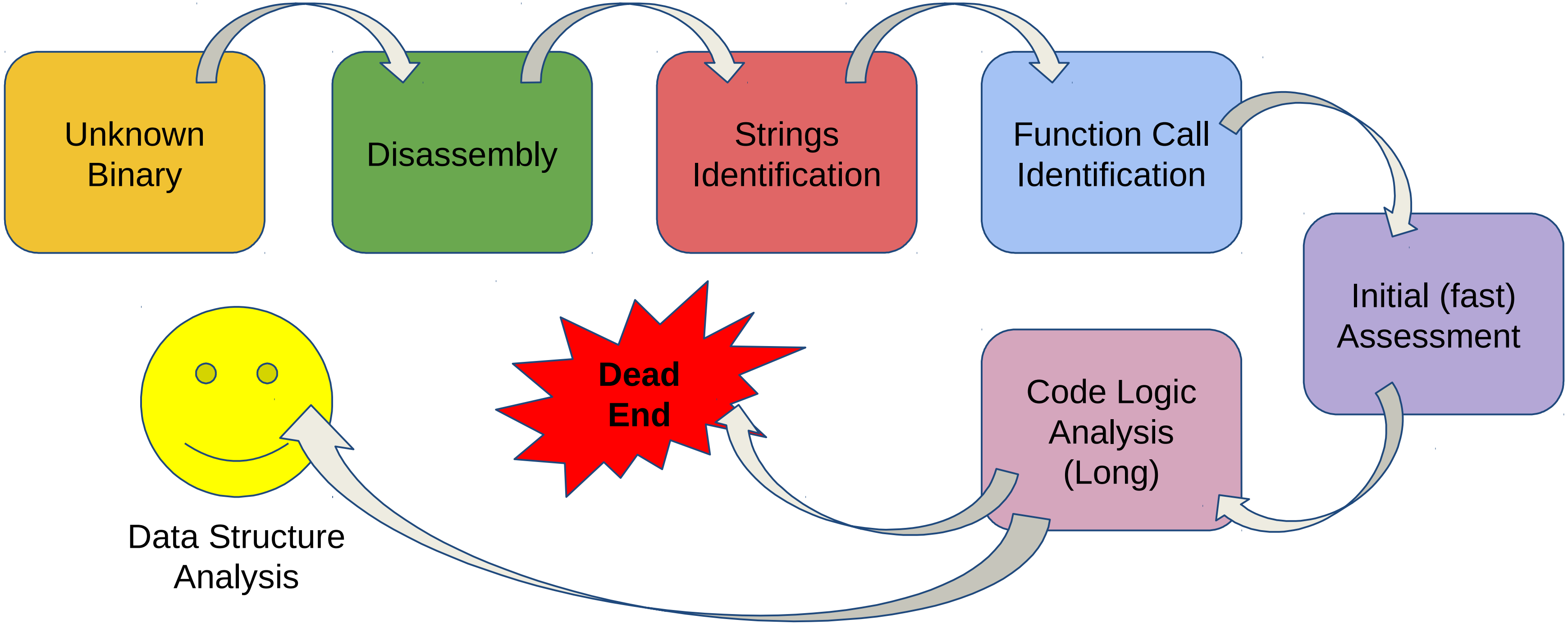
Data structure in assembly

Making sense of base + displacement

Let’s talk about the software reverse engineering process (SRE) for a moment...

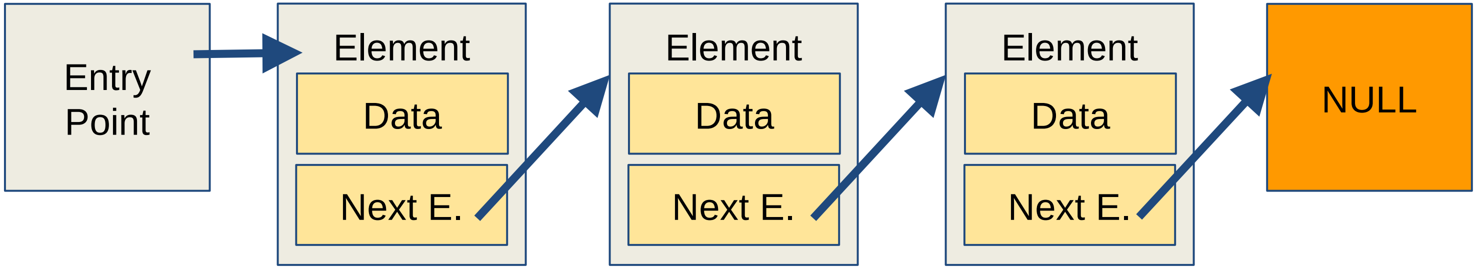
Typical SRE project (static analysis - rough)



Code is typically organised around data structures!

You need to be able to find and make sense of these

Linked list - A quick review



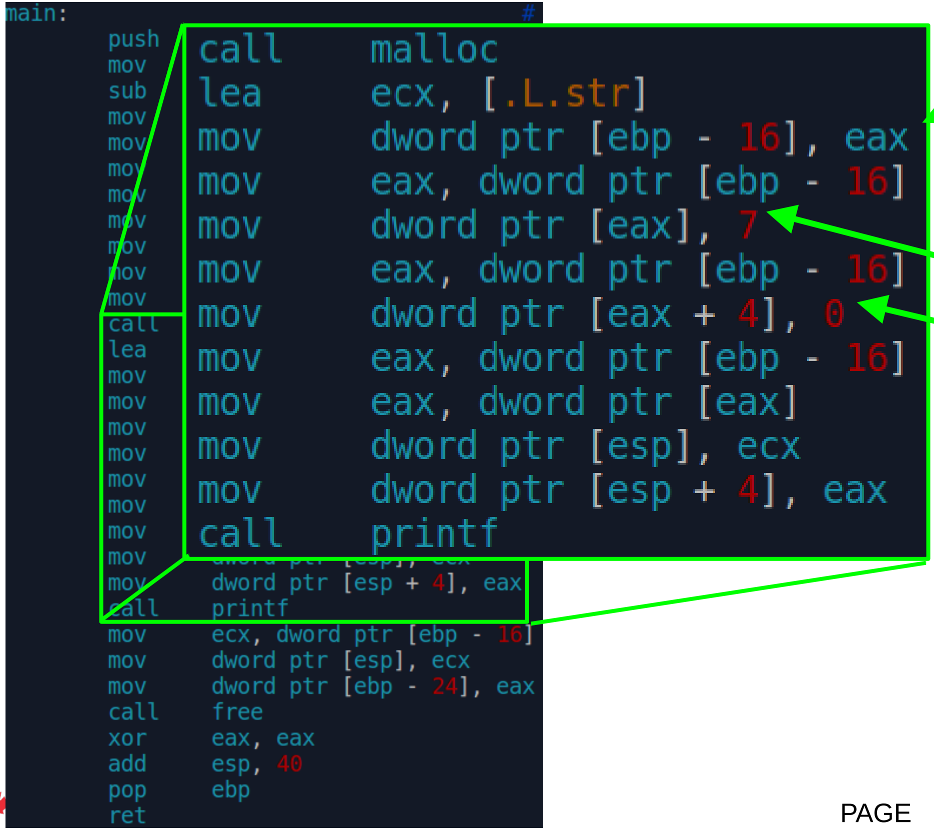
Conceptually, a linked list must have an **entry point** and an **exit point**. Each element is an individual data structure independant one of another. Contrary to a classical array, linked list **elements** are often **located** in **non contiguous memory**. Hence the **need for** "pointers" to **next element**. Operations on these need to be carefully planned as a **break in the "link"** between elements could and will result in **loss of data and memory leaks.**

Linked list - C

```c
#include <stdio.h>
#include <stdlib.h>

struct element{
    int data;
    struct element *next;
};

typedef struct element IntLinkedList;


int main(int argc, char* argv[]){

        IntLinkedList *first = (IntLinkedList*)malloc(sizeof(IntLinkedList));
        first->data = 7;
        first->next = NULL;

        printf("First element data is %d\n", first->data);
        free(first);
        return 0;
}
```

In C, structures have definitions that can be used in accessing data element and next element pointers easily.
That definition is, however, only useful for the programer and the compiler when generating assembly code.
Structures definitions are lost when code is translated to assembly by the compiler.

Linked list - Lost definition



In this example, the **pointer to the buffer** allocated for the first element of the structure is **located at ebp-16**

Here is the definition of our original structure:

```
struct element{
    int data;
    struct element* next;
};
```

The original code was using “data” and “next” to refer to various parts of the element structure. This has been lost and a **base + displacement** memory access is now **required** to reach the various parts of the structure.

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As you can see, any structure can become a real challenge in conducting SRE… Let’s do a quick IDA pro demonstration...

Are there any questions?

Understanding data structures is essential for the next practical exercise and to understand the next topic we will cover.