

ELF1 1D String Table Section

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- 1 Based on
- 2 String table section

"Study of ELF loading and relocs", 1999

http://netwinder.osuosl.org/users/p/patb/public_html/elf_relocs.html

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Compiling 32-bit program on 64-bit gcc

- `gcc -v`
- `gcc -m32 t.c`
- `sudo apt-get install gcc-multilib`
- `sudo apt-get install g++-multilib`
- `gcc-multilib`
- `g++-multilib`
- `gcc -m32`
- `objdump -m i386`

TOC: String table section

String table (1)

- **string table** sections hold null-terminated character sequences, commonly called strings.
- The object file uses these strings to represent symbol and section names. You reference a string as an index into the **string table** section.

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table (2)

- section name / section header string table section
- symbol string table section

- e_shstrndx
- sh_name
- st_name

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table and ELF header

- `e_shstrndx` in `ELF header` structure type
 - the `section header table` `index` of the entry that is associated with the `section name` `string table`.
 - If the file has *no* `section name` `string table`, this member holds the value `SHN_UNDEF`.

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Section header table and index

- section header table index

| <i>index</i> | <i>entry</i> |
|--------------|---|
| 0 | entry for section 1 |
| 1 | entry for section 2 |
| | ... |
| e_shstrndx | entry for section name string table section |
| | ... |
| n-1 | entry section n |

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Section header table and section name

- section name members in **section header table**

| <i>index</i> | <i>section name member in each entry</i> |
|--------------|---|
| 0 | entry for section 1 - st_name for section 1 name |
| 1 | entry for section 2 - st_name for section 2 name |
| ... | |
| ... | |
| n-1 | entry section n - st_name for section n name |

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table and section header

- **sh_name** in **section header** entry type
 - for the name of a given section
 - its value is an index into the section header (section name) **string table** section giving the location of a null-terminated string.
 - an index into the section header **string table** section
 - that section is designated by the **e_shstrndx** member of the **ELF header**

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Section header string table section

- section header / section name string table section

| <i>index</i> | <i>null terminated string</i> |
|--------------|-------------------------------|
| 0 | \0 |
| at index 1 | section name 1 string |
| at index 2 | section name 2 string |
| ... | ... |
| at index n | section name n string |

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

- **st_name** in **symbol table** entry type
 - An index into the object file's symbol string table, which holds the character representations of the symbol names.
 - If the value is nonzero, it represents a **string table index** that gives the symbol name.
 - Otherwise, the symbol table entry has no name.

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Symbol string table section

- symbol string table section

| <i>index</i> | <i>null terminated string</i> |
|--------------|-------------------------------|
| 0 | \0 |
| at index 1 | symbol name 1 string |
| at index 2 | symbol name 2 string |
| ... | ... |
| at index n | symbol name n string |

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Elf32_Shdr and section name string table

```
typedef struct {
    Elf32_Word  sh_name;  // <--
    Elf32_Word  sh_type;
    Elf32_Word  sh_flags;
    Elf32_Addr  sh_addr;
    Elf32_Off   sh_offset;
    Elf32_Word  sh_size;
    Elf32_Word  sh_link;
    Elf32_Word  sh_info;
    Elf32_Word  sh_addralign;
    Elf32_Word  sh_entsize;
} Elf32_Shdr;
```

- **sh_name** :
holds an index into the section header string table section, as designated by the **e_shstrndx** member of the **ELF header**

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Elf32_Ehdr and section name string table

```
typedef struct {
    unsigned char e_ident[EI_NIDENT];
    Elf32_Half    e_type;
    Elf32_Half    e_machine;
    Elf32_Word    e_version;
    Elf32_Addr    e_entry;
    Elf32_Off     e_phoff;
    Elf32_Off     e_shoff;
    Elf32_Word    e_flags;
    Elf32_Half    e_ehsize;
    Elf32_Half    e_phentsize;
    Elf32_Half    e_phnum;
    Elf32_Half    e_shentsize;
    Elf32_Half    e_shnum;
    Elf32_Half    e_shstrndx; // <--
} Elf32_Ehdr;
```

- `e_shstrndx` : holds an index into the **section header table** of the entry that is associated with the section name **string table**.
- an entry of **section header** is associated with section name **string table** section via `st_name` member of the entry

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table examples (1)

```
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Index | +0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|      0 | \0 | n  | a  | m  | e  | .  | \0 | V  | a  | r  |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|     10 | i  | a  | b  | l  | e  | \0 | a  | b  | l  | e  |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
|     20 | \0 | \0 | x  | x  | \0 |   |   |   |   |   |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
```

| | | | | | | |
|--------|------|------|----------|------|------|------|
| index | 0 | 1 | 7 | 11 | 16 | 24 |
| string | none | name | Variable | able | able | null |

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table examples (2)

- The first byte, which is index zero, holds a null character
- a string table's last byte holds a null character, ensuring null termination for all strings.
- A string whose index is zero specifies either *no name* or a *null name*, depending on the context.

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

String table examples (3)

- An empty string table section is permitted.
- The section header's `sh_size` member will contain zero
- Nonzero indexes are invalid for an empty string table

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

Section of type SHT_STRTAB, SHT_DYNSTR

`sh_type = SHT_STRTAB, SHT_DYNSTR`

- identifies a **string table**
- an object file can have multiple **string table** sections.

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>

the section header index of the associated string table

`sh_type =`

- DYNAMIC
- SHT_SYMTAB, SHT_DYNSYM
- in these sections, `sh_link` represents the **section header index** of the associated **string table**

<https://docs.oracle.com/cd/E19683-01/816-1386/6m7qcoblh/index.html>