Common Defects in C

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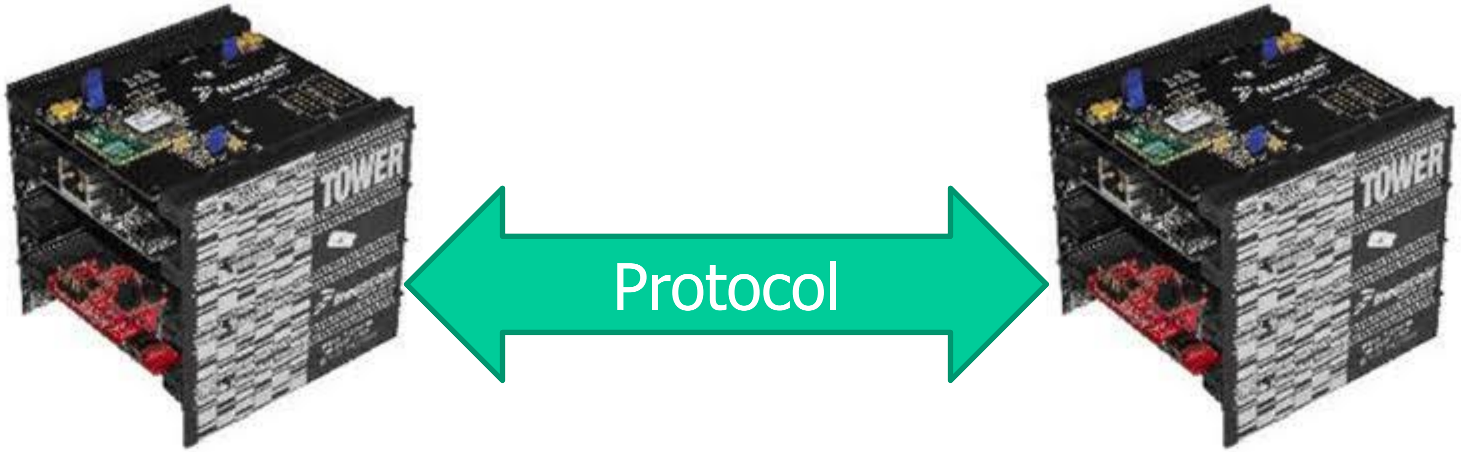
Jan, 2013

Alignment and packing

The device A communicates with device B by a protocol. In this protocol, each transaction conveys a formatted message.



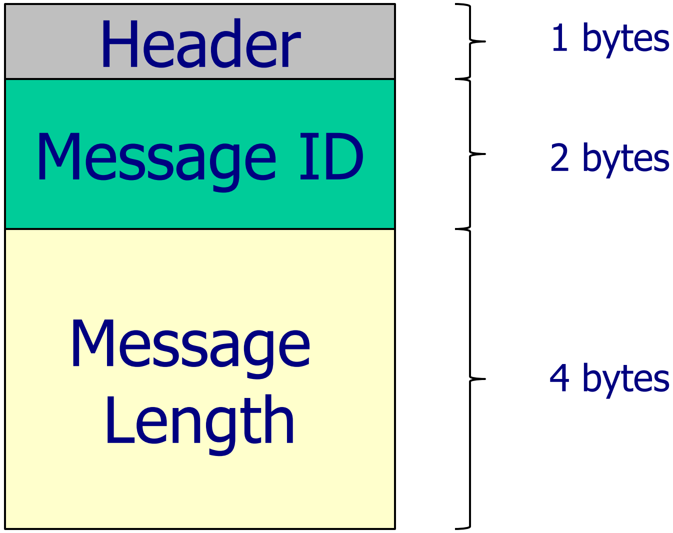
Protocol

Device A

Device B

Alignment and packing (cont)

- The format of message:



Header

Message ID

Message Length

1 bytes

2 bytes

4 bytes

Alignment and packing (cont)

- The solution to get fields of message
  - ★ Create a struct which fields as the message format

```
typedef struct _MESSAGE_HEADER {
          char            head_byte;
          short           message_id;
          unsigned int    length;
} MESSAGE_HEADER, * MESSAGE_HEADER_PTR;
```

  - ★ Declare a pointer which type is above struct and cast to data received

```
void receive_data_complete( void *buffer) /* Buffer is received message data */
{
          MESSAGE_HEADER_PTR p_message_header;
          p_message_header = (MESSAGE_HEADER_PTR)buffer;
          /* Add code here */
}
```

- Are there any problems? If yes, how to fix them???

Alignment and packing (cont)

```
struct  struct1{
        char a;
        short b;
        char c;
}
```

```
struct  struct2{
        char a;
        int b;
        char c;
}
```

```
struct  struct3{
        char a;
        double b;
        char c;
}
```

```
struct  struct4{
        char a;
        double* b;
        char c;
}
```

```
struct  struct5{
        char a;
        struct struct3 b;
        char c;
}
```

- What are the size of these structs?
  (Assumption: int(4 bytes), double(8 bytes))

#define

- #define CUBE(x) x*x*x
  int x = 3;
  what will be CUBE(x + 1)???
- #define DOUBLE(x) x+x
  int x = 3;
  what will be DOUBLE((++x))???
- How to fix it???

#define

- #define max(a,b) ((a) > (b)? (a): (b)) is this always run true???

-
  ```
  biggest = x[0]
  int i = 1;
  while(i<n)
        biggest = max(biggest, x[i++]);
  ```
  biggest will be the biggest number in x array???
- Never pass an expression that has side effects as a macro argument

Overflow and underflow

- int x;
  Consider to x*3/5. What problem in this expression???
- Can be fix that: (x/5)*3 ???
- int x;
  (float) (3/5) * x; ???

const

- const char *p;
  char * const p;
  what is difference???
- const char *p;
  const char p[];
  what is difference???

Type

- unsigned char c;
  c = '\xff';
  if (c != '\xff') printf("Impossible!\n")
  else printf(“Possible!\n")
  what it will print???
- char *p = “ab”;
  char p1[2] = {‘a’, ‘b’};
  are they identical???

Operator

- if(-5 <= x <= 5){…}
  is it wrong???
- what it mean???

-
  ```
  if ( x < 0 ) {
      printf( "Invalid value.\n" );
      exit;
  }
  ```
  is it exit if x is a negative number???

array

- int x[10][10];
  int y = x[++i, ++j];
- C doesn't actually have true multi-dimensional arrays
- x[++i, ++j] ~ *(x+(++j)) which is an address, not an integer.
- In C, always use one pair of [] for each level of array subscripting

Strings and Characters

-
  ```
  char c = ‘\n’
  char *p = “\n”
  printf(“%s”, &c);
  printf(“%s”, p);
  ```
  is it the same???
- How to fix???

Precedence

- r to an 8-bit value whose low-order bits are those of l and whose high-order bits are those of h:
  r = h<<4 + l;
- but the real mean: r = h << (4 + l);
- How to fix???
- r = (h << 4) + l;
- r = h << 4 | l;
- *p++ is ???

Precedence (cont.)

- Arithmetic operators (++, --, +, -, …)
- Shift Operators (<<, >>)
- Relation Operator (==, !=, <, <=, >, >=)
- Logical Operators (&&, ||)
- Assignment Operators

Syntax

-
  ```
  if (xcnt < 2)
        return
  date = x[0];
  time = x[1];
  ```
  what it mean???

-
  ```
  int x = 3;
  int *p = &x;
  int y = x/*p   /* p point to x */;
  ```
  what is value of y???

Syntax (cont.)

-
  ```
  int *g(), (*h)();
  ```
  are these the same???

-
  ```
  struct foo{
          int x;
  }
  f()
  {
          ...
  }
  ```
  what’s problem???

Pointer

-
  ```
  char * curstr;
  char * prvstr;
  curstr = (char *) malloc( 10 );
  prvstr = (char *) malloc( 10 );
  strcpy( curstr, "abc" );
  prvstr = curstr;
  strcpy( curstr, "xyz" );
  ```
  what is prvstr value???
- `*prvstr = *curstr;` ???

Misc

-
  ```
  char *p;
  if(p == (char *) 0) …
  if(strcmp(p, (char *) 0) == 0) …
  ```
  are they the same???

-
  ```
  char c;
  while ((c=getchar()) != EOF)
      putchar(c);
  ```
  what is problem???

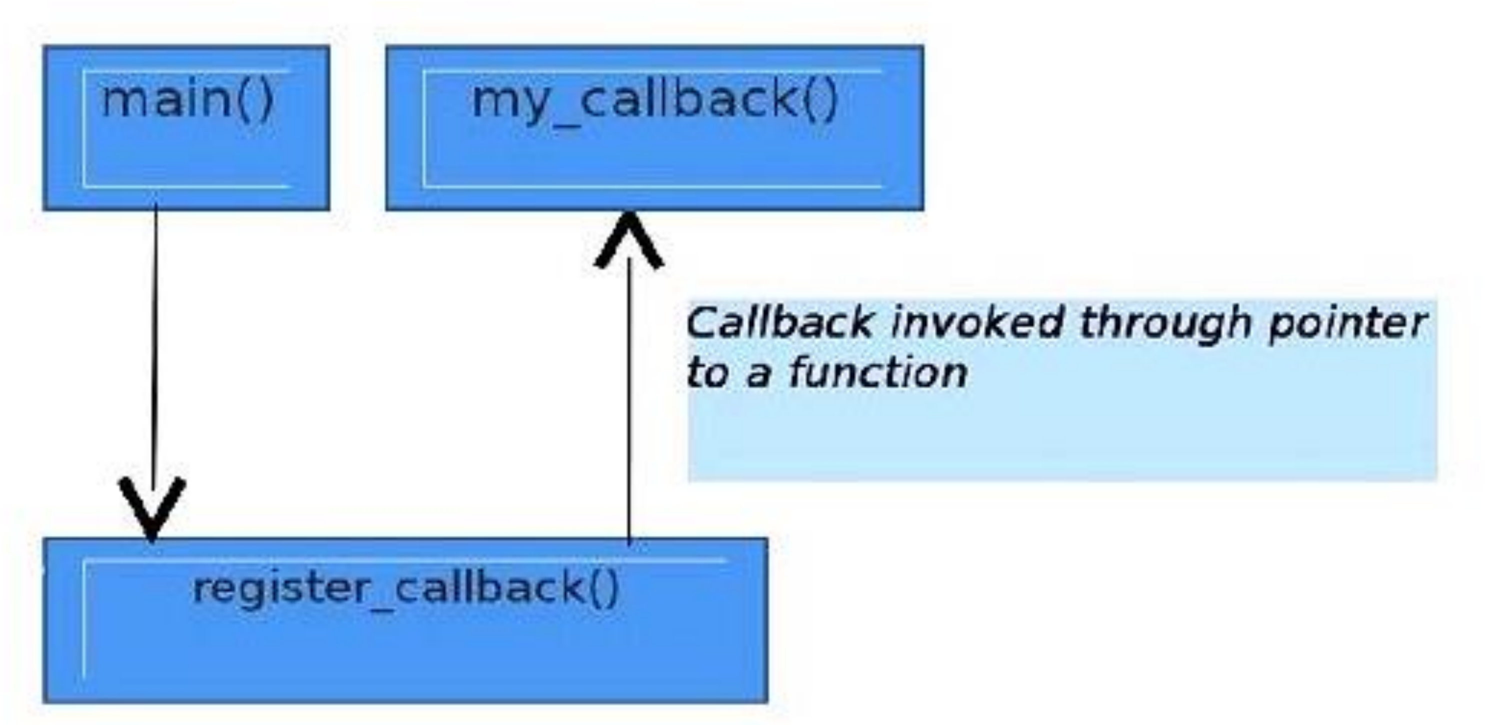
Function pointer

- Definition: Function pointer is a pointer that points to functions
- Declaration:

  <return_type> (* pfunc)(arg1, arg2);
- Purpose
  - Menu implementation
  - Callback function

Function pointer

- Callback function



Thanks for your attention!