Verlässliche Echtzeitsysteme

Übungen zur Vorlesung

Dynamische Stackbedarfsanalyse

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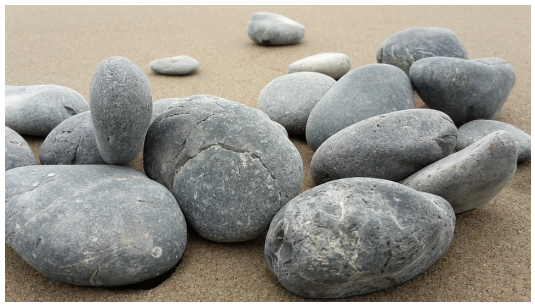
Lehrstuhl Informatik 4 (Verteilte Systeme und Betriebssysteme)
https://www4.cs.fau.de

Sommersemester 2020

Analyse Harter Echtzeitsysteme



- Harte, verlässliche Echtzeitsysteme
  - Garantien über Ressourcenbedarf notwendig
    ☞ statische Analyse unabdingbar
- Mögliche Ressourcen: Speicherbedarf, Laufzeit, etc.
- Übung: Analyse des Stackbedarfs einer Bibliothek
- Stack-Analyse

1. Dynamisch: Wasserstandstechnik
2. Statisch: „Eigenbau“ und aiT (Stack-Analyzer der a^3 Suite)

Beispiel: Programmstapel

```
int main(void) {
  return f(4, 2);
}
```

```
52a:    push ebp
52b:    mov ebp,esp
52d:    lea ...
534:    or ...
538:    lea ...
53f:    push 0x2
541:    push 0x4
543:    call 4fd <f>
548:    add esp,0x8
54b:    leave
54c:    ret
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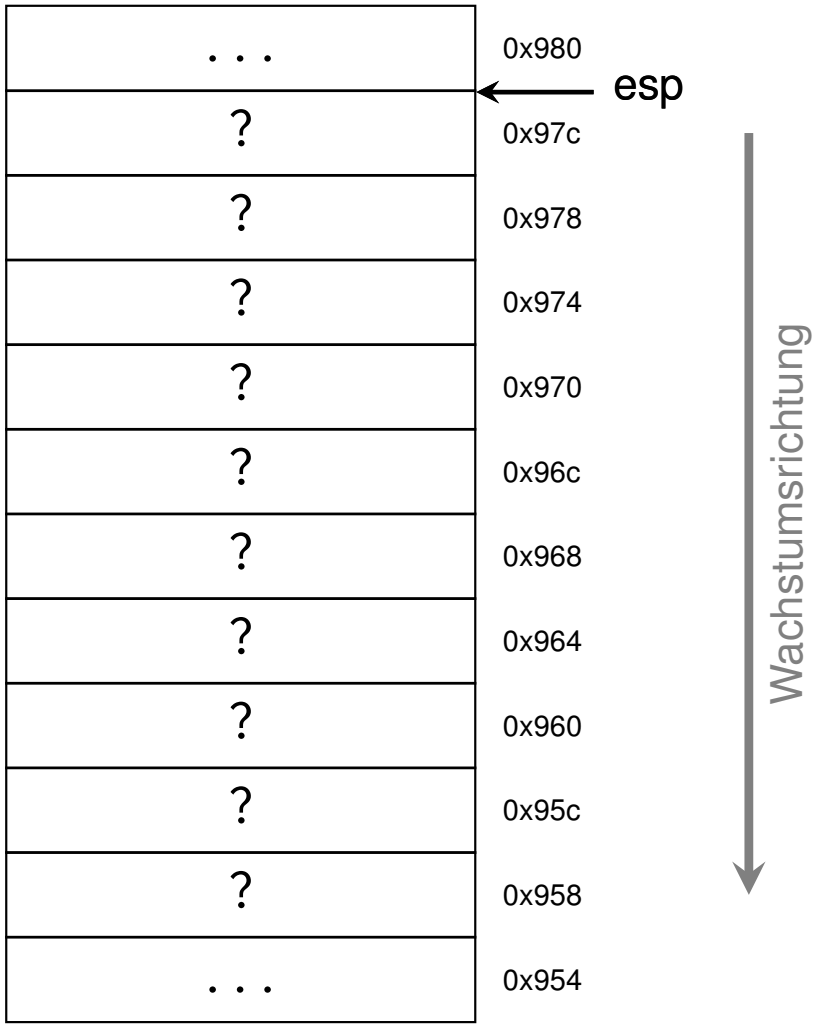

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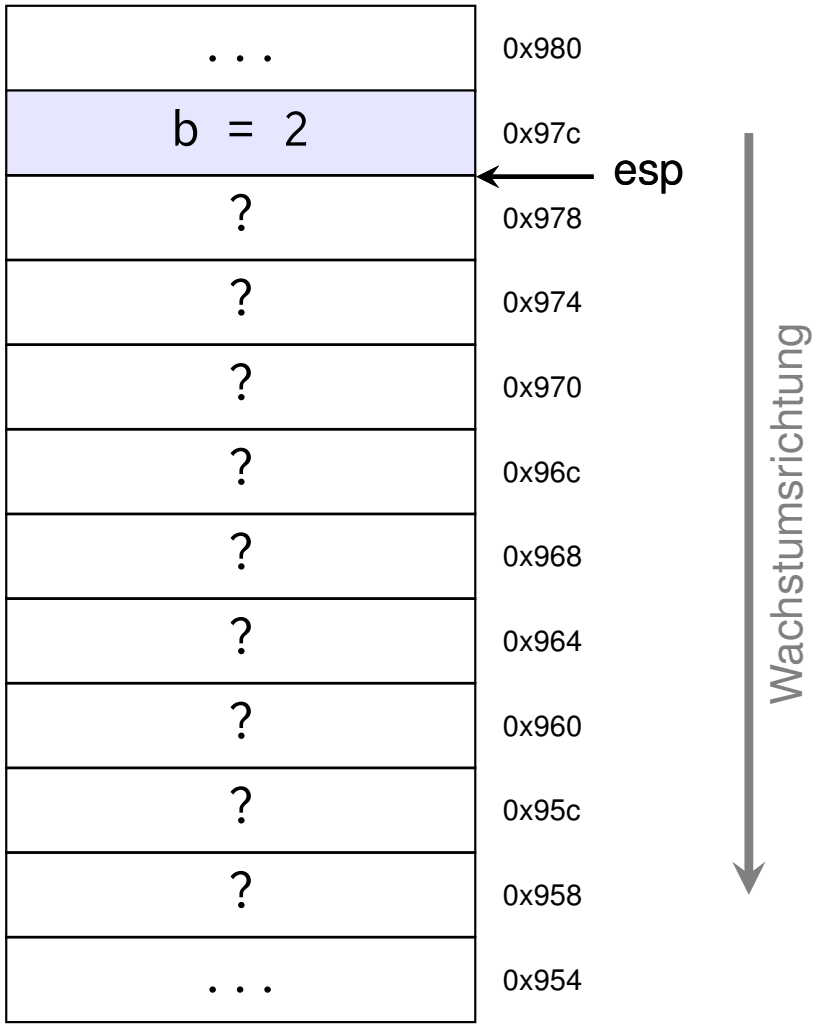

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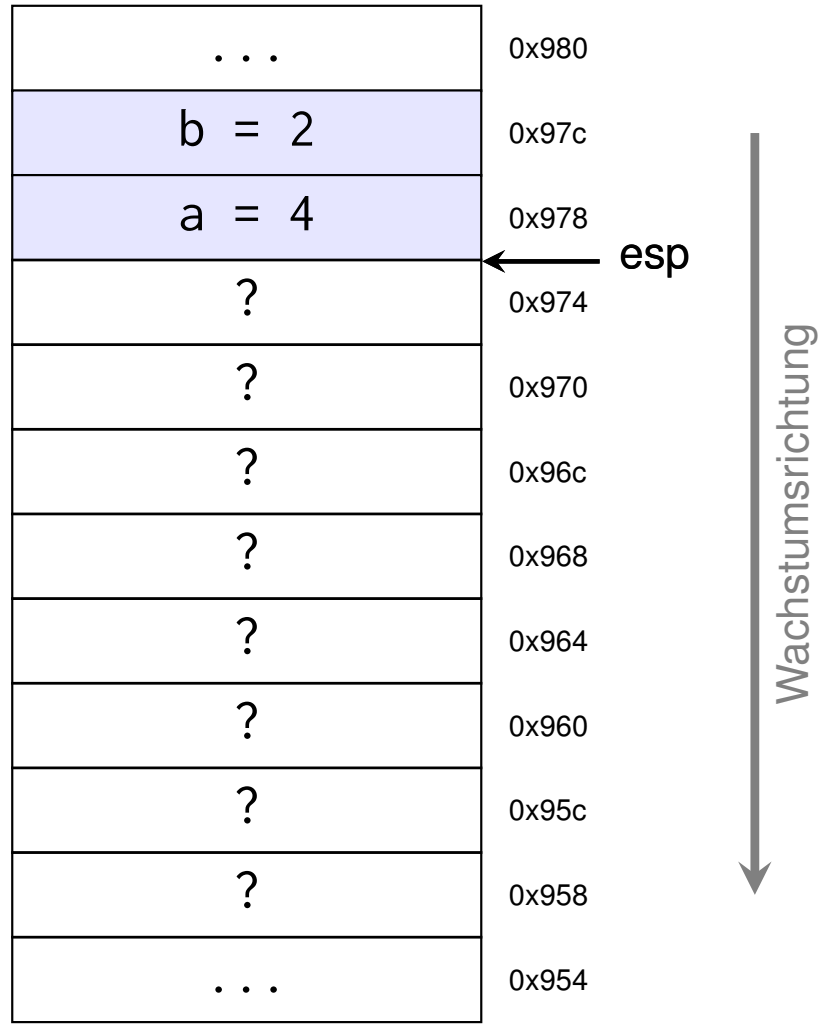

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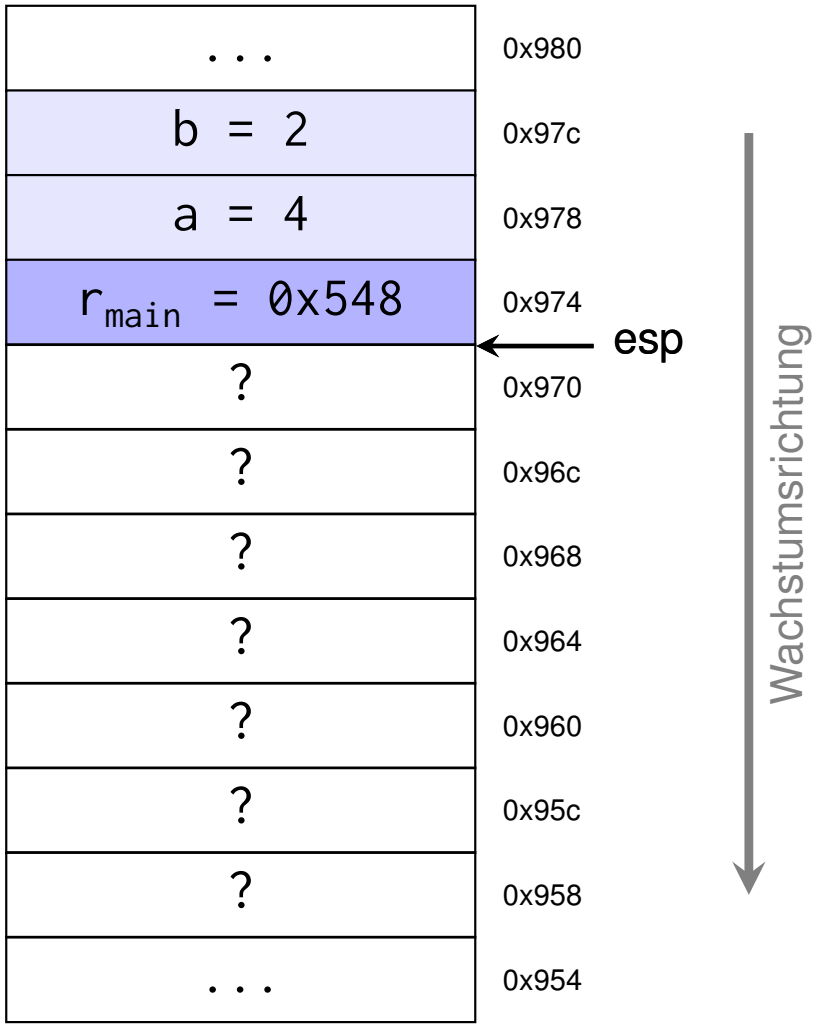

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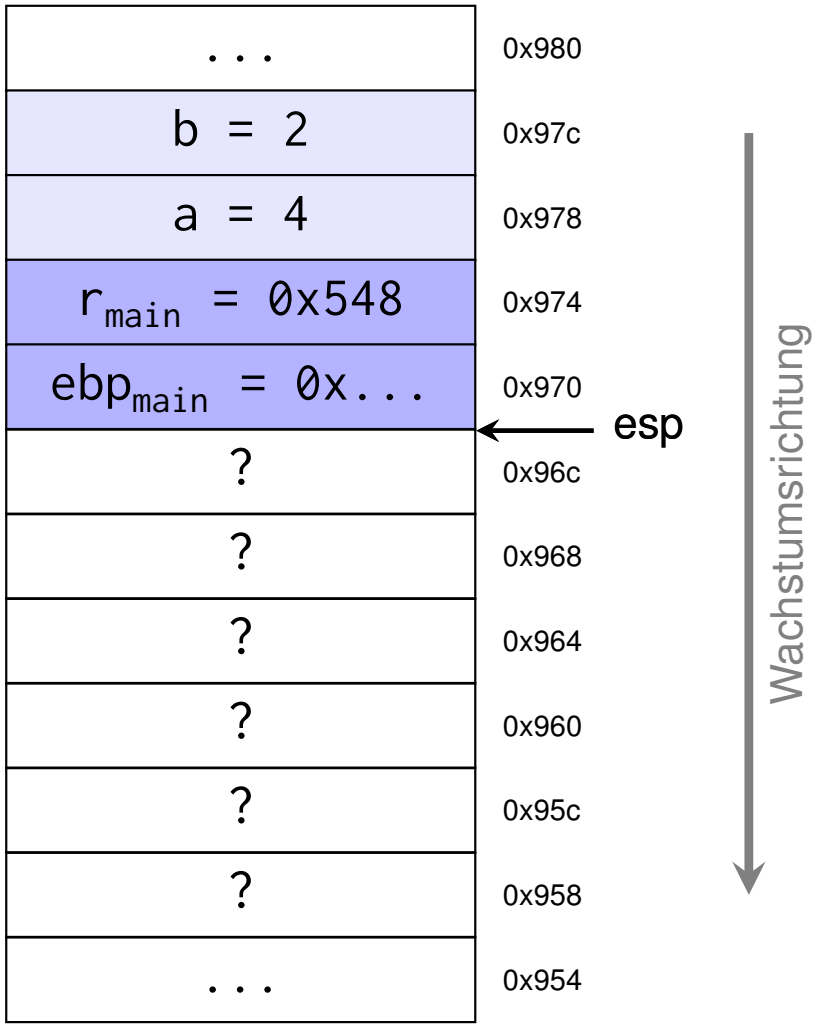

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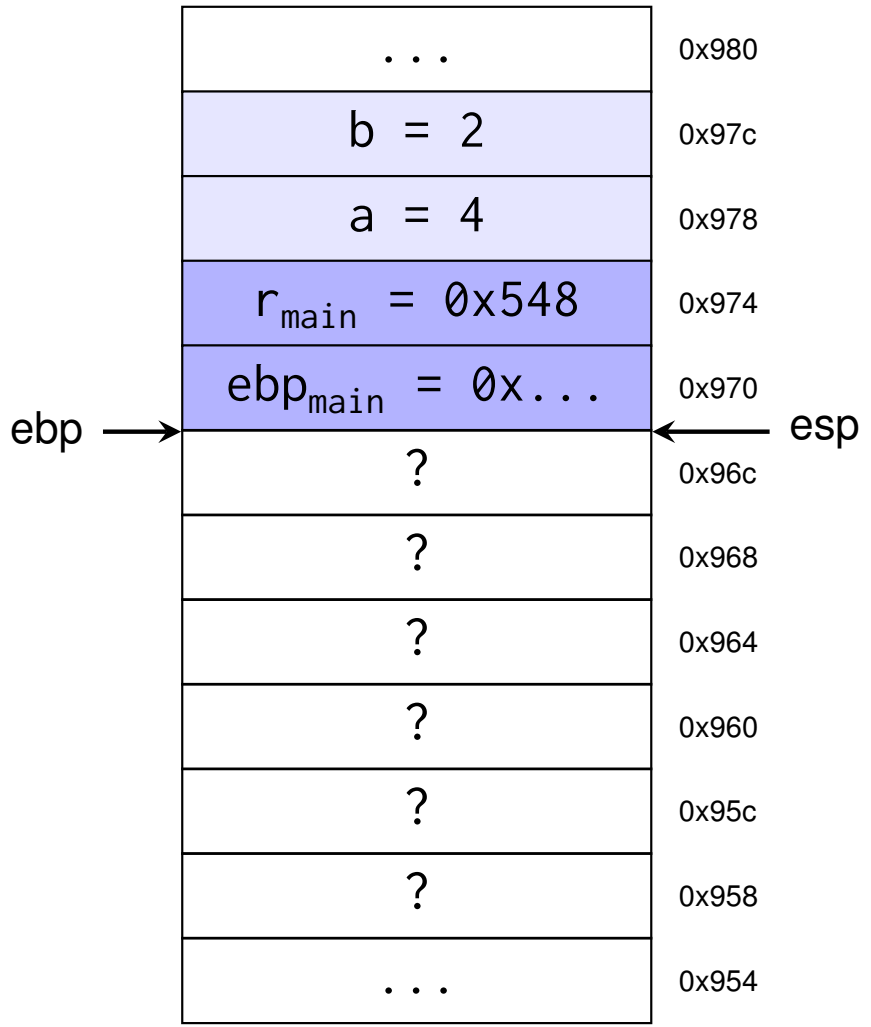

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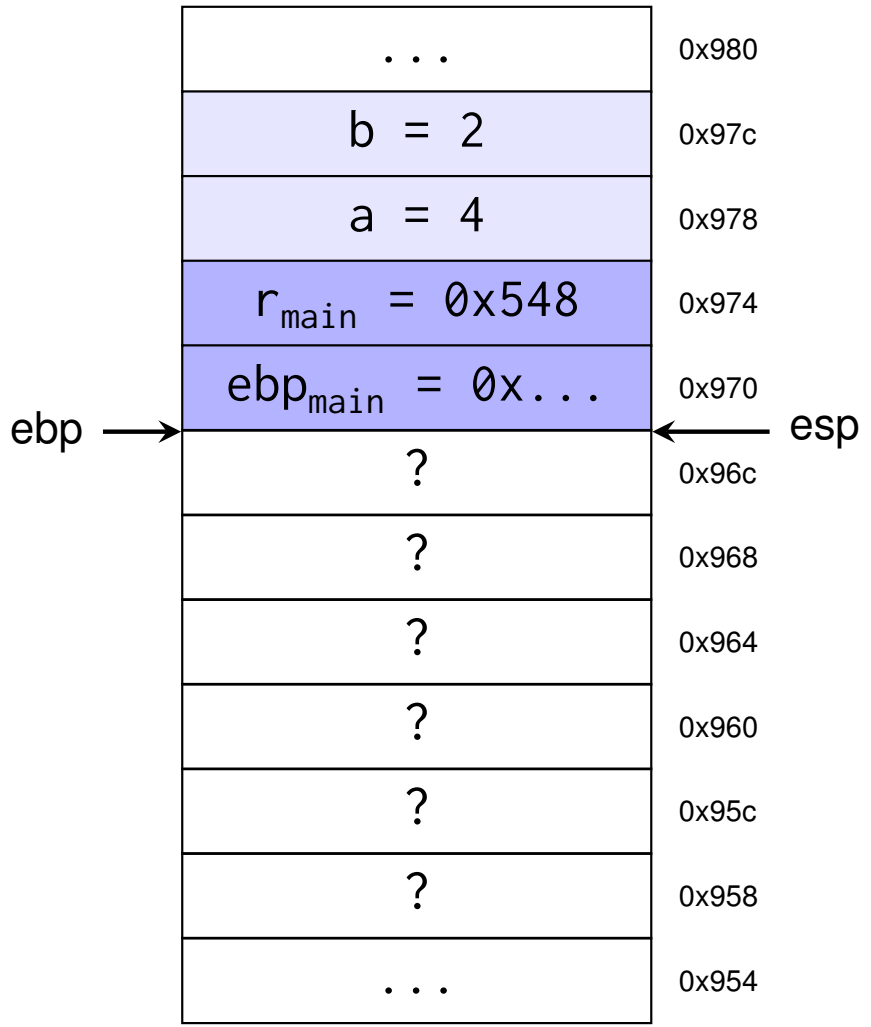

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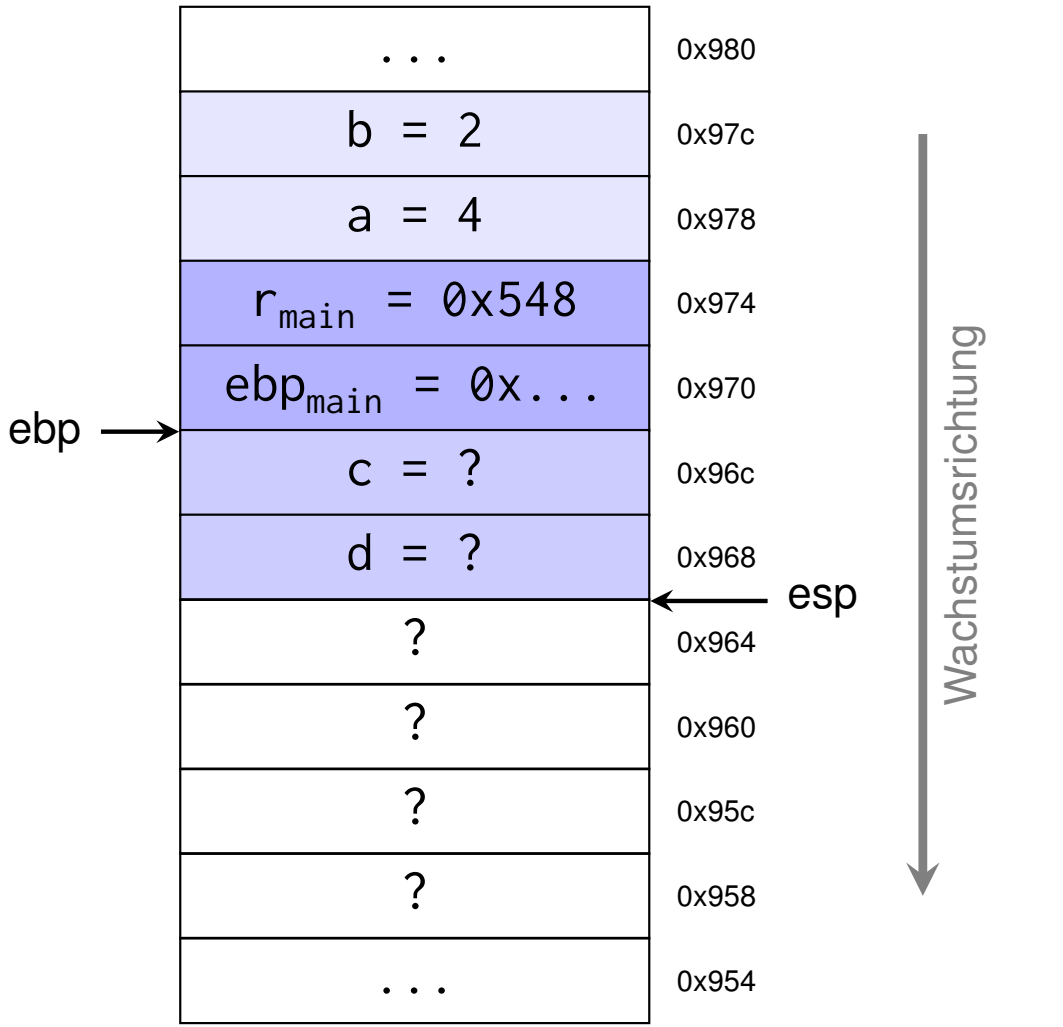

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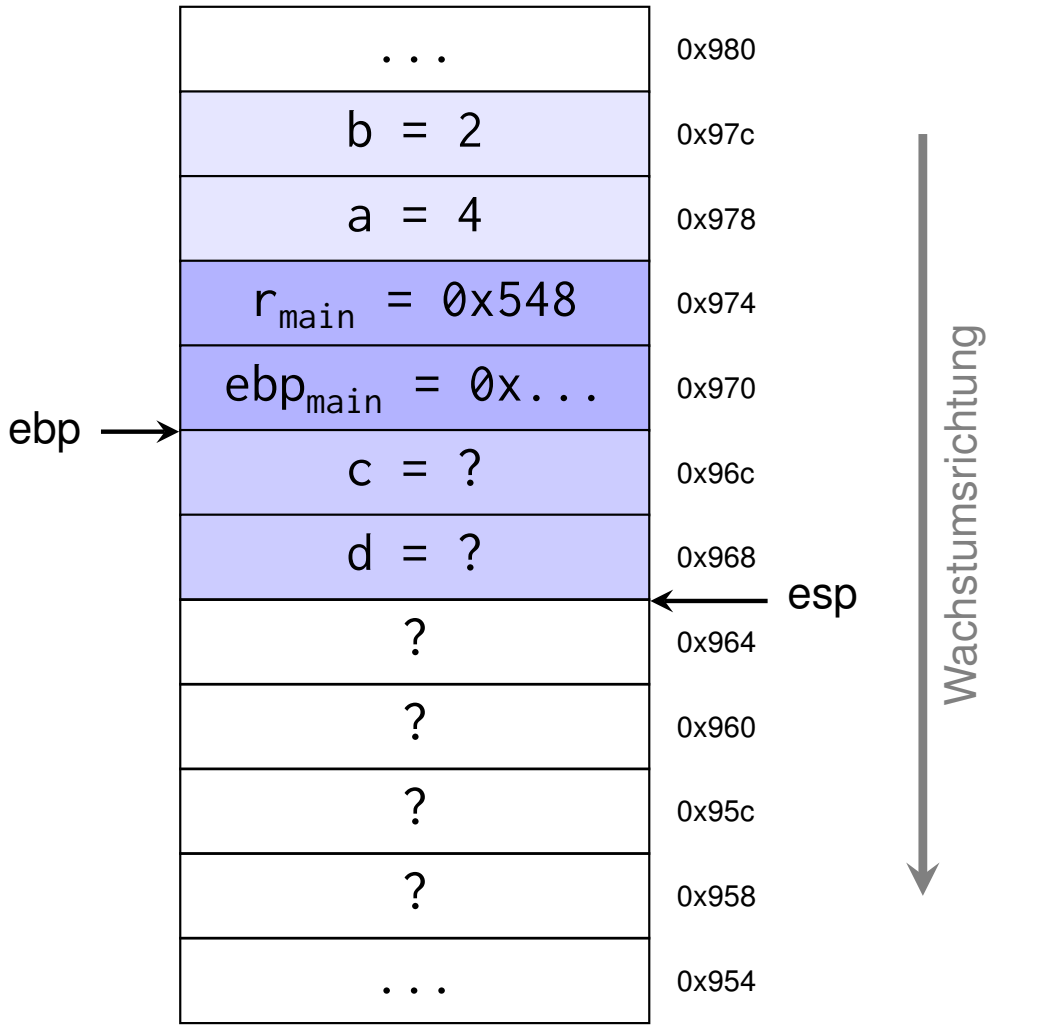

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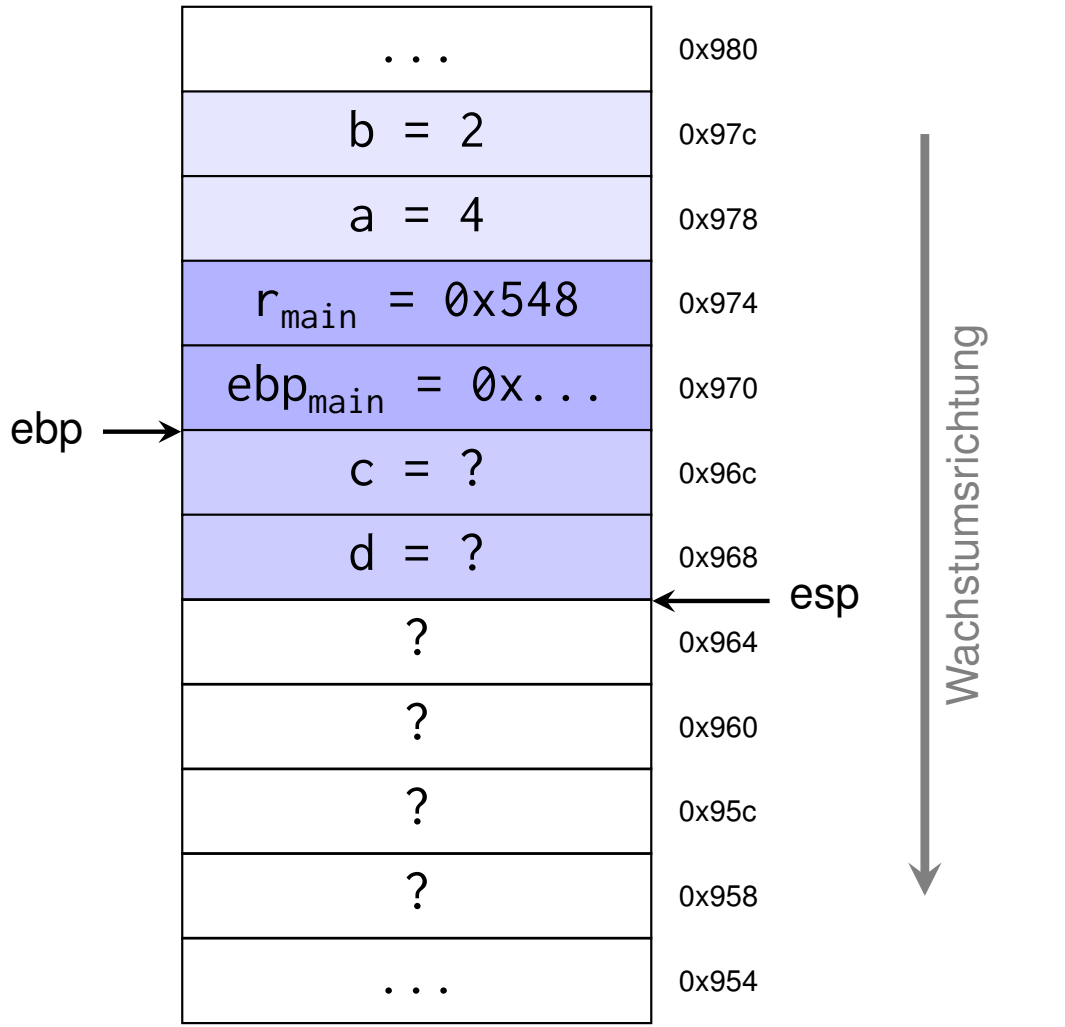

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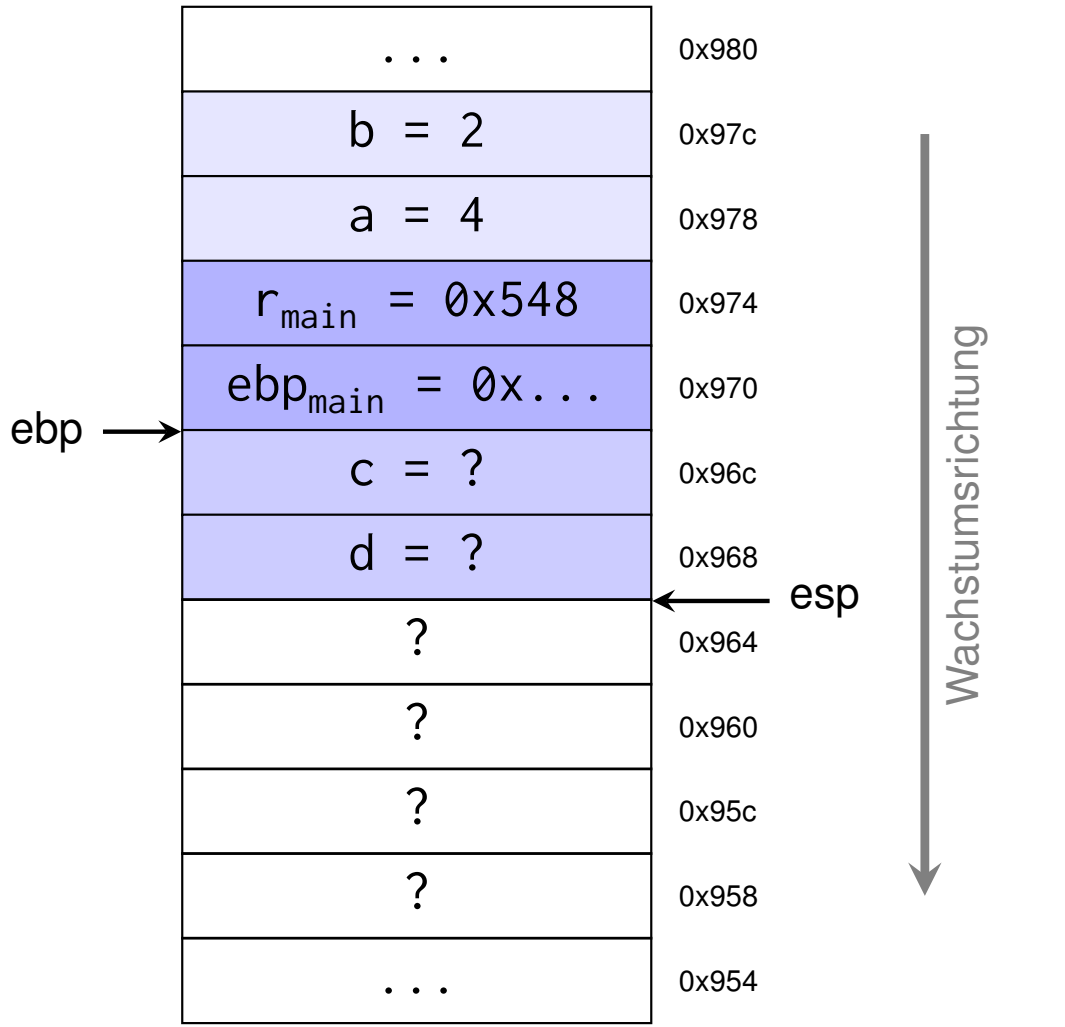

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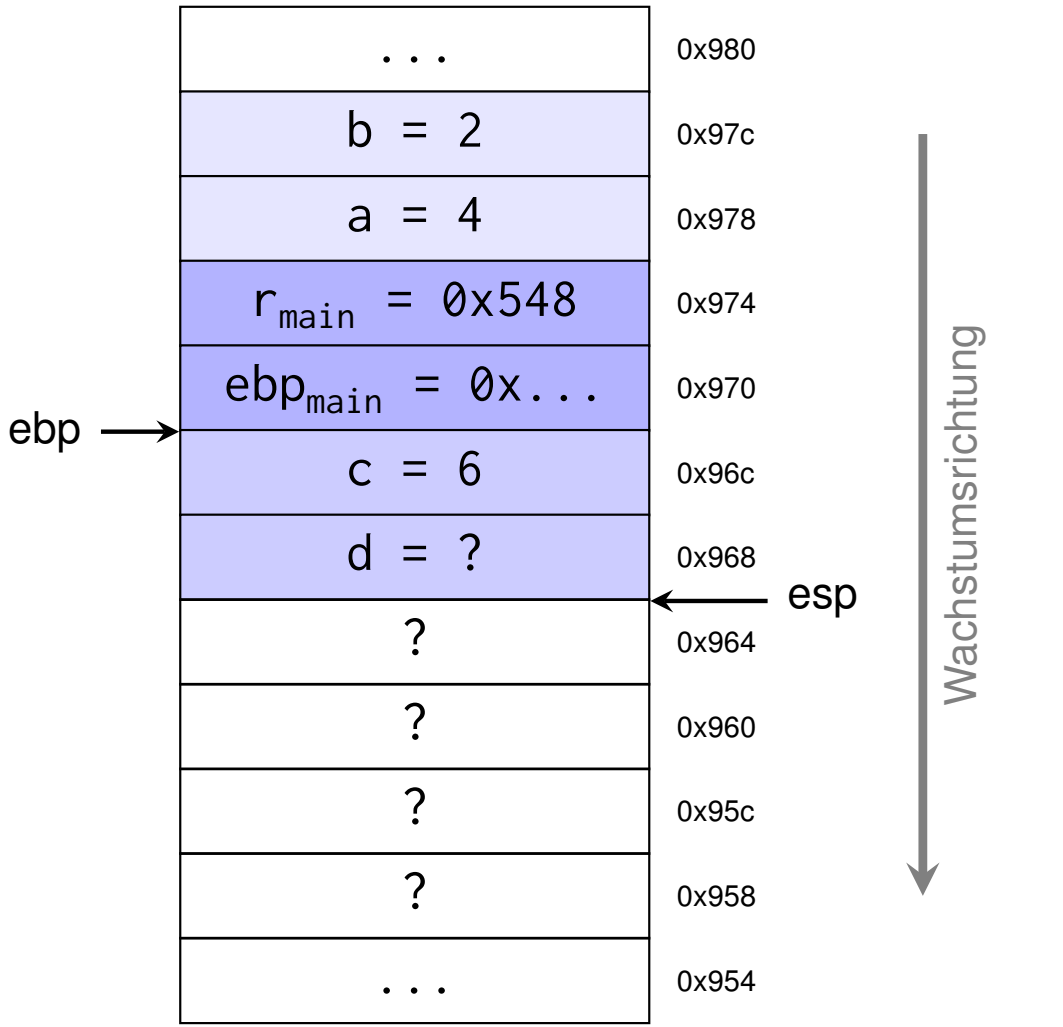

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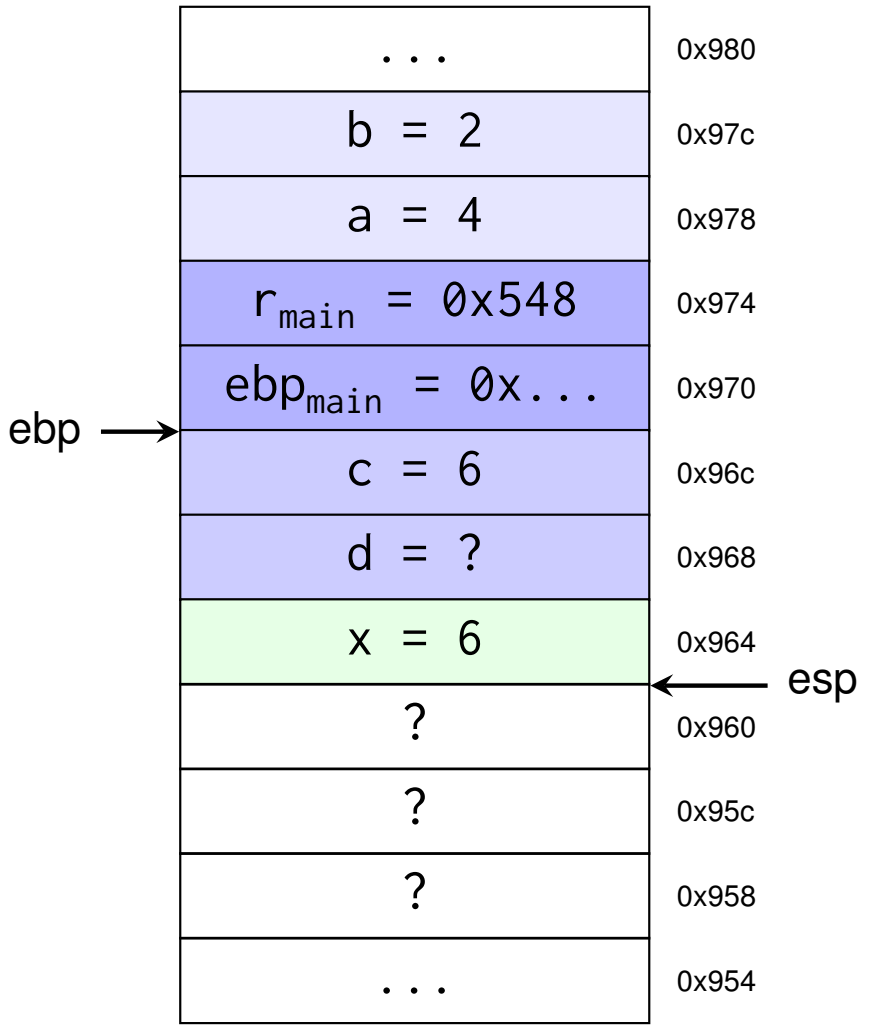

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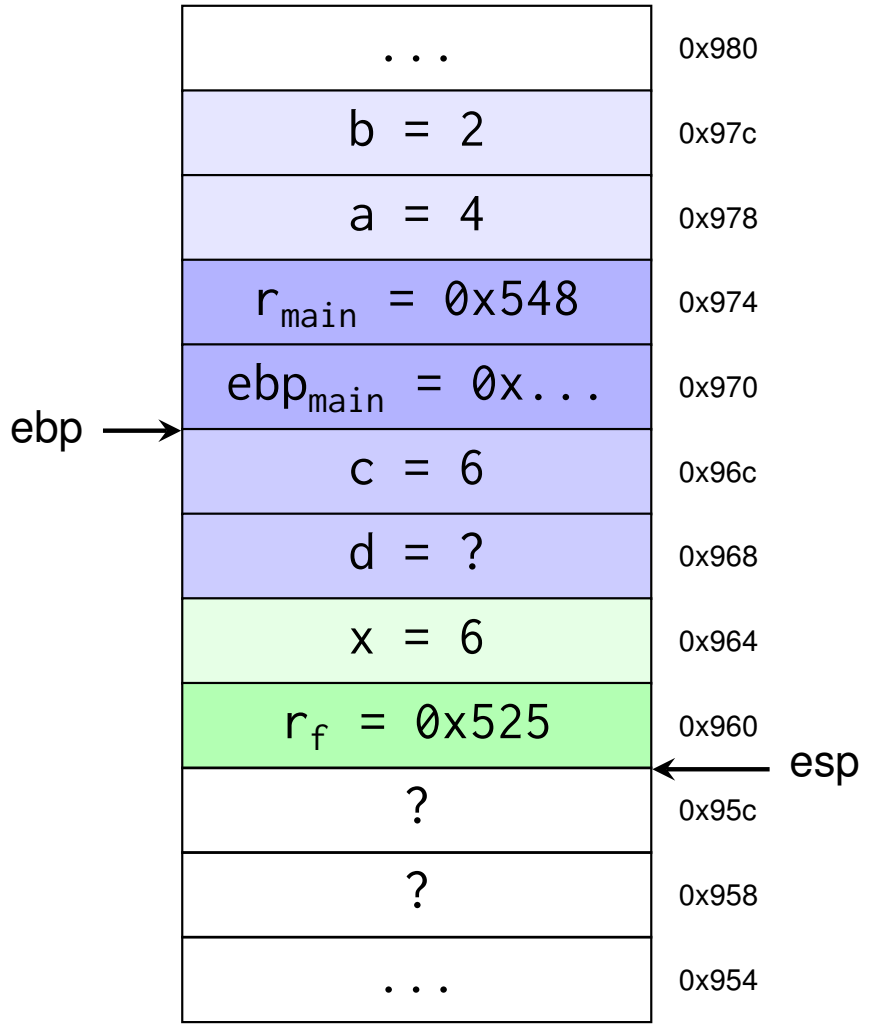

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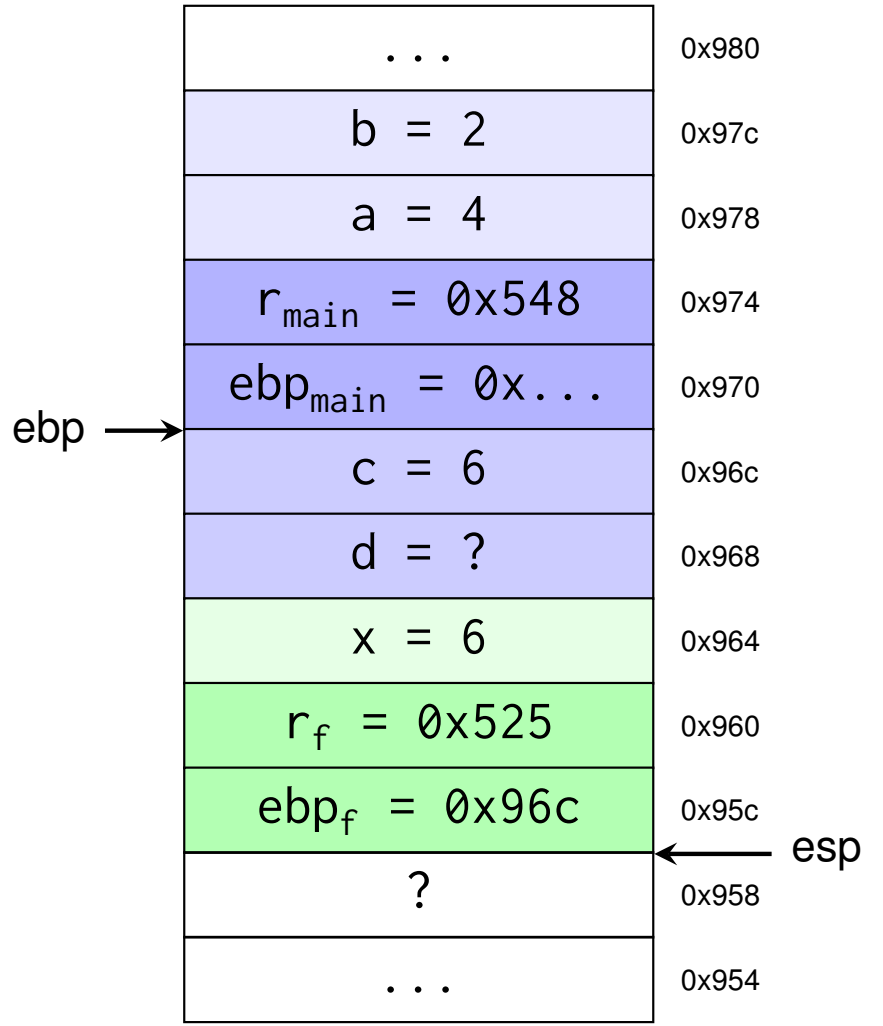

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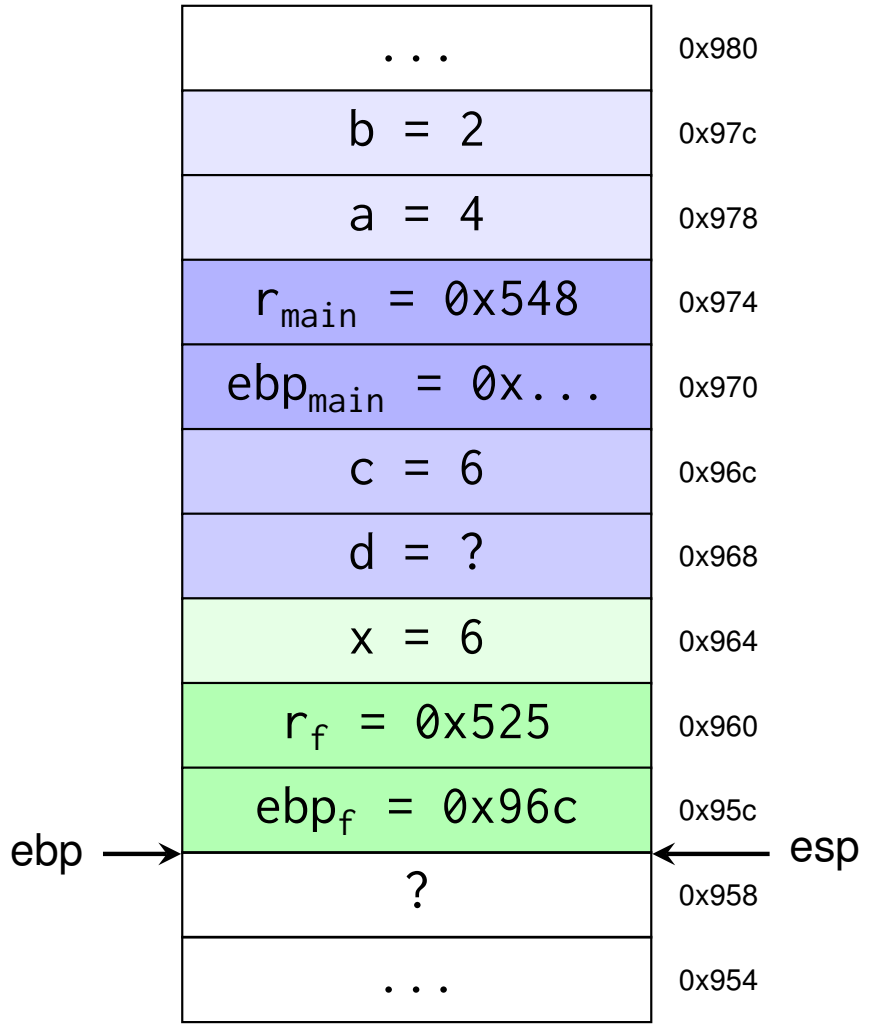

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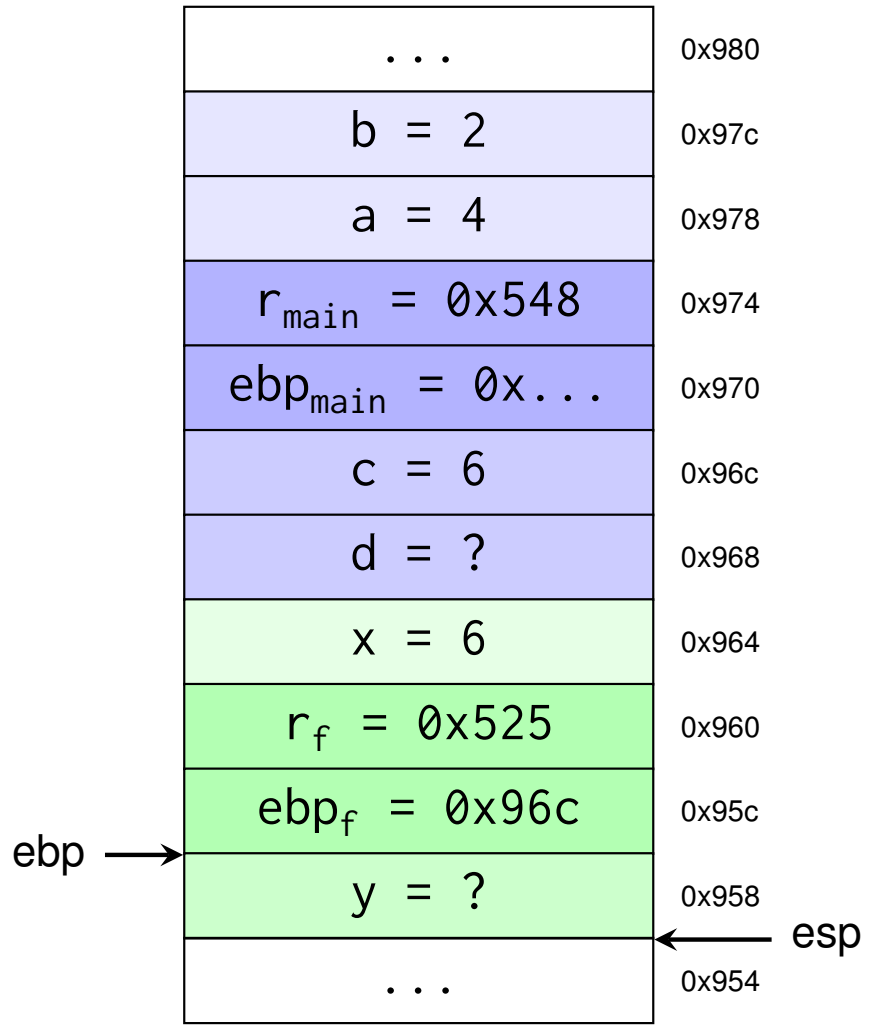

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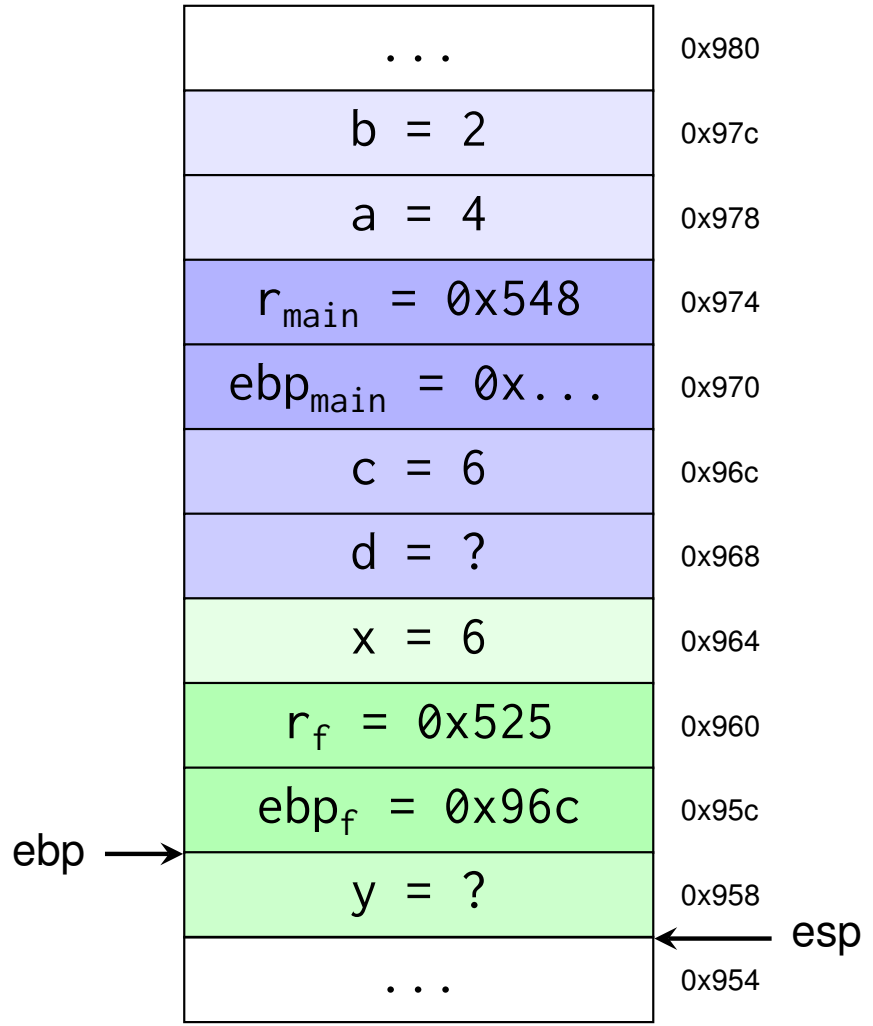

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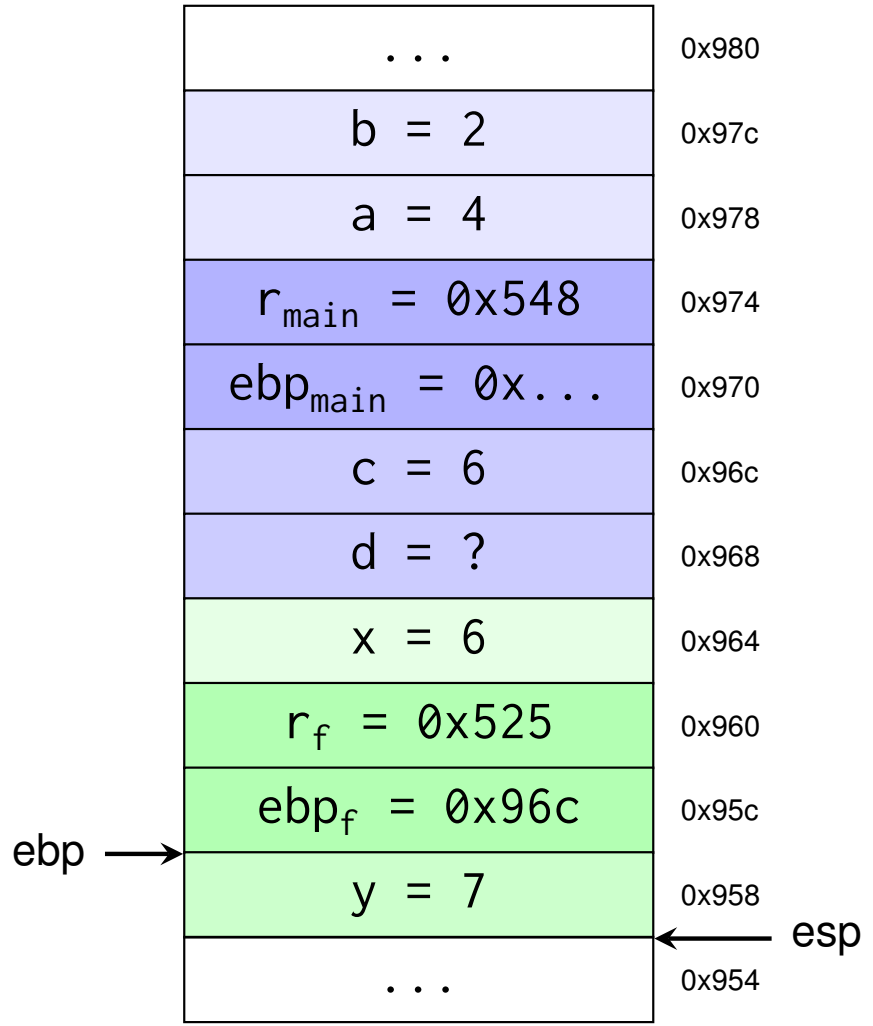

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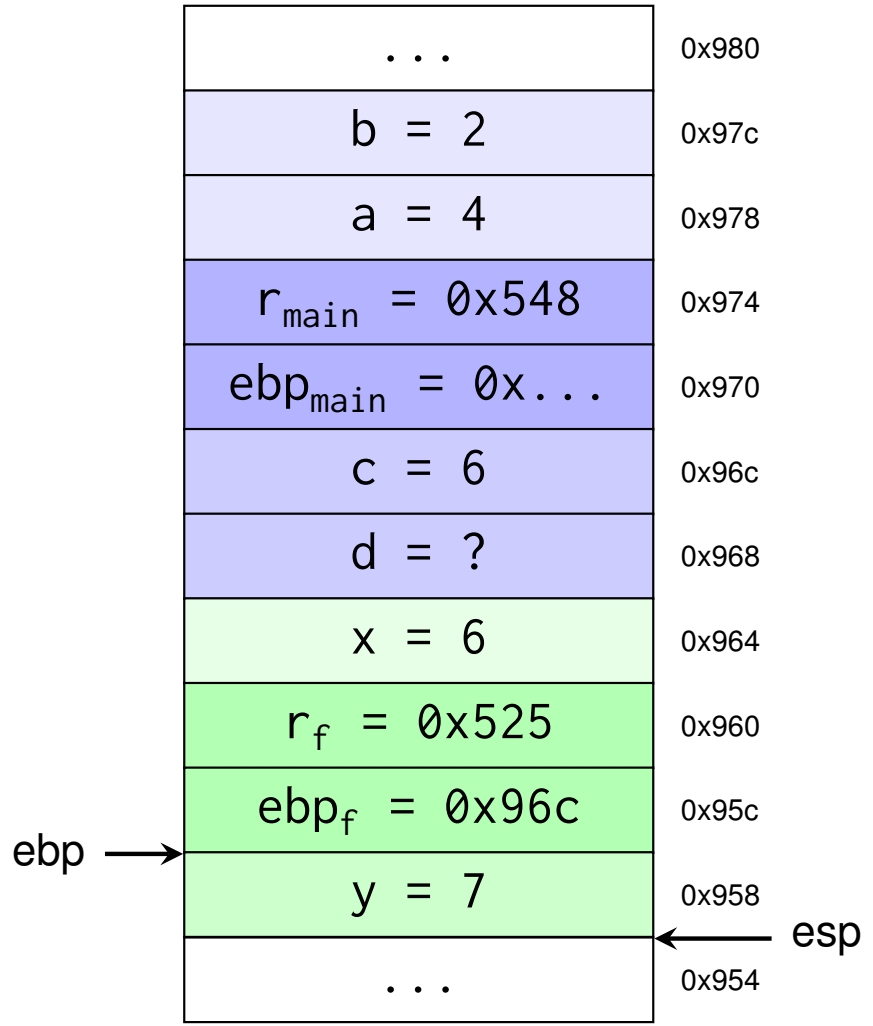

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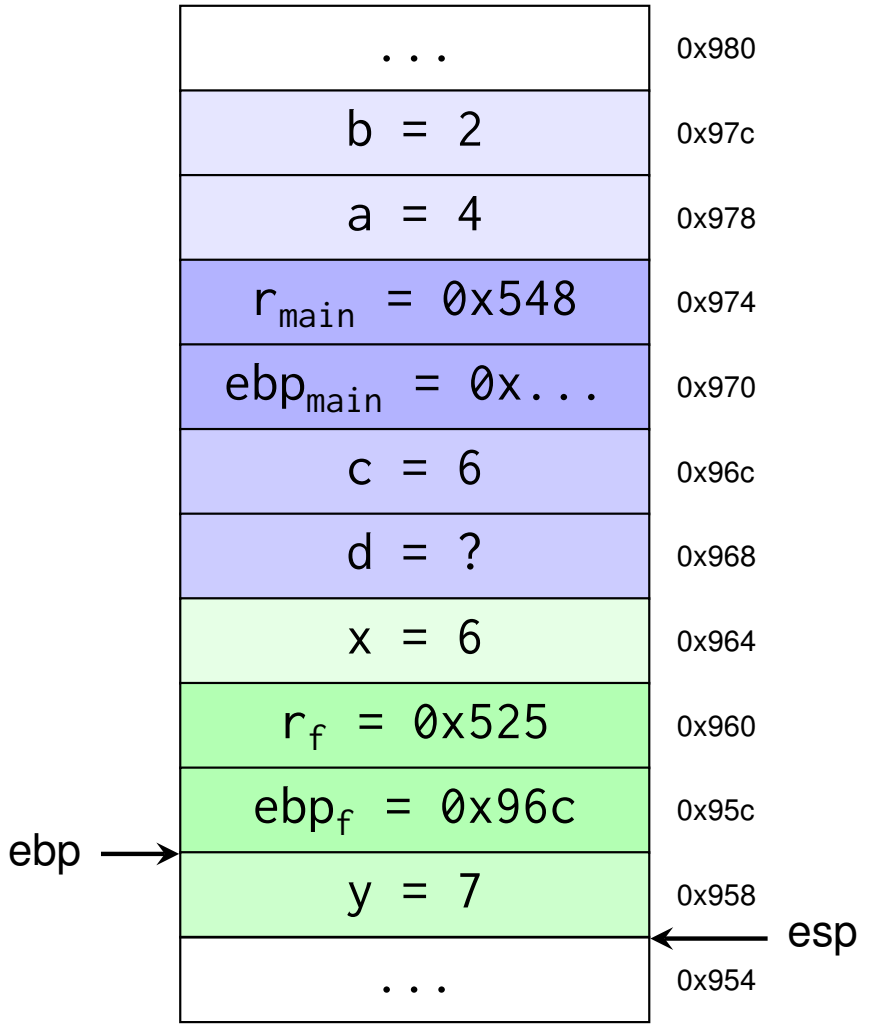

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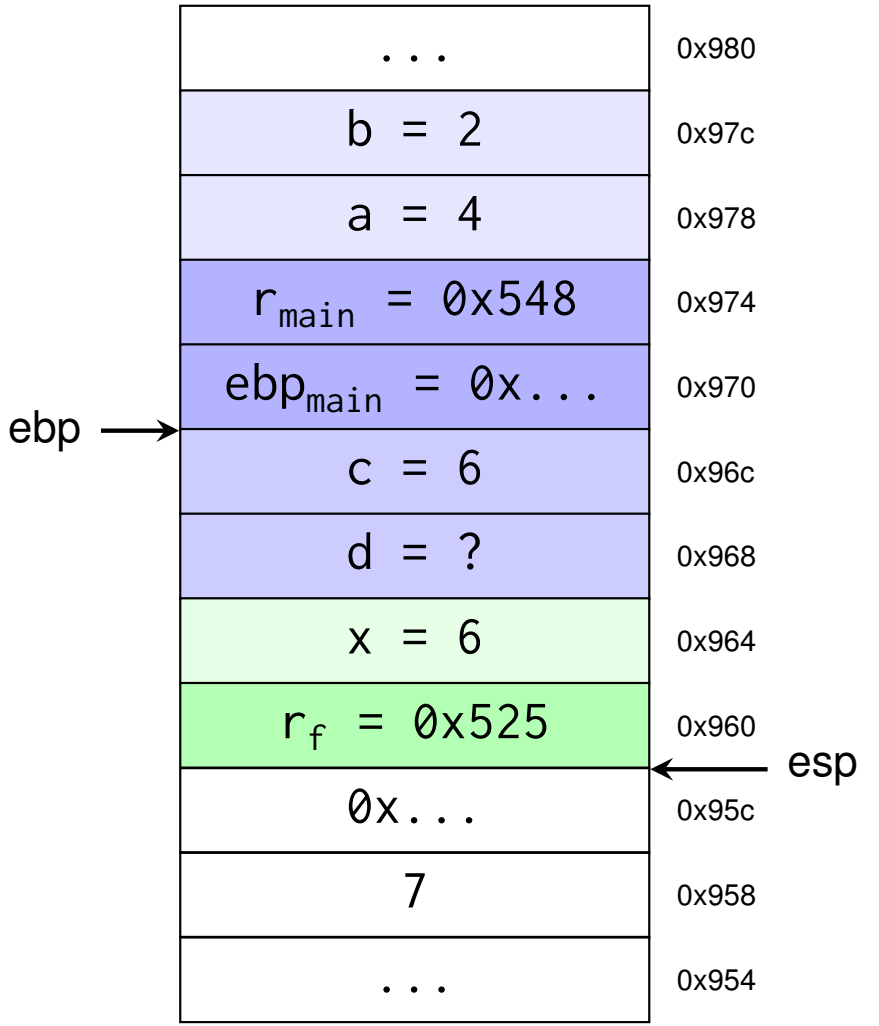

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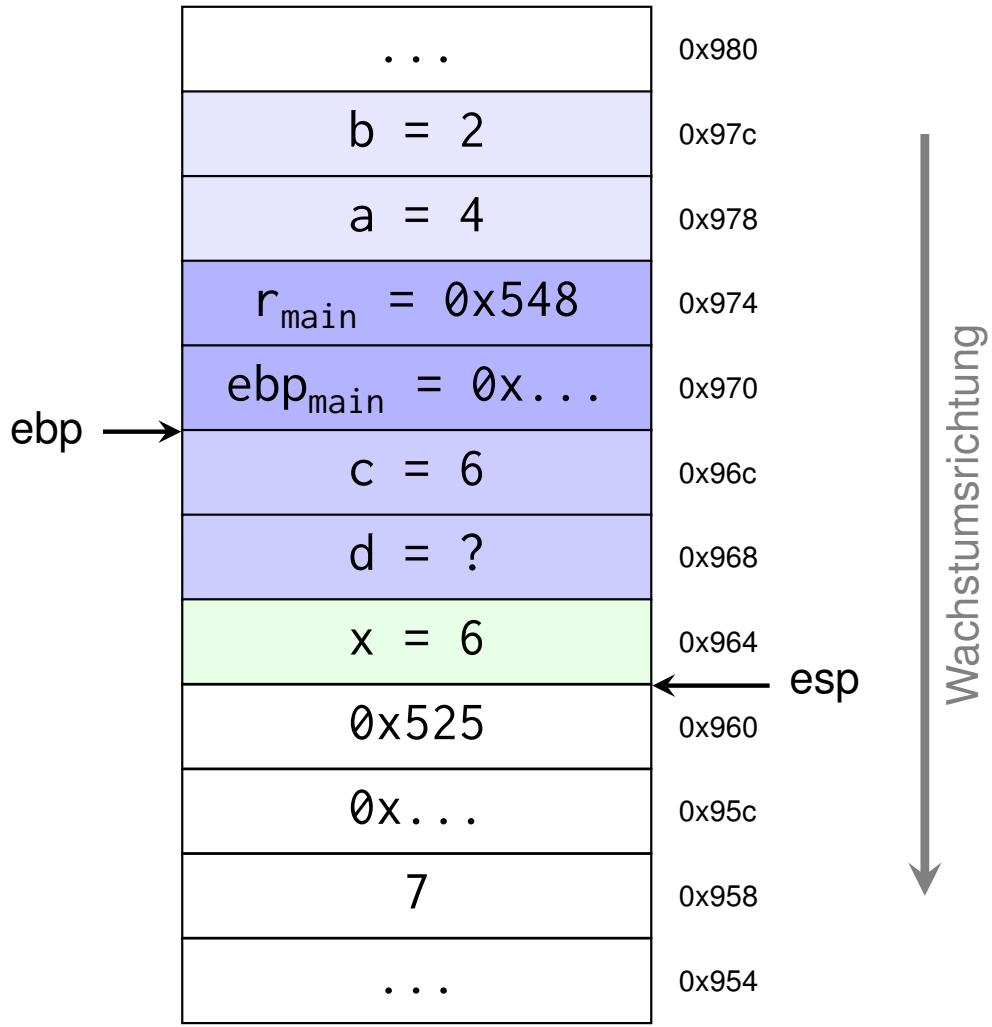

Beispiel: Programmstapel

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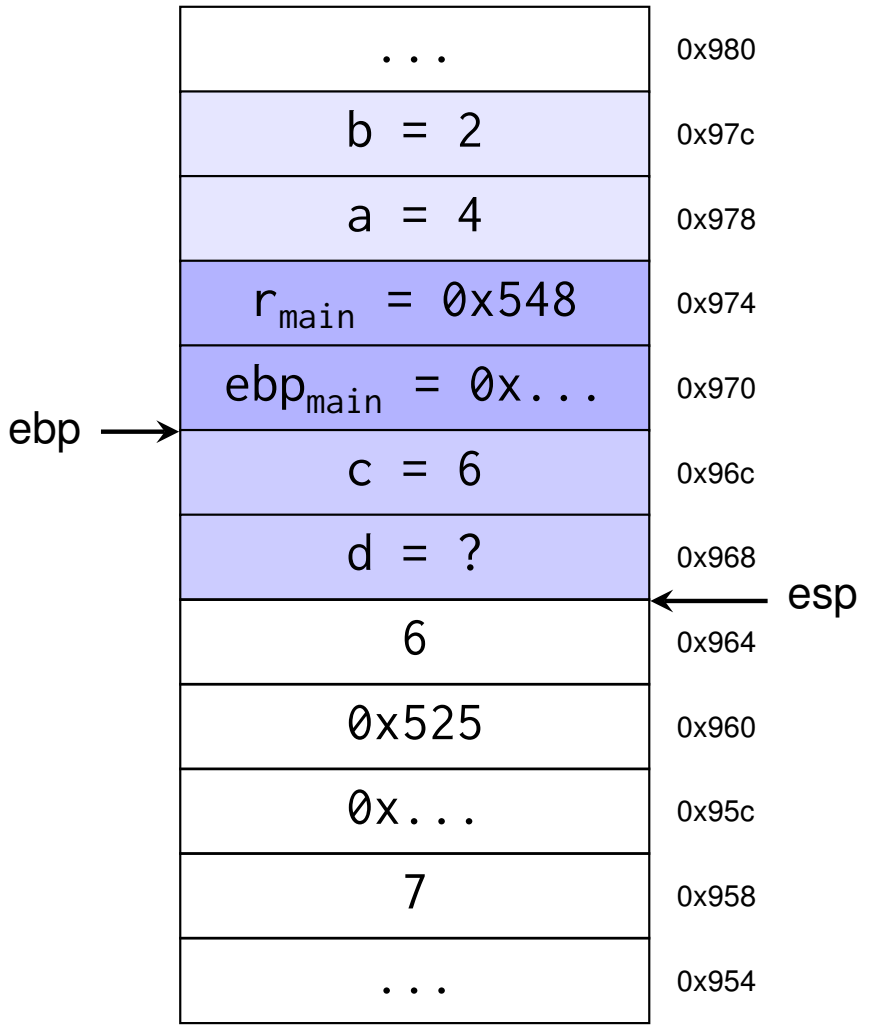

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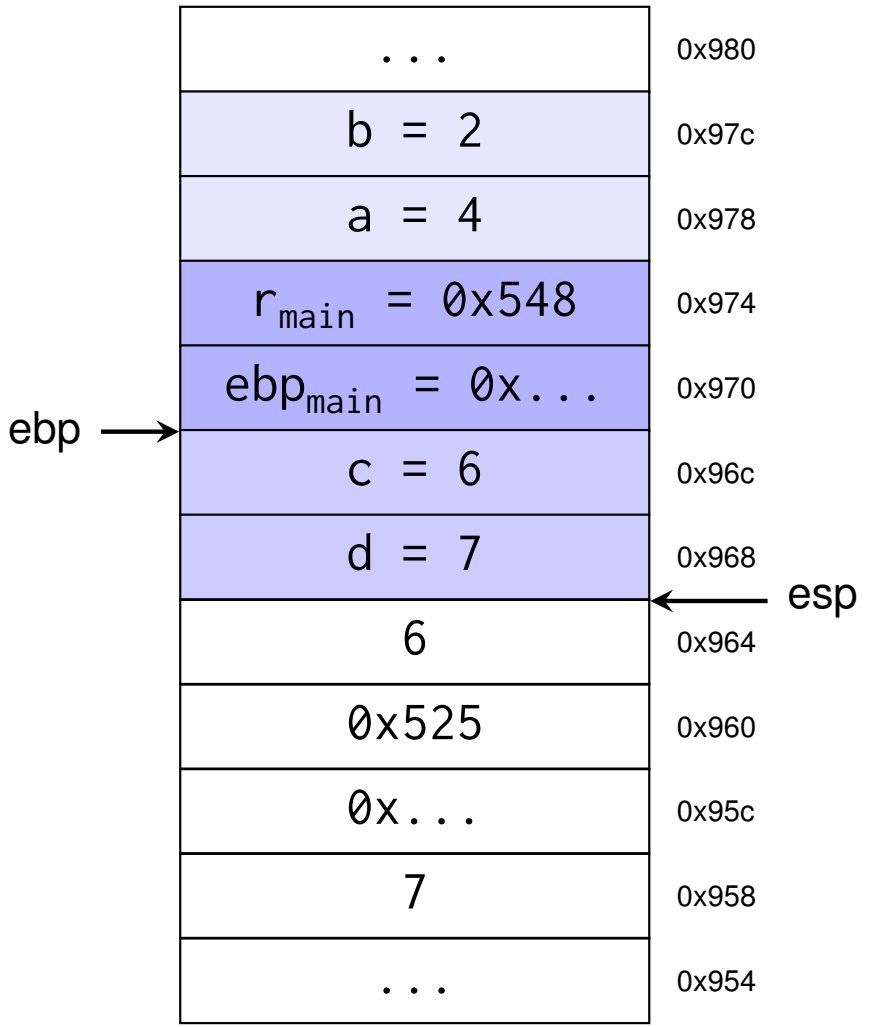

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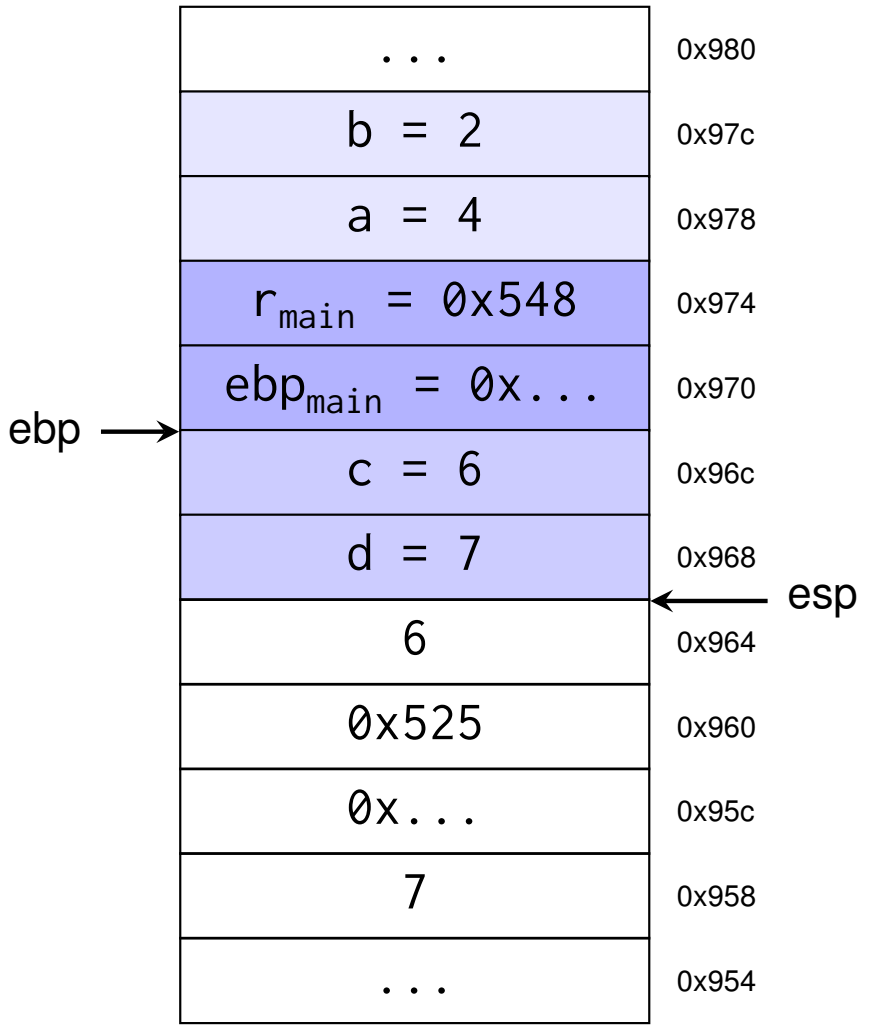

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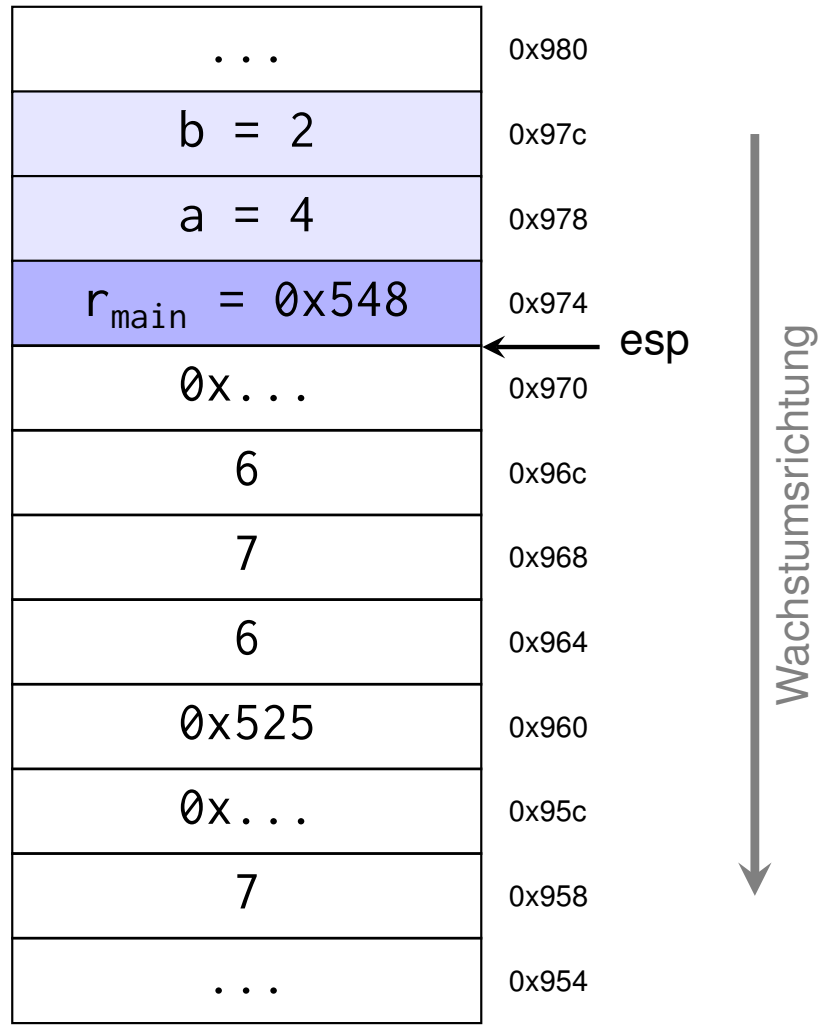

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```
int main(void) {
  return f(4, 2);
}
```

```
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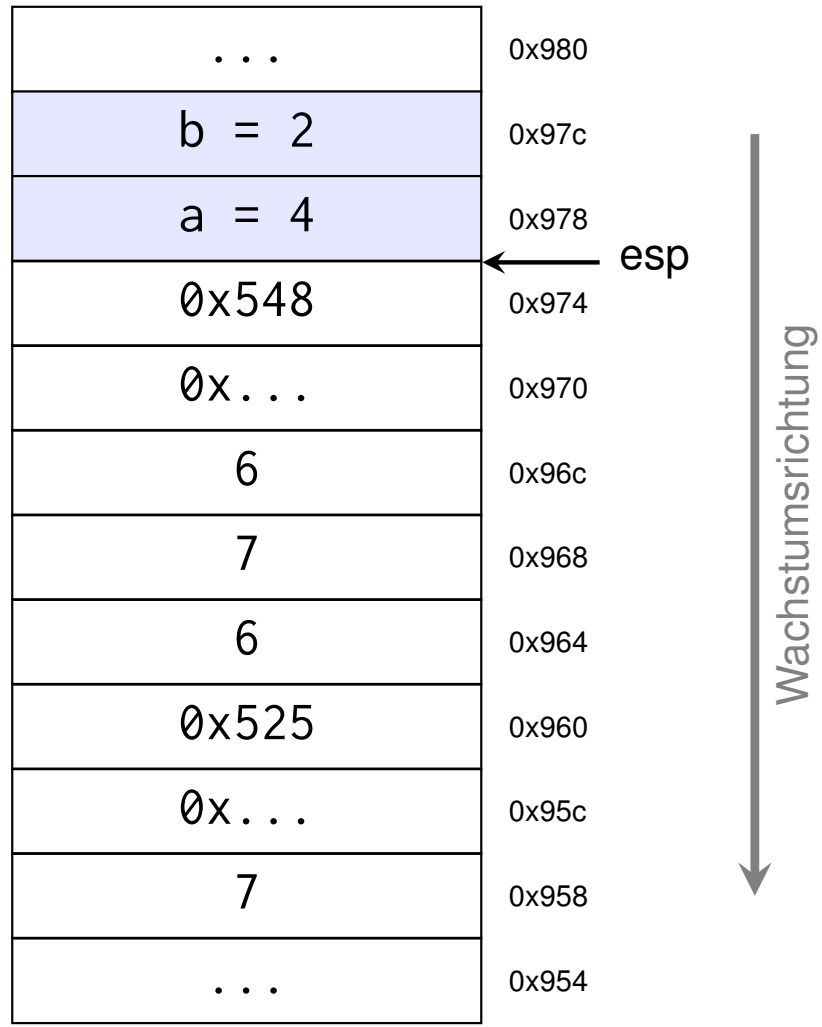

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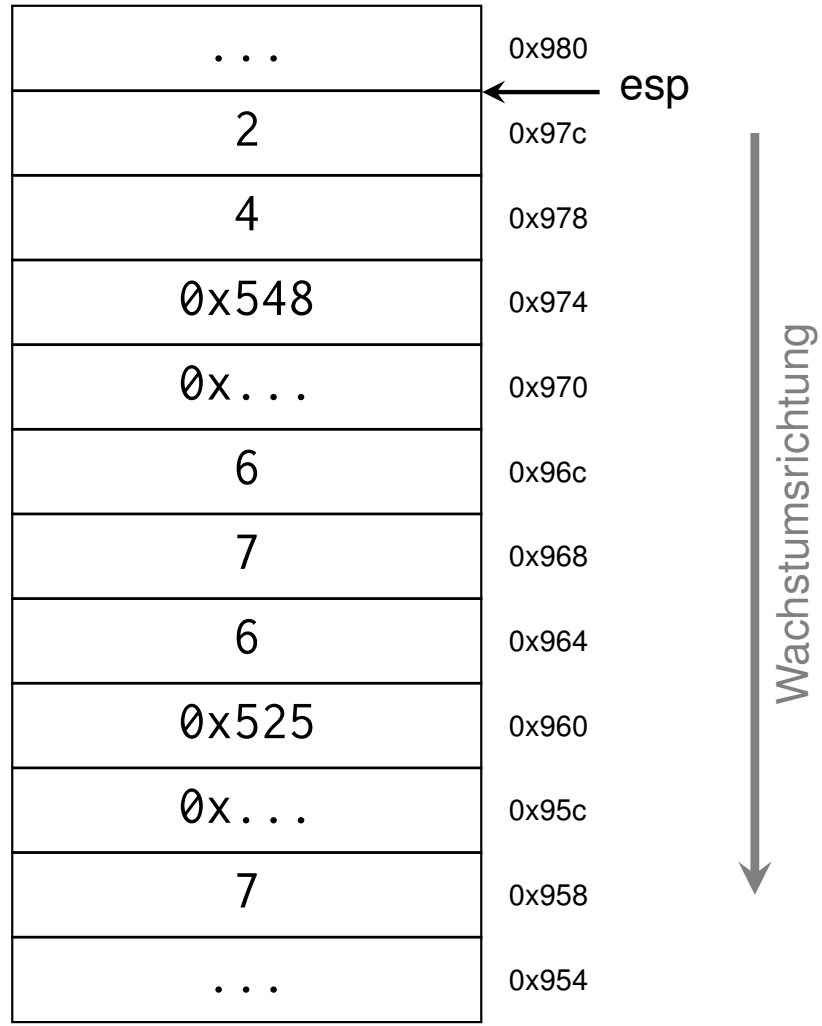

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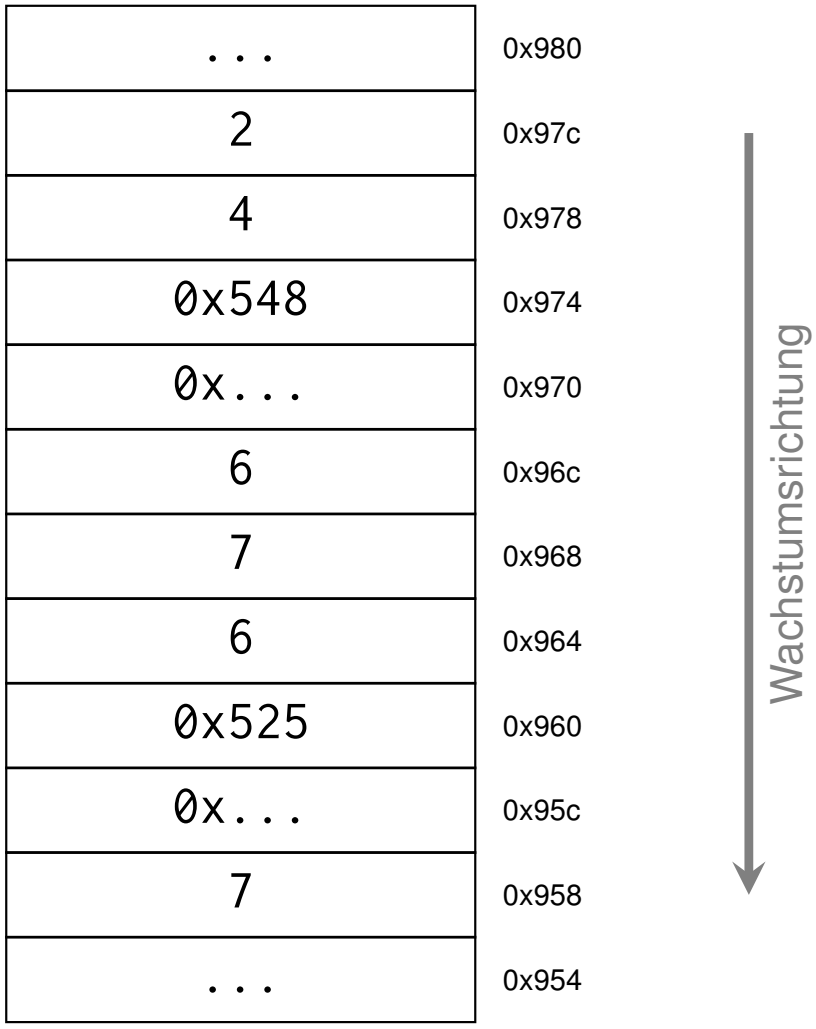

Dynamische Analyse des Stapelspeicherbedarfs

- Messung zur Laufzeit: Wasserstandsmessung
- Grundidee: Einfügen von **Stack Canaries**
- Explizite Verwaltung des Stapelspeichers notwendig
- pthread-Bibliothek ermöglicht Verwaltung
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  - Lesbare Bitmuster: `0xDEADBEEF`
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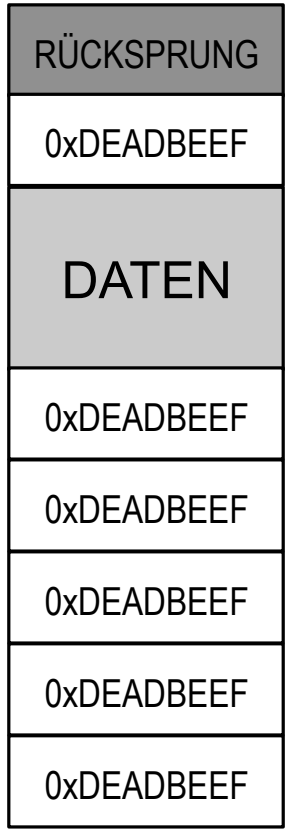

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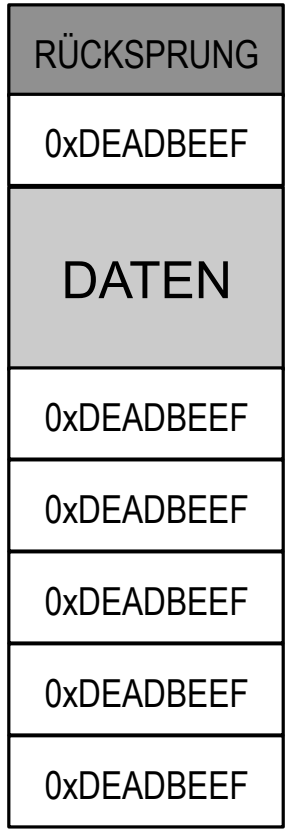
- Einsatz zur dynamischen Fehlererkennung



pthread-Bibliothek

1. (Globalen) Stack anlegen:

```
1   static unsigned int g_data[DATA_SIZE];
```

2. Thread anlegen & starten:

```
1   pthread_t thread;
2   pthread_attr_t attr;
3   pthread_attr_init(&attr);
4   pthread_attr_setstack(&attr, &g_stack, STACK_SIZE);
5   // worker function: void *run(void *param)
6   int status = pthread_create(&thread, &attr, run, NULL);
7   if (status != 0) { ... // handle error
```

3. Auf Thread warten:

```
1   pthread_join(thread, &ret);
```

pthread Stack