsigned int * dw_debuglink_path_length_returned,
            unsigned int * dw_buildid_type_returned,
            char ** dw_buildid_owner_name_returned,
            unsigned char ** dw_buildid_returned,
            unsigned int * dw_buildid_length_returned,
            char *** dw_paths_returned,
            unsigned int * dw_paths_length_returned,
            Dwarf_Error * dw_error )
```

Find a separated DWARF object file.

.gnu_debuglink and/or the section .note.gnu.build-id.

Unless something is odd and you want to know details of the two sections you will not need this function.

See also

`https://sourceware.org/gdb/onlinedocs/gdb/Separate-Debug-Files.html`

Using GNU debuglink data

If no debuglink then name_returned,crc_returned and debuglink_path_returned will get set 0 through the pointers.

If no .note.gnu.build-id then buildid_length_returned, and buildid_returned will be set 0 through the pointers.

In most cases output arguments can be passed as zero and the function will simply not return data through such arguments. Useful if you only care about some of the data potentially returned.

If dw_debuglink_fullpath returned is set by the call the space allocated must be freed by the caller with free(dw_↩ debuglink_fullpath_returned).

if dw_debuglink_paths_returned is set by the call the space allocated must be free by the caller with free(dw_↩ debuglink_paths_returned).

dwarf_finish() will not free strings dw_debuglink_fullpath_returned or dw_debuglink_paths_returned.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_debuglink_path_returned	On success returns a pointer to a path in the debuglink section. Do not free!
dw_crc_returned	On success returns a pointer to a 4 byte area through the pointer.
dw_debuglink_fullpath_returned	On success returns a pointer to a full path computed from debuglink data of a correct path to a file with DWARF sections. Free this string when no longer of interest.
dw_debuglink_path_length_returned	On success returns the strlen() of dw_debuglink_fullpath_returned .
dw_buildid_type_returned	On success returns a pointer to integer with a type code. See the buildid definition.
dw_buildid_owner_name_returned	On success returns a pointer to the owner name from the buildid section. Do not free this.
dw_buildid_returned	On success returns a pointer to a sequence of bytes containing the buildid.
dw_buildid_length_returned	On success this is set to the length of the set of bytes pointed to by dw_buildid_returned .
dw_paths_returned	On success sets a pointer to an array of pointers to strings, each with a global path. These strings must be freed by the caller, dwarf_finish() will not free these strings. Call free(dw_paths_returned).
dw_paths_length_returned	On success returns the length of the array of string pointers dw_paths_returned points at.
dw_error	The usual pointer to return error details.

Returns

Returns DW_DLV_OK etc.

9.31.2.5 dwarf_suppress_debuglink_crc()

```
DW_API int dwarf_suppress_debuglink_crc (
            int dw_suppress )
```

Suppressing crc calculations.

The .gnu_debuglink section contains a compilation-system created crc (4 byte) value. If dwarf_init_path[_dl]() is called such a section can result in the reader/consumer calculating the crc value of a different object file. Which on a large object file could seem slow. See `https://en.wikipedia.org/wiki/Cyclic_redundancy↩ _check`

When one is confident that any debug_link file found is the appropriate one one can call dwarf_suppress_↩ debuglink_crc with a non-zero argument and any dwarf_init_path[_dl] call will skip debuglink crc calculations and just assume the crc would match whenever it applies. This is a global flag, applies to all Dwarf_Debug opened after the call in the program execution.

Does not apply to the .note.gnu.buildid section as that section never implies the reader/consumer needs to do a crc calculation.

Parameters

dw_suppress	Pass in 1 to suppress future calculation of crc values to verify a debuglink target is correct. So use only when you know this is safe. Pass in 0 to ensure future dwarf_init_path_dl calls compute debuglink CRC values as required.

Returns

Returns the previous value of the global flag.

Details on separate DWARF object access

9.32 Harmless Error recording

Macros

- #define **DW_HARMLESS_ERROR_CIRCULAR_LIST_DEFAULT_SIZE** 4

  Default size of the libdwarf-internal circular list.

Functions

- DW_API int dwarf_get_harmless_error_list (Dwarf_Debug dw_dbg, unsigned int dw_count, const char ∗∗dw_errmsg_ptrs_array, unsigned int ∗dw_newerr_count)

  Get the harmless error count and content.
- DW_API unsigned int dwarf_set_harmless_error_list_size (Dwarf_Debug dw_dbg, unsigned int dw_↩ maxcount)

  The size of the circular list of strings libdwarf holds internally may be set and reset as needed. If it is shortened excess messages are simply dropped. It returns the previous size. If zero passed in the size is unchanged and it simply returns the current size.
- DW_API void dwarf_insert_harmless_error (Dwarf_Debug dw_dbg, char ∗dw_newerror)

  Harmless Error Insertion is only for testing.

9.32.1 Detailed Description

The harmless error list is a fixed size circular buffer of errors we note but which do not stop us from processing the object. Created so dwarfdump or other tools can report such inconsequential errors without causing anything to stop early.

You can change the list size from the default of DW_HARMLESS_ERROR_CIRCULAR_LIST_DEFAULT_SIZE at any time for a Dwarf_Debug dbg.

Harmless error data is dealloc'd by dwarf_finish().

9.32.2 Function Documentation

9.32.2.1 dwarf_get_harmless_error_list()

```
DW_API int dwarf_get_harmless_error_list (
            Dwarf_Debug dw_dbg,
            unsigned int dw_count,
            const char ** dw_errmsg_ptrs_array,
            unsigned int * dw_newerr_count )
```

Get the harmless error count and content.

User code supplies size of array of pointers dw_errmsg_ptrs_array in count and the array of pointers (the pointers themselves need not be initialized). The pointers returned in the array of pointers are invalidated by ANY call to libdwarf. Use them before making another libdwarf call! The array of string pointers passed in always has a final null pointer, so if there are N pointers the and M actual strings, then MIN(M,N-1) pointers are set to point to error strings. The array of pointers to strings always terminates with a NULL pointer. Do not free the strings. Every string is null-terminated.

Each call empties the error list (discarding all current entries). and fills in your array

Parameters

dw_dbg	The applicable Dwarf_Debug.
dw_count	The number of string buffers. If count is passed as zero no elements of the array are touched.
dw_errmsg_ptrs_array	A pointer to a user-created array of pointer to const char.
dw_newerr_count	If non-NULL the count of harmless errors pointers since the last call is returned through the pointer. If dw_count is greater than zero the first dw_count of the pointers in the user-created array point to null-terminated strings. Do not free the strings. print or copy the strings before any other libdwarf call.

Returns

Returns DW_DLV_NO_ENTRY if no harmless errors were noted so far. Returns DW_DLV_OK if there are harmless errors. Never returns DW_DLV_ERROR.

If DW_DLV_NO_ENTRY is returned none of the arguments other than dw_dbg are touched or used.

9.32.2.2 dwarf_insert_harmless_error()

```
DW_API void dwarf_insert_harmless_error (
            Dwarf_Debug dw_dbg,
            char * dw_newerror )
```

Harmless Error Insertion is only for testing.

Useful for testing the harmless error mechanism.

Parameters

dw_dbg	Pass in an open Dwarf_Debug
dw_newerror	Pass in a string whose content the function inserts as a harmless error (which dwarf_get_harmless_error_list will retrieve).

9.32.2.3 dwarf_set_harmless_error_list_size()

```
DW_API unsigned int dwarf_set_harmless_error_list_size (
            Dwarf_Debug dw_dbg,
            unsigned int dw_maxcount )
```

The size of the circular list of strings libdwarf holds internally may be set and reset as needed. If it is shortened excess messages are simply dropped. It returns the previous size. If zero passed in the size is unchanged and it simply returns the current size.

Parameters

dw_dbg	The applicable Dwarf_Debug.
dw_maxcount	Set the new internal buffer count to a number greater than zero.

Returns

returns the current size of the internal circular buffer if dw_maxcount is zero. If dw_maxcount is greater than zero the internal array is adjusted to hold that many and the previous number of harmless errors possible in the circular buffer is returned.

9.33 Names DW_TAG_member etc as strings

Functions

- DW_API int **dwarf_get_ACCESS_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_ACCESS_name
- DW_API int **dwarf_get_ADDR_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_ADDR_name
- DW_API int **dwarf_get_AT_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_AT_name
- DW_API int **dwarf_get_ATCF_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_AT_name

- DW_API int **dwarf_get_ATE_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_ATE_name
- DW_API int **dwarf_get_CC_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_CC_name
- DW_API int **dwarf_get_CFA_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_CFA_name
- DW_API int **dwarf_get_children_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_children_namea - historic misspelling.
- DW_API int **dwarf_get_CHILDREN_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_CHILDREN_name
- DW_API int **dwarf_get_DEFAULTED_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_DEFAULTED_name
- DW_API int **dwarf_get_DS_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_DS_name
- DW_API int **dwarf_get_DSC_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_DSC_name
- DW_API int dwarf_get_GNUIKIND_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_GNUIKIND_name - libdwarf invention
- DW_API int dwarf_get_EH_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_EH_name
- DW_API int **dwarf_get_END_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_END_name
- DW_API int **dwarf_get_FORM_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_FORM_name
- DW_API int dwarf_get_FRAME_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

  This is a set of register names.
- DW_API int dwarf_get_GNUIVIS_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_GNUIVIS_name - a libdwarf invention
- DW_API int **dwarf_get_ID_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_ID_name
- DW_API int **dwarf_get_IDX_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_IDX_name
- DW_API int **dwarf_get_INL_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_INL_name
- DW_API int **dwarf_get_ISA_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_ISA_name
- DW_API int **dwarf_get_LANG_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LANG_name
- DW_API int **dwarf_get_LLE_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LLE_name
- DW_API int dwarf_get_LLEX_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LLEX_name - a GNU extension.
- DW_API int **dwarf_get_LNAME_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LNAME
- DW_API int **dwarf_get_LNCT_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LNCT_name
- DW_API int **dwarf_get_LNE_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LNE_name
- DW_API int **dwarf_get_LNS_name** (unsigned int dw_val_in, const char ∗∗dw_s_out)

  dwarf_get_LNS_name
- DW_API int dwarf_get_MACINFO_name (unsigned int dw_val_in, const char ∗∗dw_s_out)

dwarf_get_MACINFO_name
- DW_API int dwarf_get_MACRO_name (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_MACRO_name
- DW_API int **dwarf_get_OP_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_OP_name
- DW_API int **dwarf_get_ORD_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_ORD_name
- DW_API int **dwarf_get_RLE_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_RLE_name
- DW_API int **dwarf_get_SECT_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_SECT_name
- DW_API int **dwarf_get_TAG_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_TAG_name
- DW_API int **dwarf_get_UT_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_UT_name
- DW_API int **dwarf_get_VIRTUALITY_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_VIRTUALITY_name
- DW_API int **dwarf_get_VIS_name** (unsigned int dw_val_in, const char **dw_s_out)

  dwarf_get_VIS_name
- DW_API int dwarf_get_FORM_CLASS_name (enum Dwarf_Form_Class dw_fc, const char **dw_s_out)

  dwarf_get_FORM_CLASS_name is for a libdwarf extension. Not defined by the DWARF standard though the concept is defined in the standard. It seemed essential to invent it for libdwarf to report correctly.

9.33.1 Detailed Description

Given a value you know is one of a particular name category in DWARF2 or later, call the appropriate function and on finding the name it returns DW_DLV_OK and sets the identifier for the value through a pointer. On success these functions return the string corresponding to **dw_val_in** passed in through the pointer **dw_s_out** and the value returned is DW_DLV_OK.

The strings returned on sucess are in static storage and must not be freed.

These functions are generated from information in dwarf.h, not hand coded functions.

If DW_DLV_NO_ENTRY is returned the **dw_val_in** is not known and ***s_out** is not set. This is unusual.

DW_DLV_ERROR is never returned.

The example referred to offers the suggested way to use functions like these.

See also

Retrieving tag,attribute,etc names

9.33.2 Function Documentation

9.33.2.1 dwarf_get_EH_name()

```
DW_API int dwarf_get_EH_name (
            unsigned int dw_val_in,
            const char ** dw_s_out )
```

dwarf_get_EH_name

So we can report this GNU extension sensibly.

9.33.2.2 dwarf_get_FORM_CLASS_name()

```
DW_API int dwarf_get_FORM_CLASS_name (
             enum Dwarf_Form_Class dw_fc,
             const char ** dw_s_out )
```

dwarf_get_FORM_CLASS_name is for a libdwarf extension. Not defined by the DWARF standard though the concept is defined in the standard. It seemed essential to invent it for libdwarf to report correctly.

See DWARF5 Table 2.3, Classes of Attribute Value page 23. Earlier DWARF versions have a similar table.

9.33.2.3 dwarf_get_FRAME_name()

```
DW_API int dwarf_get_FRAME_name (
             unsigned int dw_val_in,
             const char ** dw_s_out )
```

This is a set of register names.

The set of register names is unlikely to match your register set, but perhaps this is better than no name.

9.33.2.4 dwarf_get_GNUIKIND_name()

```
DW_API int dwarf_get_GNUIKIND_name (
             unsigned int dw_val_in,
             const char ** dw_s_out )
```

dwarf_get_GNUIKIND_name - libdwarf invention

So we can report things GNU extensions sensibly.

9.33.2.5 dwarf_get_GNUIVIS_name()

```
DW_API int dwarf_get_GNUIVIS_name (
             unsigned int dw_val_in,
             const char ** dw_s_out )
```

dwarf_get_GNUIVIS_name - a libdwarf invention

So we report a GNU extension sensibly.

9.33.2.6 dwarf_get_LLEX_name()

```
DW_API int dwarf_get_LLEX_name (
             unsigned int dw_val_in,
             const char ** dw_s_out )
```

dwarf_get_LLEX_name - a GNU extension.

The name is a libdwarf invention for the GNU extension. So we report a GNU extension sensibly.

9.33.2.7 dwarf_get_MACINFO_name()

```
DW_API int dwarf_get_MACINFO_name (
            unsigned int dw_val_in,
            const char ** dw_s_out )
```

dwarf_get_MACINFO_name

Used in DWARF2-DWARF4

9.33.2.8 dwarf_get_MACRO_name()

```
DW_API int dwarf_get_MACRO_name (
            unsigned int dw_val_in,
            const char ** dw_s_out )
```

dwarf_get_MACRO_name

Used in DWARF5

9.34 Object Sections Data

Functions

- DW_API int dwarf_get_die_section_name (Dwarf_Debug dw_dbg, Dwarf_Bool dw_is_info, const char ∗∗dw_sec_name, Dwarf_Error ∗dw_error)

  Get the real name a DIE section.
- DW_API int dwarf_get_die_section_name_b (Dwarf_Die dw_die, const char ∗∗dw_sec_name, Dwarf_Error ∗dw_error)

  Get the real name of a DIE section.
- DW_API int **dwarf_get_macro_section_name** (Dwarf_Debug dw_dbg, const char ∗∗dw_sec_name_out, Dwarf_Error ∗dw_err)

  Get the real name of a .debug_macro section.
- DW_API int dwarf_get_real_section_name (Dwarf_Debug dw_dbg, const char ∗dw_std_section_name, const char ∗∗dw_actual_sec_name_out, Dwarf_Small ∗dw_marked_zcompressed, Dwarf_Small ∗dw_marked_↩ zlib_compressed, Dwarf_Small ∗dw_marked_shf_compressed, Dwarf_Unsigned ∗dw_compressed_length, Dwarf_Unsigned ∗dw_uncompressed_length, Dwarf_Error ∗dw_error)

  Get the real name of a section.
- DW_API int dwarf_get_frame_section_name (Dwarf_Debug dw_dbg, const char ∗∗dw_section_name_out, Dwarf_Error ∗dw_error)

  Get .debug_frame section name.
- DW_API int dwarf_get_frame_section_name_eh_gnu (Dwarf_Debug dw_dbg, const char ∗∗dw_section_↩ name_out, Dwarf_Error ∗dw_error)

  Get GNU .eh_frame section name.
- DW_API int **dwarf_get_aranges_section_name** (Dwarf_Debug dw_dbg, const char ∗∗dw_section_name↩ _out, Dwarf_Error ∗dw_error)

  Get .debug_aranges section name The usual arguments.
- DW_API int **dwarf_get_ranges_section_name** (Dwarf_Debug dw_dbg, const char ∗∗dw_section_name_↩ out, Dwarf_Error ∗dw_error)

  Get .debug_ranges section name The usual arguments and return values.

- DW_API int dwarf_get_offset_size (Dwarf_Debug dw_dbg, Dwarf_Half ∗dw_offset_size, Dwarf_Error ∗dw←_error)

  Get offset size as defined by the object.
- DW_API int dwarf_get_address_size (Dwarf_Debug dw_dbg, Dwarf_Half ∗dw_addr_size, Dwarf_Error ∗dw←_error)

  Get the address size as defined by the object.
- DW_API int **dwarf_get_string_section_name** (Dwarf_Debug dw_dbg, const char ∗∗dw_section_name_out, Dwarf_Error ∗dw_error)

  Get the string table section name The usual arguments and return values.
- DW_API int **dwarf_get_line_section_name** (Dwarf_Debug dw_dbg, const char ∗∗dw_section_name_out, Dwarf_Error ∗dw_error)

  Get the line table section name The usual arguments and return values.
- DW_API int dwarf_get_line_section_name_from_die (Dwarf_Die dw_die, const char ∗∗dw_section_name←_out, Dwarf_Error ∗dw_error)

  Get the line table section name.
- DW_API int dwarf_get_section_info_by_name_a (Dwarf_Debug dw_dbg, const char ∗dw_section_name, Dwarf_Addr ∗dw_section_addr, Dwarf_Unsigned ∗dw_section_size, Dwarf_Unsigned ∗dw_section_flags, Dwarf_Unsigned ∗dw_section_offset, Dwarf_Error ∗dw_error)

  Given a section name, get its size, address, etc.
- DW_API int dwarf_get_section_info_by_name (Dwarf_Debug dw_dbg, const char ∗dw_section_name, Dwarf_Addr ∗dw_section_addr, Dwarf_Unsigned ∗dw_section_size, Dwarf_Error ∗dw_error)

  Given a section name, get its size and address.
- DW_API int dwarf_get_section_info_by_index_a (Dwarf_Debug dw_dbg, int dw_section_index, const char ∗∗dw_section_name, Dwarf_Addr ∗dw_section_addr, Dwarf_Unsigned ∗dw_section_size, Dwarf_Unsigned ∗dw_section_flags, Dwarf_Unsigned ∗dw_section_offset, Dwarf_Error ∗dw_error)

  Given a section index, get its size and address, etc.
- DW_API int dwarf_get_section_info_by_index (Dwarf_Debug dw_dbg, int dw_section_index, const char ∗∗dw_section_name, Dwarf_Addr ∗dw_section_addr, Dwarf_Unsigned ∗dw_section_size, Dwarf_Error ∗dw_error)

  Given a section index, get its size and address.
- DW_API int dwarf_machine_architecture_a (Dwarf_Debug dw_dbg, Dwarf_Small ∗dw_ftype, Dwarf_Small ∗dw_obj_pointersize, Dwarf_Bool ∗dw_obj_is_big_endian, Dwarf_Unsigned ∗dw_obj_machine, Dwarf_Unsigned ∗dw_obj_type, Dwarf_Unsigned ∗dw_obj_flags, Dwarf_Small ∗dw_path_source, Dwarf_Unsigned ∗dw_ub←_offset, Dwarf_Unsigned ∗dw_ub_count, Dwarf_Unsigned ∗dw_ub_index, Dwarf_Unsigned ∗dw_comdat_←groupnumber)

  Get basic object information from Dwarf_Debug.
- DW_API int dwarf_machine_architecture (Dwarf_Debug dw_dbg, Dwarf_Small ∗dw_ftype, Dwarf_Small ∗dw_obj_pointersize, Dwarf_Bool ∗dw_obj_is_big_endian, Dwarf_Unsigned ∗dw_obj_machine, Dwarf_Unsigned ∗dw_obj_flags, Dwarf_Small ∗dw_path_source, Dwarf_Unsigned ∗dw_ub_offset, Dwarf_Unsigned ∗dw_←ub_count, Dwarf_Unsigned ∗dw_ub_index, Dwarf_Unsigned ∗dw_comdat_groupnumber)

  Get basic object information original version.
- DW_API Dwarf_Unsigned dwarf_get_section_count (Dwarf_Debug dw_dbg)

  Get section count (of object file sections).
- DW_API int dwarf_get_section_max_offsets_d (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_debug_info←_size, Dwarf_Unsigned ∗dw_debug_abbrev_size, Dwarf_Unsigned ∗dw_debug_line_size, Dwarf_Unsigned ∗dw_debug_loc_size, Dwarf_Unsigned ∗dw_debug_aranges_size, Dwarf_Unsigned ∗dw_debug_←macinfo_size, Dwarf_Unsigned ∗dw_debug_pubnames_size, Dwarf_Unsigned ∗dw_debug_str_size, Dwarf_Unsigned ∗dw_debug_frame_size, Dwarf_Unsigned ∗dw_debug_ranges_size, Dwarf_Unsigned ∗dw_debug_pubtypes_size, Dwarf_Unsigned ∗dw_debug_types_size, Dwarf_Unsigned ∗dw_debug←_macro_size, Dwarf_Unsigned ∗dw_debug_str_offsets_size, Dwarf_Unsigned ∗dw_debug_sup_size, Dwarf_Unsigned ∗dw_debug_cu_index_size, Dwarf_Unsigned ∗dw_debug_tu_index_size, Dwarf_Unsigned ∗dw_debug_names_size, Dwarf_Unsigned ∗dw_debug_loclists_size, Dwarf_Unsigned ∗dw_debug_←rnglists_size)

  Get section sizes for many sections.

9.34.1 Detailed Description

These functions are not often used. They give access to section- and objectfile-related information, and that sort of information is not generally needed to understand DWARF content..

Section name access. Because names sections such as .debug_info might end with .dwo or be .zdebug or might not.

String pointers returned via these functions must not be freed, the strings are statically declared.

For non-Elf the name reported will be as if it were Elf sections. For example, not the names Macos puts in its object sections (which the Macos reader translates).

These calls returning selected object header {machine architecture,flags) and section (offset, flags) data are not of interest to most library callers: dwarf_machine_architecture(), dwarf_get_section_info_by_index_a(), and dwarf_get_section_info_by_name_a().

The simple calls will not be documented in full detail here.

9.34.2 Function Documentation

9.34.2.1 dwarf_get_address_size()

```
DW_API int dwarf_get_address_size (
             Dwarf_Debug dw_dbg,
             Dwarf_Half * dw_addr_size,
             Dwarf_Error * dw_error )
```

Get the address size as defined by the object.

This is not from DWARF information, it is from object file headers.

9.34.2.2 dwarf_get_die_section_name()

```
DW_API int dwarf_get_die_section_name (
             Dwarf_Debug dw_dbg,
             Dwarf_Bool dw_is_info,
             const char ** dw_sec_name,
             Dwarf_Error * dw_error )
```

Get the real name a DIE section.

dw_is_info

Parameters

dw_dbg	The Dwarf_Debug of interest
dw_is_info	We do not pass in a DIE, so we have to pass in TRUE for for .debug_info, or if DWARF4 .debug_types pass in FALSE.
dw_sec_name	On success returns a pointer to the actual section name in the object file. Do not free the string.
dw_error	The usual error argument to report error details.

Returns

DW_DLV_OK etc.

9.34.2.3 dwarf_get_die_section_name_b()

```
DW_API int dwarf_get_die_section_name_b (
            Dwarf_Die dw_die,
            const char ** dw_sec_name,
            Dwarf_Error * dw_error )
```

Get the real name of a DIE section.

The same as **dwarf_get_die_section_name** except we have a DIE so do not need **dw_is_info** as a argument.

9.34.2.4 dwarf_get_frame_section_name()

```
DW_API int dwarf_get_frame_section_name (
            Dwarf_Debug dw_dbg,
            const char ** dw_section_name_out,
            Dwarf_Error * dw_error )
```

Get .debug_frame section name.

Returns

returns DW_DLV_OK if the .debug_frame exists

9.34.2.5 dwarf_get_frame_section_name_eh_gnu()

```
DW_API int dwarf_get_frame_section_name_eh_gnu (
            Dwarf_Debug dw_dbg,
            const char ** dw_section_name_out,
            Dwarf_Error * dw_error )
```

Get GNU .eh_frame section name.

Returns

Returns DW_DLV_OK if the .debug_frame is present Returns DW_DLV_NO_ENTRY if it is not present.

9.34.2.6 dwarf_get_line_section_name_from_die()

```
DW_API int dwarf_get_line_section_name_from_die (
            Dwarf_Die dw_die,
            const char ** dw_section_name_out,
            Dwarf_Error * dw_error )
```

Get the line table section name.

Parameters

dw_die	Pass in a Dwarf_Die pointer.
dw_section_name_out	On success returns the section name, usually some .debug_info∗ name but in DWARF4 could be a .debug_types∗ name.
dw_error	On error returns the usual error pointer.

Returns

Returns DW_DLV_OK etc.

9.34.2.7 dwarf_get_offset_size()

```
DW_API int dwarf_get_offset_size (
            Dwarf_Debug dw_dbg,
            Dwarf_Half * dw_offset_size,
            Dwarf_Error * dw_error )
```

Get offset size as defined by the object.

This is not from DWARF information, it is from object file headers.

9.34.2.8 dwarf_get_real_section_name()

```
DW_API int dwarf_get_real_section_name (
            Dwarf_Debug dw_dbg,
            const char * dw_std_section_name,
            const char ** dw_actual_sec_name_out,
            Dwarf_Small * dw_marked_zcompressed,
            Dwarf_Small * dw_marked_zlib_compressed,
            Dwarf_Small * dw_marked_shf_compressed,
            Dwarf_Unsigned * dw_compressed_length,
            Dwarf_Unsigned * dw_uncompressed_length,
            Dwarf_Error * dw_error )
```

Get the real name of a section.

If the object has section groups only the sections in the group in dw_dbg will be found.

Whether .zdebug or ZLIB or SHF_COMPRESSED is the marker there is just one uncompress algorithm (zlib) for all three cases.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_std_section_name	Pass in a standard section name, such as .debug_info or .debug_info.dwo .
dw_actual_sec_name_out	On success returns the actual section name from the object file.
dw_marked_zcompressed	On success returns TRUE if the original section name ends in .zdebug
dw_marked_zlib_compressed	On success returns TRUE if the section has the ZLIB string at the front of the section.
dw_marked_shf_compressed	On success returns TRUE if the section flag (Elf SHF_COMPRESSED) is marked as compressed.
dw_compressed_length	On success if the section was compressed it returns the original section length in the object file.
dw_uncompressed_length	On success if the section was compressed this returns the uncompressed length of the object section.
dw_error	On error returns the error usual details.

Returns

The usual DW_DLV_OK etc. If the section is not relevant to this Dwarf_Debug or is not in the object file at all, returns DW_DLV_NO_ENTRY

9.34.2.9 dwarf_get_section_count()

```
DW_API Dwarf_Unsigned dwarf_get_section_count (
             Dwarf_Debug dw_dbg )
```

Get section count (of object file sections).

Return the section count. Returns 0 if the dw_dbg argument is improper in any way.

Parameters

dw_dbg	Pass in a valid Dwarf_Debug of interest.

Returns

Returns the count of sections in the object file or zero.

9.34.2.10 dwarf_get_section_info_by_index()

```
DW_API int dwarf_get_section_info_by_index (
             Dwarf_Debug dw_dbg,
             int dw_section_index,
             const char ** dw_section_name,
             Dwarf_Addr * dw_section_addr,
             Dwarf_Unsigned * dw_section_size,
             Dwarf_Error * dw_error )
```

Given a section index, get its size and address.

See dwarf_get_section_info_by_index_a() for the newest version which returns additional values.

Fields and meanings in dwarf_get_section_info_by_index() are the same as in dwarf_get_section_info_by_index_a() except that the arguments dw_section_flags and dw_section_offset are missing here.

9.34.2.11 dwarf_get_section_info_by_index_a()

```
DW_API int dwarf_get_section_info_by_index_a (
             Dwarf_Debug dw_dbg,
             int dw_section_index,
             const char ** dw_section_name,
             Dwarf_Addr * dw_section_addr,
             Dwarf_Unsigned * dw_section_size,
             Dwarf_Unsigned * dw_section_flags,
             Dwarf_Unsigned * dw_section_offset,
             Dwarf_Error * dw_error )
```

Given a section index, get its size and address, etc.

See dwarf_get_section_info_by_index() for the older and still current version.

Any of the pointers dw_section_addr, dw_section_size, dw_section_flags, and dw_section_offset may be passed in as zero and those will be ignored by the function.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_section_index	Pass in an index, 0 through N-1 where N is the count returned from dwarf_get_section_count . As an index type -int- works in practice, but should really be Dwarf_Unsigned.
dw_section_name	On success returns a pointer to the section name as it appears in the object file.
dw_section_addr	On success returns the section address as defined by an object header.
dw_section_size	On success returns the section size as defined by an object header.
dw_section_flags	On success returns the section flags as defined by an object header. The flag meaning depends on which object format is being read and the meaning is defined by the object format. In PE object files this field is called **Characteristics**. We hope it is of some use.
dw_section_offset	On success returns the section offset as defined by an object header. The offset meaning is supposedly an object file offset but the meaning depends on the object file type(!). We hope it is of some use.
dw_error	On error returns the usual error pointer.

Returns

Returns DW_DLV_OK etc.

9.34.2.12 dwarf_get_section_info_by_name()

```
DW_API int dwarf_get_section_info_by_name (
            Dwarf_Debug dw_dbg,
            const char * dw_section_name,
            Dwarf_Addr * dw_section_addr,
            Dwarf_Unsigned * dw_section_size,
            Dwarf_Error * dw_error )
```

Given a section name, get its size and address.

See dwarf_get_section_info_by_name_a() for the newest version which returns additional values.

Fields and meanings in dwarf_get_section_info_by_name() are the same as in dwarf_get_section_info_by_name_a() except that the arguments dw_section_flags and dw_section_offset are missing here.

9.34.2.13 dwarf_get_section_info_by_name_a()

```
DW_API int dwarf_get_section_info_by_name_a (
            Dwarf_Debug dw_dbg,
            const char * dw_section_name,
            Dwarf_Addr * dw_section_addr,
            Dwarf_Unsigned * dw_section_size,
            Dwarf_Unsigned * dw_section_flags,
            Dwarf_Unsigned * dw_section_offset,
            Dwarf_Error * dw_error )
```

Given a section name, get its size, address, etc.

New in v0.9.0 November 2023.

This is not often used and is completely unnecessary for most to call.

See dwarf_get_section_info_by_name() for the older and still current version.

Any of the pointers dw_section_addr, dw_section_size, dw_section_flags, and dw_section_offset may be passed in as zero and those will be ignored by the function.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_section_name	Pass in a pointer to a section name. It must be an exact match to the real section name.
dw_section_addr	On success returns the section address as defined by an object header.
dw_section_size	On success returns the section size as defined by an object header.
dw_section_flags	On success returns the section flags as defined by an object header. The flag meaning depends on which object format is being read and the meaning is defined by the object format. We hope it is of some use. In PE object files this field is called **Characteristics**.
dw_section_offset	On success returns the section offset as defined by an object header. The offset meaning is supposedly an object file offset but the meaning depends on the object file type(!). We hope it is of some use.
dw_error	On error returns the usual error pointer.

Returns

Returns DW_DLV_OK etc.

9.34.2.14 dwarf_get_section_max_offsets_d()

```
DW_API int dwarf_get_section_max_offsets_d (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned * dw_debug_info_size,
            Dwarf_Unsigned * dw_debug_abbrev_size,
            Dwarf_Unsigned * dw_debug_line_size,
            Dwarf_Unsigned * dw_debug_loc_size,
            Dwarf_Unsigned * dw_debug_aranges_size,
            Dwarf_Unsigned * dw_debug_macinfo_size,
            Dwarf_Unsigned * dw_debug_pubnames_size,
            Dwarf_Unsigned * dw_debug_str_size,
            Dwarf_Unsigned * dw_debug_frame_size,
            Dwarf_Unsigned * dw_debug_ranges_size,
            Dwarf_Unsigned * dw_debug_pubtypes_size,
            Dwarf_Unsigned * dw_debug_types_size,
            Dwarf_Unsigned * dw_debug_macro_size,
            Dwarf_Unsigned * dw_debug_str_offsets_size,
            Dwarf_Unsigned * dw_debug_sup_size,
            Dwarf_Unsigned * dw_debug_cu_index_size,
            Dwarf_Unsigned * dw_debug_tu_index_size,
            Dwarf_Unsigned * dw_debug_names_size,
            Dwarf_Unsigned * dw_debug_loclists_size,
            Dwarf_Unsigned * dw_debug_rnglists_size )
```

Get section sizes for many sections.

The list of sections is incomplete and the argument list is ... too long ... making this an unusual function

Originally a hack so clients could verify offsets. Added so that one can detect broken offsets (which happened in an IRIX executable larger than 2GB with MIPSpro 7.3.1.3 toolchain.).

Parameters

dw_dbg	Pass in a valid Dwarf_Debug of interest.

Returns

If the dw_dbg is non-null it returns DW_DLV_OK. If dw_dbg is NULL it returns DW_DLV_NO_ENTRY.

9.34.2.15 dwarf_machine_architecture()

```
DW_API int dwarf_machine_architecture (
             Dwarf_Debug dw_dbg,
             Dwarf_Small * dw_ftype,
             Dwarf_Small * dw_obj_pointersize,
             Dwarf_Bool * dw_obj_is_big_endian,
             Dwarf_Unsigned * dw_obj_machine,
             Dwarf_Unsigned * dw_obj_flags,
             Dwarf_Small * dw_path_source,
             Dwarf_Unsigned * dw_ub_offset,
             Dwarf_Unsigned * dw_ub_count,
             Dwarf_Unsigned * dw_ub_index,
             Dwarf_Unsigned * dw_comdat_groupnumber )
```

Get basic object information original version.

Identical to dwarf_machine_architecture_a() except that this older version does not have the the dw_obj_type argument so it cannot return the Elf e_type value..

9.34.2.16 dwarf_machine_architecture_a()

```
DW_API int dwarf_machine_architecture_a (
             Dwarf_Debug dw_dbg,
             Dwarf_Small * dw_ftype,
             Dwarf_Small * dw_obj_pointersize,
             Dwarf_Bool * dw_obj_is_big_endian,
             Dwarf_Unsigned * dw_obj_machine,
             Dwarf_Unsigned * dw_obj_type,
             Dwarf_Unsigned * dw_obj_flags,
             Dwarf_Small * dw_path_source,
             Dwarf_Unsigned * dw_ub_offset,
             Dwarf_Unsigned * dw_ub_count,
             Dwarf_Unsigned * dw_ub_index,
             Dwarf_Unsigned * dw_comdat_groupnumber )
```

Get basic object information from Dwarf_Debug.

Not all the fields here are relevant for all object types, and the dw_obj_machine and dw_obj_flags have ABI-defined values which have nothing to do with DWARF.

This version added December 2024 with an additional argument: dw_obj_type.

dwarf_ub_offset, dw_ub_count, dw_ub_index only apply to DW_FTYPE_APPLEUNIVERSAL.

dw_comdat_groupnumber only applies to DW_FTYPE_ELF.

Other than dw_dbg one can pass in NULL for any pointer parameter whose value is not of interest.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_ftype	Pass in a pointer. On success the value pointed to will be set to the the applicable DW_FTYPE value (see libdwarf.h).
dw_obj_pointersize	Pass in a pointer. On success the value pointed to will be set to the the applicable pointer size, which is almost always either 4 or 8.
dw_obj_is_big_endian	Pass in a pointer. On success the value pointed to will be set to either 1 (the object being read is big-endia) or 0 (the object being read is little-endian.
dw_obj_machine	Pass in a pointer. On success the value pointed to will be set to a value that the specific ABI uses for the machine-architecture the object file says it is for.
dw_obj_type	Pass in a pointer. On success the value pointed to will be set to a value that the specific ABI uses for the machine-architecture the object file says it is for (for ELF is elf header e_type).
dw_obj_flags	Pass in a pointer. On success the value pointed to will be set to a value that the specific ABI uses for a header record flags word (in a PE object the flags word is called **Characteristics**).
dw_path_source	Pass in a pointer. On success the value pointed to will be set to a value that libdwarf sets to a DW_PATHSOURCE value indicating what caused the file path.
dw_ub_offset	Pass in a pointer. On success if the value of dw_ftype is DW_FTYPE_APPLEUNIVERSAL the returned value will be set to the count (in all other cases, the value is set to 0)
dw_ub_count	Pass in a pointer. On success if the value of dw_ftype is DW_FTYPE_APPLEUNIVERSAL the returned value will be set to the number of object files in the binary (in all other cases, the value is set to 0)
dw_ub_index	Pass in a pointer. On success if the value of dw_ftype is DW_FTYPE_APPLEUNIVERSAL the returned value will be set to the number of the specific object from the universal-binary, usable values are 0 through dw_ub_count-1. (in all other cases, the value is set to 0)
dw_comdat_groupnumber	Pass in a pointer. On success if the value of dw_ftype is DW_FTYPE_ELF the returned value will be the comdat group being referenced. (in all other cases, the value is set to 0)

Returns

Returns DW_DLV_NO_ENTRY if the Dwarf_Debug passed in is null or stale. Otherwise returns DW_DLV_OK and non-null return-value pointers will have meaningful data.

9.35 Section Groups Objectfile Data

Functions

- DW_API int dwarf_sec_group_sizes (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_section_count_out, Dwarf_Unsigned ∗dw_group_count_out, Dwarf_Unsigned ∗dw_selected_group_out, Dwarf_Unsigned ∗dw↩_map_entry_count_out, Dwarf_Error ∗dw_error)

  Get Section Groups data counts.
- DW_API int dwarf_sec_group_map (Dwarf_Debug dw_dbg, Dwarf_Unsigned dw_map_entry_count, Dwarf_Unsigned ∗dw_group_numbers_array, Dwarf_Unsigned ∗dw_sec_numbers_array, const char ∗∗dw↩_sec_names_array, Dwarf_Error ∗dw_error)

  Return a map between group numbers and section numbers.

9.35.1 Detailed Description

Section Groups are defined in the extended Elf ABI and are seen in relocatable Elf object files, not executables or shared objects.

Section Groups Overview

9.35.2 Function Documentation

9.35.2.1 dwarf_sec_group_map()

```
DW_API int dwarf_sec_group_map (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned dw_map_entry_count,
            Dwarf_Unsigned * dw_group_numbers_array,
            Dwarf_Unsigned * dw_sec_numbers_array,
            const char ** dw_sec_names_array,
            Dwarf_Error * dw_error )
```

Return a map between group numbers and section numbers.

This map shows all the groups in the object file and shows which object sections go with which group.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_map_entry_count	Pass in the dw_map_entry_count_out from dwarf_sec_group_sizes
dw_group_numbers_array	Pass in an array of Dwarf_Unsigned with dw_map_entry_count entries. Zero the data before the call here. On success returns a list of group numbers.
dw_sec_numbers_array	Pass in an array of Dwarf_Unsigned with dw_map_entry_count entries. Zero the data before the call here. On success returns a list of section numbers.
dw_sec_names_array	Pass in an array of const char ∗ with dw_map_entry_count entries. Zero the data before the call here. On success returns a list of section names.
dw_error	The usual error details pointer.

Returns

On success returns DW_DLV_OK

9.35.2.2 dwarf_sec_group_sizes()

```
DW_API int dwarf_sec_group_sizes (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned * dw_section_count_out,
            Dwarf_Unsigned * dw_group_count_out,
            Dwarf_Unsigned * dw_selected_group_out,
            Dwarf_Unsigned * dw_map_entry_count_out,
            Dwarf_Error * dw_error )
```

Get Section Groups data counts.

Allows callers to find out what groups (dwo or COMDAT) are in the object and how much to allocate so one can get the group-section map data.

This is relevant for Debug Fission. If an object file has both .dwo sections and non-dwo sections or it has Elf COMDAT GROUP sections this becomes important.

Section Groups Overview

Parameters

dw_dbg	Pass in the Dwarf_Debug of interest.
dw_section_count_out	On success returns the number of DWARF sections in the object file. Can sometimes be many more than are of interest.
dw_group_count_out	On success returns the number of groups. Though usually one, it can be much larger.
dw_selected_group_out	On success returns the groupnumber that applies to this specific open Dwarf_Debug.
dw_map_entry_count_out	On success returns the count of record allocations needed to call dwarf_sec_group_map successfully. dw_map_entry_count_out will be less than or equal to dw_section_count_out.
dw_error	The usual error details pointer.

Returns

On success returns DW_DLV_OK

9.36 LEB Encode and Decode

Functions

- DW_API int **dwarf_encode_leb128** (Dwarf_Unsigned dw_val, int ∗dw_nbytes, char ∗dw_space, int dw_↩ splen)
- DW_API int **dwarf_encode_signed_leb128** (Dwarf_Signed dw_val, int ∗dw_nbytes, char ∗dw_space, int dw_splen)
- DW_API int **dwarf_decode_leb128** (char ∗dw_leb, Dwarf_Unsigned ∗dw_leblen, Dwarf_Unsigned ∗dw_↩ outval, char ∗dw_endptr)
- DW_API int **dwarf_decode_signed_leb128** (char ∗dw_leb, Dwarf_Unsigned ∗dw_leblen, Dwarf_Signed ∗dw_outval, char ∗dw_endptr)

9.36.1 Detailed Description

These are LEB/ULEB reading and writing functions heavily used inside libdwarf.

While the DWARF Standard does not mention allowing extra insignificant trailing bytes in a ULEB these functions allow a few such for compilers using extras for alignment in DWARF.

9.37 Miscellaneous Functions

Functions

- DW_API const char ∗ dwarf_package_version (void)

  Return the version string in the library.
- DW_API int dwarf_set_stringcheck (int dw_stringcheck)

  Turn off libdwarf checks of strings.
- DW_API int dwarf_set_reloc_application (int dw_apply)

  Set libdwarf response to ∗.rela relocations.
- DW_API void dwarf_record_cmdline_options (Dwarf_Cmdline_Options dw_dd_options)

  Tell libdwarf to add verbosity to Line Header errors By default the flag in the struct argument is zero. dwarfdump uses this when -v used on dwarfdump.
- DW_API int dwarf_set_de_alloc_flag (int dw_v)

  Eliminate libdwarf tracking of allocations Independent of any Dwarf_Debug and applicable to all whenever the setting is changed. Defaults to non-zero.
- DW_API int dwarf_library_allow_dup_attr (int dw_v)

  Eliminate libdwarf checking attribute duplication.
- DW_API Dwarf_Small dwarf_set_default_address_size (Dwarf_Debug dw_dbg, Dwarf_Small dw_value)

  Set the address size on a Dwarf_Debug.
- DW_API int dwarf_get_universalbinary_count (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_current_index, Dwarf_Unsigned ∗dw_available_count)

  Retrieve universal binary index.

Variables

- DW_API void(∗)(void ∗, const void ∗, unsigned long) dwarf_get_endian_copy_function (Dwarf_Debug dw_↩ dbg)

  Get a pointer to the applicable swap/noswap function.
- DW_API Dwarf_Cmdline_Options **dwarf_cmdline_options**

9.37.1 Detailed Description

9.37.2 Function Documentation

9.37.2.1 dwarf_get_universalbinary_count()

```
DW_API int dwarf_get_universalbinary_count (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned * dw_current_index,
            Dwarf_Unsigned * dw_available_count )
```

Retrieve universal binary index.

For Mach-O universal binaries this returns relevant information.

For non-universal binaries (Mach-O, Elf, or PE) the values are not meaningful, so the function returns DW_DLV_↩ NO_ENTRY..

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_current_index	If dw_current_index is passed in non-null the function returns the universal-binary index of the current object (which came from a universal binary).
dw_available_count	If dw_current_index is passed in non-null the function returns the count of binaries in the universal binary.

Returns

Returns DW_DLV_NO_ENTRY if the object file is not from a Mach-O universal binary. Returns DW_DLV_↩
NO_ENTRY if dw_dbg is passed in NULL. Never returns DW_DLV_ERROR.

9.37.2.2 dwarf_library_allow_dup_attr()

```
DW_API int dwarf_library_allow_dup_attr (
            int dw_v )
```

Eliminate libdwarf checking attribute duplication.

Independent of any Dwarf_Debug, this is sets a global flag in libdwarf and is applicable to all whenever the setting is changed. Defaults to zero so by default libdwarf does check every set of abbreviations for duplicate attributes.

DWARF5 Sec 2.2 Attribute Types Each attribute value is characterized by an attribute name. No more than one attribute with a given name may appear in any debugging information entry. Essentially the same wording is in Sec 2.2 of DWARF2, DWARF3 and DWARF4.

Do not call this with non-zero dw_v unless you really want the library to avoid this basic DWARF-correctness check.

Since

{0.12.0}

Parameters

dw↩ _v	If non-zero passed in libdwarf will avoid the checks and will not return errors for an abbreviation list with duplicate attributes.

Returns

Returns the previous version of the flag.

9.37.2.3 dwarf_package_version()

```
DW_API const char * dwarf_package_version (
            void )
```

Return the version string in the library.

An example: "0.3.0" which is a Semantic Version identifier. Before September 2021 the version string was a date, for example "20210528", which is in ISO date format. See DW_LIBDWARF_VERSION DW_LIBDWARF_VERSION↩
_MAJOR DW_LIBDWARF_VERSION_MINOR DW_LIBDWARF_VERSION_MICRO

Returns

The Package Version built into libdwarf.so or libdwarf.a

9.37.2.4 dwarf_record_cmdline_options()

```
DW_API void dwarf_record_cmdline_options (
            Dwarf_Cmdline_Options dw_dd_options )
```

Tell libdwarf to add verbosity to Line Header errors By default the flag in the struct argument is zero. dwarfdump uses this when -v used on dwarfdump.

See also

dwarf_register_printf_callback

Parameters

dw_dd_options	The structure has one flag, and if the flag is nonzero and there is an error in reading a line table header the function passes back detail error messages via dwarf_register_printf_callback.

9.37.2.5 dwarf_set_de_alloc_flag()

```
DW_API int dwarf_set_de_alloc_flag (
            int dw_v )
```

Eliminate libdwarf tracking of allocations Independent of any Dwarf_Debug and applicable to all whenever the setting is changed. Defaults to non-zero.

Parameters

dw←_v	If zero passed in libdwarf will run somewhat faster and library memory allocations will not all be tracked and dwarf_finish() will be unable to free/dealloc some things. User code can do the necessary deallocs (as documented), but the normal guarantee that libdwarf will clean up is revoked. If non-zero passed in libdwarf will resume or continue tracking allocations

Returns

Returns the previous version of the flag.

9.37.2.6 dwarf_set_default_address_size()

```
DW_API Dwarf_Small dwarf_set_default_address_size (
            Dwarf_Debug dw_dbg,
            Dwarf_Small dw_value )
```

Set the address size on a Dwarf_Debug.

DWARF information CUs and other section DWARF headers define a CU-specific address size, but this Dwarf_←Debug value is used when other address size information does not exist, for example in a DWARF2 CIE or FDE.

Parameters

dw_dbg	The Dwarf_Debug of interest.
dw_value	Sets the address size for the Dwarf_Debug to a non-zero value. The default address size is derived from headers in the object file. Values larger than the size of Dwarf_Addr are not set. If zero passed the default is not changed.

Returns

Returns the last set address size.

9.37.2.7 dwarf_set_reloc_application()

```
DW_API int dwarf_set_reloc_application (
            int dw_apply )
```

Set libdwarf response to ∗.rela relocations.

dw_apply defaults to 1 and means apply all '.rela' relocations on reading in a dwarf object section of such relocations. Best to just ignore this function It applies to all Dwarf_Debug open and all opened later in this library instance.

Parameters

dw_apply	Pass in a zero to turn off reading and applying of .rela relocations, which will likely break reading of .o object files but probably will not break reading executables or shared objects. Pass in non zero (it is really just an 8 bit value, so use a small value) to turn off inspecting .rela sections.

Returns

Returns the previous value of the apply flag.

9.37.2.8 dwarf_set_stringcheck()

```
DW_API int dwarf_set_stringcheck (
            int dw_stringcheck )
```

Turn off libdwarf checks of strings.

Zero is the default and means do all string length validity checks. It applies to all Dwarf_Debug open and all opened later in this library instance.

Parameters

dw_stringcheck	Pass in a small non-zero value to turn off all libdwarf string validity checks. It speeds up libdwarf, but...is dangerous and voids all promises the library will not segfault.

Returns

Returns the previous value of this flag.

9.37.3 Variable Documentation

9.37.3.1 dwarf_get_endian_copy_function

```
DW_API void(*)(void *, const void *, unsigned long) dwarf_get_endian_copy_function(Dwarf_Debug
dw_dbg) (
            Dwarf_Debug dw_dbg )
```

Get a pointer to the applicable swap/noswap function.

the function pointer returned enables libdwarf users to use the same 64bit/32bit/16bit word copy as libdwarf does internally for the Dwarf_Debug passed in. The function makes it possible for libdwarf to read either endianness.

Parameters

dw_dbg	Pass in a pointer to the applicable Dwarf_Debug.

Returns

a pointer to a copy function. If the object file referred to and the libdwarf reading that file are the same endianness the function returned will, when called, do a simple memcpy, effectively, while otherwise it would do a byte-swapping copy. It seems unlikely this will be useful to most library users. To call the copy function returned the first argument must be a pointer to the target word and the second must be a pointer to the input word. The third argument is the length to be copied and it must be 2,4,or 8.

9.38 Determine Object Type of a File

Functions

- DW_API int **dwarf_object_detector_path_b** (const char ∗dw_path, char ∗dw_outpath_buffer, unsigned long dw_outpathlen, char ∗∗dw_gl_pathnames, unsigned int dw_gl_pathcount, unsigned int ∗dw_ftype, unsigned int ∗dw_endian, unsigned int ∗dw_offsetsize, Dwarf_Unsigned ∗dw_filesize, unsigned char ∗dw_pathsource, int ∗dw_errcode)
- DW_API int **dwarf_object_detector_path_dSYM** (const char ∗dw_path, char ∗dw_outpath, unsigned long dw_outpath_len, char ∗∗dw_gl_pathnames, unsigned int dw_gl_pathcount, unsigned int ∗dw_ftype, unsigned int ∗dw_endian, unsigned int ∗dw_offsetsize, Dwarf_Unsigned ∗dw_filesize, unsigned char ∗dw_pathsource, int ∗dw_errcode)
- DW_API int **dwarf_object_detector_fd** (int dw_fd, unsigned int ∗dw_ftype, unsigned int ∗dw_endian, unsigned int ∗dw_offsetsize, Dwarf_Unsigned ∗dw_filesize, int ∗dw_errcode)

9.38.1 Detailed Description

This group of functions are unlikely to be called by your code unless your code needs to know the basic data about an object file without actually opening a Dwarf_Debug.

These are crucial for libdwarf itself. The dw_ftype returned is one of DW_FTYPE_ELF, DW_FTYPE_PE, DW_↩ FTYPE_MACH_O, or DW_FTYPE_APPLEUNIVERSAL.

These are not meant to deal with a specific binary inside a Macos Universal Binary (DW_FTYPE_↩ APPLEUNIVERSAL).

9.39 Section allocation: malloc or mmap

Functions

- DW_API enum Dwarf_Sec_Alloc_Pref dwarf_set_load_preference (enum Dwarf_Sec_Alloc_Pref dw_load↩ _preference)

  Set/Retrieve section allocation preference.
- DW_API int dwarf_get_mmap_count (Dwarf_Debug dw_dbg, Dwarf_Unsigned ∗dw_mmap_count, Dwarf_Unsigned ∗dw_mmap_size, Dwarf_Unsigned ∗dw_malloc_count, Dwarf_Unsigned ∗dw_malloc↩ _size)

  Retrieve count of mmap/malloc sections.

9.39.1 Detailed Description

Functions related to the choice of malloc/read or mmap for object section memory allocation.

The default allocation preference is malloc().

The shell environment variable DWARF_WHICH_ALLOC is also involved at runtime but it only applies to reading Elf object files.. If the value is 'malloc' then use of read/malloc is preferred. If the value is 'mmap' then use of mmap is preferred (Example: 'export DWARF_WHICH_ALLOC=mmap'). Otherwise, the environment value is checked and ignored.

If present and valid this environment variable takes precedence over dwarf_set_load_preference().

9.39.2 Function Documentation

9.39.2.1 dwarf_get_mmap_count()

```
DW_API int dwarf_get_mmap_count (
            Dwarf_Debug dw_dbg,
            Dwarf_Unsigned ∗ dw_mmap_count,
            Dwarf_Unsigned ∗ dw_mmap_size,
            Dwarf_Unsigned ∗ dw_malloc_count,
            Dwarf_Unsigned ∗ dw_malloc_size )
```

Retrieve count of mmap/malloc sections.

Since

{0.12.0}

Note that compressed section contents will be expanded into a malloc/read section in all cases.

Parameters

dw_dbg	A valid open Dwarf_Debug.
dw_mmap_count	On success the number of sections allocated with mmap is returned. If null passed in the argument is ignored.
dw_mmap_size	On success the size total in bytes of sections allocated with mmap is returned. If null passed in the argument is ignored.
dw_malloc_count	On success the number of sections read/allocated with read/malloc is returned. If null passed in the argument is ignored. On success the number of sections allocated with malloc/read is returned.
dw_malloc_size	On success the total size in bytes of sections with malloc/read is returned. If null passed in the argument is ignored. On success the number of sections read/allocated with

Returns

On success returns DW_DLV_OK and sets the counts and total size through the respective non-null pointer arguments. If dw_dbg is invalid or NULL the function returns DW_DLV_ERROR. Never returns DW_DLV_↩ NO_ENTRY.

9.39.2.2 dwarf_set_load_preference()

```
DW_API enum Dwarf_Sec_Alloc_Pref dwarf_set_load_preference (
            enum Dwarf_Sec_Alloc_Pref dw_load_preference )
```

Set/Retrieve section allocation preference.

Since

{0.12.0}

By default object file sections are loaded using malloc and read (Dwarf_Alloc_Malloc). This works everywhere and works well on all but gigantic object files.

The preference of Dwarf_Alloc_Mmap does not guarantee mmap will be used for object section data, but does cause mmap() to be used when possible.

In 0.12.0 mmap() is only usable on Elf object files.

dw_load_preference is one of Dwarf_Alloc_Malloc (1) Dwarf_Alloc_Mmap (2)

Must be called before calling a dwarf_init∗() to be effective in a dwarf_init∗(). The value is remembered for subsequent dwarf_init∗() in the library runtime being executed.

Parameters

dw_load_preference	If passed in Dwarf_Alloc_Mmap then future calls to any dwarf_init∗() function will use mmap to load object sections if possible. If passed in Dwarf_Alloc_Malloc then future calls to any dwarf_init∗() function will use mmap to load sections. Any other value passed in dw_load_preference is ignored.

Returns

Always returns the value before dw_load_preference applied, of this runtime global preference.

9.40 Using dwarf_init_path()

Example of a libdwarf initialization call.

Example of a libdwarf initialization call.

An example calling dwarf_init_path() and dwarf_finish()

Parameters

path	Path to an object we wish to open.
groupnumber	Desired groupnumber. Use DW_DW_GROUPNUMBER_ANY unless you have reason to do otherwise.

Returns

Returns the applicable result. DW_DLV_OK etc.

```
*/
int exampleinit(const char *path, unsigned groupnumber)
{
    static char true_pathbuf[FILENAME_MAX];
    unsigned tpathlen = FILENAME_MAX;
    Dwarf_Handler errhand = 0;
    Dwarf_Ptr errarg = 0;
    Dwarf_Error error = 0;
    Dwarf_Debug dbg = 0;
    int res = 0;

    res = dwarf_init_path(path,true_pathbuf,
        tpathlen,groupnumber,errhand,
        errarg,&dbg, &error);
    if (res == DW_DLV_ERROR) {
        /*  Necessary call even though dbg is null!
            This avoids a memory leak.  */
        dwarf_dealloc_error(dbg,error);
        return res;
    }
    if (res == DW_DLV_NO_ENTRY) {
        /*  Nothing we can do */
        return res;
    }
    printf("The file we actually opened is %s\n",
        true_pathbuf);
    /* Call libdwarf functions here */
    dwarf_finish(dbg);
    return DW_DLV_OK;
}
```

9.41 Using dwarf_init_path_dl()

Example focused on GNU debuglink data.

Example focused on GNU debuglink data.

In case GNU debuglink data is followed the true_pathbuf content will not match path. The path actually used is copied to true_path_out.

In the case of MacOS dSYM the true_path_out may not match path.

If debuglink data is missing from the Elf executable or shared-object (ie, it is a normal object!) or unusable by libdwarf or true_path_buffer len is zero or true_path_out_buffer is zero libdwarf accepts the path given as the object to report on, no debuglink or dSYM processing will be used.

See also

https://sourceware.org/gdb/onlinedocs/gdb/Separate-Debug-Files.html

An example calling dwarf_init_path_dl() and dwarf_finish()

Parameters

path	Path to an object we wish to open.
groupnumber	Desired groupnumber. Use DW_DW_GROUPNUMBER_ANY unless you have reason to do otherwise.
error	A pointer we can use to record error details.

Returns

Returns the applicable result. DW_DLV_OK etc.

```
*/
int exampleinit_dl(const char *path, unsigned groupnumber,
    Dwarf_Error *error)
{
    static char true_pathbuf[FILENAME_MAX];
    static const char *glpath[3] = {
        "/usr/local/debug",
        "/usr/local/private/debug",
        "/usr/local/libdwarf/debug"
    };
    unsigned      tpathlen = FILENAME_MAX;
    Dwarf_Handler errhand = 0;
    Dwarf_Ptr     errarg = 0;
    Dwarf_Debug   dbg = 0;
    int           res = 0;
    unsigned char path_source = 0;

    res = dwarf_init_path_dl(path,true_pathbuf,
        tpathlen,groupnumber,errhand,
        errarg,&dbg,
        (char **)glpath,
        3,
        &path_source,
        error);
    if (res == DW_DLV_ERROR) {
        /*  We are not returning dbg, so we must do:
            dwarf_dealloc_error(dbg,*error);
            here to free the error details. */
        dwarf_dealloc_error(dbg,*error);
        *error = 0;
        return res;
    }
    if (res == DW_DLV_NO_ENTRY) {
        return res;
    }
    printf("The file we actually opened is %s\n",
        true_pathbuf);
    /* Call libdwarf functions here */
    dwarf_finish(dbg);
    return res;
}
```

9.42 Using dwarf_attrlist()

Example showing dwarf_attrlist()

Example showing dwarf_attrlist()

Parameters

somedie	Pass in any valid relevant DIE pointer.
error	An error pointer we can use.

Returns

Return DW_DLV_OK (etc).

```
*/
int example1(Dwarf_Die somedie,Dwarf_Error *error)
{
    Dwarf_Debug dbg = 0;
    Dwarf_Signed atcount;
    Dwarf_Attribute *atlist;
    Dwarf_Signed i = 0;
    int errv;

    errv = dwarf_attrlist(somedie, &atlist,&atcount, error);
    if (errv != DW_DLV_OK) {
        return errv;
    }
    for (i = 0; i < atcount; ++i) {
        Dwarf_Half attrnum = 0;
        const char *attrname = 0;

        /*  use atlist[i], likely calling
            libdwarf functions and likely
            returning DW_DLV_ERROR if
            what you call gets DW_DLV_ERROR */
        errv = dwarf_whatattr(atlist[i],&attrnum,error);
        if (errv != DW_DLV_OK) {
            /* Something really bad happened. */
            return errv;
        }
        dwarf_get_AT_name(attrnum,&attrname);
        printf("Attribute[%ld], value %u name %s\n",
            (long int)i,attrnum,attrname);
        dwarf_dealloc_attribute(atlist[i]);
        atlist[i] = 0;
    }
    dwarf_dealloc(dbg, atlist, DW_DLA_LIST);
    return DW_DLV_OK;
}
```

9.43 Attaching a tied dbg

Example attaching base dbg to a split-DWARF object.

Example attaching base dbg to a split-DWARF object.

See DWARF5 Appendix F on Split-DWARF.

By libdwarf convention, open the split Dwarf_Debug using a dwarf_init call. Then open the executable as the tied object. Then call dwarf_set_tied_dbg() so the library can look for relevant data in the tied-dbg (the executable).

With split dwarf your libdwarf calls after the the initial open are done against the split Dwarf_Dbg and libdwarf automatically looks in the tied dbg when and as appropriate. the tied_dbg can be detached too, see example3 link, though you must call dwarf_finish() on the detached dw_tied_dbg, the library will not do that for you.

Parameters

split_dbg	
tied_dbg	
error	

Returns

Returns DW_DLV_OK or DW_DLV_ERROR or DW_DLV_NO_ENTRY to the caller.

```
*/
int example2(Dwarf_Debug split_dbg, Dwarf_Debug tied_dbg,
    Dwarf_Error *error)
```

```
{
    int res = 0;

    /*  The caller should have opened dbg
        on the split-dwarf object/dwp,
        an object with DWARF, but no executable
        code.
        And it should have opened tieddbg on the
        runnable shared object or executable. */
    res = dwarf_set_tied_dbg(split_dbg,tied_dbg,error);
    /*  Let the caller (who initialized the dbg
        values) deal with doing dwarf_finish()
     /
    return res;
}
```

9.44 Detaching a tied dbg

Example detaching a tied (executable) dbg.

Example detaching a tied (executable) dbg.

See DWARF5 Appendix F on Split-DWARF.

With split dwarf your libdwarf calls after than the initial open are done against the split Dwarf_Dbg and libdwarf automatically looks in the open tied dbg when and as appropriate. the tied-dbg can be detached too, see example3 link, though you must call dwarf_finish() on the detached dw_tied_dbg, the library will not do that for you..

```
*/
int example3(Dwarf_Debug split_dbg,Dwarf_Error *error)
{
    int res = 0;
    res = dwarf_set_tied_dbg(split_dbg,NULL,error);
    if (res != DW_DLV_OK) {
        /* Something went wrong*/
        return res;
    }
    return res;
}
```

9.45 Examining Section Group data

Example accessing Section Group data.

Example accessing Section Group data.

With split dwarf your libdwarf calls after than the initial open are done against the base Dwarf_Dbg and libdwarf automatically looks in the open tied dbg when and as appropriate. the tied-dbg can be detached too, see example3 link, though you must call dwarf_finish() on the detached dw_tied_dbg, the library will not do that for you..

Section groups apply to Elf COMDAT groups too.

```
*/
void examplesecgroup(Dwarf_Debug dbg)
{
    int res = 0;
    Dwarf_Unsigned  section_count = 0;
    Dwarf_Unsigned  group_count;
    Dwarf_Unsigned  selected_group = 0;
    Dwarf_Unsigned  group_map_entry_count = 0;
    Dwarf_Unsigned *sec_nums = 0;
    Dwarf_Unsigned *group_nums = 0;
    const char **   sec_names = 0;
    Dwarf_Error     error = 0;
    Dwarf_Unsigned  i = 0;

    res = dwarf_sec_group_sizes(dbg,&section_count,
        &group_count,&selected_group, &group_map_entry_count,
        &error);
    if (res != DW_DLV_OK) {
        /* Something is badly wrong*/
        return;
    }
    /*  In an object without split-dwarf sections
        or COMDAT sections we now have
        selected_group == 1. */
    sec_nums = calloc(group_map_entry_count,sizeof(Dwarf_Unsigned));
    if (!sec_nums) {
        /* FAIL. out of memory */
        return;
    }
    group_nums = calloc(group_map_entry_count,sizeof(Dwarf_Unsigned));
    if (!group_nums) {
        free(group_nums);
        /* FAIL. out of memory */
        return;
    }
    sec_names = calloc(group_map_entry_count,sizeof(char*));
    if (!sec_names) {
        free(group_nums);
        free(sec_nums);
        /* FAIL. out of memory */
        return;
    }

    res = dwarf_sec_group_map(dbg,group_map_entry_count,
        group_nums,sec_nums,sec_names,&error);
    if (res != DW_DLV_OK) {
        /* FAIL. Something badly wrong. */
        free(sec_names);
        free(group_nums);
        free(sec_nums);
    }
    for ( i = 0; i < group_map_entry_count; ++i) {
        /*  Now do something with
            group_nums[i],sec_nums[i],sec_names[i] */
    }
    /*  The strings are in Elf data.
        Do not free() the strings themselves.*/
    free(sec_names);
    free(group_nums);
    free(sec_nums);
}
```

9.46 Using dwarf_siblingof_c()

Example accessing a DIE sibling.

Example accessing a DIE sibling.

Access to each DIE on a sibling list. This is the preferred form as it is slightly more efficient than dwarf_siblingof_b().

```
*/
int example4c(Dwarf_Die in_die,
    Dwarf_Error *error)
{
    Dwarf_Die return_sib = 0;
    int res = 0;

    /* in_die must be a valid Dwarf_Die */
    res = dwarf_siblingof_c(in_die,&return_sib, error);
    if (res == DW_DLV_OK) {
        /* Use return_sib here. */
        dwarf_dealloc_die(return_sib);
        /*  return_sib is no longer usable for anything, we
            ensure we do not use it accidentally with: */
        return_sib = 0;
        return res;
    }
    return res;
}
```

9.47 Using dwarf_siblingof_b()

Example accessing a DIE sibling.

Example accessing a DIE sibling.

Access to each DIE on a sibling list This is the older form, required after dwarf_next_cu_header_d().

Better to use dwarf_next_cu_header_e() and dwarf_siblingof_c().
```
*/
int example4b(Dwarf_Debug dbg,Dwarf_Die in_die,
    Dwarf_Bool is_info,
    Dwarf_Error *error)
{
    Dwarf_Die return_sib = 0;
    int res = 0;

    /*  in_die might be NULL following a call
        to dwarf_next_cu_header_d()
        or a valid Dwarf_Die */
    res = dwarf_siblingof_b(dbg,in_die,is_info,&return_sib, error);
    if (res == DW_DLV_OK) {
        /* Use return_sib here. */
        dwarf_dealloc_die(return_sib);
        /*  return_sib is no longer usable for anything, we
            ensure we do not use it accidentally with: */
        return_sib = 0;
        return res;
    }
    return res;
}
```

9.48 Using dwarf_child()

Example accessing a DIE child.

Example accessing a DIE child.

If the DIE has children (for example inner scopes in a function or members of a struct) this retrieves the DIE which appears first. The child itself may have its own sibling chain.
```
*/
void example5(Dwarf_Die in_die)
{
    Dwarf_Die return_kid = 0;
    Dwarf_Error error = 0;
    int res = 0;

    res = dwarf_child(in_die,&return_kid, &error);
    if (res == DW_DLV_OK) {
        /* Use return_kid here. */
        dwarf_dealloc_die(return_kid);
        /*  The original form of dealloc still works
            dwarf_dealloc(dbg, return_kid, DW_DLA_DIE);
             /
        /*  return_kid is no longer usable for anything, we
            ensure we do not use it accidentally with: */
        return_kid = 0;
    }
}
```

9.49 using dwarf_validate_die_sibling

Example of a DIE tree validation.

Example of a DIE tree validation.

Here we show how one uses dwarf_validate_die_sibling(). Dwarfdump uses this function as a part of its validation of DIE trees.

It is not something you need to use. But one must use it in a specific pattern for it to work properly.

dwarf_validate_die_sibling() depends on data set by dwarf_child() preceeding dwarf_siblingof_b() . dwarf_child() records a little bit of information invisibly in the Dwarf_Debug data.

```
*/

int example_sibvalid(Dwarf_Debug dbg,
    Dwarf_Die in_die,
    Dwarf_Error*error)
{
    int         cres = DW_DLV_OK;
    int         sibres = DW_DLV_OK;
    Dwarf_Die   die = 0;
    Dwarf_Die   sibdie = 0;
    Dwarf_Die   child = 0;
    Dwarf_Bool is_info = dwarf_get_die_infotypes_flag(die);

    die = in_die;
    for ( ; die ; die = sibdie) {
        int vres = 0;
        Dwarf_Unsigned offset = 0;

        /* Maybe print something you extract from the DIE */
        cres = dwarf_child(die,&child,error);
        if (cres == DW_DLV_ERROR) {
            if (die != in_die) {
                dwarf_dealloc_die(die);
            }
            printf("dwarf_child ERROR\n");
            return DW_DLV_ERROR;
        }
        if (cres == DW_DLV_OK) {
            int lres = 0;

            child = 0;
            lres = example_sibvalid(dbg,child,error);
            if (lres == DW_DLV_ERROR) {
                if (die != in_die) {
                    dwarf_dealloc_die(die);
                }
                dwarf_dealloc_die(child);
                printf("example_sibvalid ERROR\n");
                return lres;
            }
        }
        sibdie = 0;
        sibres = dwarf_siblingof_b(dbg,die,is_info,
            &sibdie,error);
        if (sibres == DW_DLV_ERROR) {
            if (die != in_die) {
                dwarf_dealloc_die(die);
            }
            if (child) {
                dwarf_dealloc_die(child);
            }
            printf("dwarf_siblingof_b ERROR\n");
            return DW_DLV_ERROR;
        }
        if (sibres == DW_DLV_NO_ENTRY) {
            if (die != in_die) {
                dwarf_dealloc_die(die);
            }
            if (child) {
                dwarf_dealloc_die(child);
            }
            return DW_DLV_OK;
        }
        vres = dwarf_validate_die_sibling(sibdie,&offset);
        if (vres == DW_DLV_ERROR) {
            if (die != in_die) {
                dwarf_dealloc_die(die);
            }
            if (child) {
                dwarf_dealloc_die(child);
            }
            dwarf_dealloc_die(sibdie);
            printf("Invalid sibling DIE\n");
            return DW_DLV_ERROR;
        }
        /*  loop again */
        if (die != in_die) {
            dwarf_dealloc_die(die);
        }
        die = 0;
    }
    return DW_DLV_OK;
}
```

9.50 Example walking CUs(e)

Example examining CUs looking for specific items(e).

Example examining CUs looking for specific items(e).

Loops through as many CUs as needed, stops and returns once a CU provides the desired data.

Assumes certain functions you write to remember the aspect of CUs that matter to you so once found in a cu my_needed_data_exists() or some other function of yours can identify the correct record.

Depending on your goals in examining the DIE tree it may be helpful to maintain a DIE stack of active DIEs, pushing and popping as you make your way throught the DIE levels.

We assume that on a serious error we will give up (for simplicity here).

We assume the caller to examplecuhdre() will know what to retrieve (when we return DW_DLV_OK from examplecuhdree() and that myrecords points to a record with all the data needed by my_needed_data_exists() and recorded by myrecord_data_for_die().

```
*/

struct myrecords_struct *myrecords;
void myrecord_data_for_die(struct myrecords_struct *myrecords_data,
    Dwarf_Die d)
{
    /* do somthing */
    /*  avoid compiler warnings */
    (void)myrecords_data;
    (void)d;
}
int  my_needed_data_exists(struct myrecords_struct *myrecords_data)
{
    /* do something */
    /*  avoid compiler warnings */
    (void)myrecords_data;
    return DW_DLV_OK;
}

/*  Loop on DIE tree.  */
static void
record_die_and_siblings_e(Dwarf_Debug dbg, Dwarf_Die in_die,
    int is_info, int in_level,
    struct myrecords_struct *myrec,
    Dwarf_Error *error)
{
    int       res = DW_DLV_OK;
    Dwarf_Die cur_die=in_die;
    Dwarf_Die child = 0;

    myrecord_data_for_die(myrec,in_die);

    /*   Loop on a list of siblings */
    for (;;) {
        Dwarf_Die sib_die = 0;

        /*  Depending on your goals, the in_level,
            and the DW_TAG of cur_die, you may want
            to skip the dwarf_child call. We descend
            the DWARF-standard way of depth-first. */
        res = dwarf_child(cur_die,&child,error);
        if (res == DW_DLV_ERROR) {
            printf("Error in dwarf_child , level %d \n",in_level);
            exit(EXIT_FAILURE);
        }
        if (res == DW_DLV_OK) {
            record_die_and_siblings_e(dbg,child,is_info,
                in_level+1,myrec,error);
            /* No longer need 'child' die. */
            dwarf_dealloc(dbg,child,DW_DLA_DIE);
            child = 0;
        }
        /* res == DW_DLV_NO_ENTRY or DW_DLV_OK */
        res = dwarf_siblingof_c(cur_die,&sib_die,error);
        if (res == DW_DLV_ERROR) {
            exit(EXIT_FAILURE);
        }
        if (res == DW_DLV_NO_ENTRY) {
            /* Done at this level. */
            break;
        }
        /* res == DW_DLV_OK */
        if (cur_die != in_die) {
            dwarf_dealloc(dbg,cur_die,DW_DLA_DIE);
            cur_die = 0;
        }
        cur_die = sib_die;
        myrecord_data_for_die(myrec,sib_die);
    }
    return;
}

/*  Assuming records properly initialized for your use. */
int examplecuhdre(Dwarf_Debug dbg,
    struct myrecords_struct *myrec,
    Dwarf_Error *error)
{
    Dwarf_Unsigned abbrev_offset = 0;
    Dwarf_Half     address_size = 0;
    Dwarf_Half     version_stamp = 0;
    Dwarf_Half     offset_size = 0;
    Dwarf_Half     extension_size = 0;
    Dwarf_Sig8     signature;
    Dwarf_Unsigned typeoffset = 0;
    Dwarf_Unsigned next_cu_header = 0;
    Dwarf_Half     header_cu_type = 0;
    Dwarf_Bool     is_info = TRUE;
    int            res = 0;

    while(!my_needed_data_exists(myrec)) {
        Dwarf_Die cu_die = 0;
        Dwarf_Unsigned cu_header_length = 0;

        memset(&signature,0, sizeof(signature));
        res = dwarf_next_cu_header_e(dbg,is_info,
            &cu_die,
            &cu_header_length,
            &version_stamp, &abbrev_offset,
            &address_size, &offset_size,
            &extension_size,&signature,
            &typeoffset, &next_cu_header,
            &header_cu_type,error);
        if (res == DW_DLV_ERROR) {
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            if (is_info == TRUE) {
                /*  Done with .debug_info, now check for
                    .debug_types. */
                is_info = FALSE;
                continue;
            }
            /*  No more CUs to read! Never found
                what we were looking for in either
                .debug_info or .debug_types. */
            return res;
        }
        /*  We have the cu_die .
            New in v0.9.0 because the connection of
            the CU_DIE to the CU header is clear
            in the argument list.
             /
        record_die_and_siblings_e(dbg,cu_die,is_info,
            0, myrec,error);
        dwarf_dealloc_die(cu_die);
    }
    /*  Found what we looked for */
    return DW_DLV_OK;
}
```

9.51 Example walking CUs(d)

Example accessing all CUs looking for specific items(d).

Example accessing all CUs looking for specific items(d).

Loops through as many CUs as needed, stops and returns once a CU provides the desired data.

Assumes certain functions you write to remember the aspect of CUs that matter to you so once found in a cu my_↩ needed_data_exists() or some other function of yours can identify the correct record. (Possibly a DIE global offset. Remember to note if each DIE has is_info TRUE or FALSE so libdwarf can find the DIE properly.)

Depending on your goals in examining the DIE tree it may be helpful to maintain a DIE stack of active DIEs, pushing and popping as you make your way throught the DIE levels.

We assume that on a serious error we will give up (for simplicity here).

We assume the caller to examplecuhdrd() will know what to retrieve (when we return DW_DLV_OK from examplecuhdrd() and that myrecords points to a record with all the data needed by my_needed_data_exists() and recorded by myrecord_data_for_die().

```
*/
struct myrecords_struct *myrecords;
void myrecord_data_for_die(struct myrecords_struct *myrecords,
    Dwarf_Die d);
int  my_needed_data_exists(struct myrecords_struct *myrecords);

/*  Loop on DIE tree. */
static void
record_die_and_siblingsd(Dwarf_Debug dbg, Dwarf_Die in_die,
    int is_info, int in_level,
    struct myrecords_struct *myrec,
    Dwarf_Error *error)
{
    int       res = DW_DLV_OK;
    Dwarf_Die cur_die=in_die;
    Dwarf_Die child = 0;

    myrecord_data_for_die(myrec,in_die);

    /*   Loop on a list of siblings */
    for (;;) {
        Dwarf_Die sib_die = 0;

        /*  Depending on your goals, the in_level,
            and the DW_TAG of cur_die, you may want
            to skip the dwarf_child call. */
        res = dwarf_child(cur_die,&child,error);
        if (res == DW_DLV_ERROR) {
            printf("Error in dwarf_child , level %d \n",in_level);
            exit(EXIT_FAILURE);
        }
        if (res == DW_DLV_OK) {
            record_die_and_siblingsd(dbg,child,is_info,
                in_level+1,myrec,error);
            /* No longer need 'child' die. */
            dwarf_dealloc(dbg,child,DW_DLA_DIE);
            child = 0;
        }
        /* res == DW_DLV_NO_ENTRY or DW_DLV_OK */
        res = dwarf_siblingof_b(dbg,cur_die,is_info,&sib_die,error);
        if (res == DW_DLV_ERROR) {
            exit(EXIT_FAILURE);
        }
        if (res == DW_DLV_NO_ENTRY) {
            /* Done at this level. */
            break;
        }
        /* res == DW_DLV_OK */
        if (cur_die != in_die) {
            dwarf_dealloc(dbg,cur_die,DW_DLA_DIE);
            cur_die = 0;
        }
        cur_die = sib_die;
        myrecord_data_for_die(myrec,sib_die);
    }
    return;
}

/*  Assuming records properly initialized for your use. */
int examplecuhdrd(Dwarf_Debug dbg,
    struct myrecords_struct *myrec,
    Dwarf_Error *error)
{
    Dwarf_Unsigned abbrev_offset = 0;
    Dwarf_Half     address_size = 0;
    Dwarf_Half     version_stamp = 0;
    Dwarf_Half     offset_size = 0;
    Dwarf_Half     extension_size = 0;
    Dwarf_Sig8     signature;
    Dwarf_Unsigned typeoffset = 0;
    Dwarf_Unsigned next_cu_header = 0;
    Dwarf_Half     header_cu_type = 0;
    Dwarf_Bool     is_info = TRUE;
    int            res = 0;

    while(!my_needed_data_exists(myrec)) {
        Dwarf_Die no_die = 0;
        Dwarf_Die cu_die = 0;
        Dwarf_Unsigned cu_header_length = 0;

        memset(&signature,0, sizeof(signature));
        res = dwarf_next_cu_header_d(dbg,is_info,&cu_header_length,
            &version_stamp, &abbrev_offset,
            &address_size, &offset_size,
            &extension_size,&signature,
            &typeoffset, &next_cu_header,
            &header_cu_type,error);
        if (res == DW_DLV_ERROR) {
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            if (is_info == TRUE) {
                /*  Done with .debug_info, now check for
                    .debug_types. */
                is_info = FALSE;
                continue;
            }
            /*  No more CUs to read! Never found
                what we were looking for in either
                .debug_info or .debug_types. */
            return res;
        }
        /*  The CU will have a single sibling, a cu_die.
            It is essential to call this right after
            a call to dwarf_next_cu_header_d() because
            there is no explicit connection provided to
            dwarf_siblingof_b(), which returns a DIE
            from whatever CU was last accessed by
            dwarf_next_cu_header_d()!
            The lack of explicit connection was a
            design mistake in the API (made in 1992). */

        res = dwarf_siblingof_b(dbg,no_die,is_info,
            &cu_die,error);
        if (res == DW_DLV_ERROR) {
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            /*  Impossible */
            exit(EXIT_FAILURE);
        }
        record_die_and_siblingsd(dbg,cu_die,is_info,
            0, myrec,error);
        dwarf_dealloc_die(cu_die);
    }
    /*  Found what we looked for */
    return DW_DLV_OK;
}
```

9.52 Using dwarf_offdie_b()

Example accessing a DIE by its offset.

Example accessing a DIE by its offset.

```
*/
int example6(Dwarf_Debug dbg,Dwarf_Off die_offset,
    Dwarf_Bool is_info,
    Dwarf_Error *error)
{
    Dwarf_Die return_die = 0;
    int res = 0;

    res = dwarf_offdie_b(dbg,die_offset,is_info,&return_die, error);
    if (res != DW_DLV_OK) {
        /*  res could be NO ENTRY or ERROR, so no
            dealloc necessary.  */
        return res;
    }
    /* Use return_die here. */
    dwarf_dealloc_die(return_die);
    /*  return_die is no longer usable for anything, we
        ensure we do not use it accidentally
        though a bit silly here given the return_die
        goes out of scope... */
    return_die = 0;
    return res;
}
```

9.53 Using dwarf_offset_given_die()

Example finding the section offset of a DIE.

Example finding the section offset of a DIE.

Here finding the offset of a CU-DIE.

```
*/
int example7(Dwarf_Debug dbg, Dwarf_Die in_die,
    Dwarf_Bool    is_info,
    Dwarf_Error * error)
{
    int res = 0;
    Dwarf_Off cudieoff = 0;
    Dwarf_Die cudie = 0;

    res = dwarf_CU_dieoffset_given_die(in_die,&cudieoff,error);
    if (res != DW_DLV_OK) {
        /*  FAIL */
        return res;
    }
    res = dwarf_offdie_b(dbg,cudieoff,is_info,&cudie,error);
    if (res != DW_DLV_OK) {
        /* FAIL */
        return res;
    }
    /* do something with cu_die */
    dwarf_dealloc_die(cudie);
    return res;
}
```

9.54 Using dwarf_attrlist()

Example Calling dwarf_attrlist()

Example Calling dwarf_attrlist()

```
*/
int example8(Dwarf_Debug dbg, Dwarf_Die somedie, Dwarf_Error *error)
{
    Dwarf_Signed atcount = 0;
    Dwarf_Attribute *atlist = 0;
    int errv = 0;
    Dwarf_Signed i = 0;

    errv = dwarf_attrlist(somedie, &atlist,&atcount, error);
    if (errv != DW_DLV_OK) {
        return errv;
    }
    for (i = 0; i < atcount; ++i) {
        /* use atlist[i] */
        dwarf_dealloc_attribute(atlist[i]);
        atlist[i] = 0;
    }
    dwarf_dealloc(dbg, atlist, DW_DLA_LIST);
    return DW_DLV_OK;
}
```

9.55 Using dwarf_offset_list()

Example using dwarf_offset_list.

Example using dwarf_offset_list.

An example calling dwarf_offset_list

Parameters

dbg	the Dwarf_Debug of interest
dieoffset	The section offset of a Dwarf_Die
is_info	Pass in TRUE if the dieoffset is for the .debug_info section, else pass in FALSE meaning the dieoffset is for the DWARF4 .debug_types section.
error	The usual error detail return.

Returns

Returns DW_DLV_OK etc

```
*/
int exampleoffset_list(Dwarf_Debug dbg, Dwarf_Off dieoffset,
    Dwarf_Bool is_info,Dwarf_Error * error)
{
    Dwarf_Unsigned offcnt = 0;
    Dwarf_Off *offbuf = 0;
    int errv = 0;
    Dwarf_Unsigned i = 0;

    errv = dwarf_offset_list(dbg,dieoffset, is_info,
        &offbuf,&offcnt, error);
    if (errv != DW_DLV_OK) {
        return errv;
    }
    for (i = 0; i < offcnt; ++i) {
        /* use offbuf[i] */
        /*  No need to free the offbuf entry, it
            is just an offset value. */
    }
    dwarf_dealloc(dbg, offbuf, DW_DLA_LIST);
    return DW_DLV_OK;
}
```

9.56 Documenting Form_Block

Example documents Form_Block content.

Example documents Form_Block content.

Used with certain location information functions, a frame expression function, expanded frame instructions, and DW_FORM_block<> functions and more.

See also

dwarf_formblock

Dwarf_Block_s

```
struct Dwarf_Block_s fields {

Dwarf_Unsigned  bl_len;
    Length of block bl_data points at

Dwarf_Ptr       bl_data;
    Uninterpreted data bytes

Dwarf_Small     bl_from_loclist;
    See libdwarf.h DW_LKIND, defaults to
    DW_LKIND_expression and except in certain
    location expressions the field is ignored.

Dwarf_Unsigned  bl_section_offset;
    Section offset of what bl_data points to
```

9.57 Using dwarf_discr_list()

Example using dwarf_discr_list, dwarf_formblock.

Example using dwarf_discr_list, dwarf_formblock.

An example calling dwarf_get_form_class, dwarf_discr_list, and dwarf_formblock. and the dwarf_deallocs applicable.

See also

dwarf_discr_list

dwarf_get_form_class

dwarf_formblock

Parameters

dw_dbg	The applicable Dwarf_Debug
dw_die	The applicable Dwarf_Die
dw_attr	The applicable Dwarf_Attribute
dw_attrnum,The	attribute number passed in to shorten this example a bit.
dw_isunsigned,The	attribute number passed in to shorten this example a bit.
dw_theform,The	form number passed in to shorten this example a bit.
dw_error	The usual error pointer.

Returns

Returns DW_DLV_OK etc

```
*/
int example_discr_list(Dwarf_Debug dbg,
    Dwarf_Die die,
    Dwarf_Attribute attr,
    Dwarf_Half attrnum,
    Dwarf_Bool isunsigned,
    Dwarf_Half theform,
    Dwarf_Error *error)
{
    /*  The example here assumes that
        attribute attr is a DW_AT_discr_list.
        isunsigned should be set from the signedness
        of the parent of 'die' per DWARF rules for
        DW_AT_discr_list. */
    enum Dwarf_Form_Class fc = DW_FORM_CLASS_UNKNOWN;
    Dwarf_Half version = 0;
    Dwarf_Half offset_size = 0;
    int wres = 0;

    wres = dwarf_get_version_of_die(die,&version,&offset_size);
    if (wres != DW_DLV_OK) {
        /* FAIL */
        return wres;
    }
    fc = dwarf_get_form_class(version,attrnum,offset_size,theform);
    if (fc == DW_FORM_CLASS_BLOCK) {
        int fres = 0;
        Dwarf_Block *tempb = 0;
        fres = dwarf_formblock(attr, &tempb, error);
        if (fres == DW_DLV_OK) {
            Dwarf_Dsc_Head h = 0;
            Dwarf_Unsigned u = 0;
            Dwarf_Unsigned arraycount = 0;
            int sres = 0;

            sres = dwarf_discr_list(dbg,
                (Dwarf_Small *)tempb->bl_data,
                tempb->bl_len,
                &h,&arraycount,error);
            if (sres == DW_DLV_NO_ENTRY) {
                /* Nothing here. */
                dwarf_dealloc(dbg, tempb, DW_DLA_BLOCK);
                return sres;
            }
            if (sres == DW_DLV_ERROR) {
                /* FAIL . */
                dwarf_dealloc(dbg, tempb, DW_DLA_BLOCK);
                return sres ;
            }
            for (u = 0; u < arraycount; u++) {
                int u2res = 0;
                Dwarf_Half dtype = 0;
                Dwarf_Signed dlow = 0;
                Dwarf_Signed dhigh = 0;
                Dwarf_Unsigned ulow = 0;
                Dwarf_Unsigned uhigh = 0;

                if (isunsigned) {
                    u2res = dwarf_discr_entry_u(h,u,
                        &dtype,&ulow,&uhigh,error);
                } else {
                    u2res = dwarf_discr_entry_s(h,u,
                        &dtype,&dlow,&dhigh,error);
                }
                if (u2res == DW_DLV_ERROR) {
                    /* Something wrong */
                    dwarf_dealloc(dbg,h,DW_DLA_DSC_HEAD);
                    dwarf_dealloc(dbg, tempb, DW_DLA_BLOCK);
                    return u2res ;
                }
                if (u2res == DW_DLV_NO_ENTRY) {
                    /* Impossible. u < arraycount. */
                    dwarf_dealloc(dbg,h,DW_DLA_DSC_HEAD);
                    dwarf_dealloc(dbg, tempb, DW_DLA_BLOCK);
                    return u2res;
                }
                /*  Do something with dtype, and whichever
                    of ulow, uhigh,dlow,dhigh got set.
                    Probably save the values somewhere.
                    Simple casting of dlow to ulow (or vice versa)
                    will not get the right value due to the nature
                    of LEB values. Similarly for uhigh, dhigh.
                    One must use the right call.  */
            }
            dwarf_dealloc(dbg,h,DW_DLA_DSC_HEAD);
            dwarf_dealloc(dbg, tempb, DW_DLA_BLOCK);
        }
    }
    return DW_DLV_OK;
}
```

9.58 Location/expression access

Example using DWARF2-5 loclists and loc-expressions.

Example using DWARF2-5 loclists and loc-expressions.

Valid for DWARF2 and later DWARF.

This example simply *assumes* the attribute has a form which relates to location lists or location expressions. Use dwarf_get_form_class() to determine if this attribute fits. Use dwarf_get_version_of_die() to help get the data you need.

See also

dwarf_get_form_class

dwarf_get_version_of_die

Reading a location expression

```
*/
int example_loclistcv5(Dwarf_Attribute someattr,
    Dwarf_Error *error)
{
    Dwarf_Unsigned lcount = 0;
    Dwarf_Loc_Head_c loclist_head = 0;
    int lres = 0;

    lres = dwarf_get_loclist_c(someattr,&loclist_head,
        &lcount,error);
    if (lres == DW_DLV_OK) {
        Dwarf_Unsigned i = 0;

        /*  Before any return remember to call
            dwarf_loc_head_c_dealloc(loclist_head); */
        for (i = 0; i < lcount; ++i) {
            Dwarf_Small loclist_lkind = 0;
            Dwarf_Small lle_value = 0;
            Dwarf_Unsigned rawval1 = 0;
            Dwarf_Unsigned rawval2 = 0;
            Dwarf_Bool debug_addr_unavailable = FALSE;
            Dwarf_Addr lopc = 0;
            Dwarf_Addr hipc = 0;
            Dwarf_Unsigned loclist_expr_op_count = 0;
            Dwarf_Locdesc_c locdesc_entry = 0;
            Dwarf_Unsigned expression_offset = 0;
            Dwarf_Unsigned locdesc_offset = 0;

            lres = dwarf_get_locdesc_entry_d(loclist_head,
                i,
                &lle_value,
                &rawval1,&rawval2,
                &debug_addr_unavailable,
                &lopc,&hipc,
                &loclist_expr_op_count,
                &locdesc_entry,
                &loclist_lkind,
                &expression_offset,
                &locdesc_offset,
                error);
            if (lres == DW_DLV_OK) {
                Dwarf_Unsigned j = 0;
                int opres = 0;
                Dwarf_Small op = 0;

                for (j = 0; j < loclist_expr_op_count; ++j) {
                    Dwarf_Unsigned opd1 = 0;
                    Dwarf_Unsigned opd2 = 0;
                    Dwarf_Unsigned opd3 = 0;
                    Dwarf_Unsigned offsetforbranch = 0;

                    opres = dwarf_get_location_op_value_c(
                        locdesc_entry, j,&op,
                        &opd1,&opd2,&opd3,
                        &offsetforbranch,
                        error);
                    if (opres == DW_DLV_OK) {
                        /*  Do something with the operators.
                            Usually you want to use opd1,2,3
                            as appropriate. Calculations
                            involving base addresses etc
                            have already been incorporated
                            in opd1,2,3.  */
                    } else {
                        dwarf_dealloc_loc_head_c(loclist_head);
                        /*Something is wrong. */
                        return opres;
                    }
                }
            } else {
                /* Something is wrong. Do something. */
                dwarf_dealloc_loc_head_c(loclist_head);
                return lres;
            }
        }
    }
    /*  Always call dwarf_loc_head_c_dealloc()
        to free all the memory associated with loclist_head.  */
    dwarf_dealloc_loc_head_c(loclist_head);
    loclist_head = 0;
    return lres;
}
```

9.59 Reading a location expression

Example getting details of a location expression.

Example getting details of a location expression.

See also

Location/expression access

```
*/
int example_locexprc(Dwarf_Debug dbg,Dwarf_Ptr expr_bytes,
    Dwarf_Unsigned expr_len,
    Dwarf_Half addr_size,
    Dwarf_Half offset_size,
    Dwarf_Half version,
    Dwarf_Error*error)
{
    Dwarf_Loc_Head_c head = 0;
    Dwarf_Locdesc_c  locentry = 0;
    int              res2 = 0;
    Dwarf_Unsigned rawlopc = 0;
    Dwarf_Unsigned rawhipc = 0;
    Dwarf_Bool     debug_addr_unavail = FALSE;
    Dwarf_Unsigned lopc = 0;
    Dwarf_Unsigned hipc = 0;
    Dwarf_Unsigned ulistlen = 0;
    Dwarf_Unsigned ulocentry_count = 0;
    Dwarf_Unsigned section_offset = 0;
    Dwarf_Unsigned locdesc_offset = 0;
    Dwarf_Small    lle_value = 0;
    Dwarf_Small    loclist_source = 0;
    Dwarf_Unsigned i = 0;

    res2 = dwarf_loclist_from_expr_c(dbg,
        expr_bytes,expr_len,
        addr_size,
        offset_size,
        version,
        &head,
        &ulistlen,
        error);
    if (res2 != DW_DLV_OK) {
        return res2;
    }
    /*  These are a location expression, not loclist.
        So we just need the 0th entry. */
    res2 = dwarf_get_locdesc_entry_d(head,
        0, /* Data from 0th because it is a loc expr,
            there is no list */
        &lle_value,
        &rawlopc, &rawhipc, &debug_addr_unavail, &lopc, &hipc,
        &ulocentry_count, &locentry,
        &loclist_source, &section_offset, &locdesc_offset,
        error);
    if (res2 == DW_DLV_ERROR) {
        dwarf_dealloc_loc_head_c(head);
        return res2;
    } else if (res2 == DW_DLV_NO_ENTRY) {
        dwarf_dealloc_loc_head_c(head);
        return res2;
    }
    /*  ASSERT: ulistlen == 1 */
    for (i = 0; i < ulocentry_count;++i) {
        Dwarf_Small op = 0;
        Dwarf_Unsigned opd1 = 0;
        Dwarf_Unsigned opd2 = 0;
        Dwarf_Unsigned opd3 = 0;
        Dwarf_Unsigned offsetforbranch = 0;

        res2 = dwarf_get_location_op_value_c(locentry,
            i, &op,&opd1,&opd2,&opd3,
            &offsetforbranch,
            error);
        /* Do something with the expression operator and operands */
        if (res2 != DW_DLV_OK) {
            dwarf_dealloc_loc_head_c(head);
            return res2;
        }
    }
    dwarf_dealloc_loc_head_c(head);
    return DW_DLV_OK;
}
```

9.60 Using dwarf_srclines_b()

Example using dwarf_srclines_b()

Example using dwarf_srclines_b()

An example calling dwarf_srclines_b

dwarf_srclines_dealloc_b dwarf_srclines_from_linecontext dwarf_srclines_files_indexes dwarf_srclines_files_↩
data_b dwarf_srclines_two_level_from_linecontext

Parameters

path	Path to an object we wish to open.
error	Allows passing back error details to the caller.

Returns

Return DW_DLV_OK etc.

```
*/
int examplec(Dwarf_Die cu_die,Dwarf_Error *error)
{
    /* EXAMPLE: DWARF2-DWARF5  access.  */
    Dwarf_Line     *linebuf = 0;
    Dwarf_Signed    linecount = 0;
    Dwarf_Line     *linebuf_actuals = 0;
    Dwarf_Signed    linecount_actuals = 0;
    Dwarf_Line_Context line_context = 0;
    Dwarf_Small     table_count = 0;
    Dwarf_Unsigned lineversion = 0;
    int sres = 0;
    /* ... */
    /*  we use 'return' here to signify we can do nothing more
        at this point in the code. */
    sres = dwarf_srclines_b(cu_die,&lineversion,
        &table_count,&line_context,error);
    if (sres != DW_DLV_OK) {
        /*  Handle the DW_DLV_NO_ENTRY  or DW_DLV_ERROR
            No memory was allocated so there nothing
            to dealloc here. */
        return sres;
    }
    if (table_count == 0) {
        /*  A line table with no actual lines.  */
        /*...do something, see dwarf_srclines_files_count()
            etc below. */

        dwarf_srclines_dealloc_b(line_context);
        /*  All the memory is released, the line_context
            and linebuf zeroed now
            as a reminder they are stale. */
        linebuf = 0;
        line_context = 0;
    } else if (table_count == 1) {
        Dwarf_Signed i = 0;
        Dwarf_Signed baseindex = 0;
        Dwarf_Signed file_count = 0;
        Dwarf_Signed endindex = 0;
        /*  Standard dwarf 2,3,4, or 5 line table */
        /*  Do something. */

        /*  First let us index through all the files listed
            in the line table header. */
        sres = dwarf_srclines_files_indexes(line_context,
            &baseindex,&file_count,&endindex,error);
        if (sres != DW_DLV_OK) {
            /* Something badly wrong! */
            return sres;
        }
        /*  Works for DWARF2,3,4 (one-based index)
            and DWARF5 (zero-based index) */
        for (i = baseindex; i < endindex; i++) {
            Dwarf_Unsigned dirindex = 0;
            Dwarf_Unsigned modtime = 0;
            Dwarf_Unsigned flength = 0;
            Dwarf_Form_Data16 *md5data = 0;
            int vres = 0;
            const char *name = 0;

            vres = dwarf_srclines_files_data_b(line_context,i,
                &name,&dirindex, &modtime,&flength,
                &md5data,error);
            if (vres != DW_DLV_OK) {
                /* something very wrong. */
                return vres;
            }
            /* do something */
        }

        /*  For this case where we have a line table we will likely
            wish to get the line details: */
        sres = dwarf_srclines_from_linecontext(line_context,
            &linebuf,&linecount,
            error);
        if (sres != DW_DLV_OK) {
            /* Error. Clean up the context information. */
            dwarf_srclines_dealloc_b(line_context);
            return sres;
        }
        /* The lines are normal line table lines. */
        for (i = 0; i < linecount; ++i) {
            /* use linebuf[i] */
        }
        dwarf_srclines_dealloc_b(line_context);
        /*  All the memory is released, the line_context
            and linebuf zeroed now as a reminder they are stale */
        linebuf = 0;
        line_context = 0;
        linecount = 0;
    } else {
        Dwarf_Signed i = 0;
        /*  ASSERT: table_count == 2,
            Experimental two-level line table. Version 0xf006
            We do not define the meaning of this non-standard
            set of tables here. */

        /*  For 'something C' (two-level line tables)
            one codes something like this
            Note that we do not define the meaning or
            use of two-level line
            tables as these are experimental, not standard DWARF. */
        sres = dwarf_srclines_two_level_from_linecontext(line_context,
            &linebuf,&linecount,
            &linebuf_actuals,&linecount_actuals,
            error);
        if (sres == DW_DLV_OK) {
            for (i = 0; i < linecount; ++i) {
                /*  use linebuf[i], these are the 'logicals'
                    entries. */
            }
            for (i = 0; i < linecount_actuals; ++i) {
                /*  use linebuf_actuals[i], these are the
                    actuals entries */
            }
            dwarf_srclines_dealloc_b(line_context);
            line_context = 0;
            linebuf = 0;
            linecount = 0;
            linebuf_actuals = 0;
            linecount_actuals = 0;
        } else if (sres == DW_DLV_NO_ENTRY) {
            /* This should be impossible, but do something.   */
            /* Then Free the line_context */
            dwarf_srclines_dealloc_b(line_context);
            line_context = 0;
            linebuf = 0;
            linecount = 0;
            linebuf_actuals = 0;
            linecount_actuals = 0;
        } else {
            /*  ERROR, show the error or something.
                Free the line_context. */
            dwarf_srclines_dealloc_b(line_context);
            line_context = 0;
            linebuf = 0;
            linecount = 0;
            linebuf_actuals = 0;
            linecount_actuals = 0;
        }
    }
    return DW_DLV_OK;
}
```

9.61 Using dwarf_srclines_b() and linecontext

Example two using dwarf_srclines_b(), dwarf_linesrc().

Example two using dwarf_srclines_b(), dwarf_linesrc().

See also

dwarf_srclines_b

dwarf_srclines_from_linecontext

dwarf_srclines_dealloc_b

```
*/
int exampled(Dwarf_Debug dbg,Dwarf_Die somedie,Dwarf_Error *error)
{
    Dwarf_Signed       count = 0;
    Dwarf_Line_Context context = 0;
    Dwarf_Line        *linebuf = 0;
    Dwarf_Signed       i = 0;
    Dwarf_Line        *line;
    Dwarf_Small        table_count =0;
    Dwarf_Unsigned     version = 0;
    int                sres = 0;

    sres = dwarf_srclines_b(somedie,
        &version, &table_count,&context,error);
    if (sres != DW_DLV_OK) {
        return sres;
    }
    sres = dwarf_srclines_from_linecontext(context,
        &linebuf,&count,error);
    if (sres != DW_DLV_OK) {
        dwarf_srclines_dealloc_b(context);
        return sres;
    }
    line = linebuf;
    for (i = 0; i < count; ++line,++i) {
        char * filename = 0;
        int lres = 0;
        Dwarf_Line dline = linebuf[i];

        lres = dwarf_linesrc(dline,&filename,error);
        if (lres != DW_DLV_OK) {
            dwarf_srclines_dealloc_b(context);
            return lres;
        }
        /* use filename */
        dwarf_dealloc(dbg, filename, DW_DLA_STRING);
    }
    dwarf_srclines_dealloc_b(context);
    return DW_DLV_OK;
}
```

9.62 Using dwarf_srcfiles()

Example getting source file names given a DIE.

Example getting source file names given a DIE.

```
*/
int examplee(Dwarf_Debug dbg,Dwarf_Die somedie,Dwarf_Error *error)
{
    /*  It is an annoying historical mistake in libdwarf
        that the count is a signed value. */
    Dwarf_Signed       count = 0;
    char             **srcfiles = 0;
    Dwarf_Signed       i = 0;
    int                 res = 0;
    Dwarf_Line_Context line_context = 0;
    Dwarf_Small         table_count = 0;
    Dwarf_Unsigned      lineversion = 0;

    res = dwarf_srclines_b(somedie,&lineversion,
        &table_count,&line_context,error);
    if (res != DW_DLV_OK) {
        /*  dwarf_finish() will dealloc srcfiles, not doing
            that here.  */
        return res;
    }
    res = dwarf_srcfiles(somedie, &srcfiles,&count,error);
    if (res != DW_DLV_OK) {
        dwarf_srclines_dealloc_b(line_context);
        return res;
    }

    for (i = 0; i < count; ++i) {
        Dwarf_Signed propernumber = 0;

        /*  Use srcfiles[i] If you  wish to print 'i'
            mostusefully
            you should reflect the numbering that
            a DW_AT_decl_file attribute would report in
            this CU. */
        if (lineversion ==  5) {
            propernumber = i;
        } else {
            propernumber = i+1;
        }
        printf("File %4ld %s\n",(unsigned long)propernumber,
            srcfiles[i]);
        dwarf_dealloc(dbg, srcfiles[i], DW_DLA_STRING);
        srcfiles[i] = 0;
    }
    /*  We could leave all dealloc to dwarf_finish() to
        handle, but this tidies up sooner. */
    dwarf_dealloc(dbg, srcfiles, DW_DLA_LIST);
    dwarf_srclines_dealloc_b(line_context);
    return DW_DLV_OK;
}
```

9.63 Using dwarf_get_globals()

Example using global symbol names.

Example using global symbol names.

For 0.4.2 and earlier this returned .debug_pubnames content. As of version 0.5.0 (October 2022) this returns .debug_pubnames (if it exists) and the relevant portion of .debug_names (if .debug_names exists) data.

```
*/
int examplef(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *globs = 0;
    Dwarf_Signed  i = 0;
    int           res = 0;

    res = dwarf_get_globals(dbg, &globs,&count, error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < count; ++i) {
        /* use globs[i] */
        char *name = 0;
        res = dwarf_globname(globs[i],&name,error);
        if (res != DW_DLV_OK) {
            dwarf_globals_dealloc(dbg,globs,count);
            return res;
        }
    }
    dwarf_globals_dealloc(dbg, globs, count);
    return DW_DLV_OK;
}
```

9.64 Using dwarf_globals_by_type()

Example reading .debug_pubtypes.

Example reading .debug_pubtypes.

The .debug_pubtypes section was in DWARF4, it could appear as an extension in other DWARF versions.. In libdwarf 0.5.0 and earlier the function dwarf_get_pubtypes() was used instead.

```
*/
int exampleg(Dwarf_Debug dbg, Dwarf_Error *error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *types = 0;
    Dwarf_Signed  i = 0;
    int           res = 0;

    res = dwarf_globals_by_type(dbg,DW_GL_PUBTYPES,
        &types,&count,error);
    /*  Alternatively the 0.5.0 and earlier call:
        res=dwarf_get_pubtypes(dbg, &types,&count, error); */
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < count; ++i) {
        /* use types[i] */
    }
    dwarf_globals_dealloc(dbg, types, count);
    return DW_DLV_OK;
}
```

9.65 Reading .debug_weaknames (nonstandard)

Example. weaknames was IRIX/MIPS only.

Example. weaknames was IRIX/MIPS only.

This section is an SGI/MIPS extension, not created by modern compilers.

```
*/
int exampleh(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *weaks = 0;
    Dwarf_Signed  i = 0;
    int           res = 0;

    res = dwarf_globals_by_type(dbg,DW_GL_WEAKS,
        &weaks,&count,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < count; ++i) {
        /* use weaks[i] */
    }
    dwarf_globals_dealloc(dbg, weaks, count);
    return DW_DLV_OK;
}
```

9.66 Reading .debug_funcnames (nonstandard)

Example. funcnames was IRIX/MIPS only.

Example. funcnames was IRIX/MIPS only.

This section is an SGI/MIPS extension, not created by modern compilers.

```
*/
int examplej(Dwarf_Debug dbg, Dwarf_Error*error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *funcs = 0;
    Dwarf_Signed  i = 0;
    int           fres = 0;

    fres = dwarf_globals_by_type(dbg,DW_GL_FUNCS,
        &funcs,&count,error);
    if (fres != DW_DLV_OK) {
        return fres;
    }
    for (i = 0; i < count; ++i) {
        /* use funcs[i] */
    }
    dwarf_globals_dealloc(dbg, funcs, count);
    return DW_DLV_OK;
}
```

9.67 Reading .debug_types (nonstandard)

Example .debug_types was IRIX/MIPS only.

Example .debug_types was IRIX/MIPS only.

This section is an SGI/MIPS extension, not created by modern compilers.

```
*/
int examplel(Dwarf_Debug dbg, Dwarf_Error *error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *types = 0;
    Dwarf_Signed  i = 0;
    int           res = 0;

    res = dwarf_globals_by_type(dbg,DW_GL_TYPES,
        &types,&count,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < count; ++i) {
        /* use types[i] */
    }
    dwarf_globals_dealloc(dbg, types, count);
    return DW_DLV_OK;
}
```

9.68 Reading .debug_varnames data (nonstandard)

Example .debug_varnames was IRIX/MIPS only.

Example .debug_varnames was IRIX/MIPS only.

This section is an SGI/MIPS extension, not created by modern compilers.

```
*/
int examplen(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Signed  count = 0;
    Dwarf_Global *vars = 0;
    Dwarf_Signed  i = 0;
    int           res = 0;

    res = dwarf_globals_by_type(dbg,DW_GL_VARS,
        &vars,&count,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < count; ++i) {
        /* use vars[i] */
    }
    dwarf_globals_dealloc(dbg, vars, count);
    return DW_DLV_OK;
}
```

9.69 Reading .debug_names data

Example access to .debug_names.

Example access to .debug_names.

This is accessing DWARF5 .debug_names, a section intended to provide fast access to DIEs.

It bears a strong resemblance to what libdwarf does in dwarf_global.c.

Making this a single (long) function here, though that is not how libdwarf or dwarfdump are written.

That is just one possible sort of access. There are many, and we would love to hear suggestions for specific new API functions in the library.

There is a wealth of information in .debug_names and the following is all taken care of for you by dwarf_get_globals().

```
*/
#define MAXPAIRS 8 /* The standard defines 5.*/
int exampledebugnames(Dwarf_Debug dbg,
    Dwarf_Unsigned *dnentrycount,
    Dwarf_Error *error)
{
    int                res = DW_DLV_OK;
    Dwarf_Unsigned     offset = 0;
    Dwarf_Dnames_Head dn   = 0;
    Dwarf_Unsigned     new_offset = 0;

    for (   ;res == DW_DLV_OK; offset = new_offset) {
        Dwarf_Unsigned comp_unit_count = 0;
        Dwarf_Unsigned local_type_unit_count = 0;
        Dwarf_Unsigned foreign_type_unit_count = 0;
        Dwarf_Unsigned bucket_count = 0;
        Dwarf_Unsigned name_count = 0;
        Dwarf_Unsigned abbrev_table_size = 0;
        Dwarf_Unsigned entry_pool_size = 0;
        Dwarf_Unsigned augmentation_string_size = 0;
        char           *aug_string = 0;
        Dwarf_Unsigned section_size = 0;
        Dwarf_Half     table_version = 0;
        Dwarf_Half     offset_size = 0;
        Dwarf_Unsigned i = 0;

        res = dwarf_dnames_header(dbg,offset,&dn,
            &new_offset,error);
        if (res == DW_DLV_ERROR) {
            /*  Something wrong. */
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            /*  Done. Normal end of the .debug_names section. */
            break;
        }
        *dnentrycount += 1;

        res = dwarf_dnames_sizes(dn,&comp_unit_count,
            &local_type_unit_count,
            &foreign_type_unit_count,
            &bucket_count,
            &name_count,&abbrev_table_size,
            &entry_pool_size,&augmentation_string_size,
            &aug_string,
            &section_size,&table_version,
            &offset_size,
            error);
        if (res != DW_DLV_OK) {
            /*  Something wrong. */
            return res;
        }
        /*  name indexes start with one */
        for (i = 1 ; i <= name_count; ++i) {
            Dwarf_Unsigned j = 0;
            /* dnames_name data */
            Dwarf_Unsigned bucketnum = 0;
            Dwarf_Unsigned hashvalunsign = 0;
            Dwarf_Unsigned offset_to_debug_str = 0;
            char           *ptrtostr          = 0;
            Dwarf_Unsigned offset_in_entrypool = 0;
            Dwarf_Unsigned abbrev_code = 0;
            Dwarf_Half     abbrev_tag    = 0;
            Dwarf_Half     nt_idxattr_array[MAXPAIRS];
            Dwarf_Half     nt_form_array[MAXPAIRS];
            Dwarf_Unsigned attr_count = 0;

            /* dnames_entrypool data */
            Dwarf_Half     tag          = 0;
            Dwarf_Bool     single_cu_case = 0;
            Dwarf_Unsigned single_cu_offset = 0;
            Dwarf_Unsigned value_count = 0;
            Dwarf_Unsigned index_of_abbrev = 0;
            Dwarf_Unsigned offset_of_initial_value = 0;
            Dwarf_Unsigned offset_next_entry_pool = 0;
            Dwarf_Half     idx_array[MAXPAIRS];
            Dwarf_Half     form_array[MAXPAIRS];
            Dwarf_Unsigned offsets_array[MAXPAIRS];
            Dwarf_Sig8     signatures_array[MAXPAIRS];

            Dwarf_Unsigned cu_table_index = 0;
            Dwarf_Unsigned tu_table_index = 0;
            Dwarf_Unsigned local_die_offset = 0;
            Dwarf_Unsigned parent_index = 0;
            Dwarf_Sig8     parenthash;

            (void)parent_index;     /* avoids warning */
            (void)local_die_offset; /* avoids warning */
            (void)tu_table_index;   /* avoids warning */
            (void)cu_table_index;   /* avoids warning */

            memset(&parenthash,0,sizeof(parenthash));
            /*  This gets us the entry pool offset we need.
                we provide idxattr and nt_form arrays (need
                not be initialized) and on return
                attr_count of those arrays are filled in.
                if attr_count < array_size then array_size
                is too small and things will not go well!
                See the count of DW_IDX entries in dwarf.h
                and make the arrays (say) 2 or more larger
                ensuring against future new DW_IDX index
                attributes..

                ptrtostring is the name in the Names Table. */
            res = dwarf_dnames_name(dn,i,
                &bucketnum, &hashvalunsign,
                &offset_to_debug_str,&ptrtostr,
                &offset_in_entrypool, &abbrev_code,
                &abbrev_tag,
                MAXPAIRS,
                nt_idxattr_array, nt_form_array,
                &attr_count,error);
            if (res == DW_DLV_NO_ENTRY) {
                /* past end. Normal. */
                break;
            }
            if (res == DW_DLV_ERROR) {
                dwarf_dealloc_dnames(dn);
                return res;
            }

            /*  Check attr_count < MAXPAIRS ! */
            /*  Now check the value of TAG to ensure it
                is something of interest as data or function.
                Plausible choices: */
            switch (abbrev_tag) {
            case DW_TAG_subprogram:
            case DW_TAG_variable:
            case DW_TAG_label:
            case DW_TAG_member:
            case DW_TAG_common_block:
            case DW_TAG_enumerator:
            case DW_TAG_namelist:
            case DW_TAG_module:
                break;
            default:
                /*  Not data or variable DIE involved.
                    Loop on the next i */
                continue;
            }

            /*  We need the number of values for this name
                from this call. tag will match abbrev_tag.  */
            res = dwarf_dnames_entrypool(dn,
                offset_in_entrypool,
                &abbrev_code,&tag,&value_count,&index_of_abbrev,
                &offset_of_initial_value,
                error);
            if (res != DW_DLV_OK) {
                dwarf_dealloc_dnames(dn);
                return res;
            }

            /*  This gets us an actual array of values
                as the library combines abbreviations,
                IDX attributes and values. We use
                the idx_array and form_array data
                created above. */

            res = dwarf_dnames_entrypool_values(dn,
                index_of_abbrev,
                offset_of_initial_value,
                value_count,
                idx_array,
                form_array,
                offsets_array,
                signatures_array,
                &single_cu_case,&single_cu_offset,
                &offset_next_entry_pool,
                error);
            if (res != DW_DLV_OK) {
                dwarf_dealloc_dnames(dn);
                return res;
            }
            for (j = 0; j < value_count; ++j) {
                Dwarf_Half idx = idx_array[j];

                switch(idx) {
                case DW_IDX_compile_unit:
                    cu_table_index = offsets_array[j];
                    break;
                case DW_IDX_die_offset:
                    local_die_offset = offsets_array[j];
                    break;
                /* The following are not meaninful when
                    reading globals. */
                case DW_IDX_type_unit:
                    tu_table_index = offsets_array[j];
                    break;
                case DW_IDX_parent:
                    parent_index = offsets_array[j];
                    break;
                case DW_IDX_type_hash:
                    parenthash = signatures_array[j];
                    break;
                default:
                    /* Not handled DW_IDX_GNU... */
                    break;
                }
            }
            /*  Now do something with the data aggregated */

        }
        dwarf_dealloc_dnames(dn);
    }
    return DW_DLV_OK;
}
```

9.70 Reading .debug_macro data (DWARF5)

Example reading DWARF5 macro data.

Example reading DWARF5 macro data.

This builds an list or some other data structure (not defined) to give an import somewhere to list the import offset and then later to enquire if the list has unexamined offsets. The code compiles but is not yet tested.

This example does not actually do the import at the correct time as this is just checking import offsets, not creating a proper full list (in the proper order) of the macros with the imports inserted. Here we find the macro context for a DIE, report those macro entries, noting any macro_import in a list loop extracting unchecked macro offsets from the list note any import in a list Of course some functions are not implemented here...

```
*/
int   has_unchecked_import_in_list(void)
{
    /* Do something */
    return DW_DLV_OK;
}
Dwarf_Unsigned get_next_import_from_list(void)
{
    /* Do something */
    return 22;
}
void  mark_this_offset_as_examined(
    Dwarf_Unsigned macro_unit_offset)
{
    /* do something */
    /*  avoid compiler warnings. */
    (void)macro_unit_offset;
}
void  add_offset_to_list(Dwarf_Unsigned offset)
{
    /* do something */
    /*  avoid compiler warnings. */
    (void)offset;;
}
int  examplep5(Dwarf_Die cu_die,Dwarf_Error *error)
{
    int lres = 0;
    Dwarf_Unsigned      k = 0;
    Dwarf_Unsigned      version = 0;
    Dwarf_Macro_Context macro_context = 0;
    Dwarf_Unsigned      macro_unit_offset = 0;
    Dwarf_Unsigned      number_of_ops = 0;
    Dwarf_Unsigned      ops_total_byte_len = 0;
    Dwarf_Bool          is_primary = TRUE;

    /*  Just call once each way to test both.
        Really the second is just for imported units.*/
    for ( ; ; ) {
        if (is_primary) {
            lres = dwarf_get_macro_context(cu_die,
                &version,&macro_context,
                &macro_unit_offset,
                &number_of_ops,
                &ops_total_byte_len,
                error);
            is_primary = FALSE;
        } else {
            if (has_unchecked_import_in_list()) {
                macro_unit_offset = get_next_import_from_list();
            } else {
                /* We are done */
                break;
            }
            lres = dwarf_get_macro_context_by_offset(cu_die,
                macro_unit_offset,
                &version,
                &macro_context,
                &number_of_ops,
                &ops_total_byte_len,
                error);
            mark_this_offset_as_examined(macro_unit_offset);
        }

        if (lres == DW_DLV_ERROR) {
            /* Something is wrong. */
            return lres;
        }
        if (lres == DW_DLV_NO_ENTRY) {
            /* We are done. */
            break;
        }
        /* lres ==  DW_DLV_OK) */
        for (k = 0; k < number_of_ops; ++k) {
            Dwarf_Unsigned  section_offset = 0;
            Dwarf_Half      macro_operator = 0;
            Dwarf_Half      forms_count = 0;
            const Dwarf_Small *formcode_array = 0;
            Dwarf_Unsigned  line_number = 0;
            Dwarf_Unsigned  index = 0;
            Dwarf_Unsigned  offset =0;
            const char     * macro_string =0;
            int lres2 = 0;

            lres2 = dwarf_get_macro_op(macro_context,
                k, &section_offset,&macro_operator,
                &forms_count, &formcode_array,error);
            if (lres2 != DW_DLV_OK) {
                /* Some error. Deal with it */
                dwarf_dealloc_macro_context(macro_context);
                return lres2;
            }
            switch(macro_operator) {
            case 0:
                /* Nothing to do. */
                break;
            case DW_MACRO_end_file:
                /* Do something */
                break;
            case DW_MACRO_define:
            case DW_MACRO_undef:
            case DW_MACRO_define_strp:
            case DW_MACRO_undef_strp:
            case DW_MACRO_define_strx:
            case DW_MACRO_undef_strx:
            case DW_MACRO_define_sup:
            case DW_MACRO_undef_sup: {
                lres2 = dwarf_get_macro_defundef(macro_context,
                    k,
                    &line_number,
                    &index,
                    &offset,
                    &forms_count,
                    &macro_string,
                    error);
                if (lres2 != DW_DLV_OK) {
                    /* Some error. Deal with it */
                    dwarf_dealloc_macro_context(macro_context);
                    return lres2;
                }
                /* do something */
                }
                break;
            case DW_MACRO_start_file: {
                lres2 = dwarf_get_macro_startend_file(macro_context,
                    k,&line_number,
                    &index,
                    &macro_string,error);
                if (lres2 != DW_DLV_OK) {
                    /* Some error. Deal with it */
                    dwarf_dealloc_macro_context(macro_context);
                    return lres2;
                }
                /* do something */
                }
                break;
            case DW_MACRO_import: {
                lres2 = dwarf_get_macro_import(macro_context,
                    k,&offset,error);
                if (lres2 != DW_DLV_OK) {
                    /* Some error. Deal with it */
                    dwarf_dealloc_macro_context(macro_context);
                    return lres2;
                }
                add_offset_to_list(offset);
                }
                break;
            case DW_MACRO_import_sup: {
                lres2 = dwarf_get_macro_import(macro_context,
                    k,&offset,error);
                if (lres2 != DW_DLV_OK) {
                    /* Some error. Deal with it */
                    dwarf_dealloc_macro_context(macro_context);
                    return lres2;
                }
                /* do something */
                }
                break;
            default:
                /*  This is an error or an omission
                    in the code here.  We do not
                    know what to do.
                    Do something appropriate, print something?. */
                break;
            }
        }
        dwarf_dealloc_macro_context(macro_context);
        macro_context = 0;
    }
    return DW_DLV_OK;
}
/*
```

9.71 Reading .debug_macinfo (DWARF2-4)

Example reading .debug_macinfo, DWARF2-4.

Example reading .debug_macinfo, DWARF2-4.
```
*/

void functionusingsigned(Dwarf_Signed s) {
    /* Do something */
    /* Avoid compiler warnings. */
    (void)s;
}

int examplep2(Dwarf_Debug dbg, Dwarf_Off cur_off,
    Dwarf_Error*error)
{
    Dwarf_Signed         count = 0;
    Dwarf_Macro_Details *maclist = 0;
    Dwarf_Signed         i = 0;
    Dwarf_Unsigned       max = 500000; /* sanity limit */
    int errv = 0;

    /*  This is for DWARF2,DWARF3, and DWARF4
        .debug_macinfo section only.*/
    /*  Given an offset from a compilation unit,
        start at that offset (from DW_AT_macroinfo)
        and get its macro details. */
    errv = dwarf_get_macro_details(dbg, cur_off,max,
        &count,&maclist,error);
    if (errv == DW_DLV_OK) {
        for (i = 0; i < count; ++i) {
            Dwarf_Macro_Details *  mentry = maclist +i;
            /* example of use */
            Dwarf_Signed lineno = mentry->dmd_lineno;
            functionusingsigned(lineno);
        }
        dwarf_dealloc(dbg, maclist, DW_DLA_STRING);
    }
    /*  Loop through all the compilation units macro info from zero.
        This is not guaranteed to work because DWARF does not
        guarantee every byte in the section is meaningful:
        there can be garbage between the macro info
        for CUs.  But this loop will sometimes work.
     /
    cur_off = 0;
    while((errv = dwarf_get_macro_details(dbg, cur_off,max,
        &count,&maclist,error))== DW_DLV_OK) {
        for (i = 0; i < count; ++i) {
            Dwarf_Macro_Details *  mentry = maclist +i;
            /* example of use */
            Dwarf_Signed lineno = mentry->dmd_lineno;
            functionusingsigned(lineno);
        }
        cur_off = maclist[count-1].dmd_offset + 1;
        dwarf_dealloc(dbg, maclist, DW_DLA_STRING);
    }
    return DW_DLV_OK;
}
```

9.72 Extracting fde, cie lists.

Example Opening FDE and CIE lists.

Example Opening FDE and CIE lists.
```
*/
int exampleq(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Cie    *cie_data = 0;
    Dwarf_Signed cie_count = 0;
    Dwarf_Fde    *fde_data = 0;
    Dwarf_Signed fde_count = 0;
    int          fres = 0;

    fres = dwarf_get_fde_list(dbg,&cie_data,&cie_count,
        &fde_data,&fde_count,error);
    if (fres != DW_DLV_OK) {
        return fres;
    }
    /*  Do something with the lists*/
    dwarf_dealloc_fde_cie_list(dbg, cie_data, cie_count,
        fde_data,fde_count);
    return fres;
}
```

9.73 Reading the .eh_frame section

Example access to .eh_frame.

Example access to .eh_frame.

```
*/
int exampler(Dwarf_Debug dbg,Dwarf_Addr mypcval,Dwarf_Error *error)
{
    /*  Given a pc value
        for a function find the FDE and CIE data for
        the function.
        Example shows basic access to FDE/CIE plus
        one way to access details given a PC value.
        dwarf_get_fde_n() allows accessing all FDE/CIE
        data so one could build up an application-specific
        table of information if that is more useful.  */
    Dwarf_Cie   *cie_data = 0;
    Dwarf_Signed cie_count = 0;
    Dwarf_Fde   *fde_data = 0;
    Dwarf_Signed fde_count = 0;
    int          fres = 0;

    fres = dwarf_get_fde_list_eh(dbg,&cie_data,&cie_count,
        &fde_data,&fde_count,error);
    if (fres == DW_DLV_OK) {
        Dwarf_Fde myfde = 0;
        Dwarf_Addr low_pc = 0;
        Dwarf_Addr high_pc = 0;

        fres = dwarf_get_fde_at_pc(fde_data,mypcval,
            &myfde,&low_pc,&high_pc,
            error);
        if (fres == DW_DLV_OK) {
            Dwarf_Cie mycie = 0;
            fres = dwarf_get_cie_of_fde(myfde,&mycie,error);
            if (fres == DW_DLV_ERROR) {
                return fres;
            }
            if (fres == DW_DLV_OK) {
                /*  Now we can access a range of information
                    about the fde and cie applicable. */
            }
        }
        dwarf_dealloc_fde_cie_list(dbg, cie_data, cie_count,
            fde_data,fde_count);
        return fres;
    }
    return fres;
}
```

9.74 Using dwarf_expand_frame_instructions

Example using dwarf_expand_frame_instructions.

Example using dwarf_expand_frame_instructions.

```
*/
int examples(Dwarf_Cie cie,
    Dwarf_Ptr instruction,Dwarf_Unsigned len,
    Dwarf_Error *error)
{
    Dwarf_Frame_Instr_Head head = 0;
    Dwarf_Unsigned         count = 0;
    int                    res = 0;
    Dwarf_Unsigned         i = 0;

    res = dwarf_expand_frame_instructions(cie,instruction,len,
        &head,&count, error);
    if (res != DW_DLV_OK) {
        return res;
    }

    for (i = 0; i < count; ++i) {
        Dwarf_Unsigned  instr_offset_in_instrs = 0;
        Dwarf_Small     cfa_operation          = 0;
        const char     *fields_description     = 0;
        Dwarf_Unsigned  u0 = 0;
        Dwarf_Unsigned  u1 = 0;
        Dwarf_Signed    s0 = 0;
        Dwarf_Signed    s1 = 0;
        Dwarf_Unsigned  code_alignment_factor = 0;
        Dwarf_Signed    data_alignment_factor = 0;
        Dwarf_Block     expression_block;
        const char *    op_name = 0;

        memset(&expression_block,0,sizeof(expression_block));
        res = dwarf_get_frame_instruction(head,i,
            &instr_offset_in_instrs,&cfa_operation,
            &fields_description,&u0,&u1,
            &s0,&s1,
            &code_alignment_factor,
            &data_alignment_factor,
            &expression_block,error);
        if (res == DW_DLV_ERROR) {
            dwarf_dealloc_frame_instr_head(head);
            return res;
        }
        if (res == DW_DLV_OK) {
            res = dwarf_get_CFA_name(cfa_operation,
                &op_name);
            if (res != DW_DLV_OK) {
                op_name = "unknown op";
            }
            printf("Instr %2lu %-22s %s\n",
                (unsigned long)i,
                op_name,
                fields_description);
            /*  Do something with the various data
                as guided by the fields_description. */
        }
    }
    dwarf_dealloc_frame_instr_head(head);
    return DW_DLV_OK;
}
```

9.75 Reading string offsets section data

Example accessing the string offsets section.

Example accessing the string offsets section.

An example accessing the string offsets section

Parameters

dbg	The Dwarf_Debug of interest.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

```
*/
int examplestrngoffsets(Dwarf_Debug dbg,Dwarf_Error *error)
{
    int                      res = 0;
    Dwarf_Str_Offsets_Table sot = 0;
    Dwarf_Unsigned           wasted_byte_count = 0;
    Dwarf_Unsigned           table_count = 0;
    Dwarf_Error              closeerror = 0;

    res = dwarf_open_str_offsets_table_access(dbg, &sot,error);
    if (res == DW_DLV_NO_ENTRY) {
        /* No such table */
        return res;
    }
    if (res == DW_DLV_ERROR) {
        /* Something is very wrong. Print the error? */
        return res;
    }
    for (;;) {
        Dwarf_Unsigned unit_length =0;
        Dwarf_Unsigned unit_length_offset =0;
        Dwarf_Unsigned table_start_offset =0;
        Dwarf_Half     entry_size = 0;
        Dwarf_Half     version =0;
        Dwarf_Half     padding =0;
        Dwarf_Unsigned table_value_count =0;
        Dwarf_Unsigned i = 0;
        Dwarf_Unsigned table_entry_value = 0;

        res = dwarf_next_str_offsets_table(sot,
            &unit_length, &unit_length_offset,
            &table_start_offset,
            &entry_size,&version,&padding,
            &table_value_count,error);
        if (res == DW_DLV_NO_ENTRY) {
            /* We have dealt with all tables */

            break;
        }
        if (res == DW_DLV_ERROR) {
            /* Something badly wrong. Do something. */
            dwarf_close_str_offsets_table_access(sot,&closeerror);
            dwarf_dealloc_error(dbg,closeerror);
            return res;
        }
        /*  One could call dwarf_str_offsets_statistics to
            get the wasted bytes so far, but we do not do that
            in this example. */
        /*  Possibly print the various table-related values
            returned just above. */
        for (i=0; i < table_value_count; ++i) {
            res = dwarf_str_offsets_value_by_index(sot,i,
                &table_entry_value,error);
            if (res != DW_DLV_OK) {
                /* Something is badly wrong. Do something. */
                dwarf_close_str_offsets_table_access(sot,&closeerror);
                dwarf_dealloc_error(dbg,closeerror);
                return res;
            }
            /*  Do something with the table_entry_value
                at this index. Maybe just print it.
                It is an offset in .debug_str. */
        }
    }
    res = dwarf_str_offsets_statistics(sot,&wasted_byte_count,
        &table_count,error);
    if (res != DW_DLV_OK) {
        dwarf_close_str_offsets_table_access(sot,&closeerror);
        dwarf_dealloc_error(dbg,closeerror);
        return res;
    }
    res = dwarf_close_str_offsets_table_access(sot,error);
    /*  little can be done about any error. */
    sot = 0;
    return res;
}
/*
```

9.76 Reading an aranges section

Example reading .debug_aranges.

Example reading .debug_aranges.

An example accessing the .debug_aranges section. Looking all the aranges entries. This example is not searching for anything.

Parameters

dbg	The Dwarf_Debug of interest.
dw_error	On error dw_error is set to point to the error details.

Returns

DW_DLV_OK etc.

```
*/
static void cleanupbadarange(Dwarf_Debug dbg,
    Dwarf_Arange *arange, Dwarf_Signed i, Dwarf_Signed count)
{
    Dwarf_Signed k = i;

    for ( ; k < count; ++k) {
        dwarf_dealloc(dbg,arange[k] , DW_DLA_ARANGE);
        arange[k] = 0;
    }
}
int exampleu(Dwarf_Debug dbg,Dwarf_Error *error)
{
    /*  It is a historical accident that the count is signed.
        No negative count is possible. */
    Dwarf_Signed  count = 0;
    Dwarf_Arange *arange = 0;
    int           res = 0;

    res = dwarf_get_aranges(dbg, &arange,&count, error);
    if (res == DW_DLV_OK) {
        Dwarf_Signed i = 0;

        for (i = 0; i < count; ++i) {
            Dwarf_Arange ara = arange[i];
            Dwarf_Unsigned segment = 0;
            Dwarf_Unsigned segment_entry_size = 0;
            Dwarf_Addr start = 0;
            Dwarf_Unsigned length = 0;
            Dwarf_Off  cu_die_offset = 0;

            res = dwarf_get_arange_info_b(ara,
                &segment,&segment_entry_size,
                &start, &length,
                &cu_die_offset,error);
            if (res != DW_DLV_OK) {
                cleanupbadarange(dbg,arange,i,count);
                dwarf_dealloc(dbg, arange, DW_DLA_LIST);
                return res;
            }
            /*  Do something with ara */
            dwarf_dealloc(dbg, ara, DW_DLA_ARANGE);
            arange[i] = 0;
        }
        dwarf_dealloc(dbg, arange, DW_DLA_LIST);
    }
    return res;
}
```

9.77 Example getting .debug_ranges data

Example accessing ranges data.

Example accessing ranges data.

If have_base_addr is false there is no die (as in reading the raw .debug_ranges section) or there is some serious data corruption somewhere.

```
*/

static
void functionusingrange(Dwarf_Signed i,Dwarf_Ranges *r,
    Dwarf_Bool *have_base_addr,
    Dwarf_Unsigned *baseaddr)
{
    Dwarf_Unsigned base = *baseaddr;

    printf("[%4ld] ",(signed long)i);
    switch(r->dwr_type) {
    case DW_RANGES_ENTRY:
        printf(
            "DW_RANGES_ENTRY: raw    addr1 " PRX
            " addr2 " PRX,
            r->dwr_addr1,r->dwr_addr2);
        if (r->dwr_addr1 == r->dwr_addr2) {
            printf(" (empty range)");
        }
        printf("\n");
        if (*have_base_addr) {
            printf("        "
            "DW_RANGES_ENTRY: cooked addr1 0x%08llx"
            " addr2  " PRX "\n" ,
            r->dwr_addr1+base,r->dwr_addr2+base);
        }
        break;
    case DW_RANGES_ADDRESS_SELECTION:
        printf(
            "Base Address    : " PRX "\n",
            r->dwr_addr2);
        *have_base_addr = TRUE;
        *baseaddr = r->dwr_addr2;
        break;
    case DW_RANGES_END:
        printf(
            "DW_RANGES_END   : 0,0\n");
        *have_base_addr = FALSE;
        *baseaddr = 0;
        break;
    default:
        printf(
            "ERROR           : incorrect dwr_type is 0x%lx\n",
            (unsigned long)r->dwr_type);
    }
}

/* On call the rangesoffset is a default zero. */
int examplev(Dwarf_Debug dbg,Dwarf_Off rangesoffset_in,
    Dwarf_Die die, Dwarf_Error*error)
{
    Dwarf_Signed   count = 0;
    Dwarf_Off      realoffset = 0;
    Dwarf_Ranges  *rangesbuf = 0;
    Dwarf_Unsigned bytecount = 0;
    int            res = 0;
    Dwarf_Unsigned base_address = 0;
    Dwarf_Bool have_base_addr = FALSE;
    Dwarf_Bool have_rangesoffset = FALSE;
    Dwarf_Unsigned rangesoffset = (Dwarf_Unsigned)rangesoffset_in;

    (void)have_rangesoffset;
    if (die) {
        /*  Find the ranges for a specific DIE */
        res = dwarf_get_ranges_baseaddress(dbg,die,&have_base_addr,
        &base_address,&have_rangesoffset,&rangesoffset,error);
        if (res == DW_DLV_ERROR) {
            /* Just pretend not an error. */
            dwarf_dealloc_error(dbg,*error);
            *error = 0;
        }
    } else {
        /*  To test getting all ranges and no knowledge
            of the base address (so cooked values
            cannot be definitely known unless
            the base is in the .debug_ranges entries
            themselves */

    }
    res = dwarf_get_ranges_b(dbg,rangesoffset,die,
        &realoffset,
        &rangesbuf,&count,&bytecount,error);
    if (res != DW_DLV_OK) {
        if (res == DW_DLV_ERROR) {
            printf("ERROR dwarf_get_ranges_b %s\n",
                dwarf_errmsg(*error));
        } else {
            printf("NO_ENTRY dwarf_get_ranges_b\n");
        }
        return res;
    }
    {
        Dwarf_Signed i = 0;
        printf("Range group base address: " PRX
            ", offset in .debug_ranges:"
            " 0x%08llx\n",
            base_address, rangesoffset);
        for ( i = 0; i < count; ++i ) {
            Dwarf_Ranges *cur = rangesbuf+i;
            /* Use cur. */
            functionusingrange(i,cur,&have_base_addr,&base_address);
        }
        dwarf_dealloc_ranges(dbg,rangesbuf,count);
    }
    return DW_DLV_OK;
}
```

9.78 Reading gdbindex data

Example accessing gdbindex section data.

Example accessing gdbindex section data.

```
*/
int examplew(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Gdbindex gindexptr = 0;
    Dwarf_Unsigned version = 0;
    Dwarf_Unsigned cu_list_offset = 0;
    Dwarf_Unsigned types_cu_list_offset = 0;
    Dwarf_Unsigned address_area_offset = 0;
    Dwarf_Unsigned symbol_table_offset = 0;
    Dwarf_Unsigned constant_pool_offset = 0;
    Dwarf_Unsigned section_size = 0;
    const char *   section_name = 0;
    int            res = 0;

    res = dwarf_gdbindex_header(dbg,&gindexptr,
        &version,&cu_list_offset, &types_cu_list_offset,
        &address_area_offset,&symbol_table_offset,
        &constant_pool_offset, &section_size,
        &section_name,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    {
        /* do something with the data */
        Dwarf_Unsigned length = 0;
        Dwarf_Unsigned typeslength = 0;
        Dwarf_Unsigned i = 0;
        res = dwarf_gdbindex_culist_array(gindexptr,
            &length,error);
        /* Example actions. */
        if (res != DW_DLV_OK) {
            dwarf_dealloc_gdbindex(gindexptr);
            return res;
        }
        for (i = 0; i < length; ++i) {
            Dwarf_Unsigned cuoffset = 0;
            Dwarf_Unsigned culength = 0;
            res = dwarf_gdbindex_culist_entry(gindexptr,
                i,&cuoffset,&culength,error);
            if (res != DW_DLV_OK) {
                return res;
            }
            /* Do something with cuoffset, culength */
        }
        res = dwarf_gdbindex_types_culist_array(gindexptr,
            &typeslength,error);
        if (res != DW_DLV_OK) {
            dwarf_dealloc_gdbindex(gindexptr);
            return res;
        }
        for (i = 0; i < typeslength; ++i) {
            Dwarf_Unsigned cuoffset = 0;
            Dwarf_Unsigned tuoffset = 0;
            Dwarf_Unsigned type_signature  = 0;
            res = dwarf_gdbindex_types_culist_entry(gindexptr,
                i,&cuoffset,&tuoffset,&type_signature,error);
            if (res != DW_DLV_OK) {
                dwarf_dealloc_gdbindex(gindexptr);
                return res;
            }
            /* Do something with cuoffset etc. */
        }
        dwarf_dealloc_gdbindex(gindexptr);
    }
    return DW_DLV_OK;
}
```

9.79 Reading gdbindex addressarea

Example accessing gdbindex addressarea data.

Example accessing gdbindex addressarea data.

```
*/
int examplewgdbindex(Dwarf_Gdbindex gdbindex,
    Dwarf_Error *error)
{
    Dwarf_Unsigned list_len = 0;
    Dwarf_Unsigned i = 0;
    int            res = 0;

    res = dwarf_gdbindex_addressarea(gdbindex, &list_len,error);
    if (res != DW_DLV_OK) {
        /* Something wrong, ignore the addressarea */
        return res;
    }
    /* Iterate through the address area. */
    for (i  = 0; i < list_len; i++) {
        Dwarf_Unsigned lowpc = 0;
        Dwarf_Unsigned highpc = 0;
        Dwarf_Unsigned cu_index = 0;

        res = dwarf_gdbindex_addressarea_entry(gdbindex,i,
            &lowpc,&highpc,
            &cu_index,
            error);
        if (res != DW_DLV_OK) {
            /* Something wrong, ignore the addressarea */
            return res;
        }
        /*  We have a valid address area entry, do something
            with it. */
    }
    return DW_DLV_OK;
}
```

9.80 Reading the gdbindex symbol table

Example accessing gdbindex symbol table data.

Example accessing gdbindex symbol table data.

```
*/
int examplex(Dwarf_Gdbindex gdbindex,Dwarf_Error*error)
{
    Dwarf_Unsigned symtab_list_length = 0;
    Dwarf_Unsigned i = 0;
    int            res = 0;

    res = dwarf_gdbindex_symboltable_array(gdbindex,
        &symtab_list_length,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i  = 0; i < symtab_list_length; i++) {
        Dwarf_Unsigned symnameoffset = 0;
        Dwarf_Unsigned cuvecoffset = 0;
        Dwarf_Unsigned cuvec_len = 0;
        Dwarf_Unsigned ii = 0;
        const char *name = 0;
        int resl = 0;

        resl = dwarf_gdbindex_symboltable_entry(gdbindex,i,
            &symnameoffset,&cuvecoffset,
            error);
        if (resl != DW_DLV_OK) {
            return resl;
        }
        resl = dwarf_gdbindex_string_by_offset(gdbindex,
            symnameoffset,&name,error);
        if (resl != DW_DLV_OK) {
            return resl;
        }
        resl = dwarf_gdbindex_cuvector_length(gdbindex,
            cuvecoffset,&cuvec_len,error);
        if (resl != DW_DLV_OK) {
            return resl;
        }
        for (ii = 0; ii < cuvec_len; ++ii ) {
            Dwarf_Unsigned attributes = 0;
            Dwarf_Unsigned cu_index = 0;
            Dwarf_Unsigned symbol_kind = 0;
            Dwarf_Unsigned is_static = 0;
            int res2 = 0;

            res2 = dwarf_gdbindex_cuvector_inner_attributes(
                gdbindex,cuvecoffset,ii,
                &attributes,error);
            if (res2 != DW_DLV_OK) {
                return res2;
            }
            /*  'attributes' is a value with various internal
                fields so we expand the fields. */
            res2 = dwarf_gdbindex_cuvector_instance_expand_value(
                gdbindex, attributes, &cu_index,
                &symbol_kind, &is_static,
                error);
            if (res2 != DW_DLV_OK) {
                return res2;
            }
            /* Do something with the attributes. */
        }
    }
    return DW_DLV_OK;
}
```

9.81 Reading cu and tu Debug Fission data

Example using dwarf_get_xu_index_header.

Example using dwarf_get_xu_index_header.

Debug Fission is an older name for Split Dwarf.

```
*/
int exampley(Dwarf_Debug dbg, const char *type,
    Dwarf_Error *error)
{
    /* type is "tu" or "cu" */
    int                     res = 0;
    Dwarf_Xu_Index_Header xuhdr = 0;
    Dwarf_Unsigned          version_number = 0;
    Dwarf_Unsigned          offsets_count = 0; /*L */
    Dwarf_Unsigned          units_count = 0; /* M */
    Dwarf_Unsigned          hash_slots_count = 0; /* N */
    const char             *section_name = 0;

    res = dwarf_get_xu_index_header(dbg,
        type,
        &xuhdr,
        &version_number,
        &offsets_count,
        &units_count,
        &hash_slots_count,
        &section_name,
        error);
    if (res != DW_DLV_OK) {
        return res;
    }
    /* Do something with the xuhdr here . */
    dwarf_dealloc_xu_header(xuhdr);
    return DW_DLV_OK;
}
```

9.82 Reading Split Dwarf (Debug Fission) hash slots

Example using dwarf_get_xu_hash_entry()

Example using dwarf_get_xu_hash_entry()
```
*/
int examplez( Dwarf_Xu_Index_Header xuhdr,
    Dwarf_Unsigned hash_slots_count,
    Dwarf_Error *error)
{
    /*  hash_slots_count returned by
        dwarf_get_xu_index_header() */
    static Dwarf_Sig8 zerohashval;
    Dwarf_Unsigned h = 0;

    for (h = 0; h < hash_slots_count; h++) {
        Dwarf_Sig8 hashval;
        Dwarf_Unsigned index = 0;
        int res = 0;

        res = dwarf_get_xu_hash_entry(xuhdr,h,
            &hashval,&index,error);
        if (res != DW_DLV_OK) {
            return res;
        }
        if (!memcmp(&hashval,&zerohashval,
            sizeof(Dwarf_Sig8)) && index == 0 ) {
            /* An unused hash slot */
            continue;
        }
        /*  Here, hashval and index (a row index into
            offsets and lengths) are valid. Do
            something with them */
    }
    return DW_DLV_OK;
}
```

9.83 Reading high pc from a DIE.

Example get high-pc from a DIE.

Example get high-pc from a DIE.
```
*/
int examplehighpc(Dwarf_Die die,
    Dwarf_Addr *highpc,
    Dwarf_Error *error)
{
    int        res = 0;
    Dwarf_Addr localhighpc = 0;
    Dwarf_Half form = 0;
    enum Dwarf_Form_Class formclass = DW_FORM_CLASS_UNKNOWN;

    res = dwarf_highpc_b(die,&localhighpc,
        &form,&formclass, error);
    if (res != DW_DLV_OK) {
        return res;
    }
    if (form != DW_FORM_addr &&
        !dwarf_addr_form_is_indexed(form)) {
        Dwarf_Addr low_pc = 0;

        /*  The localhighpc is an offset from
            DW_AT_low_pc. */
        res = dwarf_lowpc(die,&low_pc,error);
        if (res != DW_DLV_OK) {
            return res;
        } else  {
            localhighpc += low_pc;
        }
    }
    *highpc = localhighpc;
    return DW_DLV_OK;
}
```

9.84 Reading Split Dwarf (Debug Fission) data

Example getting cu/tu name, offset.

Example getting cu/tu name, offset.
```
*/
int exampleza(Dwarf_Xu_Index_Header xuhdr,
    Dwarf_Unsigned offsets_count,
    Dwarf_Unsigned index,
    Dwarf_Error *error)
{
    Dwarf_Unsigned col = 0;

    /*  We use  'offsets_count' returned by
        a dwarf_get_xu_index_header() call.
        We use 'index' returned by a
        dwarf_get_xu_hash_entry() call. */
    for (col = 0; col < offsets_count; col++) {
        Dwarf_Unsigned off = 0;
        Dwarf_Unsigned len = 0;
        const char     *name = 0;
        Dwarf_Unsigned num = 0;
        int res = 0;

        res = dwarf_get_xu_section_names(xuhdr,
            col,&num,&name,error);
        if (res == DW_DLV_ERROR) {
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            break;
        }
        res = dwarf_get_xu_section_offset(xuhdr,
            index,col,&off,&len,error);
        if (res == DW_DLV_ERROR) {
            return res;
        }
        if (res == DW_DLV_NO_ENTRY) {
            break;
        }
        /*  Here we have the DW_SECT_ name and number
            and the base offset and length of the
            section data applicable to the hash
            that got us here.
            Use the values.*/
    }
    return DW_DLV_OK;
}
```

9.85 Retrieving tag,attribute,etc names

Example getting tag,attribute,etc names as strings.

Example getting tag,attribute,etc names as strings.
```
*/
void examplezb(void)
{
    const char * out = "unknown something";
    int          res = 0;

    /*  The following is wrong, do not do it!
        Confusing TAG with ACCESS!  */
    res = dwarf_get_ACCESS_name(DW_TAG_entry_point,&out);
    /*  Nothing one does here with 'res' or 'out'
        is meaningful. */

    out = "<unknown TAG>"; /* Not a malloc'd string! */
    /* The following is meaningful.*/
    res = dwarf_get_TAG_name(DW_TAG_entry_point,&out);
    (void)res; /*  avoids unused var compiler warning */
    /*  If res == DW_DLV_ERROR or DW_DLV_NO_ENTRY
        out will be the locally assigned static string.
        If res == DW_DLV_OK it will be a usable
        TAG name string.
        In no case should a returned string be free()d. */
}
```

9.86 Using GNU debuglink data

Example showing dwarf_add_debuglink_global_path.

Example showing dwarf_add_debuglink_global_path.

An example using both dwarf_add_debuglink_global_path and dwarf_gnu_debuglink .

```
*/
int exampledebuglink(Dwarf_Debug dbg, Dwarf_Error* error)
{
    int      res = 0;
    char    *debuglink_path = 0;
    unsigned char *crc = 0;
    char    *debuglink_fullpath = 0;
    unsigned debuglink_fullpath_strlen = 0;
    unsigned buildid_type = 0;
    char *   buildidowner_name = 0;
    unsigned char *buildid_itself = 0;
    unsigned buildid_length = 0;
    char **  paths = 0;
    unsigned paths_count = 0;
    unsigned i = 0;

    /*  This is just an example if one knows
        of another place full-DWARF objects
        may be. "/usr/lib/debug" is automatically
        set. */
    res = dwarf_add_debuglink_global_path(dbg,
        "/some/path/debug",error);
    if (res != DW_DLV_OK) {
        /*  Something is wrong*/
        return res;
    }
    res = dwarf_gnu_debuglink(dbg,
        &debuglink_path,
        &crc,
        &debuglink_fullpath,
        &debuglink_fullpath_strlen,
        &buildid_type,
        &buildidowner_name,
        &buildid_itself,
        &buildid_length,
        &paths,
        &paths_count,
        error);
    if (res == DW_DLV_ERROR) {
        return res;
    }
    if (res == DW_DLV_NO_ENTRY) {
        /*  No such sections as .note.gnu.build-id
            or .gnu_debuglink  */
        return res;
    }
    if (debuglink_fullpath_strlen) {
        printf("debuglink     path: %s\n",debuglink_path);
        printf("crc length        : %u  crc: ",4);
        for (i = 0; i < 4;++i ) {
            printf("%02x",crc[i]);
        }
        printf("\n");
        printf("debuglink fullpath: %s\n",debuglink_fullpath);
    }
    if (buildid_length) {
        printf("buildid type      : %u\n",buildid_type);
        printf("Buildid owner     : %s\n",buildidowner_name);
        printf("buildid byte count: %u\n",buildid_length);
        printf(" ");
        /*   buildid_length should be 20. */
        for (i = 0; i < buildid_length;++i) {
            printf("%02x",buildid_itself[i]);
        }
        printf("\n");
    }
    printf("Possible paths count %u\n",paths_count);
    for ( ; i < paths_count; ++i ){
        printf("%2u: %s\n",i,paths[i]);
    }
    free(debuglink_fullpath);
    free(paths);
    return DW_DLV_OK;
}
```

9.87 Accessing accessing raw rnglist

Example showing access to rnglist.

Example showing access to rnglist.

This is accessing DWARF5 .debug_rnglists.

```
*/
int example_raw_rnglist(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Unsigned count = 0;
    int            res = 0;
    Dwarf_Unsigned i = 0;

    res = dwarf_load_rnglists(dbg,&count,error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i =0  ; i < count ; ++i) {
        Dwarf_Unsigned header_offset = 0;
        Dwarf_Small   offset_size = 0;
        Dwarf_Small   extension_size = 0;
        unsigned      version = 0; /* 5 */
        Dwarf_Small   address_size = 0;
        Dwarf_Small   segment_selector_size = 0;
        Dwarf_Unsigned offset_entry_count = 0;
        Dwarf_Unsigned offset_of_offset_array = 0;
        Dwarf_Unsigned offset_of_first_rangeentry = 0;
        Dwarf_Unsigned offset_past_last_rangeentry = 0;

        res = dwarf_get_rnglist_context_basics(dbg,i,
            &header_offset,&offset_size,&extension_size,
            &version,&address_size,&segment_selector_size,
            &offset_entry_count,&offset_of_offset_array,
            &offset_of_first_rangeentry,
            &offset_past_last_rangeentry,error);
        if (res != DW_DLV_OK) {
            return res;
        }
        {
            Dwarf_Unsigned e = 0;
            unsigned colmax = 4;
            unsigned col = 0;
            Dwarf_Unsigned global_offset_of_value = 0;

            for ( ; e < offset_entry_count; ++e) {
                Dwarf_Unsigned value = 0;
                int resc = 0;

                resc = dwarf_get_rnglist_offset_index_value(dbg,
                    i,e,&value,
                    &global_offset_of_value,error);
                if (resc != DW_DLV_OK) {
                    return resc;
                }
                /*  Do something */
                col++;
                if (col == colmax) {
                    col = 0;
                }
            }
        }
        {
            Dwarf_Unsigned curoffset = offset_of_first_rangeentry;
            Dwarf_Unsigned endoffset = offset_past_last_rangeentry;
            int            rese = 0;
            Dwarf_Unsigned ct = 0;

            for ( ; curoffset < endoffset; ++ct ) {
                unsigned entrylen = 0;
                unsigned code = 0;
                Dwarf_Unsigned v1 = 0;
                Dwarf_Unsigned v2 = 0;
                rese = dwarf_get_rnglist_rle(dbg,i,
                    curoffset,endoffset,
                    &entrylen,
                    &code,&v1,&v2,error);
                if (rese != DW_DLV_OK) {
                    return rese;
                }
                /*  Do something with the values */
                curoffset += entrylen;
                if (curoffset > endoffset) {
                    return DW_DLV_ERROR;
                }
            }
        }
    }
    return DW_DLV_OK;
}
```

9.88 Accessing rnglists section

Example showing access to rnglists on an Attribute.

Example showing access to rnglists on an Attribute.

This is accessing DWARF5 .debug_rnglists. The section first appears in DWARF5.

```
*/
int example_rnglist_for_attribute(Dwarf_Attribute attr,
    Dwarf_Unsigned attrvalue,Dwarf_Error *error)
{
    /*  attrvalue must be the DW_AT_ranges
        DW_FORM_rnglistx or DW_FORM_sec_offset value
        extracted from attr. */
    int                   res = 0;
    Dwarf_Half            theform = 0;
    Dwarf_Unsigned        entries_count;
    Dwarf_Unsigned        global_offset_of_rle_set;
    Dwarf_Rnglists_Head rnglhead = 0;
    Dwarf_Unsigned        i = 0;

    res = dwarf_rnglists_get_rle_head(attr,
        theform,
        attrvalue,
        &rnglhead,
        &entries_count,
        &global_offset_of_rle_set,
        error);
    if (res != DW_DLV_OK) {
        return res;
    }
    for (i = 0; i < entries_count; ++i) {
        unsigned entrylen     = 0;
        unsigned       code          = 0;
        Dwarf_Unsigned rawlowpc  = 0;
        Dwarf_Unsigned rawhighpc = 0;
        Dwarf_Bool     debug_addr_unavailable = FALSE;
        Dwarf_Unsigned lowpc  = 0;
        Dwarf_Unsigned highpc = 0;

        /*  Actual addresses are most likely what one
            wants to know, not the lengths/offsets
            recorded in .debug_rnglists. */
        res = dwarf_get_rnglists_entry_fields_a(rnglhead,
            i,&entrylen,&code,
            &rawlowpc,&rawhighpc,
            &debug_addr_unavailable,
            &lowpc,&highpc,error);
        if (res != DW_DLV_OK) {
            dwarf_dealloc_rnglists_head(rnglhead);
            return res;
        }
        if (code == DW_RLE_end_of_list) {
            /* we are done */
            break;
        }
        if (code == DW_RLE_base_addressx ||
            code == DW_RLE_base_address) {
            /*  We do not need to use these, they
                have been accounted for already. */
            continue;
        }
        if (debug_addr_unavailable) {
            /* lowpc and highpc are not real addresses */
            continue;
        }
        /*  Here do something with lowpc and highpc, these
            are real addresses */
    }
    dwarf_dealloc_rnglists_head(rnglhead);
    return DW_DLV_OK;
}
```

9.89 Demonstrating reading DWARF without a file.

How to read DWARF2 and later from memory.

How to read DWARF2 and later from memory.
```
*/

#include <config.h>

#include <stddef.h> /* NULL */
#include <stdio.h>  /* printf() */
#include <stdlib.h> /* exit() */
#include <string.h> /* strcmp() */

#include "dwarf.h"
#include "libdwarf.h"
#include "libdwarf_private.h"

/*
    This demonstates processing DWARF
    from in_memory data.  For simplicity
    in this example we are using static arrays.
    The C source is src/bin/dwarfexample/jitreader.c

    The motivation is from JIT compiling, where
    at runtime of some application, it generates
    code on the file and DWARF information for it too.

    This gives an example of enabling all of libdwarf's
    functions without actually having the DWARF information
    in a file.  (If you have a file in some odd format
    you can use this approach to have libdwarf access
    the format for DWARF data and work normally without
    ever exposing the format to libdwarf.)

    None of the structures defined here in this source
    (or any source using this feature)
    are ever known to libdwarf. They are totally
    private to your code.
    The code you write (like this example) you compile
    separate from libdwarf. You never place your code
    into libdwarf, you just link your code into
    your application and link against libdwarf.
*/

/* Some valid DWARF2 data */
static Dwarf_Small abbrevbytes[] = {
0x01, 0x11, 0x01, 0x25, 0x0e, 0x13, 0x0b, 0x03, 0x08, 0x1b,
0x0e, 0x11, 0x01, 0x12, 0x01, 0x10, 0x06, 0x00, 0x00, 0x02,
0x2e, 0x01, 0x3f, 0x0c, 0x03, 0x08, 0x3a, 0x0b, 0x3b, 0x0b,
0x39, 0x0b, 0x27, 0x0c, 0x11, 0x01, 0x12, 0x01, 0x40, 0x06,
0x97, 0x42, 0x0c, 0x01, 0x13, 0x00, 0x00, 0x03, 0x34, 0x00,
0x03, 0x08, 0x3a, 0x0b, 0x3b, 0x0b, 0x39, 0x0b, 0x49, 0x13,
0x02, 0x0a, 0x00, 0x00, 0x04, 0x24, 0x00, 0x0b, 0x0b, 0x3e,
0x0b, 0x03, 0x08, 0x00, 0x00, 0x00, };
static Dwarf_Small infobytes[] = {
0x60, 0x00, 0x00, 0x00, 0x02, 0x00, 0x00, 0x00, 0x00, 0x00,
0x08, 0x01, 0x00, 0x00, 0x00, 0x00, 0x0c, 0x74, 0x2e, 0x63,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x02, 0x01, 0x66, 0x00, 0x01,
0x02, 0x06, 0x01, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00, 0x00, 0x00, 0x01, 0x5c, 0x00, 0x00, 0x00, 0x03, 0x69,
0x00, 0x01, 0x03, 0x08, 0x5c, 0x00, 0x00, 0x00, 0x02, 0x91,
0x6c, 0x00, 0x04, 0x04, 0x05, 0x69, 0x6e, 0x74, 0x00, 0x00, };
static Dwarf_Small strbytes[] = {
0x47, 0x4e, 0x55, 0x20, 0x43, 0x31, 0x37, 0x20, 0x39, 0x2e,
0x33, 0x2e, 0x30, 0x20, 0x2d, 0x6d, 0x74, 0x75, 0x6e, 0x65,
0x3d, 0x67, 0x65, 0x6e, 0x65, 0x72, 0x69, 0x63, 0x20, 0x2d,
0x6d, 0x61, 0x72, 0x63, 0x68, 0x3d, 0x78, 0x38, 0x36, 0x2d,
0x36, 0x34, 0x20, 0x2d, 0x67, 0x64, 0x77, 0x61, 0x72, 0x66,
0x2d, 0x32, 0x20, 0x2d, 0x4f, 0x30, 0x20, 0x2d, 0x66, 0x61,
0x73, 0x79, 0x6e, 0x63, 0x68, 0x72, 0x6f, 0x6e, 0x6f, 0x75,
0x73, 0x2d, 0x75, 0x6e, 0x77, 0x69, 0x6e, 0x64, 0x2d, 0x74,
0x61, 0x62, 0x6c, 0x65, 0x73, 0x20, 0x2d, 0x66, 0x73, 0x74,
0x61, 0x63, 0x6b, 0x2d, 0x70, 0x72, 0x6f, 0x74, 0x65, 0x63,
0x74, 0x6f, 0x72, 0x2d, 0x73, 0x74, 0x72, 0x6f, 0x6e, 0x67,
0x20, 0x2d, 0x66, 0x73, 0x74, 0x61, 0x63, 0x6b, 0x2d, 0x63,
0x6c, 0x61, 0x73, 0x68, 0x2d, 0x70, 0x72, 0x6f, 0x74, 0x65,
0x63, 0x74, 0x69, 0x6f, 0x6e, 0x20, 0x2d, 0x66, 0x63, 0x66,
0x2d, 0x70, 0x72, 0x6f, 0x74, 0x65, 0x63, 0x74, 0x69, 0x6f,
0x6e, 0x00, 0x2f, 0x76, 0x61, 0x72, 0x2f, 0x74, 0x6d, 0x70,
0x2f, 0x74, 0x69, 0x6e, 0x79, 0x64, 0x77, 0x61, 0x72, 0x66,
0x00, };

/*  An internals_t , data used elsewhere but
    not directly visible elsewhere. One needs to have one
    of these but  maybe the content here too little
    or useless, this is just an example of sorts.  */
#define SECCOUNT 4
struct sectiondata_s {
    unsigned int   sd_addr;
    unsigned int   sd_objoffsetlen;
    unsigned int   sd_objpointersize;
    Dwarf_Unsigned sd_sectionsize;
    const char   * sd_secname;
    Dwarf_Small  * sd_content;
};

/*  The secname must not be 0 , pass "" if
    there is no name. */
static struct sectiondata_s sectiondata[SECCOUNT] = {
{0,0,0,0,"",0},
{0,32,32,sizeof(abbrevbytes),".debug_abbrev",abbrevbytes},
{0,32,32,sizeof(infobytes),".debug_info",infobytes},
{0,32,32,sizeof(strbytes),".debug_str",strbytes}
};

typedef struct special_filedata_s {
    int            f_is_64bit;
    Dwarf_Small    f_object_endian;
    unsigned       f_pointersize;
    unsigned       f_offsetsize;
    Dwarf_Unsigned f_filesize;
    Dwarf_Unsigned f_sectioncount;
    struct sectiondata_s * f_sectarray;
} special_filedata_internals_t;

/*  Use DW_END_little.
    Libdwarf finally sets the file-format-specific
    f_object_endianness field to a DW_END_little or
    DW_END_big (see dwarf.h).
    Here we must do that ourselves. */
static special_filedata_internals_t base_internals =
{ FALSE,DW_END_little,32,32,200,SECCOUNT, sectiondata };

static
int gsinfo(void* obj,
    Dwarf_Unsigned section_index,
    Dwarf_Obj_Access_Section_a* return_section,
    int* error )
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    struct sectiondata_s *finfo = 0;

    *error = 0; /* No error. Avoids unused arg */
    if (section_index >= SECCOUNT) {
        return DW_DLV_NO_ENTRY;
    }
    finfo = internals->f_sectarray + section_index;
    return_section->as_name   = finfo->sd_secname;
    return_section->as_type   = 0;
    return_section->as_flags  = 0;
    return_section->as_addr   = finfo->sd_addr;
    return_section->as_offset = 0;
    return_section->as_size   = finfo->sd_sectionsize;
    return_section->as_link   = 0;
    return_section->as_info   = 0;
    return_section->as_addralign = 0;
    return_section->as_entrysize = 1;
    return DW_DLV_OK;
}
static Dwarf_Small
gborder(void * obj)
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    return internals->f_object_endian;
}
static
Dwarf_Small glensize(void * obj)
{
    /* offset size */
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    return internals->f_offsetsize/8;
}
static
Dwarf_Small gptrsize(void * obj)
```

```
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    return internals->f_pointersize/8;
}
static
Dwarf_Unsigned gfilesize(void * obj)
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    return internals->f_filesize;
}
static
Dwarf_Unsigned gseccount(void* obj)
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    return internals->f_sectioncount;
}
static
int gloadsec(void * obj,
    Dwarf_Unsigned secindex,
    Dwarf_Small**rdata,
    int *error)
{
    special_filedata_internals_t *internals =
        (special_filedata_internals_t *)(obj);
    struct sectiondata_s *secp = 0;

    *error = 0; /* No Error, avoids compiler warning */
    if (secindex >= internals->f_sectioncount) {
        return DW_DLV_NO_ENTRY;
    }
    secp = secindex +internals->f_sectarray;
    *rdata = secp->sd_content;
    return DW_DLV_OK;
}

const Dwarf_Obj_Access_Methods_a methods = {
    gsinfo,
    gborder,
    glensize,
    gptrsize,
    gfilesize,
    gseccount,
    gloadsec,
    0 /* no relocating anything */,
    0 /* no file with DWARF here, so mmap impossible */,
    0 /* no destructor appropriate */
    };

struct Dwarf_Obj_Access_Interface_a_s dw_interface =
{ &base_internals,&methods };

static const Dwarf_Sig8 zerosignature;
static int
isformstring(Dwarf_Half form)
{
    /*  Not handling every form string, just the
        ones used in simple cases. */
    switch(form) {
    case DW_FORM_string:        return TRUE;
    case DW_FORM_GNU_strp_alt:  return TRUE;
    case DW_FORM_GNU_str_index: return TRUE;
    case DW_FORM_strx:          return TRUE;
    case DW_FORM_strx1:         return TRUE;
    case DW_FORM_strx2:         return TRUE;
    case DW_FORM_strx3:         return TRUE;
    case DW_FORM_strx4:         return TRUE;
    case DW_FORM_strp:          return TRUE;
    default: break;
    };
    return FALSE;
}

static int
print_attr(Dwarf_Attribute atr,
    Dwarf_Signed anumber, Dwarf_Error *error)
{
    int res = 0;
    char *str = 0;
    const char *attrname = 0;
    const char *formname = 0;
    Dwarf_Half form = 0;
    Dwarf_Half attrnum = 0;
    res = dwarf_whatform(atr,&form,error);
    if (res != DW_DLV_OK) {
        printf("dwarf_whatform failed! res %d\n",res);
        return res;
    }
    res = dwarf_whatattr(atr,&attrnum,error);
    if (res != DW_DLV_OK) {
        printf("dwarf_whatattr failed! res %d\n",res);
        return res;
    }
    res = dwarf_get_AT_name(attrnum,&attrname);
    if (res == DW_DLV_NO_ENTRY) {
        printf("Bogus attrnum 0x%x\n",attrnum);
        attrname = "<internal error ?>";
    }
    res = dwarf_get_FORM_name(form,&formname);
    if (res == DW_DLV_NO_ENTRY) {
        printf("Bogus form 0x%x\n",attrnum);
        attrname = "<internal error ?>";
    }
    if (!isformstring(form)) {
        printf("  [%2d] Attr: %-15s  Form: %-15s\n",
            (int)anumber,attrname,formname);
        return DW_DLV_OK;
    }
    res = dwarf_formstring(atr,&str,error);
    if (res != DW_DLV_OK) {
        printf("dwarf_formstring failed! res %d\n",res);
        return res;
    }
    printf("  [%2d] Attr: %-15s  Form: %-15s %s\n",
        (int)anumber,attrname,formname,str);
    return DW_DLV_OK;
}

static void
dealloc_list(Dwarf_Debug dbg,
    Dwarf_Attribute *attrbuf,
    Dwarf_Signed attrcount,
    Dwarf_Signed i)
{
    for ( ; i < attrcount; ++i) {
        dwarf_dealloc_attribute(attrbuf[i]);
    }
    dwarf_dealloc(dbg,attrbuf,DW_DLA_LIST);
}

static int
print_one_die(Dwarf_Debug dbg,Dwarf_Die in_die,int level,
    Dwarf_Error *error)
{
    Dwarf_Attribute *attrbuf = 0;
    Dwarf_Signed  attrcount = 0;
    Dwarf_Half tag = 0;
    const char * tagname = 0;
    int res = 0;
    Dwarf_Signed i = 0;

    res = dwarf_tag(in_die,&tag,error);
    if (res != DW_DLV_OK) {
        printf("dwarf_tag failed! res %d\n",res);
        return res;
    }
    res = dwarf_get_TAG_name(tag,&tagname);
    if (res != DW_DLV_OK) {
        tagname = "<bogus tag>";
    }
    printf("%3d:  Die: %s\n",level,tagname);
    res = dwarf_attrlist(in_die,&attrbuf,&attrcount,error);
    if (res != DW_DLV_OK) {
        printf("dwarf_attrlist failed! res %d\n",res);
        return res;
    }
    for (i = 0; i <attrcount;++i) {
        res  =print_attr(attrbuf[i],i,error);
        if (res != DW_DLV_OK) {
            dealloc_list(dbg,attrbuf,attrcount,0);
            printf("dwarf_attr print failed! res %d\n",res);
            return res;
        }
    }
    dealloc_list(dbg,attrbuf,attrcount,0);
    return DW_DLV_OK;
}

static int
print_object_info(Dwarf_Debug dbg,Dwarf_Error *error)
{
    Dwarf_Bool is_info = TRUE; /* our data is not DWARF4
```

```
        .debug_types. */
    Dwarf_Unsigned cu_header_length = 0;
    Dwarf_Half     version_stamp = 0;
    Dwarf_Off      abbrev_offset = 0;
    Dwarf_Half     address_size  = 0;
    Dwarf_Half     length_size   = 0;
    Dwarf_Half     extension_size = 0;
    Dwarf_Sig8     type_signature;
    Dwarf_Unsigned typeoffset     = 0;
    Dwarf_Unsigned next_cu_header_offset = 0;
    Dwarf_Half     header_cu_type = 0;
    int res = 0;
    Dwarf_Die cu_die = 0;
    int level = 0;

    type_signature = zerosignature;
    res = dwarf_next_cu_header_d(dbg,
        is_info,
        &cu_header_length,
        &version_stamp,
        &abbrev_offset,
        &address_size,
        &length_size,
        &extension_size,
        &type_signature,
        &typeoffset,
        &next_cu_header_offset,
        &header_cu_type,
        error);
    if (res != DW_DLV_OK) {
        printf("Next cu header  result %d. "
            "Something is wrong FAIL, line %d\n",res,__LINE__);
        if (res == DW_DLV_ERROR) {
            printf("Error is: %s\n",dwarf_errmsg(*error));
        }
        exit(EXIT_FAILURE);
    }
    printf("CU header length.........0x%lx\n",
        (unsigned long)cu_header_length);
    printf("Version stamp............%d\n",version_stamp);
    printf("Address size ............%d\n",address_size);
    printf("Offset size..............%d\n",length_size);
    printf("Next cu header offset.....0x%lx\n",
        (unsigned long)next_cu_header_offset);

    res = dwarf_siblingof_b(dbg, NULL,is_info, &cu_die, error);
    if (res != DW_DLV_OK) {
        /* There is no CU die, which should be impossible. */
        if (res == DW_DLV_ERROR) {
            printf("ERROR: dwarf_siblingof_b failed, no CU die\n");
            printf("Error is: %s\n",dwarf_errmsg(*error));
            return res;
        } else {
            printf("ERROR: dwarf_siblingof_b got NO_ENTRY, "
                "no CU die\n");
            return res;
        }
    }
    res = print_one_die(dbg,cu_die,level,error);
    if (res != DW_DLV_OK) {
        dwarf_dealloc_die(cu_die);
        printf("print_one_die failed! %d\n",res);
        return res;
    }
    dwarf_dealloc_die(cu_die);
    return DW_DLV_OK;
}

/*  testing interfaces useful for embedding
    libdwarf inside another program or library. */
int main(int argc, char **argv)
{
    int res = 0;
    Dwarf_Debug dbg = 0;
    Dwarf_Error error = 0;
    int fail = FALSE;
    int i = 1;

    if (i >= argc) {
        /* OK */
    } else {
        if (!strcmp(argv[i],"--suppress-de-alloc-tree")) {
            /* Do nothing, ignore the argument */
            ++i;
        }
    }
    /*  Fill in interface before this call.
```

```
        We are using a static area, see above. */
    res = dwarf_object_init_b(&dw_interface,
        0,0,DW_GROUPNUMBER_ANY,&dbg,
        &error);
    if (res == DW_DLV_NO_ENTRY) {
        printf("FAIL Cannot dwarf_object_init_b() NO ENTRY. \n");
        exit(EXIT_FAILURE);
    } else if (res == DW_DLV_ERROR){
        printf("FAIL Cannot dwarf_object_init_b(). \n");
        printf("msg: %s\n",dwarf_errmsg(error));
        dwarf_dealloc_error(dbg,error);
        exit(EXIT_FAILURE);
    }
    res = print_object_info(dbg,&error);
    if (res != DW_DLV_OK) {
        if (res == DW_DLV_ERROR) {
            dwarf_dealloc_error(dbg,error);
        }
        printf("FAIL printing, res %d line %d\n",res,__LINE__);
        exit(EXIT_FAILURE);
    }
    dwarf_object_finish(dbg);
    if (fail) {
        printf("FAIL objectaccess.c\n");
        exit(EXIT_FAILURE);
    }
    return 0;
}
```

9.90 A simple report on section groups.

Section groups are for Split DWARF.

Section groups are for Split DWARF.

```
    The C source is src/bin/dwarfexample/showsectiongroups.c
*/

#include <config.h>

#include <stdio.h>  /* printf() */
#include <stdlib.h> /* calloc() exit() free() */
#include <string.h> /* strcmp() */

#include "dwarf.h"
#include "libdwarf.h"
#define FALSE 0

char trueoutpath[2000];

static int
one_file_show_groups(char  *path_in,
    char *shortpath,
    int chosengroup)
{
    int                 res = 0;
    Dwarf_Debug         dbg = 0;
    Dwarf_Error         error = 0;
    char              * path = 0;
    Dwarf_Unsigned      section_count = 0;
    Dwarf_Unsigned      group_count = 0;
    Dwarf_Unsigned      selected_group = 0;
    Dwarf_Unsigned      map_entry_count = 0;
    Dwarf_Unsigned *  group_numbers_array = 0;
    Dwarf_Unsigned *  sec_numbers_array = 0;
    const char     ** sec_names_array = 0;
    Dwarf_Unsigned      i = 0;
    const char *grpname  = 0;

    switch(chosengroup) {
    case DW_GROUPNUMBER_ANY:
        grpname="DW_GROUPNUMBER_ANY";
        break;
    case DW_GROUPNUMBER_BASE:
        grpname="DW_GROUPNUMBER_BASE";
        break;
    case DW_GROUPNUMBER_DWO:
        grpname="DW_GROUPNUMBER_DWO";
        break;
    default:
        grpname = "";
```

```
}
path =  path_in;
res = dwarf_init_path(path,
    0,0,
    chosengroup,
    0,0, &dbg, &error);
if (res == DW_DLV_ERROR) {
    printf("Error from libdwarf opening \"%s\":  %s\n",
        shortpath, dwarf_errmsg(error));
    dwarf_dealloc_error(dbg,error);
    error = 0;
    return res;
}
if (res == DW_DLV_NO_ENTRY) {
    printf("There is no such file as \"%s\" "
        "or the selected group %d (%s) does "
        "not appear in the file\n",
        shortpath,chosengroup,grpname);
    return DW_DLV_NO_ENTRY;
}

res = dwarf_sec_group_sizes(dbg, &section_count,
    &group_count, &selected_group, &map_entry_count,
    &error);
if (res == DW_DLV_ERROR) {
    printf("Error from libdwarf getting group "
        "sizes \"%s\":  %s\n",
        shortpath, dwarf_errmsg(error));
    dwarf_dealloc_error(dbg,error);
    error = 0;
    dwarf_finish(dbg);
    return res;
}
if (res == DW_DLV_NO_ENTRY) {
    printf("Impossible. libdwarf claims no groups from %s\n",
        shortpath);
    dwarf_finish(dbg);
    return res;
}
printf("Group Map data sizes\n");
printf("  requested group : %4lu\n",
    (unsigned long)chosengroup);
printf("  section count   : %4lu\n",
    (unsigned long)section_count);
printf("  group count     : %4lu\n",
    (unsigned long)group_count);
printf("  selected group  : %4lu\n",
    (unsigned long)selected_group);
printf("  map entry count : %4lu\n",
    (unsigned long)map_entry_count);

group_numbers_array = (Dwarf_Unsigned *)calloc(map_entry_count,
    sizeof(Dwarf_Unsigned));
if (!group_numbers_array) {
    printf("Error calloc fail, group count %lu\n",
        (unsigned long)group_count);
    dwarf_finish(dbg);
    return DW_DLV_ERROR;
}
sec_numbers_array = (Dwarf_Unsigned *)calloc(map_entry_count,
    sizeof(Dwarf_Unsigned));
if (!sec_numbers_array) {
    free(group_numbers_array);
    printf("Error calloc fail sec numbers, section count %lu\n",
        (unsigned long)section_count);
    dwarf_finish(dbg);
    return DW_DLV_ERROR;
}
sec_names_array = (const char **)calloc(map_entry_count,
    sizeof(const char *));
if (!sec_names_array) {
    free(sec_numbers_array);
    free(group_numbers_array);
    printf("Error calloc fail on names, section count %lu\n",
        (unsigned long)section_count);
    dwarf_finish(dbg);
    return DW_DLV_ERROR;
}
res = dwarf_sec_group_map(dbg,map_entry_count,
    group_numbers_array,
    sec_numbers_array, sec_names_array,&error);
if (res == DW_DLV_ERROR) {
    free(sec_names_array);
    free(sec_numbers_array);
    free(group_numbers_array);
    printf("Error from libdwarf getting group detals "
        "sizes \"%s\":  %s\n",
            shortpath, dwarf_errmsg(error));
        dwarf_dealloc_error(dbg,error);
        error = 0;
        dwarf_finish(dbg);
        return res;
    }
    if (res == DW_DLV_NO_ENTRY) {
        free(sec_names_array);
        free(sec_numbers_array);
        free(group_numbers_array);
        printf("Impossible. libdwarf claims details from %s\n",
            shortpath);
        dwarf_finish(dbg);
        return res;
    }
    printf("  [index] group   section \n");
    for (i = 0; i < map_entry_count;++i) {
        printf("  [%5lu]  %4lu  %4lu %s\n",
            (unsigned long)i,
            (unsigned long)group_numbers_array[i],
            (unsigned long)sec_numbers_array[i],
            sec_names_array[i]);
    }
    free(sec_names_array);
    free(sec_numbers_array);
    free(group_numbers_array);
    dwarf_finish(dbg);
    return DW_DLV_OK;
}

/*  Does not return */
static void
usage(void)
{
    printf("Usage: showsectiongroups [-group <n>] "
        "<objectfile> ...\n");
    printf("Usage: group defaults to zero (DW_GROUPNUMBER ANY)\n");
    exit(EXIT_FAILURE);
}

/*  This trimming of the file path makes libdwarf regression
    testing easier by arranging baseline output
    not show the full path. */
static void
trimpathprefix(char *out,unsigned int outlen, char *in)
{
    char *cpo  = out;
    char *cpi  = in;
    char *suffix = 0;
    unsigned int lencopied = 0;
    for ( ; *cpi ; ++cpi) {
        if (*cpi == '/') {
            suffix= cpi+1;
        }
    }
    if (suffix) {
        cpi = suffix;
    }
    lencopied = 0;
    for ( ; lencopied < outlen; ++cpo,++cpi)
    {
        *cpo = *cpi;
        if (! *cpi) {
            return;
        }
        ++lencopied;
    }
    printf("FAIL copy file name: not terminated \n");
    exit(EXIT_FAILURE);
}

int
main(int argc, char **argv)
{
    int res = 0;
    int i = 1;
    int chosengroup = DW_GROUPNUMBER_ANY;
    static char reportingpath[16000];

    if (argc < 2) {
        usage();
        return 0;
    }
    for ( ; i < argc; ++i) {
        char *arg = argv[i];
        if (!strcmp(arg,"-group")) {
            i++;
            if (i >= argc) {
                usage();
            }
            arg = argv[i];
            chosengroup = atoi(arg);
            /*  We are ignoring errors to simplify
                this source. Use strtol, carefully,
                in real code. */
            continue;
        }
        if (!strcmp(argv[i],"--suppress-de-alloc-tree")) {
            /* Do nothing, ignore the argument */
            continue;
        }
        trimpathprefix(reportingpath,sizeof(reportingpath),arg);
        res = one_file_show_groups(arg,
            reportingpath,chosengroup);
        printf("=======done with %s, status %s\n",reportingpath,
            (res == DW_DLV_OK)?"DW_DLV_OK":
            (res == DW_DLV_ERROR)?"DW_DLV_ERROR":
            "DW_DLV_NO_ENTRY");
        printf("\n");
    }
    return 0;
}
```

Chapter 10

Class Documentation

10.1 Dwarf_Block_s Struct Reference

Public Attributes

- Dwarf_Unsigned **bl_len**
- Dwarf_Ptr **bl_data**
- Dwarf_Small **bl_from_loclist**
- Dwarf_Unsigned **bl_section_offset**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.2 Dwarf_Cmdline_Options_s Struct Reference

```
#include <libdwarf.h>
```

Public Attributes

- Dwarf_Bool **check_verbose_mode**

10.2.1 Detailed Description

check_verbose_mode defaults to FALSE. If a libdwarf-calling program sets this TRUE it means some errors in Line Table headers get a much more detailed description of the error which is reported the caller via printf←_callback() function (the caller can do something with the message). Or the libdwarf calling code can call dwarf_record_cmdline_options() to set the new value.

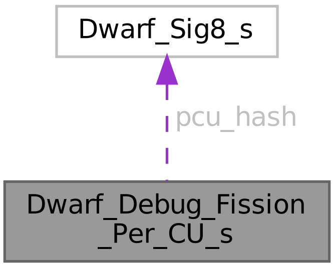
For convenience the type name for the struct is Dwarf_Cmdline_Options.

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.3 Dwarf_Debug_Fission_Per_CU_s Struct Reference

Collaboration diagram for Dwarf_Debug_Fission_Per_CU_s:



Public Attributes

- const char ∗ **pcu_type**
- Dwarf_Unsigned **pcu_index**
- Dwarf_Sig8 **pcu_hash**
- Dwarf_Unsigned **pcu_offset** [DW_FISSION_SECT_COUNT]
- Dwarf_Unsigned **pcu_size** [DW_FISSION_SECT_COUNT]
- Dwarf_Unsigned **unused1**
- Dwarf_Unsigned **unused2**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.4 Dwarf_Form_Data16_s Struct Reference

Public Attributes

- unsigned char **fd_data** [16]

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.5 Dwarf_Macro_Details_s Struct Reference

```
#include <libdwarf.h>
```

Public Attributes

- Dwarf_Off **dmd_offset**
- Dwarf_Small **dmd_type**
- Dwarf_Signed **dmd_lineno**
- Dwarf_Signed **dmd_fileindex**
- char ∗ **dmd_macro**

10.5.1 Detailed Description

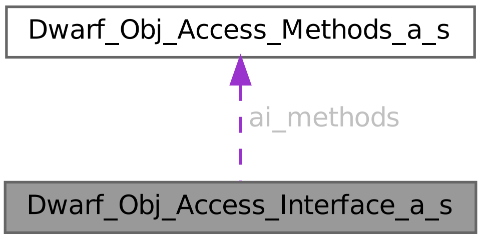
This applies to DWARF2, DWARF3, and DWARF4 compilation units. DWARF5 .debug_macro has its own function interface which does not use this struct.

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.6 Dwarf_Obj_Access_Interface_a_s Struct Reference

Collaboration diagram for Dwarf_Obj_Access_Interface_a_s:



Public Attributes

- void ∗ **ai_object**
- const Dwarf_Obj_Access_Methods_a ∗ **ai_methods**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.7 Dwarf_Obj_Access_Methods_a_s Struct Reference

```
#include <libdwarf.h>
```

Public Attributes

- int(∗ **om_get_section_info**)(void ∗obj, Dwarf_Unsigned section_index, Dwarf_Obj_Access_Section_a ∗return_section, int ∗error)
- Dwarf_Small(∗ **om_get_byte_order**)(void ∗obj)
- Dwarf_Small(∗ **om_get_length_size**)(void ∗obj)
- Dwarf_Small(∗ **om_get_pointer_size**)(void ∗obj)
- Dwarf_Unsigned(∗ **om_get_filesize**)(void ∗obj)
- Dwarf_Unsigned(∗ **om_get_section_count**)(void ∗obj)
- int(∗ **om_load_section**)(void ∗obj, Dwarf_Unsigned dw_section_index, Dwarf_Small ∗∗dw_return_data, int ∗dw_error)
- int(∗ **om_relocate_a_section**)(void ∗obj, Dwarf_Unsigned section_index, Dwarf_Debug dbg, int ∗error)
- int(∗ **om_load_section_a**)(void ∗obj, Dwarf_Unsigned dw_section_index, enum Dwarf_Sec_Alloc_Pref ∗dw_alloc_pref, Dwarf_Small ∗∗dw_return_data_ptr, Dwarf_Unsigned ∗dw_return_data_len, Dwarf_Small ∗∗dw_return_mmap_base_ptr, Dwarf_Unsigned ∗dw_return_mmap_offset, Dwarf_Unsigned ∗dw_return←_mmap_len, int ∗dw_error)
- void(∗ **om_finish**)(void ∗obj)

10.7.1 Detailed Description

The functions we need to access object data from libdwarf are declared here.

Unless you are reading object sections with your own code (as in src/bin/dwarfexample/jitreader.c) you will not need to fill in or use the struct.

om_relocate_a_section uses malloc/read to get section contents and returns a pointer to the malloc space through dw_return_data, which is recorded in the applicable section data.

om_load_section_a uses either malloc/read or mmap and consequently returns more data as needed for eventual free() or munmap().

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.8 Dwarf_Obj_Access_Section_a_s Struct Reference

Public Attributes

- const char ∗ **as_name**
- Dwarf_Unsigned **as_type**
- Dwarf_Unsigned **as_flags**
- Dwarf_Addr **as_addr**
- Dwarf_Unsigned **as_offset**
- Dwarf_Unsigned **as_size**
- Dwarf_Unsigned **as_link**
- Dwarf_Unsigned **as_info**
- Dwarf_Unsigned **as_addralign**
- Dwarf_Unsigned **as_entrysize**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.9 Dwarf_Printf_Callback_Info_s Struct Reference

```
#include <libdwarf.h>
```

Public Attributes

- void ∗ **dp_user_pointer**
- dwarf_printf_callback_function_type **dp_fptr**
- char ∗ **dp_buffer**
- unsigned int **dp_buffer_len**
- int **dp_buffer_user_provided**
- void ∗ **dp_reserved**

10.9.1 Detailed Description

If one wishes to print detailed line table information one creates an instance of this struct and fills in the fields and passes the struct to the relevant init, for example, dwarf_init_path().

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.10 Dwarf_Ranges_s Struct Reference

Public Attributes

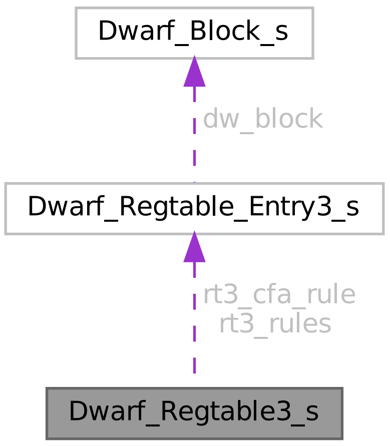
- Dwarf_Addr **dwr_addr1**
- Dwarf_Addr **dwr_addr2**
- enum Dwarf_Ranges_Entry_Type **dwr_type**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.11 Dwarf_Regtable3_s Struct Reference

Collaboration diagram for Dwarf_Regtable3_s:



Public Attributes

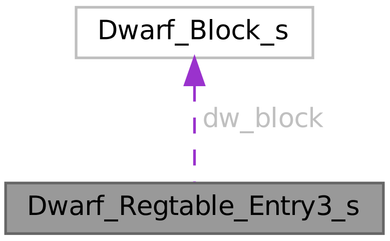
- struct Dwarf_Regtable_Entry3_s **rt3_cfa_rule**
- Dwarf_Half **rt3_reg_table_size**
- struct Dwarf_Regtable_Entry3_s ∗ **rt3_rules**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.12 Dwarf_Regtable_Entry3_s Struct Reference

Collaboration diagram for Dwarf_Regtable_Entry3_s:



Public Attributes

- Dwarf_Small **dw_offset_relevant**
- Dwarf_Small **dw_value_type**
- Dwarf_Half **dw_regnum**
- Dwarf_Unsigned **dw_offset**
- Dwarf_Unsigned **dw_args_size**
- Dwarf_Block **dw_block**

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

10.13 Dwarf_Sig8_s Struct Reference

Public Attributes

- char **signature** [8]

The documentation for this struct was generated from the following file:

- /home/davea/dwarf/code/src/lib/libdwarf/libdwarf.h

Chapter 11

File Documentation

Chapter 12

checkexamples.c

checkexamples.c contains what user code should be. Hence the code typed in checkexamples.c is PUBLIC DOMAIN and may be copied, used, and altered without any restrictions.

checkexamples.c need not be compiled routinely nor should it ever be executed.

To verify syntatic correctness compile in the libdwarf-code/doc directory with:
```
cc -c -Wall -O0 -Wpointer-arith  \
-Wdeclaration-after-statement \
-Wextra -Wcomment -Wformat -Wpedantic -Wuninitialized \
-Wno-long-long -Wshadow -Wbad-function-cast \
-Wmissing-parameter-type -Wnested-externs \
-I../src/lib/libdwarf checkexamples.c
```

12.1 /home/davea/dwarf/code/src/bin/dwarfexample/jitreader.c File Reference

12.2 /home/davea/dwarf/code/src/bin/dwarfexample/showsectiongroups.c File Reference

Chapter 13

dwarf.h

dwarf.h contains all the identifiers such as DW_TAG_compile_unit etc from the various versions of the DWARF Standard beginning with DWARF2 and containing all later Dwarf Standard identifiers.

In addition, it contains all user-defined identifiers that we have been able to find.

All identifiers here are C defines with the prefix "DW_" .

13.1 dwarf.h

Go to the documentation of this file.

```
/*
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Portions Copyright 2007-2023 David Anderson. All rights reserved.

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Public License along with this program; if not, write the
Free Software Foundation, Inc., 51 Franklin Street - Fifth
Floor, Boston MA 02110-1301, USA.
*/

#ifndef __DWARF_H
#define __DWARF_H
#ifdef __cplusplus
extern "C" {
#endif

/*
    dwarf.h   DWARF  debugging information values
    $Revision: 1.41 $    $Date: 2006/04/17 00:09:56 $

    The comment "DWARF3" appears where there are
    new entries from DWARF3 as of 2004, "DWARF3f"
    where there are new entries as of the November 2005
    public review document and other comments apply
    where extension entries appear.

    Extensions part of DWARF4 are marked DWARF4.

    A few extension names have omitted the 'vendor id'
    (See chapter 7, "Vendor Extensibility"). Please
    always use a 'vendor id' string in extension names.

    Vendors should use a vendor string in names and
    wherever possible avoid duplicating values used by
    other vendor extensions

    The DWARF1 comments indicate values unused in
    DWARF2 and later but used or reserved in DWARF1.
*/

#define DW_TAG_array_type               0x01
#define DW_TAG_class_type               0x02
#define DW_TAG_entry_point              0x03
#define DW_TAG_enumeration_type         0x04
#define DW_TAG_formal_parameter         0x05
/*  TAG_global_subroutine               0x06 DWARF1 only */
/*  TAG_global_variable                 0x07 DWARF1 only */
#define DW_TAG_imported_declaration     0x08
/*  reserved by DWARF1                  0x09 DWARF1 only */
#define DW_TAG_label                    0x0a
#define DW_TAG_lexical_block            0x0b
/*  TAG_local_variable                  0x0c DWARF1 only. */
#define DW_TAG_member                   0x0d
/*  reserved by DWARF1                  0x0e DWARF1 only */
#define DW_TAG_pointer_type             0x0f
#define DW_TAG_reference_type           0x10
#define DW_TAG_compile_unit             0x11
#define DW_TAG_string_type              0x12
#define DW_TAG_structure_type           0x13
/* TAG_subroutine                       0x14 DWARF1 only */
#define DW_TAG_subroutine_type          0x15
#define DW_TAG_typedef                  0x16
#define DW_TAG_union_type               0x17
#define DW_TAG_unspecified_parameters   0x18
#define DW_TAG_variant                  0x19
#define DW_TAG_common_block             0x1a
#define DW_TAG_common_inclusion         0x1b
#define DW_TAG_inheritance              0x1c
#define DW_TAG_inlined_subroutine       0x1d
#define DW_TAG_module                   0x1e
#define DW_TAG_ptr_to_member_type       0x1f
#define DW_TAG_set_type                 0x20
#define DW_TAG_subrange_type            0x21
#define DW_TAG_with_stmt                0x22
#define DW_TAG_access_declaration       0x23
#define DW_TAG_base_type                0x24
#define DW_TAG_catch_block              0x25
#define DW_TAG_const_type               0x26
#define DW_TAG_constant                 0x27
#define DW_TAG_enumerator               0x28
#define DW_TAG_file_type                0x29
#define DW_TAG_friend                   0x2a
#define DW_TAG_namelist                 0x2b
        /*  Early releases of this header had the following
            misspelled with a trailing 's' */
#define DW_TAG_namelist_item            0x2c /* DWARF2 spelling*/
#define DW_TAG_namelist_items           0x2c /* SGI misspelling/typo*/
#define DW_TAG_packed_type              0x2d
#define DW_TAG_subprogram               0x2e
        /*  The DWARF2 document had two spellings of the following
            two TAGs, DWARF3 specifies the longer spelling. */
#define DW_TAG_template_type_parameter  0x2f /* DWARF3-5 spelling*/
#define DW_TAG_template_type_param      0x2f /* DWARF2 inconsistent*/
#define DW_TAG_template_value_parameter 0x30 /* DWARF all versions*/
#define DW_TAG_template_value_param     0x30 /* SGI misspelling/typo*/
#define DW_TAG_thrown_type              0x31
#define DW_TAG_try_block                0x32
#define DW_TAG_variant_part             0x33
#define DW_TAG_variable                 0x34
#define DW_TAG_volatile_type            0x35
#define DW_TAG_dwarf_procedure          0x36  /* DWARF3 */
#define DW_TAG_restrict_type            0x37  /* DWARF3 */
#define DW_TAG_interface_type           0x38  /* DWARF3 */
#define DW_TAG_namespace                0x39  /* DWARF3 */
#define DW_TAG_imported_module          0x3a  /* DWARF3 */
#define DW_TAG_unspecified_type         0x3b  /* DWARF3 */
#define DW_TAG_partial_unit             0x3c  /* DWARF3 */
#define DW_TAG_imported_unit            0x3d  /* DWARF3 */
        /*  Do not use DW_TAG_mutable_type */
#define DW_TAG_mutable_type 0x3e /*Withdrawn from DWARF3 by DWARF3f*/
```

```
#define DW_TAG_condition                0x3f  /* DWARF3f */
#define DW_TAG_shared_type              0x40  /* DWARF3f */
#define DW_TAG_type_unit                0x41  /* DWARF4 */
#define DW_TAG_rvalue_reference_type    0x42  /* DWARF4 */
#define DW_TAG_template_alias           0x43  /* DWARF4 */
#define DW_TAG_coarray_type             0x44  /* DWARF5 */
#define DW_TAG_generic_subrange         0x45  /* DWARF5 */
#define DW_TAG_dynamic_type             0x46  /* DWARF5 */
#define DW_TAG_atomic_type              0x47  /* DWARF5 */
#define DW_TAG_call_site                0x48  /* DWARF5 */
#define DW_TAG_call_site_parameter      0x49  /* DWARF5 */
#define DW_TAG_skeleton_unit            0x4a  /* DWARF5 */
#define DW_TAG_immutable_type           0x4b  /* DWARF5 */

/* TI = Texas Instruments, for DWARF in COFF */
/* https://www.ti.com/lit/an/spraab5/spraab5.pdf?ts=1705994928599 */

#define DW_TAG_TI_far_type              0x4080 /* TI */
#define DW_TAG_lo_user                  0x4080 /* TI */
#define DW_TAG_MIPS_loop                0x4081
#define DW_TAG_TI_near_type             0x4081 /* TI */
#define DW_TAG_TI_assign_register       0x4082 /* TI */
#define DW_TAG_TI_ioport_type           0x4083 /* TI */
#define DW_TAG_TI_restrict_type         0x4084 /* TI */
#define DW_TAG_TI_onchip_type           0x4085 /* TI */

/*  HP extensions: ftp://ftp.hp.com/pub/lang/tools/\
    WDB/wdb-4.0.tar.gz  */
#define DW_TAG_HP_array_descriptor      0x4090 /* HP */

/* GNU extensions.  The first 3 missing the GNU_. */
#define DW_TAG_format_label             0x4101 /* GNU. Fortran. */
#define DW_TAG_function_template        0x4102 /* GNU. For C++ */
#define DW_TAG_class_template           0x4103 /* GNU. For C++ */
#define DW_TAG_GNU_BINCL                0x4104 /* GNU */
#define DW_TAG_GNU_EINCL                0x4105 /* GNU */

/* GNU extension. http://gcc.gnu.org/wiki/TemplateParmsDwarf */
#define DW_TAG_GNU_template_template_parameter  0x4106 /* GNU */
#define DW_TAG_GNU_template_template_param      0x4106 /* GNU */
#define DW_TAG_GNU_template_parameter_pack      0x4107 /* GNU */
#define DW_TAG_GNU_formal_parameter_pack        0x4108 /* GNU */

#define DW_TAG_GNU_call_site                    0x4109 /* GNU */
#define DW_TAG_GNU_call_site_parameter          0x410a /* GNU */

/* The following are SUN extensions */
#define DW_TAG_SUN_function_template    0x4201 /* SUN */
#define DW_TAG_SUN_class_template       0x4202 /* SUN */
#define DW_TAG_SUN_struct_template      0x4203 /* SUN */
#define DW_TAG_SUN_union_template       0x4204 /* SUN */
#define DW_TAG_SUN_indirect_inheritance 0x4205 /* SUN */
#define DW_TAG_SUN_codeflags            0x4206 /* SUN */
#define DW_TAG_SUN_memop_info           0x4207 /* SUN */
#define DW_TAG_SUN_omp_child_func       0x4208 /* SUN */
#define DW_TAG_SUN_rtti_descriptor      0x4209 /* SUN */
#define DW_TAG_SUN_dtor_info            0x420a /* SUN */
#define DW_TAG_SUN_dtor                 0x420b /* SUN */
#define DW_TAG_SUN_f90_interface        0x420c /* SUN */
#define DW_TAG_SUN_fortran_vax_structure 0x420d /* SUN */
#define DW_TAG_SUN_hi                   0x42ff /* SUN */

/* ALTIUM extensions */
    /* DSP-C/Starcore __circ qualifier */
#define DW_TAG_ALTIUM_circ_type         0x5101 /* ALTIUM */
    /* Starcore __mwa_circ qualifier */
#define DW_TAG_ALTIUM_mwa_circ_type     0x5102 /* ALTIUM */
    /* Starcore __rev_carry qualifier */
#define DW_TAG_ALTIUM_rev_carry_type    0x5103 /* ALTIUM */
    /* M16 __rom qualifier */
#define DW_TAG_ALTIUM_rom               0x5111 /* ALTIUM */

#define DW_TAG_LLVM_annotation          0x6000 /* September 2021*/

/* GHS C */
#define DW_TAG_ghs_namespace            0x8004
#define DW_TAG_ghs_using_namespace      0x8005
#define DW_TAG_ghs_using_declaration    0x8006
#define DW_TAG_ghs_template_templ_param 0x8007

/* The following 3 are extensions to support UPC */
#define DW_TAG_upc_shared_type          0x8765 /* UPC */
#define DW_TAG_upc_strict_type          0x8766 /* UPC */
#define DW_TAG_upc_relaxed_type         0x8767 /* UPC */

/* PGI (STMicroelectronics) extensions. */
#define DW_TAG_PGI_kanji_type           0xa000 /* PGI */
```

```
#define DW_TAG_PGI_interface_block      0xa020 /* PGI */

#define DW_TAG_BORLAND_property             0xb000
#define DW_TAG_BORLAND_Delphi_string        0xb001
#define DW_TAG_BORLAND_Delphi_dynamic_array 0xb002
#define DW_TAG_BORLAND_Delphi_set           0xb003
#define DW_TAG_BORLAND_Delphi_variant       0xb004

#define DW_TAG_hi_user                  0xffff

/*  The following two are non-standard. Use DW_CHILDREN_yes
    and DW_CHILDREN_no instead.  These could
    probably be deleted, but someone might be using them,
    so they remain.  */
#define DW_children_no                  0
#define DW_children_yes                 1

#define DW_FORM_addr                    0x01
/* FORM_REF                             0x02 DWARF1 only */
#define DW_FORM_block2                  0x03
#define DW_FORM_block4                  0x04
#define DW_FORM_data2                   0x05
#define DW_FORM_data4                   0x06
#define DW_FORM_data8                   0x07
#define DW_FORM_string                  0x08
#define DW_FORM_block                   0x09
#define DW_FORM_block1                  0x0a
#define DW_FORM_data1                   0x0b
#define DW_FORM_flag                    0x0c
#define DW_FORM_sdata                   0x0d
#define DW_FORM_strp                    0x0e
#define DW_FORM_udata                   0x0f
#define DW_FORM_ref_addr                0x10
#define DW_FORM_ref1                    0x11
#define DW_FORM_ref2                    0x12
#define DW_FORM_ref4                    0x13
#define DW_FORM_ref8                    0x14
#define DW_FORM_ref_udata               0x15
#define DW_FORM_indirect                0x16
#define DW_FORM_sec_offset              0x17 /* DWARF4 */
#define DW_FORM_exprloc                 0x18 /* DWARF4 */
#define DW_FORM_flag_present            0x19 /* DWARF4 */
#define DW_FORM_strx                    0x1a /* DWARF5 */
#define DW_FORM_addrx                   0x1b /* DWARF5 */
#define DW_FORM_ref_sup4                0x1c /* DWARF5 */
#define DW_FORM_strp_sup                0x1d /* DWARF5 */
#define DW_FORM_data16                  0x1e /* DWARF5 */
#define DW_FORM_line_strp               0x1f /* DWARF5 */
#define DW_FORM_ref_sig8                0x20 /* DWARF4 */
#define DW_FORM_implicit_const          0x21 /* DWARF5 */
#define DW_FORM_loclistx                0x22 /* DWARF5 */
#define DW_FORM_rnglistx                0x23 /* DWARF5 */
#define DW_FORM_ref_sup8                0x24 /* DWARF5 */
#define DW_FORM_strx1                   0x25 /* DWARF5 */
#define DW_FORM_strx2                   0x26 /* DWARF5 */
#define DW_FORM_strx3                   0x27 /* DWARF5 */
#define DW_FORM_strx4                   0x28 /* DWARF5 */
#define DW_FORM_addrx1                  0x29 /* DWARF5 */
#define DW_FORM_addrx2                  0x2a /* DWARF5 */
#define DW_FORM_addrx3                  0x2b /* DWARF5 */
#define DW_FORM_addrx4                  0x2c /* DWARF5 */

/* Extensions http://gcc.gnu.org/wiki/DebugFission.  */
#define DW_FORM_GNU_addr_index 0x1f01 /* GNU,  debug_info.dwo.*/

/* GNU, somewhat like DW_FORM_strp */
#define DW_FORM_GNU_str_index  0x1f02

#define DW_FORM_GNU_ref_alt  0x1f20 /* GNU, Offset in .debug_info. */

/* GNU extension. Offset in .debug_str of another object file. */
#define DW_FORM_GNU_strp_alt 0x1f21

#define DW_FORM_LLVM_addrx_offset       0x2001

#define DW_AT_sibling                           0x01
#define DW_AT_location                          0x02
#define DW_AT_name                              0x03
/* reserved DWARF1                              0x04, DWARF1 only */
/* AT_fund_type                                 0x05, DWARF1 only */
/* AT_mod_fund_type                             0x06, DWARF1 only */
/* AT_user_def_type                             0x07, DWARF1 only */
/* AT_mod_u_d_type                              0x08, DWARF1 only */
#define DW_AT_ordering                          0x09
#define DW_AT_subscr_data                       0x0a
#define DW_AT_byte_size                         0x0b
#define DW_AT_bit_offset                        0x0c
```

```
#define DW_AT_bit_size                          0x0d
/* reserved DWARF1                              0x0d, DWARF1 only */
#define DW_AT_element_list                      0x0f
#define DW_AT_stmt_list                         0x10
#define DW_AT_low_pc                            0x11
#define DW_AT_high_pc                           0x12
#define DW_AT_language                          0x13
#define DW_AT_member                            0x14
#define DW_AT_discr                             0x15
#define DW_AT_discr_value                       0x16
#define DW_AT_visibility                        0x17
#define DW_AT_import                            0x18
#define DW_AT_string_length                     0x19
#define DW_AT_common_reference                  0x1a
#define DW_AT_comp_dir                          0x1b
#define DW_AT_const_value                       0x1c
#define DW_AT_containing_type                   0x1d
#define DW_AT_default_value                     0x1e
/*  reserved                                    0x1f */
#define DW_AT_inline                            0x20
#define DW_AT_is_optional                       0x21
#define DW_AT_lower_bound                       0x22
/*  reserved                                    0x23 */
/*  reserved                                    0x24 */
#define DW_AT_producer                          0x25
/*  reserved                                    0x26 */
#define DW_AT_prototyped                        0x27
/*  reserved                                    0x28 */
/*  reserved                                    0x29 */
#define DW_AT_return_addr                       0x2a
/*  reserved                                    0x2b */
#define DW_AT_start_scope                       0x2c
/*  reserved                                    0x2d */
#define DW_AT_bit_stride                        0x2e /* DWARF3 name */
#define DW_AT_stride_size                       0x2e /* DWARF2 name */
#define DW_AT_upper_bound                       0x2f
/* AT_virtual                                   0x30, DWARF1 only */
#define DW_AT_abstract_origin                   0x31
#define DW_AT_accessibility                     0x32
#define DW_AT_address_class                     0x33
#define DW_AT_artificial                        0x34
#define DW_AT_base_types                        0x35
#define DW_AT_calling_convention                0x36
#define DW_AT_count                             0x37
#define DW_AT_data_member_location              0x38
#define DW_AT_decl_column                       0x39
#define DW_AT_decl_file                         0x3a
#define DW_AT_decl_line                         0x3b
#define DW_AT_declaration                       0x3c
#define DW_AT_discr_list                        0x3d /* DWARF2 */
#define DW_AT_encoding                          0x3e
#define DW_AT_external                          0x3f
#define DW_AT_frame_base                        0x40
#define DW_AT_friend                            0x41
#define DW_AT_identifier_case                   0x42
#define DW_AT_macro_info           0x43 /* DWARF{234} not DWARF5 */
#define DW_AT_namelist_item                     0x44
#define DW_AT_priority                          0x45
#define DW_AT_segment                           0x46
#define DW_AT_specification                     0x47
#define DW_AT_static_link                       0x48
#define DW_AT_type                              0x49
#define DW_AT_use_location                      0x4a
#define DW_AT_variable_parameter                0x4b
#define DW_AT_virtuality                        0x4c
#define DW_AT_vtable_elem_location              0x4d
#define DW_AT_allocated                         0x4e /* DWARF3 */
#define DW_AT_associated                        0x4f /* DWARF3 */
#define DW_AT_data_location                     0x50 /* DWARF3 */
#define DW_AT_byte_stride                       0x51 /* DWARF3f */
#define DW_AT_stride               0x51 /* DWARF3 (do not use) */
#define DW_AT_entry_pc                          0x52 /* DWARF3 */
#define DW_AT_use_UTF8                          0x53 /* DWARF3 */
#define DW_AT_extension                         0x54 /* DWARF3 */
#define DW_AT_ranges                            0x55 /* DWARF3 */
#define DW_AT_trampoline                        0x56 /* DWARF3 */
#define DW_AT_call_column                       0x57 /* DWARF3 */
#define DW_AT_call_file                         0x58 /* DWARF3 */
#define DW_AT_call_line                         0x59 /* DWARF3 */
#define DW_AT_description                       0x5a /* DWARF3 */
#define DW_AT_binary_scale                      0x5b /* DWARF3f */
#define DW_AT_decimal_scale                     0x5c /* DWARF3f */
#define DW_AT_small                             0x5d /* DWARF3f */
#define DW_AT_decimal_sign                      0x5e /* DWARF3f */
#define DW_AT_digit_count                       0x5f /* DWARF3f */
#define DW_AT_picture_string                    0x60 /* DWARF3f */
#define DW_AT_mutable                           0x61 /* DWARF3f */
```

```
#define DW_AT_threads_scaled                    0x62 /* DWARF3f */
#define DW_AT_explicit                          0x63 /* DWARF3f */
#define DW_AT_object_pointer                    0x64 /* DWARF3f */
#define DW_AT_endianity                         0x65 /* DWARF3f */
#define DW_AT_elemental                         0x66 /* DWARF3f */
#define DW_AT_pure                              0x67 /* DWARF3f */
#define DW_AT_recursive                         0x68 /* DWARF3f */
#define DW_AT_signature                         0x69 /* DWARF4 */
#define DW_AT_main_subprogram                   0x6a /* DWARF4 */
#define DW_AT_data_bit_offset                   0x6b /* DWARF4 */
#define DW_AT_const_expr                        0x6c /* DWARF4 */
#define DW_AT_enum_class                        0x6d /* DWARF4 */
#define DW_AT_linkage_name                      0x6e /* DWARF4 */
#define DW_AT_string_length_bit_size            0x6f /* DWARF5 */
#define DW_AT_string_length_byte_size           0x70 /* DWARF5 */
#define DW_AT_rank                              0x71 /* DWARF5 */
#define DW_AT_str_offsets_base                  0x72 /* DWARF5 */
#define DW_AT_addr_base                         0x73 /* DWARF5 */
/* Use DW_AT_rnglists_base, DW_AT_ranges_base is obsolete as */
/* it was only used in some DWARF5 drafts, not the final DWARF5. */
#define DW_AT_rnglists_base                     0x74 /* DWARF5 */
/*  DW_AT_dwo_id, an experiment in some DWARF4+. Not DWARF5! */
#define DW_AT_dwo_id                            0x75 /* DWARF4!*/
#define DW_AT_dwo_name                          0x76 /* DWARF5 */
#define DW_AT_reference                         0x77 /* DWARF5 */
#define DW_AT_rvalue_reference                  0x78 /* DWARF5 */
#define DW_AT_macros                            0x79 /* DWARF5 */
#define DW_AT_call_all_calls                    0x7a /* DWARF5 */
#define DW_AT_call_all_source_calls             0x7b /* DWARF5 */
#define DW_AT_call_all_tail_calls               0x7c /* DWARF5 */
#define DW_AT_call_return_pc                    0x7d /* DWARF5 */
#define DW_AT_call_value                        0x7e /* DWARF5 */
#define DW_AT_call_origin                       0x7f /* DWARF5 */
#define DW_AT_call_parameter                    0x80 /* DWARF5 */
#define DW_AT_call_pc                           0x81 /* DWARF5 */
#define DW_AT_call_tail_call                    0x82 /* DWARF5 */
#define DW_AT_call_target                       0x83 /* DWARF5 */
#define DW_AT_call_target_clobbered             0x84 /* DWARF5 */
#define DW_AT_call_data_location                0x85 /* DWARF5 */
#define DW_AT_call_data_value                   0x86 /* DWARF5 */
#define DW_AT_noreturn                          0x87 /* DWARF5 */
#define DW_AT_alignment                         0x88 /* DWARF5 */
#define DW_AT_export_symbols                    0x89 /* DWARF5 */
#define DW_AT_deleted                           0x8a /* DWARF5 */
#define DW_AT_defaulted                         0x8b /* DWARF5 */
#define DW_AT_loclists_base                     0x8c /* DWARF5 */
/*  As of 6 January 2025 the DWARF committee promises
    not to change the name or the assigned number of
    the following two attributes. So
    compilers are free to use these now with DWARF 5
    or earlier. The applicable FORMs of are
    of form class constant (See DWARF5 Section 7.5.5 Classes
    and Forms). */
#define DW_AT_language_name                     0x90 /* DWARF6 */
#define DW_AT_language_version                  0x91 /* DWARF6 */

/* GreenHills, ghs.com GHS C */
#define DW_AT_ghs_namespace_alias   0x806
#define DW_AT_ghs_using_namespace   0x807
#define DW_AT_ghs_using_declaration 0x808

/*  In extensions, we attempt to include the vendor extension
    in the name even when the vendor leaves it out. */
#define DW_AT_HP_block_index                    0x2000  /* HP */
/*  0x2000 follows extension so dwarfdump prints the
    most-likely-useful name. */
#define DW_AT_lo_user                           0x2000

#define DW_AT_TI_veneer                         0x2000  /* TI */

#define DW_AT_MIPS_fde                          0x2001 /* MIPS/SGI */
#define DW_AT_TI_symbol_name                    0x2001 /* TI */
#define DW_AT_MIPS_loop_begin                   0x2002 /* MIPS/SGI */
#define DW_AT_MIPS_tail_loop_begin              0x2003 /* MIPS/SGI */
#define DW_AT_MIPS_epilog_begin                 0x2004 /* MIPS/SGI */
#define DW_AT_MIPS_loop_unroll_factor           0x2005 /* MIPS/SGI */
#define DW_AT_MIPS_software_pipeline_depth      0x2006 /* MIPS/SGI */
#define DW_AT_MIPS_linkage_name 0x2007 /* MIPS/SGI,GNU,and others.*/
#define DW_AT_MIPS_stride                       0x2008 /* MIPS/SGI */
#define DW_AT_MIPS_abstract_name                0x2009 /* MIPS/SGI */
#define DW_AT_MIPS_clone_origin                 0x200a /* MIPS/SGI */
#define DW_AT_MIPS_has_inlines                  0x200b /* MIPS/SGI */
#define DW_AT_TI_version                        0x200b /* TI */
#define DW_AT_MIPS_stride_byte                  0x200c /* MIPS/SGI */
#define DW_AT_TI_asm                            0x200c /* TI */
#define DW_AT_MIPS_stride_elem                  0x200d /* MIPS/SGI */
#define DW_AT_MIPS_ptr_dopetype                 0x200e /* MIPS/SGI */
```

```
#define DW_AT_TI_skeletal                       0x200e /* TI */
#define DW_AT_MIPS_allocatable_dopetype         0x200f /* MIPS/SGI */
#define DW_AT_MIPS_assumed_shape_dopetype       0x2010 /* MIPS/SGI */
#define DW_AT_MIPS_assumed_size                 0x2011 /* MIPS/SGI */
#define DW_AT_TI_interrupt                      0x2011 /* TI */

/* HP extensions. */
#define DW_AT_HP_unmodifiable      0x2001 /* conflict: MIPS */
#define DW_AT_HP_prologue          0x2005 /* conflict: MIPS */
#define DW_AT_HP_epilogue          0x2008 /* conflict: MIPS */
#define DW_AT_HP_actuals_stmt_list 0x2010 /* conflict: MIPS */
#define DW_AT_HP_proc_per_section  0x2011 /* conflict: MIPS */
#define DW_AT_HP_raw_data_ptr                   0x2012 /* HP */
#define DW_AT_HP_pass_by_reference              0x2013 /* HP */
#define DW_AT_HP_opt_level                      0x2014 /* HP */
#define DW_AT_HP_prof_version_id                0x2015 /* HP */
#define DW_AT_HP_opt_flags                      0x2016 /* HP */
#define DW_AT_HP_cold_region_low_pc             0x2017 /* HP */
#define DW_AT_HP_cold_region_high_pc            0x2018 /* HP */
#define DW_AT_HP_all_variables_modifiable       0x2019 /* HP */
#define DW_AT_HP_linkage_name                   0x201a /* HP */
#define DW_AT_HP_prof_flags                     0x201b /* HP */
#define DW_AT_HP_unit_name                      0x201f /* HP */
#define DW_AT_HP_unit_size                      0x2020 /* HP */
#define DW_AT_HP_widened_byte_size              0x2021 /* HP */
#define DW_AT_HP_definition_points              0x2022 /* HP */
#define DW_AT_HP_default_location               0x2023 /* HP */
#define DW_AT_HP_is_result_param                0x2029 /* HP */

#define DW_AT_CPQ_discontig_ranges              0x2001 /* COMPAQ/HP */
#define DW_AT_CPQ_semantic_events               0x2002 /* COMPAQ/HP */
#define DW_AT_CPQ_split_lifetimes_var           0x2003 /* COMPAQ/HP */
#define DW_AT_CPQ_split_lifetimes_rtn           0x2004 /* COMPAQ/HP */
#define DW_AT_CPQ_prologue_length               0x2005 /* COMPAQ/HP */

/*  From GHS C GreenHills ghs.com */
#define DW_AT_ghs_mangled                   0x2007 /* conflict MIPS */
#define DW_AT_ghs_rsm                           0x2083
#define DW_AT_ghs_frsm                          0x2085
#define DW_AT_ghs_frames                        0x2086
#define DW_AT_ghs_rso                           0x2087
#define DW_AT_ghs_subcpu                        0x2092
#define DW_AT_ghs_lbrace_line                   0x2093

#define DW_AT_INTEL_other_endian 0x2026 /* Intel, 1 if byte swapped.*/

/* GNU extensions. */
#define DW_AT_sf_names                          0x2101 /* GNU */
#define DW_AT_src_info                          0x2102 /* GNU */
#define DW_AT_mac_info                          0x2103 /* GNU */
#define DW_AT_src_coords                        0x2104 /* GNU */
#define DW_AT_body_begin                        0x2105 /* GNU */
#define DW_AT_body_end                          0x2106 /* GNU */
#define DW_AT_GNU_vector                        0x2107 /* GNU */

/*  Thread safety, see
    http://gcc.gnu.org/wiki/ThreadSafetyAnnotation .  */
/*  The values here are from gcc-4.6.2 include/dwarf2.h.  The
    values are not given on the web page at all, nor on web pages
    it refers to. */
#define DW_AT_GNU_guarded_by                    0x2108 /* GNU */
#define DW_AT_GNU_pt_guarded_by                 0x2109 /* GNU */
#define DW_AT_GNU_guarded                       0x210a /* GNU */
#define DW_AT_GNU_pt_guarded                    0x210b /* GNU */
#define DW_AT_GNU_locks_excluded                0x210c /* GNU */
#define DW_AT_GNU_exclusive_locks_required      0x210d /* GNU */
#define DW_AT_GNU_shared_locks_required         0x210e /* GNU */

/* See http://gcc.gnu.org/wiki/DwarfSeparateTypeInfo */
#define DW_AT_GNU_odr_signature                 0x210f /* GNU */

/*  See  See http://gcc.gnu.org/wiki/TemplateParmsDwarf */
/*  The value here is from gcc-4.6.2 include/dwarf2.h.  The value is
    not consistent with the web page as of December 2011. */
#define DW_AT_GNU_template_name                 0x2110 /* GNU */
/*  The GNU call site extension.
    See http://www.dwarfstd.org/ShowIssue.php?\
    issue=100909.2&type=open .  */
#define DW_AT_GNU_call_site_value               0x2111 /* GNU */
#define DW_AT_GNU_call_site_data_value          0x2112 /* GNU */
#define DW_AT_GNU_call_site_target              0x2113 /* GNU */
#define DW_AT_GNU_call_site_target_clobbered    0x2114 /* GNU */
#define DW_AT_GNU_tail_call                     0x2115 /* GNU */
#define DW_AT_GNU_all_tail_call_sites           0x2116 /* GNU */
#define DW_AT_GNU_all_call_sites                0x2117 /* GNU */
#define DW_AT_GNU_all_source_call_sites         0x2118 /* GNU */
/*  Section offset to .debug_macro section. */
```

```
#define DW_AT_GNU_macros                        0x2119 /* GNU */
#define DW_AT_GNU_deleted                       0x211a /* GNU */
/*  The GNU DebugFission project:
    http://gcc.gnu.org/wiki/DebugFission */
#define DW_AT_GNU_dwo_name                      0x2130 /* GNU */
#define DW_AT_GNU_dwo_id                        0x2131 /* GNU */

#define DW_AT_GNU_ranges_base                   0x2132 /* GNU */
#define DW_AT_GNU_addr_base                     0x2133 /* GNU */
#define DW_AT_GNU_pubnames                      0x2134 /* GNU */
#define DW_AT_GNU_pubtypes                      0x2135 /* GNU */

/* To distinguish distinct basic blocks in a single source line. */
#define DW_AT_GNU_discriminator                 0x2136 /* GNU */
#define DW_AT_GNU_locviews                      0x2137 /* GNU */
#define DW_AT_GNU_entry_view                    0x2138 /* GNU */

/* Sun extensions */
#define DW_AT_SUN_template                      0x2201 /* SUN */
#define DW_AT_VMS_rtnbeg_pd_address             0x2201 /* VMS */
#define DW_AT_SUN_alignment                     0x2202 /* SUN */
#define DW_AT_SUN_vtable                        0x2203 /* SUN */
#define DW_AT_SUN_count_guarantee               0x2204 /* SUN */
#define DW_AT_SUN_command_line                  0x2205 /* SUN */
#define DW_AT_SUN_vbase                         0x2206 /* SUN */
#define DW_AT_SUN_compile_options               0x2207 /* SUN */
#define DW_AT_SUN_language                      0x2208 /* SUN */
#define DW_AT_SUN_browser_file                  0x2209 /* SUN */
#define DW_AT_SUN_vtable_abi                    0x2210 /* SUN */
#define DW_AT_SUN_func_offsets                  0x2211 /* SUN */
#define DW_AT_SUN_cf_kind                       0x2212 /* SUN */
#define DW_AT_SUN_vtable_index                  0x2213 /* SUN */
#define DW_AT_SUN_omp_tpriv_addr                0x2214 /* SUN */
#define DW_AT_SUN_omp_child_func                0x2215 /* SUN */
#define DW_AT_SUN_func_offset                   0x2216 /* SUN */
#define DW_AT_SUN_memop_type_ref                0x2217 /* SUN */
#define DW_AT_SUN_profile_id                    0x2218 /* SUN */
#define DW_AT_SUN_memop_signature               0x2219 /* SUN */
#define DW_AT_SUN_obj_dir                       0x2220 /* SUN */
#define DW_AT_SUN_obj_file                      0x2221 /* SUN */
#define DW_AT_SUN_original_name                 0x2222 /* SUN */
#define DW_AT_SUN_hwcprof_signature             0x2223 /* SUN */
#define DW_AT_SUN_amd64_parmdump                0x2224 /* SUN */
#define DW_AT_SUN_part_link_name                0x2225 /* SUN */
#define DW_AT_SUN_link_name                     0x2226 /* SUN */
#define DW_AT_SUN_pass_with_const               0x2227 /* SUN */
#define DW_AT_SUN_return_with_const             0x2228 /* SUN */
#define DW_AT_SUN_import_by_name                0x2229 /* SUN */
#define DW_AT_SUN_f90_pointer                   0x222a /* SUN */
#define DW_AT_SUN_pass_by_ref                   0x222b /* SUN */
#define DW_AT_SUN_f90_allocatable               0x222c /* SUN */
#define DW_AT_SUN_f90_assumed_shape_array       0x222d /* SUN */
#define DW_AT_SUN_c_vla                         0x222e /* SUN */
#define DW_AT_SUN_return_value_ptr              0x2230 /* SUN */
#define DW_AT_SUN_dtor_start                    0x2231 /* SUN */
#define DW_AT_SUN_dtor_length                   0x2232 /* SUN */
#define DW_AT_SUN_dtor_state_initial            0x2233 /* SUN */
#define DW_AT_SUN_dtor_state_final              0x2234 /* SUN */
#define DW_AT_SUN_dtor_state_deltas             0x2235 /* SUN */
#define DW_AT_SUN_import_by_lname               0x2236 /* SUN */
#define DW_AT_SUN_f90_use_only                  0x2237 /* SUN */
#define DW_AT_SUN_namelist_spec                 0x2238 /* SUN */
#define DW_AT_SUN_is_omp_child_func             0x2239 /* SUN */
#define DW_AT_SUN_fortran_main_alias            0x223a /* SUN */
#define DW_AT_SUN_fortran_based                 0x223b /* SUN */

/* ALTIUM extension: ALTIUM Compliant location lists (flag) */
#define DW_AT_ALTIUM_loclist    0x2300          /* ALTIUM  */
/*  Ada GNAT gcc attributes. constant integer forms. */
/*   See http://gcc.gnu.org/wiki/DW_AT_GNAT_descriptive_type .  */
#define DW_AT_use_GNAT_descriptive_type         0x2301
#define DW_AT_GNAT_descriptive_type             0x2302
#define DW_AT_GNU_numerator                     0x2303 /* GNU */
#define DW_AT_GNU_denominator                   0x2304 /* GNU */
/* See https://gcc.gnu.org/wiki/DW_AT_GNU_bias */
#define DW_AT_GNU_bias                          0x2305 /* GNU */

/*  Go-specific type attributes
    Naming as lower-case go instead of GO is a small mistake
    by the Go language folks, it seems. This is the
    common spelling for these. */
#define DW_AT_go_kind                           0x2900
#define DW_AT_go_key                            0x2901
#define DW_AT_go_elem                           0x2902

/*  Attribute for DW_TAG_member of a struct type.
    Nonzero value indicates the struct field is an embedded field.*/
```

```
#define DW_AT_go_embedded_field                 0x2903

#define DW_AT_go_runtime_type                   0x2904

/* UPC extension. */
#define DW_AT_upc_threads_scaled                0x3210 /* UPC */

#define DW_AT_IBM_wsa_addr                      0x393e
#define DW_AT_IBM_home_location                 0x393f
#define DW_AT_IBM_alt_srcview                   0x3940

/*  PGI (STMicroelectronics) extensions. */
/*  PGI. Block, constant, reference. This attribute is an ASTPLAB
    extension used to describe the array local base.  */
#define DW_AT_PGI_lbase                         0x3a00

/*  PGI. Block, constant, reference. ASTPLAB adds this attribute
    to describe the section offset, or the offset to the
    first element in the dimension. */
#define DW_AT_PGI_soffset                       0x3a01

/*  PGI. Block, constant, reference.  ASTPLAB adds this
    attribute to describe the linear stride or the distance
    between elements in the dimension. */
#define DW_AT_PGI_lstride                       0x3a02

#define DW_AT_BORLAND_property_read             0x3b11
#define DW_AT_BORLAND_property_write            0x3b12
#define DW_AT_BORLAND_property_implements       0x3b13
#define DW_AT_BORLAND_property_index            0x3b14
#define DW_AT_BORLAND_property_default          0x3b15
#define DW_AT_BORLAND_Delphi_unit               0x3b20
#define DW_AT_BORLAND_Delphi_class              0x3b21
#define DW_AT_BORLAND_Delphi_record             0x3b22
#define DW_AT_BORLAND_Delphi_metaclass          0x3b23
#define DW_AT_BORLAND_Delphi_constructor        0x3b24
#define DW_AT_BORLAND_Delphi_destructor         0x3b25
#define DW_AT_BORLAND_Delphi_anonymous_method   0x3b26
#define DW_AT_BORLAND_Delphi_interface          0x3b27
#define DW_AT_BORLAND_Delphi_ABI                0x3b28
#define DW_AT_BORLAND_Delphi_frameptr           0x3b30
#define DW_AT_BORLAND_closure                   0x3b31

#define DW_AT_LLVM_include_path                 0x3e00
#define DW_AT_LLVM_config_macros                0x3e01
#define DW_AT_LLVM_sysroot                      0x3e02
#define DW_AT_LLVM_tag_offset                   0x3e03
/*  LLVM intends to use 0x3e04 - 0x3e06 */
#define DW_AT_LLVM_apinotes                     0x3e07
/*  Next 6 are for Heterogeneous debugging */
#define DW_AT_LLVM_active_lane                  0x3e08
#define DW_AT_LLVM_augmentation                 0x3e09
#define DW_AT_LLVM_lanes                        0x3e0a
#define DW_AT_LLVM_lane_pc                      0x3e0b
#define DW_AT_LLVM_vector_size                  0x3e0c

#define DW_AT_APPLE_optimized                   0x3fe1
#define DW_AT_APPLE_flags                       0x3fe2
#define DW_AT_APPLE_isa                         0x3fe3
/*  0x3fe4 Also known as DW_AT_APPLE_closure, block preferred. */
#define DW_AT_APPLE_block                       0x3fe4
/* The rest of APPLE here are in support of Objective C */
#define DW_AT_APPLE_major_runtime_vers          0x3fe5
#define DW_AT_APPLE_runtime_class               0x3fe6
#define DW_AT_APPLE_omit_frame_ptr              0x3fe7
#define DW_AT_APPLE_property_name               0x3fe8
#define DW_AT_APPLE_property_getter             0x3fe9
#define DW_AT_APPLE_property_setter             0x3fea
#define DW_AT_APPLE_property_attribute          0x3feb
#define DW_AT_APPLE_objc_complete_type          0x3fec
#define DW_AT_APPLE_property                    0x3fed
#define DW_AT_APPLE_objc_direct                 0x3fee
#define DW_AT_APPLE_sdk                         0x3fef
#define DW_AT_APPLE_origin                      0x3ff0

#define DW_AT_hi_user                           0x3fff

/* OP values 0x01,0x02,0x04,0x05,0x07 are DWARF1 only */
#define DW_OP_addr                      0x03
#define DW_OP_deref                     0x06
#define DW_OP_const1u                   0x08
#define DW_OP_const1s                   0x09
#define DW_OP_const2u                   0x0a
#define DW_OP_const2s                   0x0b
#define DW_OP_const4u                   0x0c
#define DW_OP_const4s                   0x0d
#define DW_OP_const8u                   0x0e
```

```
#define DW_OP_const8s                   0x0f
#define DW_OP_constu                    0x10
#define DW_OP_consts                    0x11
#define DW_OP_dup                       0x12
#define DW_OP_drop                      0x13
#define DW_OP_over                      0x14
#define DW_OP_pick                      0x15
#define DW_OP_swap                      0x16
#define DW_OP_rot                       0x17
#define DW_OP_xderef                    0x18
#define DW_OP_abs                       0x19
#define DW_OP_and                       0x1a
#define DW_OP_div                       0x1b
#define DW_OP_minus                     0x1c
#define DW_OP_mod                       0x1d
#define DW_OP_mul                       0x1e
#define DW_OP_neg                       0x1f
#define DW_OP_not                       0x20
#define DW_OP_or                        0x21
#define DW_OP_plus                      0x22
#define DW_OP_plus_uconst               0x23
#define DW_OP_shl                       0x24
#define DW_OP_shr                       0x25
#define DW_OP_shra                      0x26
#define DW_OP_xor                       0x27
#define DW_OP_bra                       0x28
#define DW_OP_eq                        0x29
#define DW_OP_ge                        0x2a
#define DW_OP_gt                        0x2b
#define DW_OP_le                        0x2c
#define DW_OP_lt                        0x2d
#define DW_OP_ne                        0x2e
#define DW_OP_skip                      0x2f
#define DW_OP_lit0                      0x30
#define DW_OP_lit1                      0x31
#define DW_OP_lit2                      0x32
#define DW_OP_lit3                      0x33
#define DW_OP_lit4                      0x34
#define DW_OP_lit5                      0x35
#define DW_OP_lit6                      0x36
#define DW_OP_lit7                      0x37
#define DW_OP_lit8                      0x38
#define DW_OP_lit9                      0x39
#define DW_OP_lit10                     0x3a
#define DW_OP_lit11                     0x3b
#define DW_OP_lit12                     0x3c
#define DW_OP_lit13                     0x3d
#define DW_OP_lit14                     0x3e
#define DW_OP_lit15                     0x3f
#define DW_OP_lit16                     0x40
#define DW_OP_lit17                     0x41
#define DW_OP_lit18                     0x42
#define DW_OP_lit19                     0x43
#define DW_OP_lit20                     0x44
#define DW_OP_lit21                     0x45
#define DW_OP_lit22                     0x46
#define DW_OP_lit23                     0x47
#define DW_OP_lit24                     0x48
#define DW_OP_lit25                     0x49
#define DW_OP_lit26                     0x4a
#define DW_OP_lit27                     0x4b
#define DW_OP_lit28                     0x4c
#define DW_OP_lit29                     0x4d
#define DW_OP_lit30                     0x4e
#define DW_OP_lit31                     0x4f
#define DW_OP_reg0                      0x50
#define DW_OP_reg1                      0x51
#define DW_OP_reg2                      0x52
#define DW_OP_reg3                      0x53
#define DW_OP_reg4                      0x54
#define DW_OP_reg5                      0x55
#define DW_OP_reg6                      0x56
#define DW_OP_reg7                      0x57
#define DW_OP_reg8                      0x58
#define DW_OP_reg9                      0x59
#define DW_OP_reg10                     0x5a
#define DW_OP_reg11                     0x5b
#define DW_OP_reg12                     0x5c
#define DW_OP_reg13                     0x5d
#define DW_OP_reg14                     0x5e
#define DW_OP_reg15                     0x5f
#define DW_OP_reg16                     0x60
#define DW_OP_reg17                     0x61
#define DW_OP_reg18                     0x62
#define DW_OP_reg19                     0x63
#define DW_OP_reg20                     0x64
#define DW_OP_reg21                     0x65
```

```
#define DW_OP_reg22                     0x66
#define DW_OP_reg23                     0x67
#define DW_OP_reg24                     0x68
#define DW_OP_reg25                     0x69
#define DW_OP_reg26                     0x6a
#define DW_OP_reg27                     0x6b
#define DW_OP_reg28                     0x6c
#define DW_OP_reg29                     0x6d
#define DW_OP_reg30                     0x6e
#define DW_OP_reg31                     0x6f
#define DW_OP_breg0                     0x70
#define DW_OP_breg1                     0x71
#define DW_OP_breg2                     0x72
#define DW_OP_breg3                     0x73
#define DW_OP_breg4                     0x74
#define DW_OP_breg5                     0x75
#define DW_OP_breg6                     0x76
#define DW_OP_breg7                     0x77
#define DW_OP_breg8                     0x78
#define DW_OP_breg9                     0x79
#define DW_OP_breg10                    0x7a
#define DW_OP_breg11                    0x7b
#define DW_OP_breg12                    0x7c
#define DW_OP_breg13                    0x7d
#define DW_OP_breg14                    0x7e
#define DW_OP_breg15                    0x7f
#define DW_OP_breg16                    0x80
#define DW_OP_breg17                    0x81
#define DW_OP_breg18                    0x82
#define DW_OP_breg19                    0x83
#define DW_OP_breg20                    0x84
#define DW_OP_breg21                    0x85
#define DW_OP_breg22                    0x86
#define DW_OP_breg23                    0x87
#define DW_OP_breg24                    0x88
#define DW_OP_breg25                    0x89
#define DW_OP_breg26                    0x8a
#define DW_OP_breg27                    0x8b
#define DW_OP_breg28                    0x8c
#define DW_OP_breg29                    0x8d
#define DW_OP_breg30                    0x8e
#define DW_OP_breg31                    0x8f
#define DW_OP_regx                      0x90
#define DW_OP_fbreg                     0x91
#define DW_OP_bregx                     0x92
#define DW_OP_piece                     0x93
#define DW_OP_deref_size                0x94
#define DW_OP_xderef_size               0x95
#define DW_OP_nop                       0x96
#define DW_OP_push_object_address       0x97 /* DWARF3 */
#define DW_OP_call2                     0x98 /* DWARF3 */
#define DW_OP_call4                     0x99 /* DWARF3 */
#define DW_OP_call_ref                  0x9a /* DWARF3 */
#define DW_OP_form_tls_address          0x9b /* DWARF3f */
#define DW_OP_call_frame_cfa            0x9c /* DWARF3f */
#define DW_OP_bit_piece                 0x9d /* DWARF3f */
#define DW_OP_implicit_value            0x9e /* DWARF4 */
#define DW_OP_stack_value               0x9f /* DWARF4 */
#define DW_OP_implicit_pointer          0xa0 /* DWARF5 */
#define DW_OP_addrx                     0xa1 /* DWARF5 */
#define DW_OP_constx                    0xa2 /* DWARF5 */
#define DW_OP_entry_value               0xa3 /* DWARF5 */
#define DW_OP_const_type                0xa4 /* DWARF5 */
#define DW_OP_regval_type               0xa5 /* DWARF5 */
#define DW_OP_deref_type                0xa6 /* DWARF5 */
#define DW_OP_xderef_type               0xa7 /* DWARF5 */
#define DW_OP_convert                   0xa8 /* DWARF5 */
#define DW_OP_reinterpret               0xa9 /* DWARF5 */

#define DW_OP_GNU_push_tls_address      0xe0 /* GNU */
#define DW_OP_WASM_location             0xed
#define DW_OP_WASM_location_int         0xee

/* Follows extension so dwarfdump prints the
most-likely-useful name. */
#define DW_OP_lo_user                   0xe0

    /* LLVM  extensions. */
#define DW_OP_LLVM_form_aspace_address  0xe1
#define DW_OP_LLVM_push_lane            0xe2
#define DW_OP_LLVM_offset               0xe3
#define DW_OP_LLVM_offset_uconst        0xe4
#define DW_OP_LLVM_bit_offset           0xe5
#define DW_OP_LLVM_call_frame_entry_reg 0xe6
#define DW_OP_LLVM_undefined            0xe7
#define DW_OP_LLVM_aspace_bregx         0xe8
#define DW_OP_LLVM_aspace_implicit_pointer 0xe9
```

```
#define DW_OP_LLVM_piece_end            0xea
#define DW_OP_LLVM_extend               0xeb
#define DW_OP_LLVM_select_bit_piece     0xec
    /* HP extensions. */
#define DW_OP_HP_unknown                0xe0 /* HP conflict: GNU */
#define DW_OP_HP_is_value               0xe1 /* HP */
#define DW_OP_HP_fltconst4              0xe2 /* HP */
#define DW_OP_HP_fltconst8              0xe3 /* HP */
#define DW_OP_HP_mod_range              0xe4 /* HP */
#define DW_OP_HP_unmod_range            0xe5 /* HP */
#define DW_OP_HP_tls                    0xe6 /* HP */

/* Intel: made obsolete by DW_OP_bit_piece above. */
#define DW_OP_INTEL_bit_piece           0xe8

/* Apple extension. */
#define DW_OP_GNU_uninit                0xf0 /* GNU */
#define DW_OP_APPLE_uninit              0xf0 /* Apple */
#define DW_OP_GNU_encoded_addr          0xf1 /* GNU */
#define DW_OP_GNU_implicit_pointer      0xf2 /* GNU */
#define DW_OP_GNU_entry_value           0xf3 /* GNU */
#define DW_OP_GNU_const_type            0xf4 /* GNU */
#define DW_OP_GNU_regval_type           0xf5 /* GNU */
#define DW_OP_GNU_deref_type            0xf6 /* GNU */
#define DW_OP_GNU_convert               0xf7 /* GNU */
#define DW_OP_GNU_reinterpret           0xf9 /* GNU */
#define DW_OP_GNU_parameter_ref         0xfa /* GNU */
#define DW_OP_GNU_addr_index            0xfb /* GNU Fission */
#define DW_OP_GNU_const_index           0xfc /* GNU Fission */
#define DW_OP_GNU_variable_value        0xfd /* GNU 2017 */
#define DW_OP_PGI_omp_thread_num   0xf8 /* PGI (STMicroelectronics) */

#define DW_OP_hi_user                   0xff

#define DW_ATE_address                0x01
#define DW_ATE_boolean                0x02
#define DW_ATE_complex_float          0x03
#define DW_ATE_float                  0x04
#define DW_ATE_signed                 0x05
#define DW_ATE_signed_char            0x06
#define DW_ATE_unsigned               0x07
#define DW_ATE_unsigned_char          0x08
#define DW_ATE_imaginary_float        0x09  /* DWARF3 */
#define DW_ATE_packed_decimal         0x0a  /* DWARF3f */
#define DW_ATE_numeric_string         0x0b  /* DWARF3f */
#define DW_ATE_edited                 0x0c  /* DWARF3f */
#define DW_ATE_signed_fixed           0x0d  /* DWARF3f */
#define DW_ATE_unsigned_fixed         0x0e  /* DWARF3f */
#define DW_ATE_decimal_float          0x0f  /* DWARF3f */
#define DW_ATE_UTF                    0x10  /* DWARF4 */
#define DW_ATE_UCS                    0x11  /* DWARF5 */
#define DW_ATE_ASCII                  0x12  /* DWARF5 */

/* ALTIUM extensions. x80, x81 */
#define DW_ATE_ALTIUM_fract           0x80 /* ALTIUM __fract type */

/*  Follows extension so dwarfdump prints
    the most-likely-useful name. */
#define DW_ATE_lo_user                0x80

/* Shown here to help dwarfdump build script. */
#define DW_ATE_ALTIUM_accum           0x81 /* ALTIUM __accum type */

/* HP extensions. */
#define DW_ATE_HP_float80             0x80 /* (80 bit). HP */
#define DW_ATE_HP_complex_float80     0x81 /* Complex (80 bit). HP  */
#define DW_ATE_HP_float128            0x82 /* (128 bit). HP */
#define DW_ATE_HP_complex_float128    0x83 /* Complex (128 bit). HP */
#define DW_ATE_HP_floathpintel        0x84 /* (82 bit IA64). HP */
#define DW_ATE_HP_imaginary_float80   0x85 /* HP */
#define DW_ATE_HP_imaginary_float128  0x86 /* HP */
#define DW_ATE_HP_VAX_float           0x88 /* F or G floating.  */
#define DW_ATE_HP_VAX_float_d         0x89 /* D floating.  */
#define DW_ATE_HP_packed_decimal      0x8a /* Cobol.  */
#define DW_ATE_HP_zoned_decimal       0x8b /* Cobol.  */
#define DW_ATE_HP_edited              0x8c /* Cobol.  */
#define DW_ATE_HP_signed_fixed        0x8d /* Cobol.  */
#define DW_ATE_HP_unsigned_fixed      0x8e /* Cobol.  */
#define DW_ATE_HP_VAX_complex_float   0x8f /* ForG floating complex.*/
#define DW_ATE_HP_VAX_complex_float_d 0x90 /* D floating complex.  */

/* Sun extensions */
#define DW_ATE_SUN_interval_float     0x91

/* Obsolete: See DW_ATE_imaginary_float */
#define DW_ATE_SUN_imaginary_float    0x92 /* Really SUN 0x86 ? */

```

```
#define DW_ATE_hi_user                0xff

/*   DWARF5  Defaulted Member Encodings. */
#define DW_DEFAULTED_no              0x0      /* DWARF5 */
#define DW_DEFAULTED_in_class        0x1      /* DWARF5 */
#define DW_DEFAULTED_out_of_class    0x2      /* DWARF5 */

#define DW_IDX_compile_unit          0x1      /* DWARF5 */
#define DW_IDX_type_unit             0x2      /* DWARF5 */
#define DW_IDX_die_offset            0x3      /* DWARF5 */
#define DW_IDX_parent                0x4      /* DWARF5 */
#define DW_IDX_type_hash             0x5      /* DWARF5 */
#define DW_IDX_GNU_internal          0x2000
#define DW_IDX_lo_user               0x2000   /* DWARF5 */
#define DW_IDX_GNU_external          0x2001
#define DW_IDX_GNU_main              0x2002
#define DW_IDX_GNU_language          0x2003
#define DW_IDX_GNU_linkage_name      0x2004
#define DW_IDX_hi_user               0x3fff   /* DWARF5 */

/*  These with not-quite-the-same-names were used in DWARF4
    We call then DW_LLEX.
    Never official and should not be used by anyone.*/
#define DW_LLEX_end_of_list_entry            0x0
#define DW_LLEX_base_address_selection_entry 0x01
#define DW_LLEX_start_end_entry              0x02
#define DW_LLEX_start_length_entry           0x03
#define DW_LLEX_offset_pair_entry            0x04

/* DWARF5 Location List Entries in Split Objects */
#define DW_LLE_end_of_list           0x0      /* DWARF5 */
#define DW_LLE_base_addressx         0x01     /* DWARF5 */
#define DW_LLE_startx_endx           0x02     /* DWARF5 */
#define DW_LLE_startx_length         0x03     /* DWARF5 */
#define DW_LLE_offset_pair           0x04     /* DWARF5 */
#define DW_LLE_default_location      0x05     /* DWARF5 */
#define DW_LLE_base_address          0x06     /* DWARF5 */
#define DW_LLE_start_end             0x07     /* DWARF5 */
#define DW_LLE_start_length          0x08     /* DWARF5 */

/* DWARF5 Range List Entries */
#define DW_RLE_end_of_list           0x00     /* DWARF5 */
#define DW_RLE_base_addressx         0x01     /* DWARF5 */
#define DW_RLE_startx_endx           0x02     /* DWARF5 */
#define DW_RLE_startx_length         0x03     /* DWARF5 */
#define DW_RLE_offset_pair           0x04     /* DWARF5 */
#define DW_RLE_base_address          0x05     /* DWARF5 */
#define DW_RLE_start_end             0x06     /* DWARF5 */
#define DW_RLE_start_length          0x07     /* DWARF5 */

/*  GNUIndex encodings non-standard. New in 2020,
    used in .debug_gnu_pubnames .debug_gnu_pubtypes
    but no spellings provided in documentation. */
#define DW_GNUIVIS_global   0
#define DW_GNUIVIS_static   1

/*  GNUIndex encodings non-standard. New in 2020,
    used in .debug_gnu_pubnames .debug_gnu_pubtypes
    but no spellings provided in documentation. */
#define DW_GNUIKIND_none     0
#define DW_GNUIKIND_type     1
#define DW_GNUIKIND_variable 2
#define DW_GNUIKIND_function 3
#define DW_GNUIKIND_other    4

/* DWARF5 Unit header unit type encodings */
#define DW_UT_compile                0x01  /* DWARF5 */
#define DW_UT_type                   0x02  /* DWARF5 */
#define DW_UT_partial                0x03  /* DWARF5 */
#define DW_UT_skeleton               0x04  /* DWARF5 */
#define DW_UT_split_compile          0x05  /* DWARF5 */
#define DW_UT_split_type             0x06  /* DWARF5 */
#define DW_UT_lo_user                0x80  /* DWARF5 */
#define DW_UT_hi_user                0xff  /* DWARF5 */

/*  DWARF5 DebugFission object section id values
    for .dwp object section offsets hash table.
    0 is reserved, not used.
    2 is actually reserved, not used in DWARF5.
    But 2 may be seen in some DWARF4 objects.
*/
#define DW_SECT_INFO        1  /* .debug_info.dwo        DWARF5 */
#define DW_SECT_TYPES       2  /* .debug_types.dwo   pre-DWARF5 */
#define DW_SECT_ABBREV      3  /* .debug_abbrev.dwo      DWARF5 */
#define DW_SECT_LINE        4  /* .debug_line.dwo        DWARF5 */
#define DW_SECT_LOCLISTS    5  /* .debug_loclists.dwo    DWARF5 */
#define DW_SECT_STR_OFFSETS 6  /* .debug_str_offsets.dwo DWARF5 */
```

```
#define DW_SECT_MACRO       7  /* .debug_macro.dwo       DWARF5 */
#define DW_SECT_RNGLISTS    8  /* .debug_rnglists.dwo    DWARF5 */

/* Decimal Sign codes. */
#define DW_DS_unsigned                  0x01 /* DWARF3f */
#define DW_DS_leading_overpunch         0x02 /* DWARF3f */
#define DW_DS_trailing_overpunch        0x03 /* DWARF3f */
#define DW_DS_leading_separate          0x04 /* DWARF3f */
#define DW_DS_trailing_separate         0x05 /* DWARF3f */

/* Endian code name. */
#define DW_END_default                  0x00 /* DWARF3f */
#define DW_END_big                      0x01 /* DWARF3f */
#define DW_END_little                   0x02 /* DWARF3f */

#define DW_END_lo_user                  0x40 /* DWARF3f */
#define DW_END_hi_user                  0xff /* DWARF3f */

/*  For use with DW_TAG_SUN_codeflags
    If DW_TAG_SUN_codeflags is accepted as a dwarf standard, then
    standard dwarf ATCF entries start at 0x01 */
#define DW_ATCF_lo_user                 0x40 /* SUN */
#define DW_ATCF_SUN_mop_bitfield        0x41 /* SUN */
#define DW_ATCF_SUN_mop_spill           0x42 /* SUN */
#define DW_ATCF_SUN_mop_scopy           0x43 /* SUN */
#define DW_ATCF_SUN_func_start          0x44 /* SUN */
#define DW_ATCF_SUN_end_ctors           0x45 /* SUN */
#define DW_ATCF_SUN_branch_target       0x46 /* SUN */
#define DW_ATCF_SUN_mop_stack_probe     0x47 /* SUN */
#define DW_ATCF_SUN_func_epilog         0x48 /* SUN */
#define DW_ATCF_hi_user                 0xff /* SUN */

/* Accessibility code name. */
#define DW_ACCESS_public                0x01
#define DW_ACCESS_protected             0x02
#define DW_ACCESS_private               0x03

/* Visibility code name. */
#define DW_VIS_local                    0x01
#define DW_VIS_exported                 0x02
#define DW_VIS_qualified                0x03

/* Virtuality code name. */
#define DW_VIRTUALITY_none              0x00
#define DW_VIRTUALITY_virtual           0x01
#define DW_VIRTUALITY_pure_virtual      0x02

#define DW_LANG_C89                     0x0001
#define DW_LANG_C                       0x0002
#define DW_LANG_Ada83                   0x0003
#define DW_LANG_C_plus_plus             0x0004
#define DW_LANG_Cobol74                 0x0005
#define DW_LANG_Cobol85                 0x0006
#define DW_LANG_Fortran77               0x0007
#define DW_LANG_Fortran90               0x0008
#define DW_LANG_Pascal83                0x0009
#define DW_LANG_Modula2                 0x000a
#define DW_LANG_Java                    0x000b /* DWARF3 */
#define DW_LANG_C99                     0x000c /* DWARF3 */
#define DW_LANG_Ada95                   0x000d /* DWARF3 */
#define DW_LANG_Fortran95               0x000e /* DWARF3 */
#define DW_LANG_PLI                     0x000f /* DWARF3 */
#define DW_LANG_ObjC                    0x0010 /* DWARF3f */
#define DW_LANG_ObjC_plus_plus          0x0011 /* DWARF3f */
#define DW_LANG_UPC                     0x0012 /* DWARF3f */
#define DW_LANG_D                       0x0013 /* DWARF3f */
#define DW_LANG_Python                  0x0014 /* DWARF4 */
#define DW_LANG_OpenCL                  0x0015 /* DWARF5 */
#define DW_LANG_Go                      0x0016 /* DWARF5 */
#define DW_LANG_Modula3                 0x0017 /* DWARF5 */
#define DW_LANG_Haskel                  0x0018 /* DWARF5 */
#define DW_LANG_C_plus_plus_03          0x0019 /* DWARF5 */
#define DW_LANG_C_plus_plus_11          0x001a /* DWARF5 */
#define DW_LANG_OCaml                   0x001b /* DWARF5 */
#define DW_LANG_Rust                    0x001c /* DWARF5 */
#define DW_LANG_C11                     0x001d /* DWARF5 */
#define DW_LANG_Swift                   0x001e /* DWARF5 */
#define DW_LANG_Julia                   0x001f /* DWARF5 */
#define DW_LANG_Dylan                   0x0020 /* DWARF5 */
#define DW_LANG_C_plus_plus_14          0x0021 /* DWARF5 */
#define DW_LANG_Fortran03               0x0022 /* DWARF5 */
#define DW_LANG_Fortran08               0x0023 /* DWARF5 */
#define DW_LANG_RenderScript            0x0024 /* DWARF5 */
#define DW_LANG_BLISS                   0x0025 /* DWARF5 */
/*  The committee has, in
    https://dwarfstd.org/languages-v6.html
    specified that these language code, may be
    used by compilers now, and promises these
    will not change. */
#define DW_LANG_Kotlin                  0x0026 /* DWARF6 */
#define DW_LANG_Zig                     0x0027 /* DWARF6 */
#define DW_LANG_Crystal                 0x0028 /* DWARF6 */
#define DW_LANG_C_plus_plus_17          0x002a /* DWARF6 */
#define DW_LANG_C_plus_plus_20          0x002b /* DWARF6 */
#define DW_LANG_C17                     0x002c /* DWARF6 */
#define DW_LANG_Fortran18               0x002d /* DWARF6 */
#define DW_LANG_Ada2005                 0x002e /* DWARF6 */
#define DW_LANG_Ada2012                 0x002f /* DWARF6 */
#define DW_LANG_HIP                     0x0030 /* DWARF6 */
#define DW_LANG_Assembly                0x0031 /* DWARF6 */
#define DW_LANG_C_sharp                 0x0032 /* DWARF6 */
#define DW_LANG_Mojo                    0x0033 /* DWARF6 */
#define DW_LANG_GLSL                    0x0034 /* DWARF6 */
#define DW_LANG_GLSL_ES                 0x0035 /* DWARF6 */
#define DW_LANG_HLSL                    0x0036 /* DWARF6 */
#define DW_LANG_OpenCL_CPP              0x0037 /* DWARF6 */
#define DW_LANG_CPP_for_OpenCL          0x0038 /* DWARF6 */
#define DW_LANG_SYCL                    0x0039 /* DWARF6 */
#define DW_LANG_Ruby                    0x0040 /* DWARF6 */
#define DW_LANG_Move                    0x0041 /* DWARF6 */
#define DW_LANG_Hylo                    0x0042 /* DWARF6 */
#define DW_LANG_V                       0x0043 /* DWARF6 */
#define DW_LANG_Algol68                 0x0044 /* DWARF6 */

#define DW_LANG_lo_user                 0x8000
#define DW_LANG_Mips_Assembler          0x8001 /* MIPS   */
#define DW_LANG_Upc                     0x8765 /* UPC, use
                                        DW_LANG_UPC instead. */
#define DW_LANG_GOOGLE_RenderScript     0x8e57
#define DW_LANG_ALTIUM_Assembler        0x9101
#define DW_LANG_BORLAND_Delphi          0xb000

/* Sun extensions */
#define DW_LANG_SUN_Assembler           0x9001 /* SUN */

#define DW_LANG_hi_user                 0xffff

/*  The committee has, in
    https://dwarfstd.org/languages-v6.html
    specified that these language code, may be
    used by compilers now, and promises these
    will not change. */
#define DW_LNAME_Ada               0x0001  /* DWARF6 */
#define DW_LNAME_BLISS             0x0002  /* DWARF6 */
#define DW_LNAME_C                 0x0003  /* DWARF6 */
#define DW_LNAME_C_plus_plus       0x0004  /* DWARF6 */
#define DW_LNAME_Cobol             0x0005  /* DWARF6 */
#define DW_LNAME_Crystal           0x0006  /* DWARF6 */
#define DW_LNAME_D                 0x0007  /* DWARF6 */
#define DW_LNAME_Dylan             0x0008  /* DWARF6 */
#define DW_LNAME_Fortran           0x0009  /* DWARF6 */
#define DW_LNAME_Go                0x000a  /* DWARF6 */
#define DW_LNAME_Haskell           0x000b  /* DWARF6 */
#define DW_LNAME_Java              0x000c  /* DWARF6 */
#define DW_LNAME_Julia             0x000d  /* DWARF6 */
#define DW_LNAME_Kotlin            0x000e  /* DWARF6 */
#define DW_LNAME_Modula2           0x000f  /* DWARF6 */
#define DW_LNAME_Modula3           0x0010  /* DWARF6 */
#define DW_LNAME_ObjC              0x0011  /* DWARF6 */
#define DW_LNAME_ObjC_plus_plus    0x0012  /* DWARF6 */
#define DW_LNAME_OCaml             0x0013  /* DWARF6 */
#define DW_LNAME_OpenCL_C          0x0014  /* DWARF6 */
#define DW_LNAME_Pascal            0x0015  /* DWARF6 */
#define DW_LNAME_PLI               0x0016  /* DWARF6 */
#define DW_LNAME_Python            0x0017  /* DWARF6 */
#define DW_LNAME_RenderScript      0x0018  /* DWARF6 */
#define DW_LNAME_Rust              0x0019  /* DWARF6 */
#define DW_LNAME_Swift             0x001a  /* DWARF6 */
#define DW_LNAME_UPC               0x001b  /* DWARF6 */
#define DW_LNAME_Zig               0x001c  /* DWARF6 */
#define DW_LNAME_Assembly          0x001d  /* DWARF6 */
#define DW_LNAME_C_sharp           0x001e  /* DWARF6 */
#define DW_LNAME_Mojo              0x001f  /* DWARF6 */
#define DW_LNAME_GLSL              0x0020  /* DWARF6 */
#define DW_LNAME_GLSLES            0x0021  /* DWARF6 */
#define DW_LNAME_HLSL              0x0022  /* DWARF6 */
#define DW_LNAME_OpenCL_CPP        0x0023  /* DWARF6 */
#define DW_LNAME_CPP_for_OpenCL    0x0024  /* DWARF6 */
#define DW_LNAME_SYCL              0x0025  /* DWARF6 */
#define DW_LNAME_Ruby              0x0026  /* DWARF6 */
#define DW_LNAME_Move              0x0027  /* DWARF6 */
#define DW_LNAME_Hylo              0x0028  /* DWARF6 */
#define DW_LNAME_HIP               0x0029  /* DWARF6 */
#define DW_LNAME_Odin              0x002a  /* DWARF6 */
```

```
#define DW_LNAME_P4                0x002b  /* DWARF6 */
#define DW_LNAME_Metal             0x002c  /* DWARF6 */
#define DW_LNAME_V                 0x002d  /* DWARF6 */
#define DW_LNAME_Algol68           0x002e  /* DWARF6 */
#define DW_LNAME_Nim               0x002f  /* DWARF6 */

/* Identifier case name. */
#define DW_ID_case_sensitive            0x00
#define DW_ID_up_case                   0x01
#define DW_ID_down_case                 0x02
#define DW_ID_case_insensitive          0x03

/* Calling Convention Name. */
#define DW_CC_normal                    0x01
#define DW_CC_program                   0x02
#define DW_CC_nocall                    0x03
#define DW_CC_pass_by_reference         0x04 /* DWARF5 */
#define DW_CC_pass_by_value             0x05 /* DWARF5 */

#define DW_CC_GNU_renesas_sh            0x40 /* GNU */
#define DW_CC_lo_user                   0x40
#define DW_CC_GNU_borland_fastcall_i386 0x41 /* GNU */

/* ALTIUM extensions. */
/*  Function is an interrupt handler,
    return address on system stack. */
#define DW_CC_ALTIUM_interrupt          0x65  /* ALTIUM*/

/* Near function model, return address on system stack. */
#define DW_CC_ALTIUM_near_system_stack  0x66  /*ALTIUM */

/* Near function model, return address on user stack. */
#define DW_CC_ALTIUM_near_user_stack    0x67  /* ALTIUM */

/* Huge function model, return address on user stack.  */
#define DW_CC_ALTIUM_huge_user_stack  0x68  /* ALTIUM */

#define DW_CC_GNU_BORLAND_safecall    0xb0
#define DW_CC_GNU_BORLAND_stdcall     0xb1
#define DW_CC_GNU_BORLAND_pascal      0xb2
#define DW_CC_GNU_BORLAND_msfastcall  0xb3
#define DW_CC_GNU_BORLAND_msreturn    0xb4
#define DW_CC_GNU_BORLAND_thiscall    0xb5
#define DW_CC_GNU_BORLAND_fastcall    0xb6

#define DW_CC_LLVM_vectorcall         0xc0
#define DW_CC_LLVM_Win64              0xc1
#define DW_CC_LLVM_X86_64SysV         0xc2
#define DW_CC_LLVM_AAPCS              0xc3
#define DW_CC_LLVM_AAPCS_VFP          0xc4
#define DW_CC_LLVM_IntelOclBicc       0xc5
#define DW_CC_LLVM_SpirFunction       0xc6
#define DW_CC_LLVM_OpenCLKernel       0xc7
#define DW_CC_LLVM_Swift              0xc8
#define DW_CC_LLVM_PreserveMost       0xc9
#define DW_CC_LLVM_PreserveAll        0xca
#define DW_CC_LLVM_X86RegCall         0xcb
#define DW_CC_GDB_IBM_OpenCL          0xff

#define DW_CC_hi_user                   0xff

/* Inline Code Name. */
#define DW_INL_not_inlined              0x00
#define DW_INL_inlined                  0x01
#define DW_INL_declared_not_inlined     0x02
#define DW_INL_declared_inlined         0x03

/* Ordering Name. */
#define DW_ORD_row_major                0x00
#define DW_ORD_col_major                0x01

/* Discriminant Descriptor Name. */
#define DW_DSC_label                    0x00
#define DW_DSC_range                    0x01

/*  Line number header entry format encodings. DWARF5 */
#define DW_LNCT_path                    0x1 /* DWARF5 */
#define DW_LNCT_directory_index         0x2 /* DWARF5 */
#define DW_LNCT_timestamp               0x3 /* DWARF5 */
#define DW_LNCT_size                    0x4 /* DWARF5 */
#define DW_LNCT_MD5                     0x5 /* DWARF5 */
/* Experimental two-level line tables. Non standard */
#define DW_LNCT_GNU_subprogram_name     0x6
#define DW_LNCT_GNU_decl_file           0x7
#define DW_LNCT_GNU_decl_line           0x8
#define DW_LNCT_lo_user                 0x2000 /* DWARF5 */
#define DW_LNCT_LLVM_source             0x2001
```

```
#define DW_LNCT_LLVM_is_MD5             0x2002
#define DW_LNCT_hi_user                 0x3fff /* DWARF5 */

/* Line number standard opcode name. */
#define DW_LNS_copy                     0x01
#define DW_LNS_advance_pc               0x02
#define DW_LNS_advance_line             0x03
#define DW_LNS_set_file                 0x04
#define DW_LNS_set_column               0x05
#define DW_LNS_negate_stmt              0x06
#define DW_LNS_set_basic_block          0x07
#define DW_LNS_const_add_pc             0x08
#define DW_LNS_fixed_advance_pc         0x09
#define DW_LNS_set_prologue_end         0x0a /* DWARF3 */
#define DW_LNS_set_epilogue_begin       0x0b /* DWARF3 */
#define DW_LNS_set_isa                  0x0c /* DWARF3 */

/*  Experimental two-level line tables. NOT STD DWARF5 */
/*  Not saying GNU or anything. There are no
    DW_LNS_lo_user or DW_LNS_hi_user values though.
    DW_LNS_set_address_from_logical and
    DW_LNS_set_subprogram being both 0xd
    to avoid using up more space in the special opcode table.
    EXPERIMENTAL DW_LNS follow.
*/
#define DW_LNS_set_address_from_logical 0x0d /* Actuals table only */
#define DW_LNS_set_subprogram           0x0d /* Logicals table only */
#define DW_LNS_inlined_call             0x0e /* Logicals table only */
#define DW_LNS_pop_context              0x0f /* Logicals table only */

/* Line number extended opcode name. */
#define DW_LNE_end_sequence             0x01
#define DW_LNE_set_address              0x02
#define DW_LNE_define_file        0x03  /* DWARF4 and earlier only */
#define DW_LNE_set_discriminator        0x04  /* DWARF4 */

/* HP extensions. */
#define DW_LNE_HP_negate_is_UV_update       0x11 /* 17 HP */
#define DW_LNE_HP_push_context              0x12 /* 18 HP */
#define DW_LNE_HP_pop_context               0x13 /* 19 HP */
#define DW_LNE_HP_set_file_line_column      0x14 /* 20 HP */
#define DW_LNE_HP_set_routine_name          0x15 /* 21 HP */
#define DW_LNE_HP_set_sequence              0x16 /* 22 HP */
#define DW_LNE_HP_negate_post_semantics     0x17 /* 23 HP */
#define DW_LNE_HP_negate_function_exit      0x18 /* 24 HP */
#define DW_LNE_HP_negate_front_end_logical  0x19 /* 25 HP */
#define DW_LNE_HP_define_proc               0x20 /* 32 HP */

#define DW_LNE_HP_source_file_correlation   0x80 /* HP */
#define DW_LNE_lo_user                  0x80 /* DWARF3 */
#define DW_LNE_hi_user                  0xff /* DWARF3 */

/* These are known values for DW_LNS_set_isa. */
/* These identifiers are not defined by any DWARFn standard. */
#define DW_ISA_UNKNOWN   0
/* The following two are ARM specific. */
#define DW_ISA_ARM_thumb 1 /* ARM ISA */
#define DW_ISA_ARM_arm   2 /* ARM ISA */

/* Macro information, DWARF5 */
#define DW_MACRO_define                  0x01 /* DWARF5 */
#define DW_MACRO_undef                   0x02 /* DWARF5 */
#define DW_MACRO_start_file              0x03 /* DWARF5 */
#define DW_MACRO_end_file                0x04 /* DWARF5 */
#define DW_MACRO_define_strp             0x05 /* DWARF5 */
#define DW_MACRO_undef_strp              0x06 /* DWARF5 */
#define DW_MACRO_import                  0x07 /* DWARF5 */
#define DW_MACRO_define_sup              0x08 /* DWARF5 */
#define DW_MACRO_undef_sup               0x09 /* DWARF5 */
#define DW_MACRO_import_sup              0x0a /* DWARF5 */
#define DW_MACRO_define_strx             0x0b /* DWARF5 */
#define DW_MACRO_undef_strx              0x0c /* DWARF5 */
#define DW_MACRO_lo_user                 0xe0
#define DW_MACRO_hi_user                 0xff

/* Macro information, DWARF2-DWARF4. */
#define DW_MACINFO_define               0x01
#define DW_MACINFO_undef                0x02
#define DW_MACINFO_start_file           0x03
#define DW_MACINFO_end_file             0x04
#define DW_MACINFO_vendor_ext           0xff

/*  CFA operator compaction (a space saving measure, see
    the DWARF standard) means DW_CFA_extended and DW_CFA_nop
    have the same value here.  */
#define DW_CFA_advance_loc        0x40
#define DW_CFA_offset             0x80
```

```
#define DW_CFA_restore            0xc0
#define DW_CFA_nop              0x00
#define DW_CFA_extended            0
#define DW_CFA_set_loc          0x01
#define DW_CFA_advance_loc1     0x02
#define DW_CFA_advance_loc2     0x03
#define DW_CFA_advance_loc4     0x04
#define DW_CFA_offset_extended  0x05
#define DW_CFA_restore_extended 0x06
#define DW_CFA_undefined        0x07
#define DW_CFA_same_value       0x08
#define DW_CFA_register         0x09
#define DW_CFA_remember_state   0x0a
#define DW_CFA_restore_state    0x0b
#define DW_CFA_def_cfa          0x0c
#define DW_CFA_def_cfa_register 0x0d
#define DW_CFA_def_cfa_offset   0x0e
#define DW_CFA_def_cfa_expression 0x0f /* DWARF3 */
#define DW_CFA_expression         0x10 /* DWARF3 */
#define DW_CFA_offset_extended_sf 0x11 /* DWARF3 */
#define DW_CFA_def_cfa_sf         0x12 /* DWARF3 */
#define DW_CFA_def_cfa_offset_sf  0x13 /* DWARF3 */
#define DW_CFA_val_offset         0x14 /* DWARF3f */
#define DW_CFA_val_offset_sf      0x15 /* DWARF3f */
#define DW_CFA_val_expression     0x16 /* DWARF3f */
#define DW_CFA_TI_soffset_extended  0x1c /* TI */
#define DW_CFA_lo_user            0x1c
#define DW_CFA_low_user    0x1c  /* Incorrect spelling, do not use. */

/* SGI/MIPS extension. */
#define DW_CFA_MIPS_advance_loc8  0x1d   /* MIPS */
#define DW_CFA_TI_def_cfa_soffset 0x1d   /* TI */

/* GNU extensions. */
#define DW_CFA_GNU_window_save               0x2d /* GNU */
#define DW_CFA_AARCH64_negate_ra_state       0x2d
#define DW_CFA_GNU_args_size                 0x2e /* GNU */
#define DW_CFA_GNU_negative_offset_extended  0x2f /* GNU */
#define DW_CFA_LLVM_def_aspace_cfa           0x30
#define DW_CFA_LLVM_def_aspace_cfa_sf        0x31

/*  Metaware if HC is augmentation, apparently meaning High C
    and the op has a single uleb operand.
    See http://sourceforge.net/p/elftoolchain/tickets/397/  */
#define DW_CFA_METAWARE_info     0x34

#define DW_CFA_hi_user           0x3f
#define DW_CFA_high_user         0x3f /* Misspelled. Do not use. */

/* GNU exception header encoding.  See the Generic
   Elf Specification of the Linux Standard Base (LSB).
   http://refspecs.freestandards.org/LSB_3.0.0/\
   LSB-Core-generic/LSB-Core-generic/dwarfext.html
   The upper 4 bits indicate how the value is to be applied.
   The lower 4 bits indicate the format of the data.
   These identifiers are not defined by any DWARFn standard.
*/
#define DW_EH_PE_absptr   0x00  /* GNU */
#define DW_EH_PE_uleb128  0x01  /* GNU */
#define DW_EH_PE_udata2   0x02  /* GNU */
#define DW_EH_PE_udata4   0x03  /* GNU */
#define DW_EH_PE_udata8   0x04  /* GNU */
#define DW_EH_PE_sleb128  0x09  /* GNU */
#define DW_EH_PE_sdata2   0x0A  /* GNU */
#define DW_EH_PE_sdata4   0x0B  /* GNU */
#define DW_EH_PE_sdata8   0x0C  /* GNU */

#define DW_EH_PE_pcrel    0x10  /* GNU */
#define DW_EH_PE_textrel  0x20  /* GNU */
#define DW_EH_PE_datarel  0x30  /* GNU */
#define DW_EH_PE_funcrel  0x40  /* GNU */
#define DW_EH_PE_aligned  0x50  /* GNU */

#define DW_EH_PE_omit     0xff  /* GNU.  Means no value present. */

/* Mapping from machine registers and pseudo-regs into the
   .debug_frame table.  DW_FRAME entries are machine specific.
   These describe MIPS/SGI R3000, R4K, R4400 and all later
   MIPS/SGI IRIX machines.  They describe a mapping from
   hardware register number to the number used in the table
   to identify that register.

   The CFA (Canonical Frame Address) described in DWARF is
   called the Virtual Frame Pointer on MIPS/SGI machines.

   The DW_FRAME* names here are MIPS/SGI specific.
   Libdwarf interfaces defined in 2008 make the
   frame definitions here (and the fixed table sizes
   they imply) obsolete.  They are left here for compatibility.
*/
/* These identifiers are not defined by any DWARFn standard. */

#define DW_FRAME_REG1   1  /* integer reg 1 */
#define DW_FRAME_REG2   2  /* integer reg 2 */
#define DW_FRAME_REG3   3  /* integer reg 3 */
#define DW_FRAME_REG4   4  /* integer reg 4 */
#define DW_FRAME_REG5   5  /* integer reg 5 */
#define DW_FRAME_REG6   6  /* integer reg 6 */
#define DW_FRAME_REG7   7  /* integer reg 7 */
#define DW_FRAME_REG8   8  /* integer reg 8 */
#define DW_FRAME_REG9   9  /* integer reg 9 */
#define DW_FRAME_REG10  10 /* integer reg 10 */
#define DW_FRAME_REG11  11 /* integer reg 11 */
#define DW_FRAME_REG12  12 /* integer reg 12 */
#define DW_FRAME_REG13  13 /* integer reg 13 */
#define DW_FRAME_REG14  14 /* integer reg 14 */
#define DW_FRAME_REG15  15 /* integer reg 15 */
#define DW_FRAME_REG16  16 /* integer reg 16 */
#define DW_FRAME_REG17  17 /* integer reg 17 */
#define DW_FRAME_REG18  18 /* integer reg 18 */
#define DW_FRAME_REG19  19 /* integer reg 19 */
#define DW_FRAME_REG20  20 /* integer reg 20 */
#define DW_FRAME_REG21  21 /* integer reg 21 */
#define DW_FRAME_REG22  22 /* integer reg 22 */
#define DW_FRAME_REG23  23 /* integer reg 23 */
#define DW_FRAME_REG24  24 /* integer reg 24 */
#define DW_FRAME_REG25  25 /* integer reg 25 */
#define DW_FRAME_REG26  26 /* integer reg 26 */
#define DW_FRAME_REG27  27 /* integer reg 27 */
#define DW_FRAME_REG28  28 /* integer reg 28 */
#define DW_FRAME_REG29  29 /* integer reg 29 */
#define DW_FRAME_REG30  30 /* integer reg 30 */
#define DW_FRAME_REG31  31 /* integer reg 31, aka ra */

    /* MIPS1,2 have only some of these 64-bit registers.
    ** MIPS1  save/restore takes 2 instructions per 64-bit reg, and
    ** in that case, the register is considered stored after
    ** the second swc1.  */
#define DW_FRAME_FREG0  32 /* 64-bit floating point reg 0 */
#define DW_FRAME_FREG1  33 /* 64-bit floating point reg 1 */
#define DW_FRAME_FREG2  34 /* 64-bit floating point reg 2 */
#define DW_FRAME_FREG3  35 /* 64-bit floating point reg 3 */
#define DW_FRAME_FREG4  36 /* 64-bit floating point reg 4 */
#define DW_FRAME_FREG5  37 /* 64-bit floating point reg 5 */
#define DW_FRAME_FREG6  38 /* 64-bit floating point reg 6 */
#define DW_FRAME_FREG7  39 /* 64-bit floating point reg 7 */
#define DW_FRAME_FREG8  40 /* 64-bit floating point reg 8 */
#define DW_FRAME_FREG9  41 /* 64-bit floating point reg 9 */
#define DW_FRAME_FREG10 42 /* 64-bit floating point reg 10 */
#define DW_FRAME_FREG11 43 /* 64-bit floating point reg 11 */
#define DW_FRAME_FREG12 44 /* 64-bit floating point reg 12 */
#define DW_FRAME_FREG13 45 /* 64-bit floating point reg 13 */
#define DW_FRAME_FREG14 46 /* 64-bit floating point reg 14 */
#define DW_FRAME_FREG15 47 /* 64-bit floating point reg 15 */
#define DW_FRAME_FREG16 48 /* 64-bit floating point reg 16 */
#define DW_FRAME_FREG17 49 /* 64-bit floating point reg 17 */
#define DW_FRAME_FREG18 50 /* 64-bit floating point reg 18 */
#define DW_FRAME_FREG19 51 /* 64-bit floating point reg 19 */
#define DW_FRAME_FREG20 52 /* 64-bit floating point reg 20 */
#define DW_FRAME_FREG21 53 /* 64-bit floating point reg 21 */
#define DW_FRAME_FREG22 54 /* 64-bit floating point reg 22 */
#define DW_FRAME_FREG23 55 /* 64-bit floating point reg 23 */
#define DW_FRAME_FREG24 56 /* 64-bit floating point reg 24 */
#define DW_FRAME_FREG25 57 /* 64-bit floating point reg 25 */
#define DW_FRAME_FREG26 58 /* 64-bit floating point reg 26 */
#define DW_FRAME_FREG27 59 /* 64-bit floating point reg 27 */
#define DW_FRAME_FREG28 60 /* 64-bit floating point reg 28 */
#define DW_FRAME_FREG29 61 /* 64-bit floating point reg 29 */
#define DW_FRAME_FREG30 62 /* 64-bit floating point reg 30 */
#define DW_FRAME_FREG31 63 /* 64-bit floating point reg 31 */

#define DW_FRAME_FREG32 64 /* 64-bit floating point reg 32 */
#define DW_FRAME_FREG33 65 /* 64-bit floating point reg 33 */
#define DW_FRAME_FREG34 66 /* 64-bit floating point reg 34 */
#define DW_FRAME_FREG35 67 /* 64-bit floating point reg 35 */
#define DW_FRAME_FREG36 68 /* 64-bit floating point reg 36 */
#define DW_FRAME_FREG37 69 /* 64-bit floating point reg 37 */
#define DW_FRAME_FREG38 70 /* 64-bit floating point reg 38 */
#define DW_FRAME_FREG39 71 /* 64-bit floating point reg 39 */
#define DW_FRAME_FREG40 72 /* 64-bit floating point reg 40 */
#define DW_FRAME_FREG41 73 /* 64-bit floating point reg 41 */
#define DW_FRAME_FREG42 74 /* 64-bit floating point reg 42 */
#define DW_FRAME_FREG43 75 /* 64-bit floating point reg 43 */
#define DW_FRAME_FREG44 76 /* 64-bit floating point reg 44 */
```

```
#define DW_FRAME_FREG45 77 /* 64-bit floating point reg 45 */
#define DW_FRAME_FREG46 78 /* 64-bit floating point reg 46 */
#define DW_FRAME_FREG47 79 /* 64-bit floating point reg 47 */
#define DW_FRAME_FREG48 80 /* 64-bit floating point reg 48 */
#define DW_FRAME_FREG49 81 /* 64-bit floating point reg 49 */
#define DW_FRAME_FREG50 82 /* 64-bit floating point reg 50 */
#define DW_FRAME_FREG51 83 /* 64-bit floating point reg 51 */
#define DW_FRAME_FREG52 84 /* 64-bit floating point reg 52 */
#define DW_FRAME_FREG53 85 /* 64-bit floating point reg 53 */
#define DW_FRAME_FREG54 86 /* 64-bit floating point reg 54 */
#define DW_FRAME_FREG55 87 /* 64-bit floating point reg 55 */
#define DW_FRAME_FREG56 88 /* 64-bit floating point reg 56 */
#define DW_FRAME_FREG57 89 /* 64-bit floating point reg 57 */
#define DW_FRAME_FREG58 90 /* 64-bit floating point reg 58 */
#define DW_FRAME_FREG59 91 /* 64-bit floating point reg 59 */
#define DW_FRAME_FREG60 92 /* 64-bit floating point reg 60 */
#define DW_FRAME_FREG61 93 /* 64-bit floating point reg 61 */
#define DW_FRAME_FREG62 94 /* 64-bit floating point reg 62 */
#define DW_FRAME_FREG63 95 /* 64-bit floating point reg 63 */
#define DW_FRAME_FREG64 96 /* 64-bit floating point reg 64 */
#define DW_FRAME_FREG65 97 /* 64-bit floating point reg 65 */
#define DW_FRAME_FREG66 98 /* 64-bit floating point reg 66 */
#define DW_FRAME_FREG67 99 /* 64-bit floating point reg 67 */
#define DW_FRAME_FREG68 100 /* 64-bit floating point reg 68 */
#define DW_FRAME_FREG69 101 /* 64-bit floating point reg 69 */
#define DW_FRAME_FREG70 102 /* 64-bit floating point reg 70 */
#define DW_FRAME_FREG71 103 /* 64-bit floating point reg 71 */
#define DW_FRAME_FREG72 104 /* 64-bit floating point reg 72 */
#define DW_FRAME_FREG73 105 /* 64-bit floating point reg 73 */
#define DW_FRAME_FREG74 106 /* 64-bit floating point reg 74 */
#define DW_FRAME_FREG75 107 /* 64-bit floating point reg 75 */
#define DW_FRAME_FREG76 108 /* 64-bit floating point reg 76 */

/*  Having DW_FRAME_HIGHEST_NORMAL_REGISTER be higher than
    is strictly needed ... is safe.
    These values can be changed at runtime by libdwarf.
*/
#ifndef DW_FRAME_HIGHEST_NORMAL_REGISTER
#define DW_FRAME_HIGHEST_NORMAL_REGISTER 188
#endif
/*  This is the number of columns in the Frame Table.
*/
#ifndef DW_FRAME_LAST_REG_NUM
#define DW_FRAME_LAST_REG_NUM   (DW_FRAME_HIGHEST_NORMAL_REGISTER + 1)
#endif

#define DW_CHILDREN_no               0x00
#define DW_CHILDREN_yes              0x01

#define DW_ADDR_none            0
#define DW_ADDR_TI_PTR8         0x0008   /* TI */
#define DW_ADDR_TI_PTR16         0x0010   /* TI */
#define DW_ADDR_TI_PTR22         0x0016   /* TI */
#define DW_ADDR_TI_PTR23         0x0017   /* TI */
#define DW_ADDR_TI_PTR24         0x0018   /* TI */
#define DW_ADDR_TI_PTR32         0x0020   /* TI */

#ifdef __cplusplus
}
#endif
#endif /* __DWARF_H */
```

Chapter 14

libdwarf.h

libdwarf.h contains all the type declarations and function function declarations needed to use the library. It is essential that coders include dwarf.h before including libdwarf.h.

All identifiers here in the public namespace begin with DW_ or Dwarf_ or dwarf_ . All function argument names declared here begin with dw_ .

14.1 libdwarf.h

Go to the documentation of this file.

```
/*
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  Floor, Boston MA 02110-1301, USA.

*/
#ifndef _LIBDWARF_H
#define _LIBDWARF_H

#ifdef DW_API
#undef DW_API
#endif /* DW_API */

#ifndef LIBDWARF_STATIC
# if defined(_WIN32) || defined(__CYGWIN__)
#  ifdef LIBDWARF_BUILD
#   define DW_API __declspec(dllexport)
#  else /* !LIBDWARF_BUILD */
#   define DW_API __declspec(dllimport)
#  endif /* LIBDWARF_BUILD */
# elif (defined(__SUNPRO_C)  || defined(__SUNPRO_CC))
#  if defined(PIC) || defined(__PIC__)
#   define DW_API __global
#  endif /* __PIC__ */
# elif (defined(__GNUC__) && __GNUC__ >= 4) || \
    defined(__INTEL_COMPILER)
#  if defined(PIC) || defined(__PIC__)
#   define DW_API __attribute__ ((visibility("default")))
#  endif /* PIC */
# endif /* WIN32 SUNPRO GNUC  */
#endif /* !LIBDWARF_STATIC */

#ifndef DW_API
#define DW_API
#endif /* DW_API */

#ifdef __cplusplus
extern "C" {
#endif /* __cplusplus */

/*
    libdwarf.h
    Revision: #9  Date: 2008/01/17

    For libdwarf consumers (reading DWARF2 and later)

    The interface is defined as having 8-byte signed and unsigned
    values so it can handle 64-or-32bit target on 64-or-32bit host.
    Dwarf_Ptr is the native size: it represents pointers on
    the host machine (not the target!).

    This contains declarations for types and all producer
    and consumer functions.

    Function declarations are written on a single line each here
    so one can use grep  to each declaration in its entirety.
    The declarations are a little harder to read this way, but...
*/
/* Semantic Version identity for this libdwarf.h */
#define DW_LIBDWARF_VERSION "2.2.0"
#define DW_LIBDWARF_VERSION_MAJOR 2
#define DW_LIBDWARF_VERSION_MINOR 2
#define DW_LIBDWARF_VERSION_MICRO 0

#define DW_PATHSOURCE_unspecified 0
#define DW_PATHSOURCE_basic     1
#define DW_PATHSOURCE_dsym      2 /* Macos dSYM */
#define DW_PATHSOURCE_debuglink 3 /* GNU debuglink */

#ifndef DW_FTYPE_UNKNOWN
#define DW_FTYPE_UNKNOWN    0
#define DW_FTYPE_ELF        1  /* Unix/Linux/etc */
#define DW_FTYPE_MACH_O     2  /* Macos. */
#define DW_FTYPE_PE         3  /* Windows */
#define DW_FTYPE_ARCHIVE    4  /* unix archive */
#define DW_FTYPE_APPLEUNIVERSAL    5
#endif /* DW_FTYPE_UNKNOWN */
/* standard return values for functions */
#define DW_DLV_NO_ENTRY -1
#define DW_DLV_OK        0
#define DW_DLV_ERROR     1
/*  These support opening DWARF5 split dwarf objects and
    Elf SHT_GROUP blocks of DWARF sections. */
#define DW_GROUPNUMBER_ANY  0
#define DW_GROUPNUMBER_BASE 1
#define DW_GROUPNUMBER_DWO  2

/*  FRAME special values */
/*  The following 3 are assigned numbers, but
    are only present at run time.
    Must not conflict with DW_FRAME values in dwarf.h */
/*  Taken as meaning 'undefined value', this is not
    a column or register number.  */
#ifndef DW_FRAME_UNDEFINED_VAL
#define DW_FRAME_UNDEFINED_VAL          12288
#endif
/*  Taken as meaning 'same value' as caller had,
    not a column or register number */
#ifndef DW_FRAME_SAME_VAL
#define DW_FRAME_SAME_VAL               12289
#endif
/*  DW_FRAME_CFA_COL is assigned a virtual table position
    but is accessed via CFA specific calls.  */
#ifndef DW_FRAME_CFA_COL
#define DW_FRAME_CFA_COL                12290
#endif
```

```c
#define DW_FRAME_CFA_COL3 DW_FRAME_CFA_COL /*compatibility name*/
/*  END FRAME special values */

/* dwarf_pcline function, slide arguments
*/
#define DW_DLS_BACKWARD   -1  /* slide backward to find line */
#define DW_DLS_NOSLIDE     0  /* match exactly without sliding */
#define DW_DLS_FORWARD     1  /* slide forward to find line */

/*  Defined larger than necessary.
    struct Dwarf_Debug_Fission_Per_CU_s,
    being visible, will be difficult to change:
    binary compatibility. The count is for arrays
    inside the struct, the struct itself is
    a single struct.  */
#define DW_FISSION_SECT_COUNT 12

typedef unsigned long long Dwarf_Unsigned;
typedef signed   long long Dwarf_Signed;
typedef unsigned long long Dwarf_Off;
typedef unsigned long long Dwarf_Addr;
    /*  Dwarf_Bool as int is wasteful, but for compatibility
        it must stay as int, not unsigned char. */
typedef int                Dwarf_Bool;   /* boolean type */
typedef unsigned short     Dwarf_Half;   /* 2 byte unsigned value */
typedef unsigned char      Dwarf_Small;  /* 1 byte unsigned value */
/*  If sizeof(Dwarf_Half) is greater than 2
    we believe libdwarf still works properly. */

typedef void*        Dwarf_Ptr;          /* host machine pointer */
enum Dwarf_Ranges_Entry_Type { DW_RANGES_ENTRY,
    DW_RANGES_ADDRESS_SELECTION,
    DW_RANGES_END
};

enum Dwarf_Form_Class {
    DW_FORM_CLASS_UNKNOWN = 0,
    DW_FORM_CLASS_ADDRESS = 1,
    DW_FORM_CLASS_BLOCK   = 2,
    DW_FORM_CLASS_CONSTANT =3,
    DW_FORM_CLASS_EXPRLOC = 4,
    DW_FORM_CLASS_FLAG    = 5,
    DW_FORM_CLASS_LINEPTR = 6,
    DW_FORM_CLASS_LOCLISTPTR=7,     /* DWARF2,3,4 only */
    DW_FORM_CLASS_MACPTR  = 8,      /* DWARF2,3,4 only */
    DW_FORM_CLASS_RANGELISTPTR=9,   /* DWARF2,3,4 only */
    DW_FORM_CLASS_REFERENCE=10,
    DW_FORM_CLASS_STRING  = 11,
    DW_FORM_CLASS_FRAMEPTR= 12,   /* MIPS/IRIX DWARF2 only */
    DW_FORM_CLASS_MACROPTR= 13,     /* DWARF5 */
    DW_FORM_CLASS_ADDRPTR = 14,     /* DWARF5 */
    DW_FORM_CLASS_LOCLIST = 15,     /* DWARF5 */
    DW_FORM_CLASS_LOCLISTSPTR=16,   /* DWARF5 */
    DW_FORM_CLASS_RNGLIST    =17,   /* DWARF5 */
    DW_FORM_CLASS_RNGLISTSPTR=18,   /* DWARF5 */
    DW_FORM_CLASS_STROFFSETSPTR=19 /* DWARF5 */
};
typedef struct Dwarf_Form_Data16_s {
    unsigned char fd_data[16];
} Dwarf_Form_Data16;

typedef struct Dwarf_Sig8_s  {
    char signature[8];
} Dwarf_Sig8;

typedef struct Dwarf_Block_s {
    Dwarf_Unsigned  bl_len;
    Dwarf_Ptr       bl_data;
    Dwarf_Small     bl_from_loclist;
    Dwarf_Unsigned  bl_section_offset;
} Dwarf_Block;

typedef struct Dwarf_Locdesc_c_s * Dwarf_Locdesc_c;
typedef struct Dwarf_Loc_Head_c_s * Dwarf_Loc_Head_c;

typedef struct Dwarf_Gnu_Index_Head_s * Dwarf_Gnu_Index_Head;

typedef struct Dwarf_Dsc_Head_s * Dwarf_Dsc_Head;

typedef struct Dwarf_Frame_Instr_Head_s * Dwarf_Frame_Instr_Head;

typedef void (* dwarf_printf_callback_function_type)
    (void * dw_user_pointer, const char * dw_linecontent);

struct Dwarf_Printf_Callback_Info_s {
    void *                        dp_user_pointer;
    dwarf_printf_callback_function_type dp_fptr;
    char *                          dp_buffer;
    unsigned int                    dp_buffer_len;
    int                             dp_buffer_user_provided;
    void *                          dp_reserved;
};

struct Dwarf_Cmdline_Options_s {
    Dwarf_Bool check_verbose_mode;
};
typedef struct Dwarf_Cmdline_Options_s Dwarf_Cmdline_Options;

typedef struct Dwarf_Str_Offsets_Table_s *  Dwarf_Str_Offsets_Table;

typedef struct Dwarf_Ranges_s {
    Dwarf_Addr dwr_addr1;
    Dwarf_Addr dwr_addr2;
    enum Dwarf_Ranges_Entry_Type  dwr_type;
} Dwarf_Ranges;

typedef struct Dwarf_Regtable_Entry3_s {
    Dwarf_Small         dw_offset_relevant;
    Dwarf_Small         dw_value_type;
    Dwarf_Half          dw_regnum;
    Dwarf_Unsigned      dw_offset; /* Should be Dwarf_Signed */
    Dwarf_Unsigned      dw_args_size; /* Always zero. */
    Dwarf_Block         dw_block;
} Dwarf_Regtable_Entry3;

typedef struct Dwarf_Regtable3_s {
    struct Dwarf_Regtable_Entry3_s   rt3_cfa_rule;
    Dwarf_Half                       rt3_reg_table_size;
    struct Dwarf_Regtable_Entry3_s * rt3_rules;
} Dwarf_Regtable3;

/* Opaque types for Consumer Library. */
typedef struct Dwarf_Error_s*      Dwarf_Error;

typedef struct Dwarf_Debug_s*      Dwarf_Debug;
typedef struct Dwarf_Section_s*    Dwarf_Section;

typedef struct Dwarf_Die_s*        Dwarf_Die;

typedef struct Dwarf_Debug_Addr_Table_s* Dwarf_Debug_Addr_Table;

typedef struct Dwarf_Line_s*       Dwarf_Line;

typedef struct Dwarf_Global_s*     Dwarf_Global;

typedef struct Dwarf_Type_s*       Dwarf_Type;

typedef struct Dwarf_Func_s*       Dwarf_Func;
typedef struct Dwarf_Var_s*        Dwarf_Var;
typedef struct Dwarf_Weak_s*       Dwarf_Weak;

typedef struct Dwarf_Attribute_s*  Dwarf_Attribute;

typedef struct Dwarf_Abbrev_s*     Dwarf_Abbrev;

typedef struct Dwarf_Fde_s*        Dwarf_Fde;
typedef struct Dwarf_Cie_s*        Dwarf_Cie;

typedef struct Dwarf_Arange_s*     Dwarf_Arange;
typedef struct Dwarf_Gdbindex_s*   Dwarf_Gdbindex;
typedef struct Dwarf_Xu_Index_Header_s  *Dwarf_Xu_Index_Header;
typedef struct Dwarf_Line_Context_s     *Dwarf_Line_Context;

typedef struct Dwarf_Macro_Context_s    *Dwarf_Macro_Context;

typedef struct Dwarf_Dnames_Head_s      *Dwarf_Dnames_Head;

typedef void  (*Dwarf_Handler)(Dwarf_Error dw_error,
    Dwarf_Ptr dw_errarg);

struct Dwarf_Macro_Details_s {
    Dwarf_Off    dmd_offset; /* offset, in the section,
        of this macro info */
    Dwarf_Small  dmd_type;   /* the type, DW_MACINFO_define etc*/
    Dwarf_Signed dmd_lineno; /* the source line number where
        applicable and vend_def number if
        vendor_extension op */
    Dwarf_Signed dmd_fileindex;/* the source file index */
    char *       dmd_macro;  /* macro name string */
};
typedef struct Dwarf_Macro_Details_s Dwarf_Macro_Details;

typedef struct Dwarf_Debug_Fission_Per_CU_s
    Dwarf_Debug_Fission_Per_CU;
```

```

/* ===== BEGIN Obj_Access data ===== */
typedef struct Dwarf_Obj_Access_Interface_a_s
    Dwarf_Obj_Access_Interface_a;

typedef struct Dwarf_Obj_Access_Methods_a_s
    Dwarf_Obj_Access_Methods_a;

typedef struct Dwarf_Obj_Access_Section_a_s
    Dwarf_Obj_Access_Section_a;
struct Dwarf_Obj_Access_Section_a_s {
    const char*     as_name;
    Dwarf_Unsigned as_type;
    Dwarf_Unsigned as_flags;
    Dwarf_Addr     as_addr;
    Dwarf_Unsigned as_offset;
    Dwarf_Unsigned as_size;
    Dwarf_Unsigned as_link;
    Dwarf_Unsigned as_info;
    Dwarf_Unsigned as_addralign;
    Dwarf_Unsigned as_entrysize;
};

enum Dwarf_Sec_Alloc_Pref {
    /* No dynamic allocation */
    Dwarf_Alloc_None=0,
    /* alternative allocations */
    Dwarf_Alloc_Malloc=1,
    Dwarf_Alloc_Mmap=2};

struct Dwarf_Obj_Access_Methods_a_s {
    int     (*om_get_section_info)(void* obj,
        Dwarf_Unsigned              section_index,
        Dwarf_Obj_Access_Section_a* return_section,
        int                        * error);
    Dwarf_Small      (*om_get_byte_order)(void* obj);
    Dwarf_Small      (*om_get_length_size)(void* obj);
    Dwarf_Small      (*om_get_pointer_size)(void* obj);
    Dwarf_Unsigned   (*om_get_filesize)(void* obj);
    Dwarf_Unsigned   (*om_get_section_count)(void* obj);
    /*   Always uses malloc/read */
    int              (*om_load_section)(void* obj,
        Dwarf_Unsigned dw_section_index,
        Dwarf_Small  **dw_return_data,
        int           *dw_error);
    int              (*om_relocate_a_section)(void* obj,
        Dwarf_Unsigned  section_index,
        Dwarf_Debug dbg,
        int        * error);
    /*  Added in 0.12.0 to allow mmap in section loading.
        If you are just using malloc for section loading
        and referring to this struct in your code
        you should leave this function pointer NULL (zero). */
    int              (*om_load_section_a)(void* obj,
        Dwarf_Unsigned             dw_section_index,
        /*  dw_alloc_pref is input preference and also
            output with the actual alloced type */
        enum Dwarf_Sec_Alloc_Pref *dw_alloc_pref,
        Dwarf_Small              **dw_return_data_ptr,
        Dwarf_Unsigned            *dw_return_data_len,
        Dwarf_Small              **dw_return_mmap_base_ptr,
        Dwarf_Unsigned            *dw_return_mmap_offset,
        Dwarf_Unsigned            *dw_return_mmap_len,
        int                       *dw_error);
    void             (*om_finish)(void * obj);
};
struct Dwarf_Obj_Access_Interface_a_s {
    void*                             ai_object;
    const Dwarf_Obj_Access_Methods_a *ai_methods;
};
/* ===== END Obj_Access data ===== */

/*  User code must allocate this struct, zero it,
    and pass a pointer to it
    into dwarf_get_debugfission_for_cu .  */
struct Dwarf_Debug_Fission_Per_CU_s  {
    /*  Do not free the string. It contains "cu" or "tu". */
    /*  If this is not set (ie, not a CU/TU in  DWP Package File)
        then pcu_type will be NULL.  */
    const char   * pcu_type;
    /*  pcu_index is the index (range 1 to N )
        into the tu/cu table of offsets and the table
        of sizes.  1 to N as the zero index is reserved
        for special purposes.  Not a value one
        actually needs. */
    Dwarf_Unsigned pcu_index;
    Dwarf_Sig8     pcu_hash;  /* 8 byte  */
    /*  [0] has offset and size 0.
        [1]-[8] are DW_SECT_* indexes and the
        values are  the offset and size
        of the respective section contribution
        of a single .dwo object. When pcu_size[n] is
        zero the corresponding section is not present. */
    Dwarf_Unsigned pcu_offset[DW_FISSION_SECT_COUNT];
    Dwarf_Unsigned pcu_size[DW_FISSION_SECT_COUNT];
    Dwarf_Unsigned unused1;
    Dwarf_Unsigned unused2;
};

typedef struct Dwarf_Rnglists_Head_s * Dwarf_Rnglists_Head;

/*  Special values for offset_into_exception_table field
    of dwarf fde's
    The following value indicates that there is no
    Exception table offset
    associated with a dwarf frame.
*/
#define DW_DLX_NO_EH_OFFSET         (-1LL)
/*  The following value indicates that the producer
    was unable to analyze the
    source file to generate Exception tables for this function.
*/
#define DW_DLX_EH_OFFSET_UNAVAILABLE  (-2LL)

/* The augmenter string for CIE */
#define DW_CIE_AUGMENTER_STRING_V0  "z"

/*  ***IMPORTANT NOTE, TARGET DEPENDENCY ****
    DW_REG_TABLE_SIZE must be at least as large as
    the number of registers
    DW_FRAME_LAST_REG_NUM as defined in dwarf.h
*/
#ifndef DW_REG_TABLE_SIZE
#define DW_REG_TABLE_SIZE  DW_FRAME_LAST_REG_NUM
#endif

/* For MIPS, DW_FRAME_SAME_VAL is the correct default value
   for a frame register value. For other CPUS another value
   may be better, such as DW_FRAME_UNDEFINED_VAL.
   See dwarf_set_frame_rule_table_size
*/
#ifndef DW_FRAME_REG_INITIAL_VALUE
#define DW_FRAME_REG_INITIAL_VALUE DW_FRAME_SAME_VAL
#endif

/* The following are all needed to evaluate DWARF3 register rules.
   These have nothing to do simply printing
   frame instructions.
*/
#define DW_EXPR_OFFSET         0 /* offset is from CFA reg */
#define DW_EXPR_VAL_OFFSET     1
#define DW_EXPR_EXPRESSION     2
#define DW_EXPR_VAL_EXPRESSION 3
#define DW_DLA_STRING          0x01  /* char* */
#define DW_DLA_LOC             0x02  /* Dwarf_Loc */
#define DW_DLA_LOCDESC         0x03  /* Dwarf_Locdesc */
#define DW_DLA_ELLIST          0x04  /* Dwarf_Ellist (not used)*/
#define DW_DLA_BOUNDS          0x05  /* Dwarf_Bounds (not used) */
#define DW_DLA_BLOCK           0x06  /* Dwarf_Block */
#define DW_DLA_DEBUG           0x07  /* Dwarf_Debug */
#define DW_DLA_DIE             0x08  /* Dwarf_Die */
#define DW_DLA_LINE            0x09  /* Dwarf_Line */
#define DW_DLA_ATTR            0x0a  /* Dwarf_Attribute */
#define DW_DLA_TYPE            0x0b  /* Dwarf_Type  (not used) */
#define DW_DLA_SUBSCR          0x0c  /* Dwarf_Subscr (not used) */
#define DW_DLA_GLOBAL          0x0d  /* Dwarf_Global */
#define DW_DLA_ERROR           0x0e  /* Dwarf_Error */
#define DW_DLA_LIST            0x0f  /* a list */
#define DW_DLA_LINEBUF         0x10  /* Dwarf_Line* (not used) */
#define DW_DLA_ARANGE          0x11  /* Dwarf_Arange */
#define DW_DLA_ABBREV          0x12  /* Dwarf_Abbrev */
#define DW_DLA_FRAME_INSTR_HEAD   0x13  /* Dwarf_Frame_Instr_Head */
#define DW_DLA_CIE             0x14  /* Dwarf_Cie */
#define DW_DLA_FDE             0x15  /* Dwarf_Fde */
#define DW_DLA_LOC_BLOCK       0x16  /* Dwarf_Loc */

#define DW_DLA_FRAME_OP        0x17  /* Dwarf_Frame_Op (not used) */
#define DW_DLA_FUNC            0x18  /* Dwarf_Func */
#define DW_DLA_UARRAY          0x19  /* Array of Dwarf_Off:Jan2023 */
#define DW_DLA_VAR             0x1a  /* Dwarf_Var */
#define DW_DLA_WEAK            0x1b  /* Dwarf_Weak */
#define DW_DLA_ADDR            0x1c  /* Dwarf_Addr sized entries */
#define DW_DLA_RANGES          0x1d  /* Dwarf_Ranges */
/* 0x1e (30) to 0x34 (52) reserved for internal to libdwarf types. */
/* .debug_gnu_typenames/pubnames, 2020 */
#define DW_DLA_GNU_INDEX_HEAD  0x35

#define DW_DLA_RNGLISTS_HEAD   0x36  /* .debug_rnglists DW5 */
#define DW_DLA_GDBINDEX        0x37  /* Dwarf_Gdbindex */
#define DW_DLA_XU_INDEX        0x38  /* Dwarf_Xu_Index_Header */
#define DW_DLA_LOC_BLOCK_C     0x39  /* Dwarf_Loc_c*/
#define DW_DLA_LOCDESC_C       0x3a  /* Dwarf_Locdesc_c */
#define DW_DLA_LOC_HEAD_C      0x3b  /* Dwarf_Loc_Head_c */
#define DW_DLA_MACRO_CONTEXT   0x3c  /* Dwarf_Macro_Context */
/*  0x3d (61) is for libdwarf internal use.               */
#define DW_DLA_DSC_HEAD        0x3e  /* Dwarf_Dsc_Head */
#define DW_DLA_DNAMES_HEAD     0x3f  /* Dwarf_Dnames_Head */

/* struct Dwarf_Str_Offsets_Table_s */
#define DW_DLA_STR_OFFSETS     0x40
/* struct Dwarf_Debug_Addr_Table_s */
#define DW_DLA_DEBUG_ADDR      0x41
/* libdwarf error numbers */
#define DW_DLE_NE      0  /* no error */
#define DW_DLE_VMM     1  /* dwarf format/library version mismatch */
#define DW_DLE_MAP     2  /* memory map failure */
#define DW_DLE_LEE     3  /* libelf error */
#define DW_DLE_NDS     4  /* no debug section */
#define DW_DLE_NLS     5  /* no line section */
#define DW_DLE_ID      6  /* invalid descriptor for query */
#define DW_DLE_IOF     7  /* I/O failure */
#define DW_DLE_MAF     8  /* memory allocation failure */
#define DW_DLE_IA      9  /* invalid argument */
#define DW_DLE_MDE     10 /* mangled debugging entry */
#define DW_DLE_MLE     11 /* mangled line number entry */
#define DW_DLE_FNO     12 /* file not open */
#define DW_DLE_FNR     13 /* file not a regular file */
#define DW_DLE_FWA     14 /* file open with wrong access */
#define DW_DLE_NOB     15 /* not an object file */
#define DW_DLE_MOF     16 /* mangled object file header */
#define DW_DLE_EOLL    17 /* end of location list entries */
#define DW_DLE_NOLL    18 /* no location list section */
#define DW_DLE_BADOFF  19 /* Invalid offset */
#define DW_DLE_EOS     20 /* end of section  */
#define DW_DLE_ATRUNC  21 /* abbreviations section appears truncated*/
#define DW_DLE_BADBITC 22 /* Address size passed to dwarf bad,*/
    /* It is not an allowed size (64 or 32) */
    /* Error codes defined by the current Libdwarf Implementation. */
#define DW_DLE_DBG_ALLOC                        23
#define DW_DLE_FSTAT_ERROR                      24
#define DW_DLE_FSTAT_MODE_ERROR                 25
#define DW_DLE_INIT_ACCESS_WRONG                26
#define DW_DLE_ELF_BEGIN_ERROR                  27
#define DW_DLE_ELF_GETEHDR_ERROR                28
#define DW_DLE_ELF_GETSHDR_ERROR                29
#define DW_DLE_ELF_STRPTR_ERROR                 30
#define DW_DLE_DEBUG_INFO_DUPLICATE             31
#define DW_DLE_DEBUG_INFO_NULL                  32
#define DW_DLE_DEBUG_ABBREV_DUPLICATE           33
#define DW_DLE_DEBUG_ABBREV_NULL                34
#define DW_DLE_DEBUG_ARANGES_DUPLICATE          35
#define DW_DLE_DEBUG_ARANGES_NULL               36
#define DW_DLE_DEBUG_LINE_DUPLICATE             37
#define DW_DLE_DEBUG_LINE_NULL                  38
#define DW_DLE_DEBUG_LOC_DUPLICATE              39
#define DW_DLE_DEBUG_LOC_NULL                   40
#define DW_DLE_DEBUG_MACINFO_DUPLICATE          41
#define DW_DLE_DEBUG_MACINFO_NULL               42
#define DW_DLE_DEBUG_PUBNAMES_DUPLICATE         43
#define DW_DLE_DEBUG_PUBNAMES_NULL              44
#define DW_DLE_DEBUG_STR_DUPLICATE              45
#define DW_DLE_DEBUG_STR_NULL                   46
#define DW_DLE_CU_LENGTH_ERROR                  47
#define DW_DLE_VERSION_STAMP_ERROR              48
#define DW_DLE_ABBREV_OFFSET_ERROR              49
#define DW_DLE_ADDRESS_SIZE_ERROR               50
#define DW_DLE_DEBUG_INFO_PTR_NULL              51
#define DW_DLE_DIE_NULL                         52
#define DW_DLE_STRING_OFFSET_BAD                53
#define DW_DLE_DEBUG_LINE_LENGTH_BAD            54
#define DW_DLE_LINE_PROLOG_LENGTH_BAD           55
#define DW_DLE_LINE_NUM_OPERANDS_BAD            56
#define DW_DLE_LINE_SET_ADDR_ERROR              57
#define DW_DLE_LINE_EXT_OPCODE_BAD              58
#define DW_DLE_DWARF_LINE_NULL                  59
#define DW_DLE_INCL_DIR_NUM_BAD                 60
#define DW_DLE_LINE_FILE_NUM_BAD                61
#define DW_DLE_ALLOC_FAIL                       62
#define DW_DLE_NO_CALLBACK_FUNC                 63
#define DW_DLE_SECT_ALLOC                       64
#define DW_DLE_FILE_ENTRY_ALLOC                 65
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#define DW_DLE_LINE_ALLOC                   66
#define DW_DLE_FPGM_ALLOC                   67
#define DW_DLE_INCDIR_ALLOC                 68
#define DW_DLE_STRING_ALLOC                 69
#define DW_DLE_CHUNK_ALLOC                  70
#define DW_DLE_BYTEOFF_ERR                  71
#define DW_DLE_CIE_ALLOC                    72
#define DW_DLE_FDE_ALLOC                    73
#define DW_DLE_REGNO_OVFL                   74
#define DW_DLE_CIE_OFFS_ALLOC               75
#define DW_DLE_WRONG_ADDRESS                76
#define DW_DLE_EXTRA_NEIGHBORS              77
#define DW_DLE_WRONG_TAG                    78
#define DW_DLE_DIE_ALLOC                    79
#define DW_DLE_PARENT_EXISTS                80
#define DW_DLE_DBG_NULL                     81
#define DW_DLE_DEBUGLINE_ERROR              82
#define DW_DLE_DEBUGFRAME_ERROR             83
#define DW_DLE_DEBUGINFO_ERROR              84
#define DW_DLE_ATTR_ALLOC                   85
#define DW_DLE_ABBREV_ALLOC                 86
#define DW_DLE_OFFSET_UFLW                  87
#define DW_DLE_ELF_SECT_ERR                 88
#define DW_DLE_DEBUG_FRAME_LENGTH_BAD       89
#define DW_DLE_FRAME_VERSION_BAD            90
#define DW_DLE_CIE_RET_ADDR_REG_ERROR       91
#define DW_DLE_FDE_NULL                     92
#define DW_DLE_FDE_DBG_NULL                 93
#define DW_DLE_CIE_NULL                     94
#define DW_DLE_CIE_DBG_NULL                 95
#define DW_DLE_FRAME_TABLE_COL_BAD          96
#define DW_DLE_PC_NOT_IN_FDE_RANGE          97
#define DW_DLE_CIE_INSTR_EXEC_ERROR         98
#define DW_DLE_FRAME_INSTR_EXEC_ERROR       99
#define DW_DLE_FDE_PTR_NULL                100
#define DW_DLE_RET_OP_LIST_NULL            101
#define DW_DLE_LINE_CONTEXT_NULL           102
#define DW_DLE_DBG_NO_CU_CONTEXT           103
#define DW_DLE_DIE_NO_CU_CONTEXT           104
#define DW_DLE_FIRST_DIE_NOT_CU            105
#define DW_DLE_NEXT_DIE_PTR_NULL           106
#define DW_DLE_DEBUG_FRAME_DUPLICATE       107
#define DW_DLE_DEBUG_FRAME_NULL            108
#define DW_DLE_ABBREV_DECODE_ERROR         109
#define DW_DLE_DWARF_ABBREV_NULL           110
#define DW_DLE_ATTR_NULL                   111
#define DW_DLE_DIE_BAD                     112
#define DW_DLE_DIE_ABBREV_BAD              113
#define DW_DLE_ATTR_FORM_BAD               114
#define DW_DLE_ATTR_NO_CU_CONTEXT          115
#define DW_DLE_ATTR_FORM_SIZE_BAD          116
#define DW_DLE_ATTR_DBG_NULL               117
#define DW_DLE_BAD_REF_FORM                118
#define DW_DLE_ATTR_FORM_OFFSET_BAD        119
#define DW_DLE_LINE_OFFSET_BAD             120
#define DW_DLE_DEBUG_STR_OFFSET_BAD        121
#define DW_DLE_STRING_PTR_NULL             122
#define DW_DLE_PUBNAMES_VERSION_ERROR      123
#define DW_DLE_PUBNAMES_LENGTH_BAD         124
#define DW_DLE_GLOBAL_NULL                 125
#define DW_DLE_GLOBAL_CONTEXT_NULL         126
#define DW_DLE_DIR_INDEX_BAD               127
#define DW_DLE_LOC_EXPR_BAD                128
#define DW_DLE_DIE_LOC_EXPR_BAD            129
#define DW_DLE_ADDR_ALLOC                  130
#define DW_DLE_OFFSET_BAD                  131
#define DW_DLE_MAKE_CU_CONTEXT_FAIL        132
#define DW_DLE_REL_ALLOC                   133
#define DW_DLE_ARANGE_OFFSET_BAD           134
#define DW_DLE_SEGMENT_SIZE_BAD            135
#define DW_DLE_ARANGE_LENGTH_BAD           136
#define DW_DLE_ARANGE_DECODE_ERROR         137
#define DW_DLE_ARANGES_NULL                138
#define DW_DLE_ARANGE_NULL                 139
#define DW_DLE_NO_FILE_NAME                140
#define DW_DLE_NO_COMP_DIR                 141
#define DW_DLE_CU_ADDRESS_SIZE_BAD         142
#define DW_DLE_INPUT_ATTR_BAD              143
#define DW_DLE_EXPR_NULL                   144
#define DW_DLE_BAD_EXPR_OPCODE             145
#define DW_DLE_EXPR_LENGTH_BAD             146
#define DW_DLE_MULTIPLE_RELOC_IN_EXPR      147
#define DW_DLE_ELF_GETIDENT_ERROR          148
#define DW_DLE_NO_AT_MIPS_FDE              149
#define DW_DLE_NO_CIE_FOR_FDE              150
#define DW_DLE_DIE_ABBREV_LIST_NULL        151
#define DW_DLE_DEBUG_FUNCNAMES_DUPLICATE   152
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#define DW_DLE_DEBUG_FUNCNAMES_NULL            153
#define DW_DLE_DEBUG_FUNCNAMES_VERSION_ERROR   154
#define DW_DLE_DEBUG_FUNCNAMES_LENGTH_BAD      155
#define DW_DLE_FUNC_NULL                       156
#define DW_DLE_FUNC_CONTEXT_NULL               157
#define DW_DLE_DEBUG_TYPENAMES_DUPLICATE       158
#define DW_DLE_DEBUG_TYPENAMES_NULL            159
#define DW_DLE_DEBUG_TYPENAMES_VERSION_ERROR   160
#define DW_DLE_DEBUG_TYPENAMES_LENGTH_BAD      161
#define DW_DLE_TYPE_NULL                       162
#define DW_DLE_TYPE_CONTEXT_NULL               163
#define DW_DLE_DEBUG_VARNAMES_DUPLICATE        164
#define DW_DLE_DEBUG_VARNAMES_NULL             165
#define DW_DLE_DEBUG_VARNAMES_VERSION_ERROR    166
#define DW_DLE_DEBUG_VARNAMES_LENGTH_BAD       167
#define DW_DLE_VAR_NULL                        168
#define DW_DLE_VAR_CONTEXT_NULL                169
#define DW_DLE_DEBUG_WEAKNAMES_DUPLICATE       170
#define DW_DLE_DEBUG_WEAKNAMES_NULL            171
#define DW_DLE_DEBUG_WEAKNAMES_VERSION_ERROR   172
#define DW_DLE_DEBUG_WEAKNAMES_LENGTH_BAD      173
#define DW_DLE_WEAK_NULL                       174
#define DW_DLE_WEAK_CONTEXT_NULL               175
#define DW_DLE_LOCDESC_COUNT_WRONG             176
#define DW_DLE_MACINFO_STRING_NULL             177
#define DW_DLE_MACINFO_STRING_EMPTY            178
#define DW_DLE_MACINFO_INTERNAL_ERROR_SPACE    179
#define DW_DLE_MACINFO_MALLOC_FAIL             180
#define DW_DLE_DEBUGMACINFO_ERROR              181
#define DW_DLE_DEBUG_MACRO_LENGTH_BAD          182
#define DW_DLE_DEBUG_MACRO_MAX_BAD             183
#define DW_DLE_DEBUG_MACRO_INTERNAL_ERR        184
#define DW_DLE_DEBUG_MACRO_MALLOC_SPACE        185
#define DW_DLE_DEBUG_MACRO_INCONSISTENT        186
#define DW_DLE_DF_NO_CIE_AUGMENTATION          187
#define DW_DLE_DF_REG_NUM_TOO_HIGH             188
#define DW_DLE_DF_MAKE_INSTR_NO_INIT           189
#define DW_DLE_DF_NEW_LOC_LESS_OLD_LOC         190
#define DW_DLE_DF_POP_EMPTY_STACK              191
#define DW_DLE_DF_ALLOC_FAIL                   192
#define DW_DLE_DF_FRAME_DECODING_ERROR         193
#define DW_DLE_DEBUG_LOC_SECTION_SHORT         194
#define DW_DLE_FRAME_AUGMENTATION_UNKNOWN      195
#define DW_DLE_PUBTYPE_CONTEXT                 196 /* Unused. */
#define DW_DLE_DEBUG_PUBTYPES_LENGTH_BAD       197
#define DW_DLE_DEBUG_PUBTYPES_VERSION_ERROR    198
#define DW_DLE_DEBUG_PUBTYPES_DUPLICATE        199
#define DW_DLE_FRAME_CIE_DECODE_ERROR          200
#define DW_DLE_FRAME_REGISTER_UNREPRESENTABLE  201
#define DW_DLE_FRAME_REGISTER_COUNT_MISMATCH   202
#define DW_DLE_LINK_LOOP                       203
#define DW_DLE_STRP_OFFSET_BAD                 204
#define DW_DLE_DEBUG_RANGES_DUPLICATE          205
#define DW_DLE_DEBUG_RANGES_OFFSET_BAD         206
#define DW_DLE_DEBUG_RANGES_MISSING_END        207
#define DW_DLE_DEBUG_RANGES_OUT_OF_MEM         208
#define DW_DLE_DEBUG_SYMTAB_ERR                209
#define DW_DLE_DEBUG_STRTAB_ERR                210
#define DW_DLE_RELOC_MISMATCH_INDEX            211
#define DW_DLE_RELOC_MISMATCH_RELOC_INDEX      212
#define DW_DLE_RELOC_MISMATCH_STRTAB_INDEX     213
#define DW_DLE_RELOC_SECTION_MISMATCH          214
#define DW_DLE_RELOC_SECTION_MISSING_INDEX     215
#define DW_DLE_RELOC_SECTION_LENGTH_ODD        216
#define DW_DLE_RELOC_SECTION_PTR_NULL          217
#define DW_DLE_RELOC_SECTION_MALLOC_FAIL       218
#define DW_DLE_NO_ELF64_SUPPORT                219
#define DW_DLE_MISSING_ELF64_SUPPORT           220
#define DW_DLE_ORPHAN_FDE                      221
#define DW_DLE_DUPLICATE_INST_BLOCK            222
#define DW_DLE_BAD_REF_SIG8_FORM               223
#define DW_DLE_ATTR_EXPRLOC_FORM_BAD           224
#define DW_DLE_FORM_SEC_OFFSET_LENGTH_BAD      225
#define DW_DLE_NOT_REF_FORM                    226
#define DW_DLE_DEBUG_FRAME_LENGTH_NOT_MULTIPLE 227
#define DW_DLE_REF_SIG8_NOT_HANDLED            228
#define DW_DLE_DEBUG_FRAME_POSSIBLE_ADDRESS_BOTCH 229
#define DW_DLE_LOC_BAD_TERMINATION             230
#define DW_DLE_SYMTAB_SECTION_LENGTH_ODD       231
#define DW_DLE_RELOC_SECTION_SYMBOL_INDEX_BAD  232
#define DW_DLE_RELOC_SECTION_RELOC_TARGET_SIZE_UNKNOWN  233
#define DW_DLE_SYMTAB_SECTION_ENTRYSIZE_ZERO   234
#define DW_DLE_LINE_NUMBER_HEADER_ERROR        235
#define DW_DLE_DEBUG_TYPES_NULL                236
#define DW_DLE_DEBUG_TYPES_DUPLICATE           237
#define DW_DLE_DEBUG_TYPES_ONLY_DWARF4         238
#define DW_DLE_DEBUG_TYPEOFFSET_BAD            239
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#define DW_DLE_GNU_OPCODE_ERROR                240
#define DW_DLE_DEBUGPUBTYPES_ERROR             241
#define DW_DLE_AT_FIXUP_NULL                   242
#define DW_DLE_AT_FIXUP_DUP                    243
#define DW_DLE_BAD_ABINAME                     244
#define DW_DLE_TOO_MANY_DEBUG                  245
#define DW_DLE_DEBUG_STR_OFFSETS_DUPLICATE     246
#define DW_DLE_SECTION_DUPLICATION             247
#define DW_DLE_SECTION_ERROR                   248
#define DW_DLE_DEBUG_ADDR_DUPLICATE            249
#define DW_DLE_DEBUG_CU_UNAVAILABLE_FOR_FORM   250
#define DW_DLE_DEBUG_FORM_HANDLING_INCOMPLETE  251
#define DW_DLE_NEXT_DIE_PAST_END               252
#define DW_DLE_NEXT_DIE_WRONG_FORM             253
#define DW_DLE_NEXT_DIE_NO_ABBREV_LIST         254
#define DW_DLE_NESTED_FORM_INDIRECT_ERROR      255
#define DW_DLE_CU_DIE_NO_ABBREV_LIST           256
#define DW_DLE_MISSING_NEEDED_DEBUG_ADDR_SECTION 257
#define DW_DLE_ATTR_FORM_NOT_ADDR_INDEX        258
#define DW_DLE_ATTR_FORM_NOT_STR_INDEX         259
#define DW_DLE_DUPLICATE_GDB_INDEX             260
#define DW_DLE_ERRONEOUS_GDB_INDEX_SECTION     261
#define DW_DLE_GDB_INDEX_COUNT_ERROR           262
#define DW_DLE_GDB_INDEX_COUNT_ADDR_ERROR      263
#define DW_DLE_GDB_INDEX_INDEX_ERROR           264
#define DW_DLE_GDB_INDEX_CUVEC_ERROR           265
#define DW_DLE_DUPLICATE_CU_INDEX              266
#define DW_DLE_DUPLICATE_TU_INDEX              267
#define DW_DLE_XU_TYPE_ARG_ERROR               268
#define DW_DLE_XU_IMPOSSIBLE_ERROR             269
#define DW_DLE_XU_NAME_COL_ERROR               270
#define DW_DLE_XU_HASH_ROW_ERROR               271
#define DW_DLE_XU_HASH_INDEX_ERROR             272
/* ..._FAILSAFE_ERRVAL is an aid when out of memory. */
#define DW_DLE_FAILSAFE_ERRVAL                 273
#define DW_DLE_ARANGE_ERROR                    274
#define DW_DLE_PUBNAMES_ERROR                  275
#define DW_DLE_FUNCNAMES_ERROR                 276
#define DW_DLE_TYPENAMES_ERROR                 277
#define DW_DLE_VARNAMES_ERROR                  278
#define DW_DLE_WEAKNAMES_ERROR                 279
#define DW_DLE_RELOCS_ERROR                    280
#define DW_DLE_ATTR_OUTSIDE_SECTION            281
#define DW_DLE_FISSION_INDEX_WRONG             282
#define DW_DLE_FISSION_VERSION_ERROR           283
#define DW_DLE_NEXT_DIE_LOW_ERROR              284
#define DW_DLE_CU_UT_TYPE_ERROR                285
#define DW_DLE_NO_SUCH_SIGNATURE_FOUND         286
#define DW_DLE_SIGNATURE_SECTION_NUMBER_WRONG  287
#define DW_DLE_ATTR_FORM_NOT_DATA8             288
#define DW_DLE_SIG_TYPE_WRONG_STRING           289
#define DW_DLE_MISSING_REQUIRED_TU_OFFSET_HASH 290
#define DW_DLE_MISSING_REQUIRED_CU_OFFSET_HASH 291
#define DW_DLE_DWP_MISSING_DWO_ID              292
#define DW_DLE_DWP_SIBLING_ERROR               293
#define DW_DLE_DEBUG_FISSION_INCOMPLETE        294
#define DW_DLE_FISSION_SECNUM_ERR              295
#define DW_DLE_DEBUG_MACRO_DUPLICATE           296
#define DW_DLE_DEBUG_NAMES_DUPLICATE           297
#define DW_DLE_DEBUG_LINE_STR_DUPLICATE        298
#define DW_DLE_DEBUG_SUP_DUPLICATE             299
#define DW_DLE_NO_SIGNATURE_TO_LOOKUP          300
#define DW_DLE_NO_TIED_ADDR_AVAILABLE          301
#define DW_DLE_NO_TIED_SIG_AVAILABLE           302
#define DW_DLE_STRING_NOT_TERMINATED           303
#define DW_DLE_BAD_LINE_TABLE_OPERATION        304
#define DW_DLE_LINE_CONTEXT_BOTCH              305
#define DW_DLE_LINE_CONTEXT_INDEX_WRONG        306
#define DW_DLE_NO_TIED_STRING_AVAILABLE        307
#define DW_DLE_NO_TIED_FILE_AVAILABLE          308
#define DW_DLE_CU_TYPE_MISSING                 309
#define DW_DLE_LLE_CODE_UNKNOWN                310
#define DW_DLE_LOCLIST_INTERFACE_ERROR         311
#define DW_DLE_LOCLIST_INDEX_ERROR             312
#define DW_DLE_INTERFACE_NOT_SUPPORTED         313
#define DW_DLE_ZDEBUG_REQUIRES_ZLIB            314
#define DW_DLE_ZDEBUG_INPUT_FORMAT_ODD         315
#define DW_DLE_ZLIB_BUF_ERROR                  316
#define DW_DLE_ZLIB_DATA_ERROR                 317
#define DW_DLE_MACRO_OFFSET_BAD                318
#define DW_DLE_MACRO_OPCODE_BAD                319
#define DW_DLE_MACRO_OPCODE_FORM_BAD           320
#define DW_DLE_UNKNOWN_FORM                    321
#define DW_DLE_BAD_MACRO_HEADER_POINTER        322
#define DW_DLE_BAD_MACRO_INDEX                 323
#define DW_DLE_MACRO_OP_UNHANDLED              324
#define DW_DLE_MACRO_PAST_END                  325
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#define DW_DLE_LINE_STRP_OFFSET_BAD           326
#define DW_DLE_STRING_FORM_IMPROPER           327
#define DW_DLE_ELF_FLAGS_NOT_AVAILABLE        328
#define DW_DLE_LEB_IMPROPER                   329
#define DW_DLE_DEBUG_LINE_RANGE_ZERO          330
#define DW_DLE_READ_LITTLEENDIAN_ERROR        331
#define DW_DLE_READ_BIGENDIAN_ERROR           332
#define DW_DLE_RELOC_INVALID                  333
#define DW_DLE_INFO_HEADER_ERROR              334
#define DW_DLE_ARANGES_HEADER_ERROR           335
#define DW_DLE_LINE_OFFSET_WRONG_FORM         336
#define DW_DLE_FORM_BLOCK_LENGTH_ERROR        337
#define DW_DLE_ZLIB_SECTION_SHORT             338
#define DW_DLE_CIE_INSTR_PTR_ERROR            339
#define DW_DLE_FDE_INSTR_PTR_ERROR            340
#define DW_DLE_FISSION_ADDITION_ERROR         341
#define DW_DLE_HEADER_LEN_BIGGER_THAN_SECSIZE 342
#define DW_DLE_LOCEXPR_OFF_SECTION_END        343
#define DW_DLE_POINTER_SECTION_UNKNOWN        344
#define DW_DLE_ERRONEOUS_XU_INDEX_SECTION     345
#define DW_DLE_DIRECTORY_FORMAT_COUNT_VS_DIRECTORIES_MISMATCH 346
#define DW_DLE_COMPRESSED_EMPTY_SECTION       347
#define DW_DLE_SIZE_WRAPAROUND                348
#define DW_DLE_ILLOGICAL_TSEARCH              349
#define DW_DLE_BAD_STRING_FORM                350
#define DW_DLE_DEBUGSTR_ERROR                 351
#define DW_DLE_DEBUGSTR_UNEXPECTED_REL        352
#define DW_DLE_DISCR_ARRAY_ERROR              353
#define DW_DLE_LEB_OUT_ERROR                  354
#define DW_DLE_SIBLING_LIST_IMPROPER          355
#define DW_DLE_LOCLIST_OFFSET_BAD             356
#define DW_DLE_LINE_TABLE_BAD                 357
#define DW_DLE_DEBUG_LOClISTS_DUPLICATE       358
#define DW_DLE_DEBUG_RNGLISTS_DUPLICATE       359
#define DW_DLE_ABBREV_OFF_END                 360
#define DW_DLE_FORM_STRING_BAD_STRING         361
#define DW_DLE_AUGMENTATION_STRING_OFF_END    362
#define DW_DLE_STRING_OFF_END_PUBNAMES_LIKE   363
#define DW_DLE_LINE_STRING_BAD                364
#define DW_DLE_DEFINE_FILE_STRING_BAD         365
#define DW_DLE_MACRO_STRING_BAD               366
#define DW_DLE_MACINFO_STRING_BAD             367
#define DW_DLE_ZLIB_UNCOMPRESS_ERROR          368
#define DW_DLE_IMPROPER_DWO_ID                369
#define DW_DLE_GROUPNUMBER_ERROR              370
#define DW_DLE_ADDRESS_SIZE_ZERO              371
#define DW_DLE_DEBUG_NAMES_HEADER_ERROR       372
#define DW_DLE_DEBUG_NAMES_AUG_STRING_ERROR   373
#define DW_DLE_DEBUG_NAMES_PAD_NON_ZERO       374
#define DW_DLE_DEBUG_NAMES_OFF_END            375
#define DW_DLE_DEBUG_NAMES_ABBREV_OVERFLOW    376
#define DW_DLE_DEBUG_NAMES_ABBREV_CORRUPTION  377
#define DW_DLE_DEBUG_NAMES_NULL_POINTER       378
#define DW_DLE_DEBUG_NAMES_BAD_INDEX_ARG      379
#define DW_DLE_DEBUG_NAMES_ENTRYPOOL_OFFSET   380
#define DW_DLE_DEBUG_NAMES_UNHANDLED_FORM     381
#define DW_DLE_LNCT_CODE_UNKNOWN              382
#define DW_DLE_LNCT_FORM_CODE_NOT_HANDLED     383
#define DW_DLE_LINE_HEADER_LENGTH_BOTCH       384
#define DW_DLE_STRING_HASHTAB_IDENTITY_ERROR  385
#define DW_DLE_UNIT_TYPE_NOT_HANDLED          386
#define DW_DLE_GROUP_MAP_ALLOC                387
#define DW_DLE_GROUP_MAP_DUPLICATE            388
#define DW_DLE_GROUP_COUNT_ERROR              389
#define DW_DLE_GROUP_INTERNAL_ERROR           390
#define DW_DLE_GROUP_LOAD_ERROR               391
#define DW_DLE_GROUP_LOAD_READ_ERROR          392
#define DW_DLE_AUG_DATA_LENGTH_BAD            393
#define DW_DLE_ABBREV_MISSING                 394
#define DW_DLE_NO_TAG_FOR_DIE                 395
#define DW_DLE_LOWPC_WRONG_CLASS              396
#define DW_DLE_HIGHPC_WRONG_FORM              397
#define DW_DLE_STR_OFFSETS_BASE_WRONG_FORM    398
#define DW_DLE_DATA16_OUTSIDE_SECTION         399
#define DW_DLE_LNCT_MD5_WRONG_FORM            400
#define DW_DLE_LINE_HEADER_CORRUPT            401
#define DW_DLE_STR_OFFSETS_NULLARGUMENT       402
#define DW_DLE_STR_OFFSETS_NULL_DBG           403
#define DW_DLE_STR_OFFSETS_NO_MAGIC           404
#define DW_DLE_STR_OFFSETS_ARRAY_SIZE         405
#define DW_DLE_STR_OFFSETS_VERSION_WRONG      406
#define DW_DLE_STR_OFFSETS_ARRAY_INDEX_WRONG  407
#define DW_DLE_STR_OFFSETS_EXTRA_BYTES        408
#define DW_DLE_DUP_ATTR_ON_DIE                409
#define DW_DLE_SECTION_NAME_BIG               410
#define DW_DLE_FILE_UNAVAILABLE               411
#define DW_DLE_FILE_WRONG_TYPE                412
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#define DW_DLE_SIBLING_OFFSET_WRONG            413
#define DW_DLE_OPEN_FAIL                       414
#define DW_DLE_OFFSET_SIZE                     415
#define DW_DLE_MACH_O_SEGOFFSET_BAD            416
#define DW_DLE_FILE_OFFSET_BAD                 417
#define DW_DLE_SEEK_ERROR                      418
#define DW_DLE_READ_ERROR                      419
#define DW_DLE_ELF_CLASS_BAD                   420
#define DW_DLE_ELF_ENDIAN_BAD                  421
#define DW_DLE_ELF_VERSION_BAD                 422
#define DW_DLE_FILE_TOO_SMALL                  423
#define DW_DLE_PATH_SIZE_TOO_SMALL             424
#define DW_DLE_BAD_TYPE_SIZE                   425
#define DW_DLE_PE_SIZE_SMALL                   426
#define DW_DLE_PE_OFFSET_BAD                   427
#define DW_DLE_PE_STRING_TOO_LONG              428
#define DW_DLE_IMAGE_FILE_UNKNOWN_TYPE         429
#define DW_DLE_LINE_TABLE_LINENO_ERROR         430
#define DW_DLE_PRODUCER_CODE_NOT_AVAILABLE     431
#define DW_DLE_NO_ELF_SUPPORT                  432
#define DW_DLE_NO_STREAM_RELOC_SUPPORT         433
#define DW_DLE_RETURN_EMPTY_PUBNAMES_ERROR     434
#define DW_DLE_SECTION_SIZE_ERROR              435
#define DW_DLE_INTERNAL_NULL_POINTER           436
#define DW_DLE_SECTION_STRING_OFFSET_BAD       437
#define DW_DLE_SECTION_INDEX_BAD               438
#define DW_DLE_INTEGER_TOO_SMALL               439
#define DW_DLE_ELF_SECTION_LINK_ERROR          440
#define DW_DLE_ELF_SECTION_GROUP_ERROR         441
#define DW_DLE_ELF_SECTION_COUNT_MISMATCH      442
#define DW_DLE_ELF_STRING_SECTION_MISSING      443
#define DW_DLE_SEEK_OFF_END                    444
#define DW_DLE_READ_OFF_END                    445
#define DW_DLE_ELF_SECTION_ERROR               446
#define DW_DLE_ELF_STRING_SECTION_ERROR        447
#define DW_DLE_MIXING_SPLIT_DWARF_VERSIONS     448
#define DW_DLE_TAG_CORRUPT                     449
#define DW_DLE_FORM_CORRUPT                    450
#define DW_DLE_ATTR_CORRUPT                    451
#define DW_DLE_ABBREV_ATTR_DUPLICATION         452
#define DW_DLE_DWP_SIGNATURE_MISMATCH          453
#define DW_DLE_CU_UT_TYPE_VALUE                454
#define DW_DLE_DUPLICATE_GNU_DEBUGLINK         455
#define DW_DLE_CORRUPT_GNU_DEBUGLINK           456
#define DW_DLE_CORRUPT_NOTE_GNU_DEBUGID        457
#define DW_DLE_CORRUPT_GNU_DEBUGID_SIZE        458
#define DW_DLE_CORRUPT_GNU_DEBUGID_STRING      459
#define DW_DLE_HEX_STRING_ERROR                460
#define DW_DLE_DECIMAL_STRING_ERROR            461
#define DW_DLE_PRO_INIT_EXTRAS_UNKNOWN         462
#define DW_DLE_PRO_INIT_EXTRAS_ERR             463
#define DW_DLE_NULL_ARGS_DWARF_ADD_PATH        464
#define DW_DLE_DWARF_INIT_DBG_NULL             465
#define DW_DLE_ELF_RELOC_SECTION_ERROR         466
#define DW_DLE_USER_DECLARED_ERROR             467
#define DW_DLE_RNGLISTS_ERROR                  468
#define DW_DLE_LOCLISTS_ERROR                  469
#define DW_DLE_SECTION_SIZE_OR_OFFSET_LARGE    470
#define DW_DLE_GDBINDEX_STRING_ERROR           471
#define DW_DLE_GNU_PUBNAMES_ERROR              472
#define DW_DLE_GNU_PUBTYPES_ERROR              473
#define DW_DLE_DUPLICATE_GNU_DEBUG_PUBNAMES    474
#define DW_DLE_DUPLICATE_GNU_DEBUG_PUBTYPES    475
#define DW_DLE_DEBUG_SUP_STRING_ERROR          476
#define DW_DLE_DEBUG_SUP_ERROR                 477
#define DW_DLE_LOCATION_ERROR                  478
#define DW_DLE_DEBUGLINK_PATH_SHORT            479
#define DW_DLE_SIGNATURE_MISMATCH              480
#define DW_DLE_MACRO_VERSION_ERROR             481
#define DW_DLE_NEGATIVE_SIZE                   482
#define DW_DLE_UDATA_VALUE_NEGATIVE            483
#define DW_DLE_DEBUG_NAMES_ERROR               484
#define DW_DLE_CFA_INSTRUCTION_ERROR           485
#define DW_DLE_MACHO_CORRUPT_HEADER            486
#define DW_DLE_MACHO_CORRUPT_COMMAND           487
#define DW_DLE_MACHO_CORRUPT_SECTIONDETAILS    488
#define DW_DLE_RELOCATION_SECTION_SIZE_ERROR   489
#define DW_DLE_SYMBOL_SECTION_SIZE_ERROR       490
#define DW_DLE_PE_SECTION_SIZE_ERROR           491
#define DW_DLE_DEBUG_ADDR_ERROR                492
#define DW_DLE_NO_SECT_STRINGS                 493
#define DW_DLE_TOO_FEW_SECTIONS                494
#define DW_DLE_BUILD_ID_DESCRIPTION_SIZE       495
#define DW_DLE_BAD_SECTION_FLAGS               496
#define DW_DLE_IMPROPER_SECTION_ZERO           497
#define DW_DLE_INVALID_NULL_ARGUMENT           498
#define DW_DLE_LINE_INDEX_WRONG                499
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#define DW_DLE_LINE_COUNT_WRONG                500
#define DW_DLE_ARITHMETIC_OVERFLOW             501
#define DW_DLE_UNIVERSAL_BINARY_ERROR          502
#define DW_DLE_UNIV_BIN_OFFSET_SIZE_ERROR      503
#define DW_DLE_PE_SECTION_SIZE_HEURISTIC_FAIL  504
#define DW_DLE_LLE_ERROR                       505
#define DW_DLE_RLE_ERROR                       506
#define DW_DLE_MACHO_SEGMENT_COUNT_HEURISTIC_FAIL 507
#define DW_DLE_DUPLICATE_NOTE_GNU_BUILD_ID     508
#define DW_DLE_SYSCONF_VALUE_UNUSABLE     509

#define DW_DLE_LAST        509
#define DW_DLE_LO_USER     0x10000
DW_API int dwarf_init_path(const char * dw_path,
    char *             dw_true_path_out_buffer,
    unsigned int       dw_true_path_bufferlen,
    unsigned int       dw_groupnumber,
    Dwarf_Handler      dw_errhand,
    Dwarf_Ptr          dw_errarg,
    Dwarf_Debug*       dw_dbg,
    Dwarf_Error*       dw_error);

DW_API int dwarf_init_path_a(const char * dw_path,
    char *             dw_true_path_out_buffer,
    unsigned int       dw_true_path_bufferlen,
    unsigned int       dw_groupnumber,
    unsigned int       dw_universalnumber,
    Dwarf_Handler      dw_errhand,
    Dwarf_Ptr          dw_errarg,
    Dwarf_Debug*       dw_dbg,
    Dwarf_Error*       dw_error);

DW_API int dwarf_init_path_dl(const char * dw_path,
    char *             dw_true_path_out_buffer,
    unsigned int       dw_true_path_bufferlen,
    unsigned int       dw_groupnumber,
    Dwarf_Handler      dw_errhand,
    Dwarf_Ptr          dw_errarg,
    Dwarf_Debug*       dw_dbg,
    char **            dw_dl_path_array,
    unsigned int       dw_dl_path_array_size,
    unsigned char    * dw_dl_path_source,
    Dwarf_Error*       dw_error);

DW_API int dwarf_init_path_dl_a(const char * dw_path,
    char *             dw_true_path_out_buffer,
    unsigned int       dw_true_path_bufferlen,
    unsigned int       dw_groupnumber,
    unsigned int       dw_universalnumber,
    Dwarf_Handler      dw_errhand,
    Dwarf_Ptr          dw_errarg,
    Dwarf_Debug*       dw_dbg,
    char **            dw_dl_path_array,
    unsigned int       dw_dl_path_array_size,
    unsigned char    * dw_dl_path_source,
    Dwarf_Error*       dw_error);

DW_API int dwarf_init_b(int dw_fd,
    unsigned int       dw_groupnumber,
    Dwarf_Handler      dw_errhand,
    Dwarf_Ptr          dw_errarg,
    Dwarf_Debug*       dw_dbg,
    Dwarf_Error*       dw_error);

DW_API int dwarf_finish(Dwarf_Debug dw_dbg);

DW_API int dwarf_object_init_b(Dwarf_Obj_Access_Interface_a* dw_obj,
    Dwarf_Handler dw_errhand,
    Dwarf_Ptr     dw_errarg,
    unsigned int  dw_groupnumber,
    Dwarf_Debug*  dw_dbg,
    Dwarf_Error*  dw_error);

DW_API int dwarf_object_finish(Dwarf_Debug dw_dbg);

DW_API int dwarf_set_tied_dbg(Dwarf_Debug dw_split_dbg,
    Dwarf_Debug  dw_tied_dbg,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_tied_dbg(Dwarf_Debug dw_dbg,
    Dwarf_Debug * dw_tieddbg_out,
    Dwarf_Error * dw_error);
DW_API int dwarf_next_cu_header_e(Dwarf_Debug dw_dbg,
    Dwarf_Bool      dw_is_info,
    Dwarf_Die      *dw_cu_die,
    Dwarf_Unsigned *dw_cu_header_length,
    Dwarf_Half     *dw_version_stamp,
    Dwarf_Off      *dw_abbrev_offset,
    Dwarf_Half     *dw_address_size,
    Dwarf_Half     *dw_length_size,
    Dwarf_Half     *dw_extension_size,
    Dwarf_Sig8     *dw_type_signature,
    Dwarf_Unsigned *dw_typeoffset,
    Dwarf_Unsigned *dw_next_cu_header_offset,
    Dwarf_Half     *dw_header_cu_type,
    Dwarf_Error    *dw_error);

DW_API int dwarf_next_cu_header_d(Dwarf_Debug dw_dbg,
    Dwarf_Bool      dw_is_info,
    Dwarf_Unsigned *dw_cu_header_length,
    Dwarf_Half     *dw_version_stamp,
    Dwarf_Off      *dw_abbrev_offset,
    Dwarf_Half     *dw_address_size,
    Dwarf_Half     *dw_length_size,
    Dwarf_Half     *dw_extension_size,
    Dwarf_Sig8     *dw_type_signature,
    Dwarf_Unsigned *dw_typeoffset,
    Dwarf_Unsigned *dw_next_cu_header_offset,
    Dwarf_Half     *dw_header_cu_type,
    Dwarf_Error    *dw_error);

DW_API int dwarf_siblingof_c(Dwarf_Die    dw_die,
    Dwarf_Die   *dw_return_siblingdie,
    Dwarf_Error *dw_error);

DW_API int dwarf_siblingof_b(Dwarf_Debug dw_dbg,
    Dwarf_Die    dw_die,
    Dwarf_Bool   dw_is_info,
    Dwarf_Die   *dw_return_siblingdie,
    Dwarf_Error *dw_error);

DW_API int dwarf_cu_header_basics(Dwarf_Die dw_die,
    Dwarf_Half     *dw_version,
    Dwarf_Bool     *dw_is_info,
    Dwarf_Bool     *dw_is_dwo,
    Dwarf_Half     *dw_offset_size,
    Dwarf_Half     *dw_address_size,
    Dwarf_Half     *dw_extension_size,
    Dwarf_Sig8    **dw_signature,
    Dwarf_Off      *dw_offset_of_length,
    Dwarf_Unsigned *dw_total_byte_length,
    Dwarf_Error    *dw_error);

DW_API int dwarf_child(Dwarf_Die dw_die,
    Dwarf_Die*    dw_return_childdie,
    Dwarf_Error*  dw_error);

DW_API void dwarf_dealloc_die( Dwarf_Die dw_die);

DW_API int dwarf_die_from_hash_signature(Dwarf_Debug dw_dbg,
    Dwarf_Sig8 *  dw_hash_sig,
    const char *  dw_sig_type,
    Dwarf_Die*    dw_returned_CU_die,
    Dwarf_Error*  dw_error);

DW_API int dwarf_offdie_b(Dwarf_Debug dw_dbg,
    Dwarf_Off        dw_offset,
    Dwarf_Bool       dw_is_info,
    Dwarf_Die*       dw_return_die,
    Dwarf_Error*     dw_error);

DW_API int dwarf_find_die_given_sig8(Dwarf_Debug dw_dbg,
    Dwarf_Sig8   *dw_ref,
    Dwarf_Die    *dw_die_out,
    Dwarf_Bool   *dw_is_info,
    Dwarf_Error *dw_error);

DW_API Dwarf_Bool dwarf_get_die_infotypes_flag(Dwarf_Die dw_die);
DW_API int dwarf_die_abbrev_global_offset(Dwarf_Die dw_die,
    Dwarf_Off       * dw_abbrev_offset,
    Dwarf_Unsigned  * dw_abbrev_count,
    Dwarf_Error*      dw_error);

DW_API int dwarf_tag(Dwarf_Die dw_die,
    Dwarf_Half*      dw_return_tag,
    Dwarf_Error*     dw_error);

DW_API int dwarf_dieoffset(Dwarf_Die dw_die,
    Dwarf_Off*       dw_return_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_debug_addr_index_to_addr(Dwarf_Die dw_die,
    Dwarf_Unsigned  dw_index,
    Dwarf_Addr     * dw_return_addr,
    Dwarf_Error   * dw_error);

DW_API Dwarf_Bool dwarf_addr_form_is_indexed(int dw_form);

DW_API int dwarf_CU_dieoffset_given_die(Dwarf_Die dw_die,
    Dwarf_Off*       dw_return_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_cu_die_offset_given_cu_header_offset_b(
    Dwarf_Debug  dw_dbg,
    Dwarf_Off    dw_in_cu_header_offset,
    Dwarf_Bool   dw_is_info,
    Dwarf_Off *  dw_out_cu_die_offset,
    Dwarf_Error *dw_error);

DW_API int dwarf_die_CU_offset(Dwarf_Die dw_die,
    Dwarf_Off*       dw_return_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_die_CU_offset_range(Dwarf_Die dw_die,
    Dwarf_Off*   dw_return_CU_header_offset,
    Dwarf_Off*   dw_return_CU_length_bytes,
    Dwarf_Error* dw_error);

DW_API int dwarf_attr(Dwarf_Die dw_die,
    Dwarf_Half        dw_attrnum,
    Dwarf_Attribute * dw_returned_attr,
    Dwarf_Error*      dw_error);

DW_API int dwarf_die_text(Dwarf_Die dw_die,
    Dwarf_Half    dw_attrnum,
    char       ** dw_ret_name,
    Dwarf_Error * dw_error);

DW_API int dwarf_diename(Dwarf_Die dw_die,
    char   **        dw_diename,
    Dwarf_Error*     dw_error);

DW_API Dwarf_Unsigned dwarf_die_abbrev_code(Dwarf_Die dw_die);

DW_API int dwarf_die_abbrev_children_flag(Dwarf_Die dw_die,
    Dwarf_Half * dw_ab_has_child);

DW_API int dwarf_validate_die_sibling(Dwarf_Die dw_sibling,
    Dwarf_Off* dw_offset);

/* convenience functions, alternative to using dwarf_attrlist */

DW_API int dwarf_hasattr(Dwarf_Die dw_die,
    Dwarf_Half   dw_attrnum,
    Dwarf_Bool * dw_returned_bool,
    Dwarf_Error* dw_error);

DW_API int dwarf_offset_list(Dwarf_Debug dw_dbg,
    Dwarf_Off          dw_offset,
    Dwarf_Bool         dw_is_info,
    Dwarf_Off       ** dw_offbuf,
    Dwarf_Unsigned *   dw_offcount,
    Dwarf_Error    *   dw_error);

DW_API int dwarf_get_die_address_size(Dwarf_Die dw_die,
    Dwarf_Half   * dw_addr_size,
    Dwarf_Error * dw_error);

/* Get both offsets (local and global) */
DW_API int dwarf_die_offsets(Dwarf_Die dw_die,
    Dwarf_Off*    dw_global_offset,
    Dwarf_Off*    dw_local_offset,
    Dwarf_Error*  dw_error);

DW_API int dwarf_get_version_of_die(Dwarf_Die dw_die,
    Dwarf_Half * dw_version,
    Dwarf_Half * dw_offset_size);

DW_API int dwarf_lowpc(Dwarf_Die dw_die,
    Dwarf_Addr * dw_returned_addr,
    Dwarf_Error* dw_error);

DW_API int dwarf_highpc_b(Dwarf_Die dw_die,
    Dwarf_Addr  *           dw_return_addr,
    Dwarf_Half  *           dw_return_form,
    enum Dwarf_Form_Class * dw_return_class,
    Dwarf_Error *           dw_error);

DW_API int dwarf_dietype_offset(Dwarf_Die dw_die,
    Dwarf_Off    * dw_return_offset,
    Dwarf_Bool   * dw_is_info,
    Dwarf_Error * dw_error);

DW_API int dwarf_bytesize(Dwarf_Die dw_die,
    Dwarf_Unsigned * dw_returned_size,
    Dwarf_Error*     dw_error);

DW_API int dwarf_bitsize(Dwarf_Die dw_die,
    Dwarf_Unsigned * dw_returned_size,
    Dwarf_Error*     dw_error);

DW_API int dwarf_bitoffset(Dwarf_Die dw_die,
    Dwarf_Half     * dw_attrnum,
    Dwarf_Unsigned * dw_returned_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_srclang(Dwarf_Die dw_die,
    Dwarf_Unsigned * dw_returned_lang,
    Dwarf_Error    * dw_error);

DW_API int dwarf_srclanglname(Dwarf_Die dw_die,
    Dwarf_Unsigned *dw_returned_lname,
    Dwarf_Error    *dw_error);

DW_API int dwarf_srclanglname_version(Dwarf_Die dw_die,
    const char  *dw_returned_verstring,
    Dwarf_Error *dw_error);

DW_API int dwarf_language_version_data(
    Dwarf_Unsigned dw_lname_name,
    int           *dw_default_lower_bound,
    const char   **dw_version_string);

/*  OBSOLETE NAME. Do Not use, use dwarf_language_version_data */
DW_API int dwarf_language_version_string(
    Dwarf_Unsigned dw_lname_name,
    int            *dw_default_lower_bound,
    const char   **dw_version_string);

DW_API int dwarf_lvn_name_direct(Dwarf_Unsigned dw_lv_lang,
    Dwarf_Unsigned dw_lv_ver,
    const char   **dw_ret_version_name,
    const char   **dw_ret_version_scheme);

DW_API int dwarf_lvn_name(Dwarf_Die dw_die,
    const char   **dw_ret_version_name,
    const char   **dw_ret_version_scheme);

DW_API int dwarf_lvn_table_entry(Dwarf_Unsigned dw_lvn_index,
    Dwarf_Unsigned *dw_lvn_language_name,
    Dwarf_Unsigned *dw_lvn_language_version,
    const char     **dw_lvn_language_version_scheme,
    const char     **dw_lvn_language_version_name);

DW_API int dwarf_arrayorder(Dwarf_Die dw_die,
    Dwarf_Unsigned * dw_returned_order,
    Dwarf_Error*     dw_error);
DW_API int dwarf_attrlist(Dwarf_Die dw_die,
    Dwarf_Attribute** dw_attrbuf,
    Dwarf_Signed * dw_attrcount,
    Dwarf_Error*   dw_error);

DW_API int dwarf_hasform(Dwarf_Attribute dw_attr,
    Dwarf_Half   dw_form,
    Dwarf_Bool * dw_returned_bool,
    Dwarf_Error* dw_error);

DW_API int dwarf_whatform(Dwarf_Attribute dw_attr,
    Dwarf_Half * dw_returned_final_form,
    Dwarf_Error* dw_error);

DW_API int dwarf_whatform_direct(Dwarf_Attribute dw_attr,
    Dwarf_Half * dw_returned_initial_form,
    Dwarf_Error* dw_error);

DW_API int dwarf_whatattr(Dwarf_Attribute dw_attr,
    Dwarf_Half * dw_returned_attrnum,
    Dwarf_Error* dw_error);

DW_API int dwarf_formref(Dwarf_Attribute dw_attr,
    Dwarf_Off*   dw_return_offset,
    Dwarf_Bool  *dw_is_info,
    Dwarf_Error *dw_error);

DW_API int dwarf_global_formref_b(Dwarf_Attribute dw_attr,
    Dwarf_Off   *dw_return_offset,
    Dwarf_Bool  *dw_offset_is_info,
    Dwarf_Error *dw_error);
```

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DW_API int dwarf_global_formref(Dwarf_Attribute dw_attr,
    Dwarf_Off*       dw_return_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_formsig8(Dwarf_Attribute dw_attr,
    Dwarf_Sig8 * dw_returned_sig_bytes,
    Dwarf_Error* dw_error);

DW_API int dwarf_formsig8_const(Dwarf_Attribute dw_attr,
    Dwarf_Sig8 * dw_returned_sig_bytes,
    Dwarf_Error* dw_error);

DW_API int dwarf_formaddr(Dwarf_Attribute dw_attr,
    Dwarf_Addr * dw_returned_addr,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_debug_addr_index(Dwarf_Attribute dw_attr,
    Dwarf_Unsigned * dw_return_index,
    Dwarf_Error *    dw_error);

DW_API int dwarf_formflag(Dwarf_Attribute dw_attr,
    Dwarf_Bool *     dw_returned_bool,
    Dwarf_Error*     dw_error);

DW_API int dwarf_formudata(Dwarf_Attribute dw_attr,
    Dwarf_Unsigned * dw_returned_val,
    Dwarf_Error*     dw_error);

DW_API int dwarf_formsdata(Dwarf_Attribute dw_attr,
    Dwarf_Signed  * dw_returned_val,
    Dwarf_Error*    dw_error);

DW_API int dwarf_formdata16(Dwarf_Attribute dw_attr,
    Dwarf_Form_Data16 * dw_returned_val,
    Dwarf_Error*        dw_error);

DW_API int dwarf_formblock(Dwarf_Attribute dw_attr,
    Dwarf_Block ** dw_returned_block,
    Dwarf_Error*   dw_error);

DW_API int dwarf_formstring(Dwarf_Attribute dw_attr,
    char   **        dw_returned_string,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_debug_str_index(Dwarf_Attribute dw_attr,
    Dwarf_Unsigned * dw_return_index,
    Dwarf_Error *    dw_error);

DW_API int dwarf_formexprloc(Dwarf_Attribute dw_attr,
    Dwarf_Unsigned * dw_return_exprlen,
    Dwarf_Ptr      * dw_block_ptr,
    Dwarf_Error    * dw_error);

DW_API enum Dwarf_Form_Class dwarf_get_form_class(
    Dwarf_Half dw_version,
    Dwarf_Half dw_attrnum,
    Dwarf_Half dw_offset_size,
    Dwarf_Half dw_form);

DW_API int dwarf_attr_offset(Dwarf_Die dw_die,
    Dwarf_Attribute dw_attr,
    Dwarf_Off     * dw_return_offset,
    Dwarf_Error   * dw_error);

DW_API int dwarf_uncompress_integer_block_a(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_input_length_in_bytes,
    void           * dw_input_block,
    Dwarf_Unsigned * dw_value_count,
    Dwarf_Signed  ** dw_value_array,
    Dwarf_Error    * dw_error);

DW_API void dwarf_dealloc_uncompressed_block(Dwarf_Debug dw_dbg,
    void *dw_value_array);

DW_API int dwarf_convert_to_global_offset(Dwarf_Attribute dw_attr,
    Dwarf_Off    dw_offset,
    Dwarf_Off*   dw_return_offset,
    Dwarf_Error* dw_error);

DW_API void dwarf_dealloc_attribute(Dwarf_Attribute dw_attr);

DW_API int dwarf_discr_list(Dwarf_Debug dw_dbg,
    Dwarf_Small    * dw_blockpointer,
    Dwarf_Unsigned   dw_blocklen,
    Dwarf_Dsc_Head * dw_dsc_head_out,
    Dwarf_Unsigned * dw_dsc_array_length_out,
    Dwarf_Error    * dw_error);

DW_API int dwarf_discr_entry_u(Dwarf_Dsc_Head dw_dsc,
    Dwarf_Unsigned   dw_entrynum,
    Dwarf_Half     * dw_out_type,
    Dwarf_Unsigned * dw_out_discr_low,
    Dwarf_Unsigned * dw_out_discr_high,
    Dwarf_Error    * dw_error);

DW_API int dwarf_discr_entry_s(Dwarf_Dsc_Head dw_dsc,
    Dwarf_Unsigned   dw_entrynum,
    Dwarf_Half     * dw_out_type,
    Dwarf_Signed   * dw_out_discr_low,
    Dwarf_Signed   * dw_out_discr_high,
    Dwarf_Error    * dw_error);

DW_API int dwarf_srcfiles(Dwarf_Die dw_cu_die,
    char       *** dw_srcfiles,
    Dwarf_Signed * dw_filecount,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_b(Dwarf_Die dw_cudie,
    Dwarf_Unsigned     * dw_version_out,
    Dwarf_Small        * dw_table_count,
    Dwarf_Line_Context * dw_linecontext,
    Dwarf_Error        * dw_error);

DW_API int dwarf_srclines_from_linecontext(
    Dwarf_Line_Context dw_linecontext,
    Dwarf_Line   ** dw_linebuf,
    Dwarf_Signed * dw_linecount,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_two_level_from_linecontext(
    Dwarf_Line_Context dw_context,
    Dwarf_Line  **   dw_linebuf ,
    Dwarf_Signed *   dw_linecount,
    Dwarf_Line  **   dw_linebuf_actuals,
    Dwarf_Signed *   dw_linecount_actuals,
    Dwarf_Error  *   dw_error);

DW_API void dwarf_srclines_dealloc_b(Dwarf_Line_Context dw_context);

DW_API int dwarf_srclines_table_offset(Dwarf_Line_Context dw_context,
    Dwarf_Unsigned * dw_offset,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_comp_dir(Dwarf_Line_Context dw_context,
    const char ** dw_compilation_directory,
    Dwarf_Error * dw_error);

DW_API int dwarf_srclines_subprog_count(Dwarf_Line_Context dw_context,
    Dwarf_Signed * dw_count,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_subprog_data(Dwarf_Line_Context dw_context,
    Dwarf_Signed     dw_index,
    const char     ** dw_name,
    Dwarf_Unsigned * dw_decl_file,
    Dwarf_Unsigned * dw_decl_line,
    Dwarf_Error    * dw_error);

DW_API int dwarf_srclines_files_indexes(
    Dwarf_Line_Context dw_context,
    Dwarf_Signed * dw_baseindex,
    Dwarf_Signed * dw_count,
    Dwarf_Signed * dw_endindex,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_files_data_b(
    Dwarf_Line_Context   dw_context,
    Dwarf_Signed         dw_index_in,
    const char         ** dw_name,
    Dwarf_Unsigned     * dw_directory_index,
    Dwarf_Unsigned     * dw_last_mod_time,
    Dwarf_Unsigned     * dw_file_length,
    Dwarf_Form_Data16 ** dw_md5ptr,
    Dwarf_Error        * dw_error);

DW_API int dwarf_srclines_include_dir_count(
    Dwarf_Line_Context dw_line_context,
    Dwarf_Signed * dw_count,
    Dwarf_Error  * dw_error);

DW_API int dwarf_srclines_include_dir_data(
    Dwarf_Line_Context dw_line_context,
    Dwarf_Signed    dw_index,
    const char **   dw_name,
    Dwarf_Error   * dw_error);

DW_API int dwarf_srclines_version(Dwarf_Line_Context dw_line_context,
    Dwarf_Unsigned * dw_version,
    Dwarf_Small    * dw_table_count,
    Dwarf_Error    * dw_error);

DW_API int dwarf_linebeginstatement(Dwarf_Line dw_line,
    Dwarf_Bool  * dw_returned_bool,
    Dwarf_Error * dw_error);

DW_API int dwarf_lineendsequence(Dwarf_Line dw_line,
    Dwarf_Bool  * dw_returned_bool,
    Dwarf_Error * dw_error);

DW_API int dwarf_lineno(Dwarf_Line dw_line,
    Dwarf_Unsigned * dw_returned_linenum,
    Dwarf_Error    * dw_error);

DW_API int dwarf_line_srcfileno(Dwarf_Line dw_line,
    Dwarf_Unsigned * dw_returned_filenum,
    Dwarf_Error    * dw_error);

DW_API int dwarf_line_is_addr_set(Dwarf_Line dw_line,
    Dwarf_Bool  * dw_is_addr_set,
    Dwarf_Error * dw_error);

DW_API int dwarf_lineaddr(Dwarf_Line dw_line,
    Dwarf_Addr *     dw_returned_addr,
    Dwarf_Error*     dw_error);

DW_API int dwarf_lineoff_b(Dwarf_Line dw_line,
    Dwarf_Unsigned * dw_returned_lineoffset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_linesrc(Dwarf_Line dw_line,
    char       ** dw_returned_name,
    Dwarf_Error* dw_error);

DW_API int dwarf_lineblock(Dwarf_Line dw_line,
    Dwarf_Bool  *    dw_returned_bool,
    Dwarf_Error*     dw_error);

/*  We gather these into one call as it's likely one
    will want all or none of them.  */
DW_API int dwarf_prologue_end_etc(Dwarf_Line dw_line,
    Dwarf_Bool  *    dw_prologue_end,
    Dwarf_Bool  *    dw_epilogue_begin,
    Dwarf_Unsigned * dw_isa,
    Dwarf_Unsigned * dw_discriminator,
    Dwarf_Error *    dw_error);
/* End line table operations */

DW_API int dwarf_linelogical(Dwarf_Line dw_line,
    Dwarf_Unsigned * dw_returned_logical,
    Dwarf_Error*     dw_error);

DW_API int dwarf_linecontext(Dwarf_Line dw_line,
    Dwarf_Unsigned * dw_returned_context,
    Dwarf_Error*     dw_error);

DW_API int dwarf_line_subprogno(Dwarf_Line /*line*/,
    Dwarf_Unsigned * /*ret_subprogno*/,
    Dwarf_Error *    /*error*/);

DW_API int dwarf_line_subprog(Dwarf_Line /*line*/,
    char    **         /*returned_subprog_name*/,
    char    **         /*returned_filename*/,
    Dwarf_Unsigned *   /*returned_lineno*/,
    Dwarf_Error *      /*error*/);

DW_API int dwarf_check_lineheader_b(Dwarf_Die dw_cu_die,
    int          * dw_errcount_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_print_lines(Dwarf_Die dw_cu_die,
    Dwarf_Error * dw_error,
    int * dw_errorcount_out);

DW_API struct  Dwarf_Printf_Callback_Info_s
    dwarf_register_printf_callback(Dwarf_Debug dw_dbg,
    struct Dwarf_Printf_Callback_Info_s * dw_callbackinfo);

DW_API int dwarf_get_ranges_b(Dwarf_Debug dw_dbg,
    Dwarf_Off          dw_rangesoffset,
    Dwarf_Die          dw_die,
    Dwarf_Off *      dw_return_realoffset,
    Dwarf_Ranges **  dw_rangesbuf,
    Dwarf_Signed *   dw_rangecount,
    Dwarf_Unsigned * dw_bytecount,
    Dwarf_Error *    dw_error);

DW_API void dwarf_dealloc_ranges(Dwarf_Debug dw_dbg,
    Dwarf_Ranges * dw_rangesbuf,
    Dwarf_Signed   dw_rangecount);

DW_API int dwarf_get_ranges_baseaddress(Dwarf_Debug dw_dbg,
    Dwarf_Die       dw_die,
    Dwarf_Bool     *dw_known_base,
    Dwarf_Unsigned *dw_baseaddress,
    Dwarf_Bool     *dw_at_ranges_offset_present,
    Dwarf_Unsigned *dw_at_ranges_offset,
    Dwarf_Error    *dw_error);

DW_API int dwarf_rnglists_get_rle_head(Dwarf_Attribute dw_attr,
    Dwarf_Half            dw_theform,
    Dwarf_Unsigned        dw_index_or_offset_value,
    Dwarf_Rnglists_Head * dw_head_out,
    Dwarf_Unsigned *      dw_count_of_entries_in_head,
    Dwarf_Unsigned *      dw_global_offset_of_rle_set,
    Dwarf_Error    *      dw_error);

DW_API int dwarf_get_rnglists_entry_fields_a(
    Dwarf_Rnglists_Head dw_head,
    Dwarf_Unsigned   dw_entrynum,
    unsigned int   * dw_entrylen,
    unsigned int   * dw_rle_value_out,
    Dwarf_Unsigned * dw_raw1,
    Dwarf_Unsigned * dw_raw2,
    Dwarf_Bool     * dw_debug_addr_unavailable,
    Dwarf_Unsigned * dw_cooked1,
    Dwarf_Unsigned * dw_cooked2,
    Dwarf_Error *    dw_error);

DW_API void dwarf_dealloc_rnglists_head(Dwarf_Rnglists_Head dw_head);

DW_API int dwarf_load_rnglists(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned * dw_rnglists_count,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_rnglist_offset_index_value(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_context_index,
    Dwarf_Unsigned   dw_offsetentry_index,
    Dwarf_Unsigned * dw_offset_value_out,
    Dwarf_Unsigned * dw_global_offset_value_out,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_rnglist_head_basics(Dwarf_Rnglists_Head dw_head,
    Dwarf_Unsigned * dw_rle_count,
    Dwarf_Unsigned * dw_rnglists_version,
    Dwarf_Unsigned * dw_rnglists_index_returned,
    Dwarf_Unsigned * dw_bytes_total_in_rle,
    Dwarf_Half     * dw_offset_size,
    Dwarf_Half     * dw_address_size,
    Dwarf_Half     * dw_segment_selector_size,
    Dwarf_Unsigned * dw_overall_offset_of_this_context,
    Dwarf_Unsigned * dw_total_length_of_this_context,
    Dwarf_Unsigned * dw_offset_table_offset,
    Dwarf_Unsigned * dw_offset_table_entrycount,
    Dwarf_Bool     * dw_rnglists_base_present,
    Dwarf_Unsigned * dw_rnglists_base,
    Dwarf_Bool     * dw_rnglists_base_address_present,
    Dwarf_Unsigned * dw_rnglists_base_address,
    Dwarf_Bool     * dw_rnglists_debug_addr_base_present,
    Dwarf_Unsigned * dw_rnglists_debug_addr_base,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_rnglist_context_basics(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_index,
    Dwarf_Unsigned * dw_header_offset,
    Dwarf_Small  *   dw_offset_size,
    Dwarf_Small  *   dw_extension_size,
    unsigned int *   dw_version,
    Dwarf_Small  *   dw_address_size,
    Dwarf_Small  *   dw_segment_selector_size,
    Dwarf_Unsigned * dw_offset_entry_count,
    Dwarf_Unsigned * dw_offset_of_offset_array,
    Dwarf_Unsigned * dw_offset_of_first_rangeentry,
    Dwarf_Unsigned * dw_offset_past_last_rangeentry,
    Dwarf_Error *    dw_error);

DW_API int dwarf_get_rnglist_rle(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned dw_contextnumber,
    Dwarf_Unsigned dw_entry_offset,
    Dwarf_Unsigned dw_endoffset,
    unsigned int   * dw_entrylen,
    unsigned int   * dw_entry_kind,
    Dwarf_Unsigned * dw_entry_operand1,
    Dwarf_Unsigned * dw_entry_operand2,
    Dwarf_Error    * dw_error);
DW_API int dwarf_get_loclist_c(Dwarf_Attribute dw_attr,
    Dwarf_Loc_Head_c * dw_loclist_head,
    Dwarf_Unsigned   * dw_locentry_count,
    Dwarf_Error      * dw_error);

#define DW_LKIND_expression   0 /* DWARF2,3,4,5 */
#define DW_LKIND_loclist      1 /* DWARF 2,3,4 */
#define DW_LKIND_GNU_exp_list 2 /* GNU DWARF4 .dwo extension */
#define DW_LKIND_loclists     5 /* DWARF5 loclists */
#define DW_LKIND_unknown     99

DW_API int dwarf_get_loclist_head_kind(
    Dwarf_Loc_Head_c dw_loclist_head,
    unsigned int   * dw_lkind,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_locdesc_entry_d(Dwarf_Loc_Head_c dw_loclist_head,
    Dwarf_Unsigned    dw_index,
    Dwarf_Small    *  dw_lle_value_out,
    Dwarf_Unsigned *  dw_rawlowpc,
    Dwarf_Unsigned *  dw_rawhipc,
    Dwarf_Bool     *  dw_debug_addr_unavailable,
    Dwarf_Addr     *  dw_lowpc_cooked,
    Dwarf_Addr     *  dw_hipc_cooked,
    Dwarf_Unsigned *  dw_locexpr_op_count_out,
    Dwarf_Locdesc_c * dw_locentry_out,
    Dwarf_Small    *  dw_loclist_source_out,
    Dwarf_Unsigned *  dw_expression_offset_out,
    Dwarf_Unsigned *  dw_locdesc_offset_out,
    Dwarf_Error    *  dw_error);

DW_API int dwarf_get_locdesc_entry_e(Dwarf_Loc_Head_c dw_loclist_head,
    Dwarf_Unsigned    dw_index,
    Dwarf_Small    *  dw_lle_value_out,
    Dwarf_Unsigned *  dw_rawlowpc,
    Dwarf_Unsigned *  dw_rawhipc,
    Dwarf_Bool     *  dw_debug_addr_unavailable,
    Dwarf_Addr     *  dw_lowpc_cooked,
    Dwarf_Addr     *  dw_hipc_cooked,
    Dwarf_Unsigned *  dw_locexpr_op_count_out,
    Dwarf_Unsigned *  dw_lle_bytecount,
    Dwarf_Locdesc_c * dw_locentry_out,
    Dwarf_Small    *  dw_loclist_source_out,
    Dwarf_Unsigned *  dw_expression_offset_out,
    Dwarf_Unsigned *  dw_locdesc_offset_out,
    Dwarf_Error    *  dw_error);

DW_API int dwarf_get_location_op_value_c(Dwarf_Locdesc_c dw_locdesc,
    Dwarf_Unsigned   dw_index,
    Dwarf_Small    * dw_operator_out,
    Dwarf_Unsigned * dw_operand1,
    Dwarf_Unsigned * dw_operand2,
    Dwarf_Unsigned * dw_operand3,
    Dwarf_Unsigned * dw_offset_for_branch,
    Dwarf_Error*     dw_error);
DW_API int dwarf_loclist_from_expr_c(Dwarf_Debug dw_dbg,
    Dwarf_Ptr      dw_expression_in,
    Dwarf_Unsigned dw_expression_length,
    Dwarf_Half     dw_address_size,
    Dwarf_Half     dw_offset_size,
    Dwarf_Half     dw_dwarf_version,
    Dwarf_Loc_Head_c* dw_loc_head,
    Dwarf_Unsigned  * dw_listlen,
    Dwarf_Error     * dw_error);

DW_API void dwarf_dealloc_loc_head_c(Dwarf_Loc_Head_c dw_head);

/*  These interfaces allow reading the .debug_loclists
    section. Independently of DIEs.
    Normal use of .debug_loclists uses
    dwarf_get_loclist_c() to open access to any kind of location
    or loclist and uses dwarf_loc_head_c_dealloc() to
    deallocate that memory once one is finished with
    that data. So for most purposes you do not need
    to use these functions
    See dwarf_get_loclist_c() to open a Dwarf_Loc_Head_c
    on any type of location list or expression. */

/*  Loads all the loclists headers and
    returns DW_DLV_NO_ENTRY if the section
    is missing or empty.
    Intended to be done quite early and
    it is automatically
    done if .debug_info is loaded.
    Doing it more than once is never necessary
    or harmful. There is no deallocation call
    made visible, deallocation happens
    when dwarf_finish() is called.
    With DW_DLV_OK it returns the number of
    loclists headers in the section through
    loclists_count. */
DW_API int dwarf_load_loclists(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned * dw_loclists_count,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_loclist_offset_index_value(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_context_index,
    Dwarf_Unsigned   dw_offsetentry_index,
    Dwarf_Unsigned * dw_offset_value_out,
    Dwarf_Unsigned * dw_global_offset_value_out,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_loclist_head_basics(Dwarf_Loc_Head_c dw_head,
    Dwarf_Small    * dw_lkind,
    Dwarf_Unsigned * dw_lle_count,
    Dwarf_Unsigned * dw_loclists_version,
    Dwarf_Unsigned * dw_loclists_index_returned,
    Dwarf_Unsigned * dw_bytes_total_in_rle,
    Dwarf_Half     * dw_offset_size,
    Dwarf_Half     * dw_address_size,
    Dwarf_Half     * dw_segment_selector_size,
    Dwarf_Unsigned * dw_overall_offset_of_this_context,
    Dwarf_Unsigned * dw_total_length_of_this_context,
    Dwarf_Unsigned * dw_offset_table_offset,
    Dwarf_Unsigned * dw_offset_table_entrycount,
    Dwarf_Bool     * dw_loclists_base_present,
    Dwarf_Unsigned * dw_loclists_base,
    Dwarf_Bool     * dw_loclists_base_address_present,
    Dwarf_Unsigned * dw_loclists_base_address,
    Dwarf_Bool     * dw_loclists_debug_addr_base_present,
    Dwarf_Unsigned * dw_loclists_debug_addr_base,
    Dwarf_Unsigned * dw_offset_this_lle_area,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_loclist_context_basics(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_index,
    Dwarf_Unsigned * dw_header_offset,
    Dwarf_Small    * dw_offset_size,
    Dwarf_Small    * dw_extension_size,
    unsigned int   * dw_version,
    Dwarf_Small    * dw_address_size,
    Dwarf_Small    * dw_segment_selector_size,
    Dwarf_Unsigned * dw_offset_entry_count,
    Dwarf_Unsigned * dw_offset_of_offset_array,
    Dwarf_Unsigned * dw_offset_of_first_locentry,
    Dwarf_Unsigned * dw_offset_past_last_locentry,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_loclist_lle( Dwarf_Debug dw_dbg,
    Dwarf_Unsigned   dw_contextnumber,
    Dwarf_Unsigned   dw_entry_offset,
    Dwarf_Unsigned   dw_endoffset,
    unsigned int   * dw_entrylen,
    unsigned int   * dw_entry_kind,
    Dwarf_Unsigned * dw_entry_operand1,
    Dwarf_Unsigned * dw_entry_operand2,
    Dwarf_Unsigned * dw_expr_ops_blocksize,
    Dwarf_Unsigned * dw_expr_ops_offset,
    Dwarf_Small   ** dw_expr_opsdata,
    Dwarf_Error    * dw_error);
DW_API int dwarf_debug_addr_table(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned    dw_section_offset,
    Dwarf_Debug_Addr_Table *dw_table_header,
    Dwarf_Unsigned   *dw_length,
    Dwarf_Half       *dw_version,
    Dwarf_Small      *dw_address_size,
    Dwarf_Unsigned   *dw_at_addr_base,
    Dwarf_Unsigned   *dw_entry_count,
    Dwarf_Unsigned   *dw_next_table_offset,
    Dwarf_Error      *dw_error);

DW_API int dwarf_debug_addr_by_index(Dwarf_Debug_Addr_Table dw_dat,
    Dwarf_Unsigned    dw_entry_index,
    Dwarf_Unsigned   *dw_address,
    Dwarf_Error      *dw_error);

DW_API void dwarf_dealloc_debug_addr_table(
    Dwarf_Debug_Addr_Table dw_dat);

DW_API int dwarf_get_macro_context(Dwarf_Die dw_die,
    Dwarf_Unsigned      * dw_version_out,
    Dwarf_Macro_Context * dw_macro_context,
    Dwarf_Unsigned      * dw_macro_unit_offset_out,
    Dwarf_Unsigned      * dw_macro_ops_count_out,
    Dwarf_Unsigned      * dw_macro_ops_data_length_out,
    Dwarf_Error         * dw_error);

DW_API int dwarf_get_macro_context_by_offset(Dwarf_Die dw_die,
    Dwarf_Unsigned        dw_offset,
    Dwarf_Unsigned      * dw_version_out,
    Dwarf_Macro_Context * dw_macro_context,
    Dwarf_Unsigned      * dw_macro_ops_count_out,
    Dwarf_Unsigned      * dw_macro_ops_data_length,
    Dwarf_Error         * dw_error);

/*  New December 2020. libdwarf 0.1.0
    Sometimes its necessary to know
    a context total length including macro 5 header */
DW_API int dwarf_macro_context_total_length(
    Dwarf_Macro_Context dw_context,
    Dwarf_Unsigned * dw_mac_total_len,
    Dwarf_Error    * dw_error);

DW_API void dwarf_dealloc_macro_context(Dwarf_Macro_Context dw_mc);

DW_API int dwarf_macro_context_head(Dwarf_Macro_Context dw_mc,
    Dwarf_Half     * dw_version,
    Dwarf_Unsigned * dw_mac_offset,
    Dwarf_Unsigned * dw_mac_len,
    Dwarf_Unsigned * dw_mac_header_len,
    unsigned int   * dw_flags,
    Dwarf_Bool     * dw_has_line_offset,
    Dwarf_Unsigned * dw_line_offset,
    Dwarf_Bool     * dw_has_offset_size_64,
    Dwarf_Bool     * dw_has_operands_table,
    Dwarf_Half     * dw_opcode_count,
    Dwarf_Error    * dw_error);

DW_API int dwarf_macro_operands_table(Dwarf_Macro_Context dw_mc,
    Dwarf_Half           dw_index, /* 0 to opcode_count -1 */
    Dwarf_Half         * dw_opcode_number,
    Dwarf_Half         * dw_operand_count,
    const Dwarf_Small ** dw_operand_array,
    Dwarf_Error        * dw_error);

DW_API int dwarf_get_macro_op(Dwarf_Macro_Context dw_macro_context,
    Dwarf_Unsigned       dw_op_number,
    Dwarf_Unsigned     * dw_op_start_section_offset,
    Dwarf_Half         * dw_macro_operator,
    Dwarf_Half         * dw_forms_count,
    const Dwarf_Small ** dw_formcode_array,
    Dwarf_Error        * dw_error);

DW_API int dwarf_get_macro_defundef(
    Dwarf_Macro_Context dw_macro_context,
    Dwarf_Unsigned   dw_op_number,
    Dwarf_Unsigned * dw_line_number,
    Dwarf_Unsigned * dw_index,
    Dwarf_Unsigned * dw_offset,
    Dwarf_Half     * dw_forms_count,
    const char    ** dw_macro_string,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_macro_startend_file(
    Dwarf_Macro_Context dw_macro_context,
    Dwarf_Unsigned   dw_op_number,
    Dwarf_Unsigned * dw_line_number,
    Dwarf_Unsigned * dw_name_index_to_line_tab,
    const char    ** dw_src_file_name,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_macro_import(
    Dwarf_Macro_Context dw_macro_context,
    Dwarf_Unsigned   dw_op_number,
    Dwarf_Unsigned * dw_target_offset,
    Dwarf_Error    * dw_error);
DW_API char* dwarf_find_macro_value_start(char * dw_macro_string);

DW_API int dwarf_get_macro_details(Dwarf_Debug dw_dbg,
    Dwarf_Off             dw_macro_offset,
    Dwarf_Unsigned        dw_maximum_count,
    Dwarf_Signed        * dw_entry_count,
    Dwarf_Macro_Details ** dw_details,
    Dwarf_Error *         dw_error);
```

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DW_API int dwarf_get_fde_list(Dwarf_Debug dw_dbg,
    Dwarf_Cie**      dw_cie_data,
    Dwarf_Signed*    dw_cie_element_count,
    Dwarf_Fde**      dw_fde_data,
    Dwarf_Signed*    dw_fde_element_count,
    Dwarf_Error*     dw_error);
DW_API int dwarf_get_fde_list_eh(Dwarf_Debug dw_dbg,
    Dwarf_Cie**      dw_cie_data,
    Dwarf_Signed*    dw_cie_element_count,
    Dwarf_Fde**      dw_fde_data,
    Dwarf_Signed*    dw_fde_element_count,
    Dwarf_Error*     dw_error);

DW_API void dwarf_dealloc_fde_cie_list(Dwarf_Debug dw_dbg,
    Dwarf_Cie *  dw_cie_data,
    Dwarf_Signed dw_cie_element_count,
    Dwarf_Fde *  dw_fde_data,
    Dwarf_Signed dw_fde_element_count);

DW_API int dwarf_get_fde_range(Dwarf_Fde dw_fde,
    Dwarf_Addr*      dw_low_pc,
    Dwarf_Unsigned*  dw_func_length,
    Dwarf_Small    **dw_fde_bytes,
    Dwarf_Unsigned*  dw_fde_byte_length,
    Dwarf_Off*       dw_cie_offset,
    Dwarf_Signed*    dw_cie_index,
    Dwarf_Off*       dw_fde_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_fde_exception_info(Dwarf_Fde dw_fde,
    Dwarf_Signed*    dw_offset_into_exception_tables,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_cie_of_fde(Dwarf_Fde dw_fde,
    Dwarf_Cie *      dw_cie_returned,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_cie_info_b(Dwarf_Cie dw_cie,
    Dwarf_Unsigned * dw_bytes_in_cie,
    Dwarf_Small*     dw_version,
    char          ** dw_augmenter,
    Dwarf_Unsigned*  dw_code_alignment_factor,
    Dwarf_Signed*    dw_data_alignment_factor,
    Dwarf_Half*      dw_return_address_register_rule,
    Dwarf_Small   ** dw_initial_instructions,
    Dwarf_Unsigned*  dw_initial_instructions_length,
    Dwarf_Half*      dw_offset_size,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_cie_index(Dwarf_Cie dw_cie,
    Dwarf_Signed* dw_index,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_fde_instr_bytes(Dwarf_Fde dw_fde,
    Dwarf_Small   ** dw_outinstrs,
    Dwarf_Unsigned * dw_outlen,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_fde_info_for_all_regs3_b(Dwarf_Fde dw_fde,
    Dwarf_Addr       dw_pc_requested,
    Dwarf_Regtable3* dw_reg_table,
    Dwarf_Addr*      dw_row_pc,
    Dwarf_Bool*      dw_has_more_rows,
    Dwarf_Addr*      dw_subsequent_pc,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_fde_info_for_all_regs3(Dwarf_Fde dw_fde,
    Dwarf_Addr       dw_pc_requested,
    Dwarf_Regtable3* dw_reg_table,
    Dwarf_Addr*      dw_row_pc,
    Dwarf_Error*     dw_error);

/*  See discussion of dw_value_type, libdwarf.h. */
DW_API int dwarf_get_fde_info_for_reg3_c(Dwarf_Fde dw_fde,
    Dwarf_Half       dw_table_column,
    Dwarf_Addr       dw_pc_requested,
    Dwarf_Small    * dw_value_type,
    Dwarf_Unsigned * dw_offset_relevant,
    Dwarf_Unsigned * dw_register,
    Dwarf_Signed   * dw_offset,
    Dwarf_Block    * dw_block_content,
    Dwarf_Addr     * dw_row_pc_out,
    Dwarf_Bool     * dw_has_more_rows,
    Dwarf_Addr     * dw_subsequent_pc,
    Dwarf_Error    * dw_error);

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```
DW_API int dwarf_get_fde_info_for_reg3_b(Dwarf_Fde dw_fde,
    Dwarf_Half       dw_table_column,
    Dwarf_Addr       dw_pc_requested,
    Dwarf_Small    * dw_value_type,
    Dwarf_Unsigned * dw_offset_relevant,
    Dwarf_Unsigned * dw_register,
    Dwarf_Unsigned * dw_offset,
    Dwarf_Block    * dw_block_content,
    Dwarf_Addr     * dw_row_pc_out,
    Dwarf_Bool     * dw_has_more_rows,
    Dwarf_Addr     * dw_subsequent_pc,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_fde_info_for_cfa_reg3_c(Dwarf_Fde dw_fde,
    Dwarf_Addr      dw_pc_requested,
    Dwarf_Small   * dw_value_type,
    Dwarf_Unsigned* dw_offset_relevant,
    Dwarf_Unsigned* dw_register,
    Dwarf_Signed  * dw_offset,
    Dwarf_Block   * dw_block,
    Dwarf_Addr    * dw_row_pc_out,
    Dwarf_Bool    * dw_has_more_rows,
    Dwarf_Addr    * dw_subsequent_pc,
    Dwarf_Error   * dw_error);
DW_API int dwarf_get_fde_info_for_cfa_reg3_b(Dwarf_Fde dw_fde,
    Dwarf_Addr      dw_pc_requested,
    Dwarf_Small   * dw_value_type,
    Dwarf_Unsigned* dw_offset_relevant,
    Dwarf_Unsigned* dw_register,
    Dwarf_Unsigned* dw_offset,
    Dwarf_Block   * dw_block,
    Dwarf_Addr    * dw_row_pc_out,
    Dwarf_Bool    * dw_has_more_rows,
    Dwarf_Addr    * dw_subsequent_pc,
    Dwarf_Error   * dw_error);

DW_API int dwarf_get_fde_for_die(Dwarf_Debug dw_dbg,
    Dwarf_Die        dw_subr_die,
    Dwarf_Fde  *     dw_returned_fde,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_fde_n(Dwarf_Fde* dw_fde_data,
    Dwarf_Unsigned   dw_fde_index,
    Dwarf_Fde      * dw_returned_fde,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_fde_at_pc(Dwarf_Fde* dw_fde_data,
    Dwarf_Addr   dw_pc_of_interest,
    Dwarf_Fde  * dw_returned_fde,
    Dwarf_Addr * dw_lopc,
    Dwarf_Addr * dw_hipc,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_cie_augmentation_data(Dwarf_Cie dw_cie,
    Dwarf_Small   ** dw_augdata,
    Dwarf_Unsigned * dw_augdata_len,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_fde_augmentation_data(Dwarf_Fde dw_fde,
    Dwarf_Small   ** dw_augdata,
    Dwarf_Unsigned * dw_augdata_len,
    Dwarf_Error*     dw_error);

DW_API int dwarf_expand_frame_instructions(Dwarf_Cie dw_cie,
    Dwarf_Small     * dw_instructionspointer,
    Dwarf_Unsigned    dw_length_in_bytes,
    Dwarf_Frame_Instr_Head * dw_head,
    Dwarf_Unsigned  * dw_instr_count,
    Dwarf_Error     * dw_error);

DW_API int dwarf_get_frame_instruction(
    Dwarf_Frame_Instr_Head  dw_head,
    Dwarf_Unsigned     dw_instr_index,
    Dwarf_Unsigned  *  dw_instr_offset_in_instrs,
    Dwarf_Small     *  dw_cfa_operation,
    const char      ** dw_fields_description,
    Dwarf_Unsigned  *  dw_u0,
    Dwarf_Unsigned  *  dw_u1,
    Dwarf_Signed    *  dw_s0,
    Dwarf_Signed    *  dw_s1,
    Dwarf_Unsigned  *  dw_code_alignment_factor,
    Dwarf_Signed    *  dw_data_alignment_factor,
    Dwarf_Block     *  dw_expression_block,
    Dwarf_Error     *  dw_error);

DW_API int dwarf_get_frame_instruction_a(
    Dwarf_Frame_Instr_Head dw_/* head*/,
    Dwarf_Unsigned     dw_instr_index,
    Dwarf_Unsigned  *  dw_instr_offset_in_instrs,
    Dwarf_Small     *  dw_cfa_operation,
    const char      ** dw_fields_description,
    Dwarf_Unsigned  *  dw_u0,
    Dwarf_Unsigned  *  dw_u1,
    Dwarf_Unsigned  *  dw_u2,
    Dwarf_Signed    *  dw_s0,
    Dwarf_Signed    *  dw_s1,
    Dwarf_Unsigned  *  dw_code_alignment_factor,
    Dwarf_Signed    *  dw_data_alignment_factor,
    Dwarf_Block     *  dw_expression_block,
    Dwarf_Error     *  dw_error);

DW_API void dwarf_dealloc_frame_instr_head(Dwarf_Frame_Instr_Head
    dw_head);

DW_API int dwarf_fde_section_offset(Dwarf_Debug dw_dbg,
    Dwarf_Fde     dw_in_fde,
    Dwarf_Off   * dw_fde_off,
    Dwarf_Off   * dw_cie_off,
    Dwarf_Error * dw_error);

DW_API int dwarf_cie_section_offset(Dwarf_Debug dw_dbg,
    Dwarf_Cie     dw_in_cie,
    Dwarf_Off   * dw_cie_off,
    Dwarf_Error * dw_error);

DW_API Dwarf_Half dwarf_set_frame_rule_table_size(
    Dwarf_Debug dw_dbg,
    Dwarf_Half  dw_value);
DW_API Dwarf_Half dwarf_set_frame_rule_initial_value(
    Dwarf_Debug dw_dbg,
    Dwarf_Half  dw_value);
DW_API Dwarf_Half dwarf_set_frame_cfa_value(
    Dwarf_Debug dw_dbg,
    Dwarf_Half  dw_value);

DW_API Dwarf_Half dwarf_set_frame_same_value(
    Dwarf_Debug dw_dbg,
    Dwarf_Half  dw_value);
DW_API Dwarf_Half dwarf_set_frame_undefined_value(
    Dwarf_Debug dw_dbg,
    Dwarf_Half  dw_value);
DW_API int dwarf_get_abbrev(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned  dw_offset,
    Dwarf_Abbrev  * dw_returned_abbrev,
    Dwarf_Unsigned* dw_length,
    Dwarf_Unsigned* dw_attr_count,
    Dwarf_Error*    dw_error);

DW_API int dwarf_get_abbrev_tag(Dwarf_Abbrev dw_abbrev,
    Dwarf_Half*  dw_return_tag_number,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_abbrev_code(Dwarf_Abbrev dw_abbrev,
    Dwarf_Unsigned* dw_return_code_number,
    Dwarf_Error*    dw_error);

DW_API int dwarf_get_abbrev_children_flag(Dwarf_Abbrev dw_abbrev,
    Dwarf_Signed*    dw_return_flag,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_abbrev_entry_b(Dwarf_Abbrev dw_abbrev,
    Dwarf_Unsigned   dw_indx,
    Dwarf_Bool       dw_filter_outliers,
    Dwarf_Unsigned * dw_returned_attr_num,
    Dwarf_Unsigned * dw_returned_form,
    Dwarf_Signed   * dw_returned_implicit_const,
    Dwarf_Off      * dw_offset,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_str(Dwarf_Debug dw_dbg,
    Dwarf_Off        dw_offset,
    char**           dw_string,
    Dwarf_Signed *   dw_strlen_of_string,
    Dwarf_Error*     dw_error);

/*  Allows applications to print the .debug_str_offsets
    section.
    Beginning at starting_offset zero,
    returns data about the first table found.
    The value *next_table_offset is the value
    of the next table (if any), one byte past
    the end of the table whose data is returned..
    Returns DW_DLV_NO_ENTRY if the starting offset
    is past the end of valid data.

    There is no guarantee that there are no non-0 nonsense
    bytes in the section outside of useful tables,
    so this can fail and return nonsense or
    DW_DLV_ERROR  if such garbage exists.
*/

DW_API int dwarf_open_str_offsets_table_access(Dwarf_Debug dw_dbg,
    Dwarf_Str_Offsets_Table * dw_table_data,
    Dwarf_Error             * dw_error);

DW_API int dwarf_close_str_offsets_table_access(
    Dwarf_Str_Offsets_Table  dw_table_data,
    Dwarf_Error            * dw_error);

DW_API int dwarf_next_str_offsets_table(
    Dwarf_Str_Offsets_Table dw_table_data,
    Dwarf_Unsigned * dw_unit_length,
    Dwarf_Unsigned * dw_unit_length_offset,
    Dwarf_Unsigned * dw_table_start_offset,
    Dwarf_Half     * dw_entry_size,
    Dwarf_Half     * dw_version,
    Dwarf_Half     * dw_padding,
    Dwarf_Unsigned * dw_table_value_count,
    Dwarf_Error    * dw_error);

DW_API int dwarf_str_offsets_value_by_index(
    Dwarf_Str_Offsets_Table dw_table_data,
    Dwarf_Unsigned   dw_index_to_entry,
    Dwarf_Unsigned * dw_entry_value,
    Dwarf_Error    * dw_error);

DW_API int dwarf_str_offsets_statistics(
    Dwarf_Str_Offsets_Table dw_table_data,
    Dwarf_Unsigned * dw_wasted_byte_count,
    Dwarf_Unsigned * dw_table_count,
    Dwarf_Error    * dw_error);

DW_API Dwarf_Unsigned dwarf_errno(Dwarf_Error dw_error);
DW_API char* dwarf_errmsg(Dwarf_Error dw_error);
DW_API char* dwarf_errmsg_by_number(Dwarf_Unsigned dw_errornum);

DW_API void  dwarf_error_creation(Dwarf_Debug dw_dbg ,
    Dwarf_Error * dw_error, char * dw_errmsg);

DW_API void dwarf_dealloc_error(Dwarf_Debug dw_dbg,
    Dwarf_Error dw_error);
DW_API void dwarf_dealloc(Dwarf_Debug dw_dbg,
    void* dw_space, Dwarf_Unsigned dw_type);
DW_API int dwarf_get_debug_sup(Dwarf_Debug dw_dbg,
    Dwarf_Half     * dw_version,
    Dwarf_Small    * dw_is_supplementary,
    char          ** dw_filename,
    Dwarf_Unsigned * dw_checksum_len,
    Dwarf_Small   ** dw_checksum,
    Dwarf_Error    * dw_error);
DW_API int dwarf_dnames_header(Dwarf_Debug dw_dbg,
    Dwarf_Off           dw_starting_offset,
    Dwarf_Dnames_Head * dw_dn,
    Dwarf_Off         * dw_offset_of_next_table,
    Dwarf_Error *       dw_error);

DW_API void dwarf_dealloc_dnames(Dwarf_Dnames_Head dw_dn);

DW_API int dwarf_dnames_abbrevtable(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned  dw_index,
    Dwarf_Unsigned *dw_abbrev_offset,
    Dwarf_Unsigned *dw_abbrev_code,
    Dwarf_Unsigned *dw_abbrev_tag,
    Dwarf_Unsigned  dw_array_size,
    Dwarf_Half     *dw_idxattr_array,
    Dwarf_Half     *dw_form_array,
    Dwarf_Unsigned *dw_idxattr_count);

DW_API int dwarf_dnames_sizes(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned * dw_comp_unit_count,
    Dwarf_Unsigned * dw_local_type_unit_count,
    Dwarf_Unsigned * dw_foreign_type_unit_count,
    Dwarf_Unsigned * dw_bucket_count,
    Dwarf_Unsigned * dw_name_count,
    /* The following are counted in bytes */
    Dwarf_Unsigned * dw_abbrev_table_size,
    Dwarf_Unsigned * dw_entry_pool_size,
    Dwarf_Unsigned * dw_augmentation_string_size,
    char          ** dw_augmentation_string,
    Dwarf_Unsigned * dw_section_size,
    Dwarf_Half     * dw_table_version,
    Dwarf_Half     * dw_offset_size,
    Dwarf_Error *    dw_error);

DW_API int dwarf_dnames_offsets(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned * dw_header_offset,
    Dwarf_Unsigned * dw_cu_table_offset,
    Dwarf_Unsigned * dw_tu_local_offset,
    Dwarf_Unsigned * dw_foreign_tu_offset,
    Dwarf_Unsigned * dw_bucket_offset,
    Dwarf_Unsigned * dw_hashes_offset,
    Dwarf_Unsigned * dw_stringoffsets_offset,
    Dwarf_Unsigned * dw_entryoffsets_offset,
    Dwarf_Unsigned * dw_abbrev_table_offset,
    Dwarf_Unsigned * dw_entry_pool_offset,
    Dwarf_Error *    dw_error);

DW_API int dwarf_dnames_cu_table(Dwarf_Dnames_Head dw_dn,
    const char        * dw_type,
    Dwarf_Unsigned      dw_index_number,
    Dwarf_Unsigned    * dw_offset,
    Dwarf_Sig8        * dw_sig,
    Dwarf_Error       * dw_error);

DW_API int dwarf_dnames_bucket(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned      dw_bucket_number,
    Dwarf_Unsigned    * dw_index,
    Dwarf_Unsigned    * dw_indexcount,
    Dwarf_Error *       dw_error);

DW_API int dwarf_dnames_name(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned      dw_name_index,
    Dwarf_Unsigned    * dw_bucket_number,
    Dwarf_Unsigned    * dw_hash_value,
    Dwarf_Unsigned    * dw_offset_to_debug_str,
    char *            * dw_ptrtostr,
    Dwarf_Unsigned    * dw_offset_in_entrypool,
    Dwarf_Unsigned    * dw_abbrev_number,
    Dwarf_Half        * dw_abbrev_tag,
    Dwarf_Unsigned      dw_array_size,
    Dwarf_Half        * dw_idxattr_array,
    Dwarf_Half        * dw_form_array,
    Dwarf_Unsigned    * dw_idxattr_count,
    Dwarf_Error *       dw_error);

DW_API int dwarf_dnames_entrypool(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned   dw_offset_in_entrypool,
    Dwarf_Unsigned * dw_abbrev_code,
    Dwarf_Half     * dw_tag,
    Dwarf_Unsigned * dw_value_count,
    Dwarf_Unsigned * dw_index_of_abbrev,
    Dwarf_Unsigned * dw_offset_of_initial_value,
    Dwarf_Error    * dw_error);

DW_API int dwarf_dnames_entrypool_values(Dwarf_Dnames_Head dw_dn,
    Dwarf_Unsigned  dw_index_of_abbrev,
    Dwarf_Unsigned  dw_offset_in_entrypool_of_values,
    Dwarf_Unsigned  dw_arrays_length,
    Dwarf_Half     *dw_array_idx_number,
    Dwarf_Half     *dw_array_form,
    Dwarf_Unsigned *dw_array_of_offsets,
    Dwarf_Sig8     *dw_array_of_signatures,
    Dwarf_Bool     *dw_single_cu,
    Dwarf_Unsigned *dw_cu_offset,
    Dwarf_Unsigned *dw_offset_of_next_entrypool,
    Dwarf_Error    *dw_error);

DW_API int dwarf_get_aranges(Dwarf_Debug dw_dbg,
    Dwarf_Arange**   dw_aranges,
    Dwarf_Signed *   dw_arange_count,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_arange(Dwarf_Arange* dw_aranges,
    Dwarf_Unsigned   dw_arange_count,
    Dwarf_Addr       dw_address,
    Dwarf_Arange *   dw_returned_arange,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_cu_die_offset(Dwarf_Arange dw_arange,
    Dwarf_Off  * dw_return_offset,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_arange_cu_header_offset(Dwarf_Arange dw_arange,
    Dwarf_Off  * dw_return_cu_header_offset,
    Dwarf_Error* dw_error);

DW_API int dwarf_get_arange_info_b(Dwarf_Arange dw_arange,
    Dwarf_Unsigned*  dw_segment,
    Dwarf_Unsigned*  dw_segment_entry_size,
    Dwarf_Addr    *  dw_start,
    Dwarf_Unsigned*  dw_length,
    Dwarf_Off     *  dw_cu_die_offset,
    Dwarf_Error   *  dw_error );
DW_API int dwarf_get_globals(Dwarf_Debug dw_dbg,
    Dwarf_Global** dw_globals,
    Dwarf_Signed * dw_number_of_globals,
    Dwarf_Error  * dw_error);

#define DW_GL_GLOBALS  0 /* .debug_pubnames  and .debug_names */
#define DW_GL_PUBTYPES 1 /* .debug_pubtypes */
/* the following are IRIX ONLY */
#define DW_GL_FUNCS    2 /* .debug_funcnames */
#define DW_GL_TYPES    3 /* .debug_typenames */
#define DW_GL_VARS     4 /* .debug_varnames */
#define DW_GL_WEAKS    5 /* .debug_weaknames */
DW_API int dwarf_get_pubtypes(Dwarf_Debug dw_dbg,
    Dwarf_Global** dw_pubtypes,
    Dwarf_Signed * dw_number_of_pubtypes,
    Dwarf_Error  * dw_error);

DW_API int dwarf_globals_by_type(Dwarf_Debug dw_dbg,
    int              dw_requested_section,
    Dwarf_Global   **dw_contents,
    Dwarf_Signed    *dw_count,
    Dwarf_Error     *dw_error);

DW_API void dwarf_globals_dealloc(Dwarf_Debug dw_dbg,
    Dwarf_Global* dw_global_like,
    Dwarf_Signed  dw_count);

DW_API int dwarf_globname(Dwarf_Global dw_global,
    char       ** dw_returned_name,
    Dwarf_Error* dw_error);

DW_API int dwarf_global_die_offset(Dwarf_Global dw_global,
    Dwarf_Off   * dw_die_offset,
    Dwarf_Error * dw_error);

DW_API int dwarf_global_cu_offset(Dwarf_Global dw_global,
    Dwarf_Off*       dw_cu_header_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_global_name_offsets(Dwarf_Global dw_global,
    char    **       dw_returned_name,
    Dwarf_Off*       dw_die_offset,
    Dwarf_Off*       dw_cu_die_offset,
    Dwarf_Error*     dw_error);

DW_API Dwarf_Half dwarf_global_tag_number(Dwarf_Global dw_global);

DW_API int dwarf_get_globals_header(Dwarf_Global dw_global,
    int            * dw_category, /* DW_GL_GLOBAL for example */
    Dwarf_Off      * dw_offset_pub_header,
    Dwarf_Unsigned * dw_length_size,
    Dwarf_Unsigned * dw_length_pub,
    Dwarf_Unsigned * dw_version,
    Dwarf_Unsigned * dw_header_info_offset,
    Dwarf_Unsigned * dw_info_length,
    Dwarf_Error    * dw_error);

DW_API int dwarf_return_empty_pubnames(Dwarf_Debug dw_dbg,
    int          dw_flag);

DW_API int dwarf_get_gnu_index_head(Dwarf_Debug dw_dbg,
    Dwarf_Bool            dw_which_section,
    Dwarf_Gnu_Index_Head *dw_head,
    Dwarf_Unsigned       *dw_index_block_count_out,
    Dwarf_Error          *dw_error);
DW_API void dwarf_gnu_index_dealloc(Dwarf_Gnu_Index_Head dw_head);
DW_API int dwarf_get_gnu_index_block(Dwarf_Gnu_Index_Head dw_head,
    Dwarf_Unsigned  dw_number,
    Dwarf_Unsigned *dw_block_length,
    Dwarf_Half     *dw_version,
    Dwarf_Unsigned *dw_offset_into_debug_info,
    Dwarf_Unsigned *dw_size_of_debug_info_area,
    Dwarf_Unsigned *dw_count_of_index_entries,
    Dwarf_Error    *dw_error);

DW_API int dwarf_get_gnu_index_block_entry(
    Dwarf_Gnu_Index_Head dw_head,
    Dwarf_Unsigned   dw_blocknumber,
    Dwarf_Unsigned   dw_entrynumber,
    Dwarf_Unsigned  *dw_offset_in_debug_info,
    const char     **dw_name_string,
    unsigned char   *dw_flagbyte,
    unsigned char   *dw_staticorglobal,
    unsigned char   *dw_typeofentry,
    Dwarf_Error     *dw_error);

DW_API int dwarf_gdbindex_header(Dwarf_Debug dw_dbg,
    Dwarf_Gdbindex * dw_gdbindexptr,
    Dwarf_Unsigned * dw_version,
    Dwarf_Unsigned * dw_cu_list_offset,
    Dwarf_Unsigned * dw_types_cu_list_offset,
    Dwarf_Unsigned * dw_address_area_offset,
    Dwarf_Unsigned * dw_symbol_table_offset,
    Dwarf_Unsigned * dw_constant_pool_offset,
    Dwarf_Unsigned * dw_section_size,
    const char    ** dw_section_name,
    Dwarf_Error     * dw_error);

DW_API void dwarf_dealloc_gdbindex(Dwarf_Gdbindex dw_gdbindexptr);

DW_API int dwarf_gdbindex_culist_array(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned * dw_list_length,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_culist_entry(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_entryindex,
    Dwarf_Unsigned * dw_cu_offset,
    Dwarf_Unsigned * dw_cu_length,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_types_culist_array(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned * dw_types_list_length,
    Dwarf_Error    * dw_error);

/*  entryindex: 0 to types_list_length -1 */
DW_API int dwarf_gdbindex_types_culist_entry(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_types_entryindex,
    Dwarf_Unsigned * dw_cu_offset,
    Dwarf_Unsigned * dw_tu_offset,
    Dwarf_Unsigned * dw_type_signature,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_addressarea(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned * dw_addressarea_list_length,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_addressarea_entry(
    Dwarf_Gdbindex dw_gdbindexptr,
    Dwarf_Unsigned   dw_entryindex,
    Dwarf_Unsigned * dw_low_address,
    Dwarf_Unsigned * dw_high_address,
    Dwarf_Unsigned * dw_cu_index,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_symboltable_array(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned * dw_symtab_list_length,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_symboltable_entry(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_entryindex,
    Dwarf_Unsigned * dw_string_offset,
    Dwarf_Unsigned * dw_cu_vector_offset,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_cuvector_length(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_cuvector_offset,
    Dwarf_Unsigned * dw_innercount,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_cuvector_inner_attributes(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_cuvector_offset_in,
    Dwarf_Unsigned   dw_innerindex,
    Dwarf_Unsigned * dw_field_value,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_cuvector_instance_expand_value(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_field_value,
    Dwarf_Unsigned * dw_cu_index,
    Dwarf_Unsigned * dw_symbol_kind,
    Dwarf_Unsigned * dw_is_static,
    Dwarf_Error    * dw_error);

DW_API int dwarf_gdbindex_string_by_offset(
    Dwarf_Gdbindex   dw_gdbindexptr,
    Dwarf_Unsigned   dw_stringoffset,
    const char    ** dw_string_ptr,
    Dwarf_Error   *  dw_error);
DW_API int dwarf_get_xu_index_header(Dwarf_Debug dw_dbg,
    const char *  dw_section_type, /* "tu" or "cu" */
    Dwarf_Xu_Index_Header * dw_xuhdr,
    Dwarf_Unsigned        * dw_version_number,
    Dwarf_Unsigned        * dw_section_count,
    Dwarf_Unsigned        * dw_units_count,
    Dwarf_Unsigned        * dw_hash_slots_count,
    const char           ** dw_sect_name,
    Dwarf_Error           * dw_error);

DW_API void dwarf_dealloc_xu_header(Dwarf_Xu_Index_Header dw_xuhdr);

DW_API int dwarf_get_xu_index_section_type(
    Dwarf_Xu_Index_Header dw_xuhdr,
    const char ** dw_typename,
    const char ** dw_sectionname,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_xu_hash_entry(Dwarf_Xu_Index_Header dw_xuhdr,
    Dwarf_Unsigned   dw_index,
    Dwarf_Sig8     * dw_hash_value,
    Dwarf_Unsigned * dw_index_to_sections,
    Dwarf_Error    * dw_error);

/*  Columns 0 to L-1,  valid. */
DW_API int dwarf_get_xu_section_names(Dwarf_Xu_Index_Header dw_xuhdr,
    Dwarf_Unsigned  dw_column_index,
    Dwarf_Unsigned* dw_SECT_number,
    const char   ** dw_SECT_name,
    Dwarf_Error   * dw_error);

DW_API int dwarf_get_xu_section_offset(
    Dwarf_Xu_Index_Header dw_xuhdr,
    Dwarf_Unsigned  dw_row_index,
    Dwarf_Unsigned  dw_column_index,
    Dwarf_Unsigned* dw_sec_offset,
    Dwarf_Unsigned* dw_sec_size,
    Dwarf_Error   * dw_error);

DW_API int dwarf_get_debugfission_for_die(Dwarf_Die dw_die,
    Dwarf_Debug_Fission_Per_CU * dw_percu_out,
    Dwarf_Error                * dw_error);

DW_API int dwarf_get_debugfission_for_key(Dwarf_Debug dw_dbg,
    Dwarf_Sig8                 * dw_hash_sig,
    const char                 * dw_cu_type,
    Dwarf_Debug_Fission_Per_CU * dw_percu_out,
    Dwarf_Error                * dw_error);

/*  END debugfission dwp .debug_cu_index
    and .debug_tu_index meaningful operations. */

DW_API int dwarf_gnu_debuglink(Dwarf_Debug dw_dbg,
    char           ** dw_debuglink_path_returned,
    unsigned char ** dw_crc_returned,
    char           ** dw_debuglink_fullpath_returned,
    unsigned int    * dw_debuglink_path_length_returned,
    unsigned int    * dw_buildid_type_returned,
    char           ** dw_buildid_owner_name_returned,
    unsigned char ** dw_buildid_returned,
    unsigned int    * dw_buildid_length_returned,
    char          *** dw_paths_returned,
    unsigned int    * dw_paths_length_returned,
    Dwarf_Error*      dw_error);

DW_API int dwarf_suppress_debuglink_crc(int dw_suppress);

DW_API int dwarf_add_debuglink_global_path(Dwarf_Debug dw_dbg,
    const char * dw_pathname,
    Dwarf_Error* dw_error);

DW_API int dwarf_crc32(Dwarf_Debug dw_dbg,
    unsigned char * dw_crcbuf,
    Dwarf_Error   * dw_error);

DW_API unsigned int dwarf_basic_crc32(const unsigned char * dw_buf,
    unsigned long dw_len,
    unsigned int  dw_init);
#define DW_HARMLESS_ERROR_CIRCULAR_LIST_DEFAULT_SIZE 4
```

```
DW_API int dwarf_get_harmless_error_list(Dwarf_Debug dw_dbg,
    unsigned int   dw_count,
    const char **  dw_errmsg_ptrs_array,
    unsigned int * dw_newerr_count);

DW_API unsigned int dwarf_set_harmless_error_list_size(
    Dwarf_Debug  dw_dbg,
    unsigned int dw_maxcount);

DW_API void dwarf_insert_harmless_error(Dwarf_Debug dw_dbg,
    char * dw_newerror);
DW_API int dwarf_get_ACCESS_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_ADDR_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_AT_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_ATCF_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_ATE_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_CC_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_CFA_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_children_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_CHILDREN_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_DEFAULTED_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_DS_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_DSC_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_GNUIKIND_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_EH_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_END_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_FORM_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_FRAME_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_GNUIVIS_name(unsigned int dw_val_in,
    const char ** dw_s_out);

DW_API int dwarf_get_ID_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_IDX_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_INL_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_ISA_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LANG_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LLE_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LLEX_name(unsigned int dw_val_in,
    const char ** dw_s_out );

DW_API int dwarf_get_LNAME_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LNCT_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LNE_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_LNS_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_MACINFO_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_MACRO_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_OP_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_ORD_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_RLE_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_SECT_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_TAG_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_UT_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_VIRTUALITY_name(unsigned int dw_val_in,
    const char ** dw_s_out);
DW_API int dwarf_get_VIS_name(unsigned int dw_val_in,
    const char ** dw_s_out);

DW_API int dwarf_get_FORM_CLASS_name(enum Dwarf_Form_Class dw_fc,
    const char ** dw_s_out);
DW_API int dwarf_get_die_section_name(Dwarf_Debug dw_dbg,
    Dwarf_Bool   dw_is_info,
    const char **dw_sec_name,
    Dwarf_Error *dw_error);

DW_API int dwarf_get_die_section_name_b(Dwarf_Die dw_die,
    const char ** dw_sec_name,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_macro_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_sec_name_out,
    Dwarf_Error * dw_err);

DW_API int dwarf_get_real_section_name(Dwarf_Debug dw_dbg,
    const char      * dw_std_section_name,
    const char     ** dw_actual_sec_name_out,
    Dwarf_Small     * dw_marked_zcompressed,
    Dwarf_Small     * dw_marked_zlib_compressed,
    Dwarf_Small     * dw_marked_shf_compressed,
    Dwarf_Unsigned * dw_compressed_length,
    Dwarf_Unsigned * dw_uncompressed_length,
    Dwarf_Error     * dw_error);

DW_API int dwarf_get_frame_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_frame_section_name_eh_gnu(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_aranges_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_ranges_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

/*  These two get the offset or address size as defined
    by the object format (not by DWARF). */
DW_API int dwarf_get_offset_size(Dwarf_Debug dw_dbg,
    Dwarf_Half  *    dw_offset_size,
    Dwarf_Error *    dw_error);

DW_API int dwarf_get_address_size(Dwarf_Debug dw_dbg,
    Dwarf_Half  *    dw_addr_size,
    Dwarf_Error *    dw_error);

DW_API int dwarf_get_string_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_line_section_name(Dwarf_Debug dw_dbg,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_line_section_name_from_die(Dwarf_Die dw_die,
    const char ** dw_section_name_out,
    Dwarf_Error * dw_error);

DW_API int dwarf_get_section_info_by_name_a(Dwarf_Debug dw_dbg,
    const char     * dw_section_name,
    Dwarf_Addr     * dw_section_addr,
    Dwarf_Unsigned* dw_section_size,
    Dwarf_Unsigned* dw_section_flags,
    Dwarf_Unsigned* dw_section_offset,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_section_info_by_name(Dwarf_Debug dw_dbg,
    const char     * dw_section_name,
    Dwarf_Addr     * dw_section_addr,
    Dwarf_Unsigned* dw_section_size,
    Dwarf_Error    * dw_error);

DW_API int dwarf_get_section_info_by_index_a(Dwarf_Debug dw_dbg,
    int              dw_section_index,
    const char **    dw_section_name,
    Dwarf_Addr*      dw_section_addr,
    Dwarf_Unsigned*  dw_section_size,
    Dwarf_Unsigned*  dw_section_flags,
    Dwarf_Unsigned*  dw_section_offset,
    Dwarf_Error*     dw_error);

DW_API int dwarf_get_section_info_by_index(Dwarf_Debug dw_dbg,
    int              dw_section_index,
    const char **    dw_section_name,
    Dwarf_Addr*      dw_section_addr,
    Dwarf_Unsigned*  dw_section_size,
    Dwarf_Error*     dw_error);

DW_API int dwarf_machine_architecture_a(Dwarf_Debug dw_dbg,
    Dwarf_Small    *dw_ftype,
    Dwarf_Small    *dw_obj_pointersize,
    Dwarf_Bool     *dw_obj_is_big_endian,
    Dwarf_Unsigned *dw_obj_machine, /*Elf e_machine */
    Dwarf_Unsigned *dw_obj_type, /* Elf e_type */
    Dwarf_Unsigned *dw_obj_flags,
    Dwarf_Small    *dw_path_source,
    Dwarf_Unsigned *dw_ub_offset,
    Dwarf_Unsigned *dw_ub_count,
    Dwarf_Unsigned *dw_ub_index,
    Dwarf_Unsigned *dw_comdat_groupnumber);

DW_API int dwarf_machine_architecture(Dwarf_Debug dw_dbg,
    Dwarf_Small    *dw_ftype,
    Dwarf_Small    *dw_obj_pointersize,
    Dwarf_Bool     *dw_obj_is_big_endian,
    Dwarf_Unsigned *dw_obj_machine, /*architecture*/
    Dwarf_Unsigned *dw_obj_flags,
    Dwarf_Small    *dw_path_source,
    Dwarf_Unsigned *dw_ub_offset,
    Dwarf_Unsigned *dw_ub_count,
    Dwarf_Unsigned *dw_ub_index,
    Dwarf_Unsigned *dw_comdat_groupnumber);

DW_API Dwarf_Unsigned dwarf_get_section_count(Dwarf_Debug dw_dbg);

DW_API int dwarf_get_section_max_offsets_d(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned * dw_debug_info_size,
    Dwarf_Unsigned * dw_debug_abbrev_size,
    Dwarf_Unsigned * dw_debug_line_size,
    Dwarf_Unsigned * dw_debug_loc_size,
    Dwarf_Unsigned * dw_debug_aranges_size,

    Dwarf_Unsigned * dw_debug_macinfo_size,
    Dwarf_Unsigned * dw_debug_pubnames_size,
    Dwarf_Unsigned * dw_debug_str_size,
    Dwarf_Unsigned * dw_debug_frame_size,
    Dwarf_Unsigned * dw_debug_ranges_size,

    Dwarf_Unsigned * dw_debug_pubtypes_size,
    Dwarf_Unsigned * dw_debug_types_size,
    Dwarf_Unsigned * dw_debug_macro_size,
    Dwarf_Unsigned * dw_debug_str_offsets_size,
    Dwarf_Unsigned * dw_debug_sup_size,

    Dwarf_Unsigned * dw_debug_cu_index_size,
    Dwarf_Unsigned * dw_debug_tu_index_size,
    Dwarf_Unsigned * dw_debug_names_size,
    Dwarf_Unsigned * dw_debug_loclists_size,
    Dwarf_Unsigned * dw_debug_rnglists_size);
DW_API int dwarf_sec_group_sizes(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned *dw_section_count_out,
    Dwarf_Unsigned *dw_group_count_out,
    Dwarf_Unsigned *dw_selected_group_out,
    Dwarf_Unsigned *dw_map_entry_count_out,
    Dwarf_Error    *dw_error);

DW_API int dwarf_sec_group_map(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned  dw_map_entry_count,
    Dwarf_Unsigned *dw_group_numbers_array,
    Dwarf_Unsigned *dw_sec_numbers_array,
    const char    **dw_sec_names_array,
    Dwarf_Error    *dw_error);
DW_API int dwarf_encode_leb128(Dwarf_Unsigned dw_val,
    int  *dw_nbytes,
    char *dw_space,
    int   dw_splen);
DW_API int dwarf_encode_signed_leb128(Dwarf_Signed dw_val,
    int  *dw_nbytes,
    char *dw_space,
    int   dw_splen);
/*  Same for LEB decoding routines.
    caller sets endptr to an address one past the last valid
    address the library should be allowed to
    access. */
DW_API int dwarf_decode_leb128(char *dw_leb,
    Dwarf_Unsigned *dw_leblen,
    Dwarf_Unsigned *dw_outval,
    char           *dw_endptr);
DW_API int dwarf_decode_signed_leb128(char *dw_leb,
    Dwarf_Unsigned *dw_leblen,
    Dwarf_Signed   *dw_outval,
    char           *dw_endptr);
DW_API const char * dwarf_package_version(void);

DW_API int dwarf_set_stringcheck(int dw_stringcheck);

DW_API int dwarf_set_reloc_application(int dw_apply);

DW_API void (*dwarf_get_endian_copy_function(Dwarf_Debug dw_dbg))
    (void *, const void *, unsigned long);

/*  A global flag in libdwarf. Applies to all Dwarf_Debug */
DW_API extern Dwarf_Cmdline_Options dwarf_cmdline_options;

DW_API void dwarf_record_cmdline_options(
    Dwarf_Cmdline_Options dw_dd_options);

DW_API int dwarf_set_de_alloc_flag(int dw_v);

DW_API int dwarf_library_allow_dup_attr(int dw_v);

DW_API Dwarf_Small dwarf_set_default_address_size(
    Dwarf_Debug dw_dbg,
    Dwarf_Small dw_value);

DW_API int dwarf_get_universalbinary_count(
    Dwarf_Debug dw_dbg,
    Dwarf_Unsigned *dw_current_index,
    Dwarf_Unsigned *dw_available_count);

DW_API int dwarf_object_detector_path_b(const char * dw_path,
    char           *dw_outpath_buffer,
    unsigned long   dw_outpathlen,
    char **         dw_gl_pathnames,
    unsigned int    dw_gl_pathcount,
    unsigned int   *dw_ftype,
    unsigned int   *dw_endian,
    unsigned int   *dw_offsetsize,
    Dwarf_Unsigned *dw_filesize,
    unsigned char  *dw_pathsource,
    int * dw_errcode);

/* Solely looks for dSYM */
DW_API int dwarf_object_detector_path_dSYM(const char * dw_path,
    char *          dw_outpath,
    unsigned long   dw_outpath_len,
    char **         dw_gl_pathnames,
    unsigned int    dw_gl_pathcount,
    unsigned int   *dw_ftype,
    unsigned int   *dw_endian,
    unsigned int   *dw_offsetsize,
    Dwarf_Unsigned *dw_filesize,
    unsigned char  *dw_pathsource,
    int *           dw_errcode);

DW_API int dwarf_object_detector_fd(int dw_fd,
    unsigned int   *dw_ftype,
    unsigned int   *dw_endian,
    unsigned int   *dw_offsetsize,
    Dwarf_Unsigned *dw_filesize,
    int            *dw_errcode);
DW_API enum Dwarf_Sec_Alloc_Pref dwarf_set_load_preference(
    enum Dwarf_Sec_Alloc_Pref dw_load_preference);

DW_API int dwarf_get_mmap_count(Dwarf_Debug dw_dbg,
    Dwarf_Unsigned *dw_mmap_count,
    Dwarf_Unsigned *dw_mmap_size,
    Dwarf_Unsigned *dw_malloc_count,
    Dwarf_Unsigned *dw_malloc_size);
#ifdef __cplusplus
}
#endif /* __cplusplus */
#endif /* _LIBDWARF_H */
```

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