

## Section 1 / Defining structs

Given:

```
struct Foo {
    short a;
    char b;
    int c;
};

struct Foo Bar = { 0xaaaa, 0xbb, 0cccccccc };
```

Here is one way of defining and accessing the struct:

```
                .global      main                                // 1
                .text                                              // 2
                .align       2                                    // 3
                                                        // 4
main:                                                    // 5
    str         x30, [sp, 16]!                                    // 6
                                                        // 7
    ldr         x0, =fmt                                          // 8
    ldr         x1, =Bar                                          // 9
    ldrh        w2, [x1]                                          // 10
    ldrb        w3, [x1, 2]                                       // 11
    ldr         w4, [x1, 4]                                       // 12
    bl          printf                                           // 13
                                                        // 14
    ldr         x30, [sp], 16                                     // 15
    mov         w0, wzr                                           // 16
    ret                                                  // 17
                                                        // 18
                .data                                              // 19
                                                        // 20
fmt:            .asciz      "%p a: 0x%x b: 0x%x c: 0x%x\n"      // 21
```

It would be understandable if you don't see where the `struct` is being defined. That's because it isn't. Rather, the implied `+0` on line 10 and the 2 and 4 on lines 11 and 12 are the hard coded offsets into the `struct`.

Here is a second way to define a `struct`.

```
                .global      main                                // 1
                .text                                              // 2
                .align       2                                    // 3
                                                        // 4
                .equ         foo_a, 0          # like #define     // 5
                .equ         foo_b, 2          # like #define     // 6
                .equ         foo_c, 4          # like #define     // 7
```

```

main:                                     // 8
                                           // 9
    str        x30, [sp, 16]!            // 10
                                           // 11
    ldr        x0, =fmt                  // 12
    ldr        x1, =Bar                  // 13
    ldrh       w2, [x1, foo_a]           // 14
    ldrb       w3, [x1, foo_b]           // 15
    ldr        w4, [x1, foo_c]           // 16
    bl         printf                    // 17
                                           // 18
    ldr        x30, [sp], 16             // 19
    mov        w0, wzr                   // 20
    ret                                           // 21
                                           // 22
    .data                                     // 23
                                           // 24
fmt:    .asciz    "%p a: 0x%x b: 0x%x c: 0x%x\n" // 25

```

This method uses `.equ` to make the offsets into symbolic constants. This is just like using `#define` in C and C++. That is, the above is equivalent to the following in C or C++:

```

#define foo_a    0
#define foo_b    2
#define foo_c    4

```

Finally, here is a third way of defining `structs`.

```

.global        main                       // 1
.text                                                  // 2
.align         2                                     // 3
main:                                                  // 4
    str        x30, [sp, 16]!                    // 5
                                           // 6
    ldr        x0, =fmt                          // 7
    ldr        x1, =Bar                          // 8
    ldrh       w2, [x1, Foo.a]                   // 9
    ldrb       w3, [x1, Foo.b]                   // 10
    ldr        w4, [x1, Foo.c]                   // 11
    bl         printf                            // 12
                                           // 13
    ldr        x30, [sp], 16                      // 14
    mov        w0, wzr                          // 15
    ret                                           // 16
                                           // 17
    .section    Foo                              // 18
                                           // 19

```

```

        .struct      0          // a starts at 0 and goes for 2    // 20
Foo.a:   .struct      Foo.a + 2  // b starts at 2 and goes for 2    // 21
Foo.b:   .struct      Foo.b + 2  // c starts at 4                  // 22
Foo.c:                                     // 23
                                     // 24
        .data                                     // 25
                                     // 26
fmt:     .asciz       "%p a: 0x%x b: 0x%x c: 0x%x\n"              // 27

```

This method has a *substantial* benefit over the previous methods. Imagine you need to insert a new field between `Foo.a` and `Foo.b`. Simply do so. If you're using this third method, which is based on relative offsets, the assembler will do the work of adjusting the following offsets for you.