

UNIVERSIDAD DE ZARAGOZA

**ESCUELA DE INGENIERÍA Y
ARQUITECTURA**

Grado en Ingeniería Informática



**Escuela de
Ingeniería y Arquitectura
Universidad Zaragoza**

GARANTÍA Y SEGURIDAD

peRISCVcope

Autor

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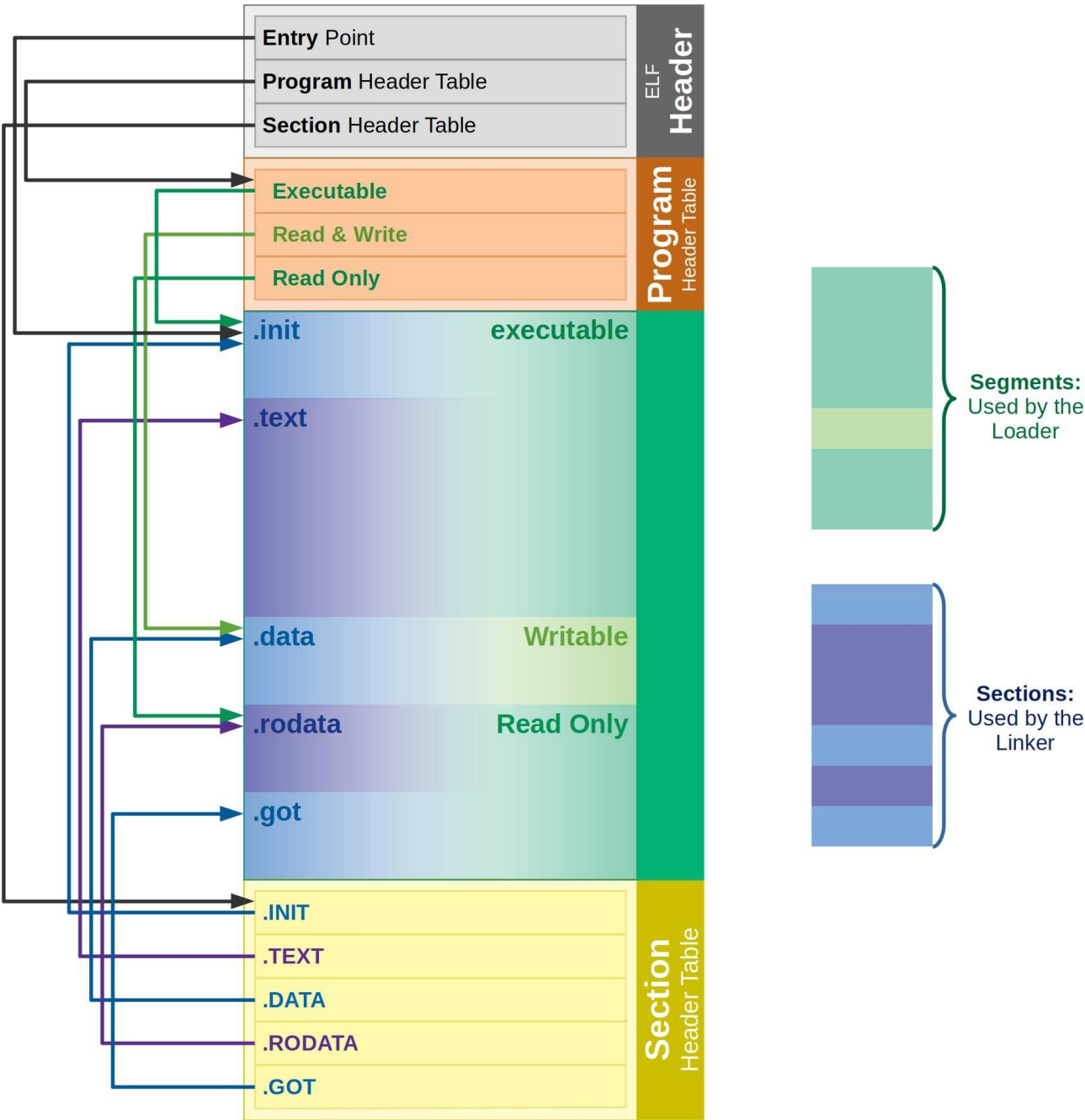
NIP

840710

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FORMATO ELF-32

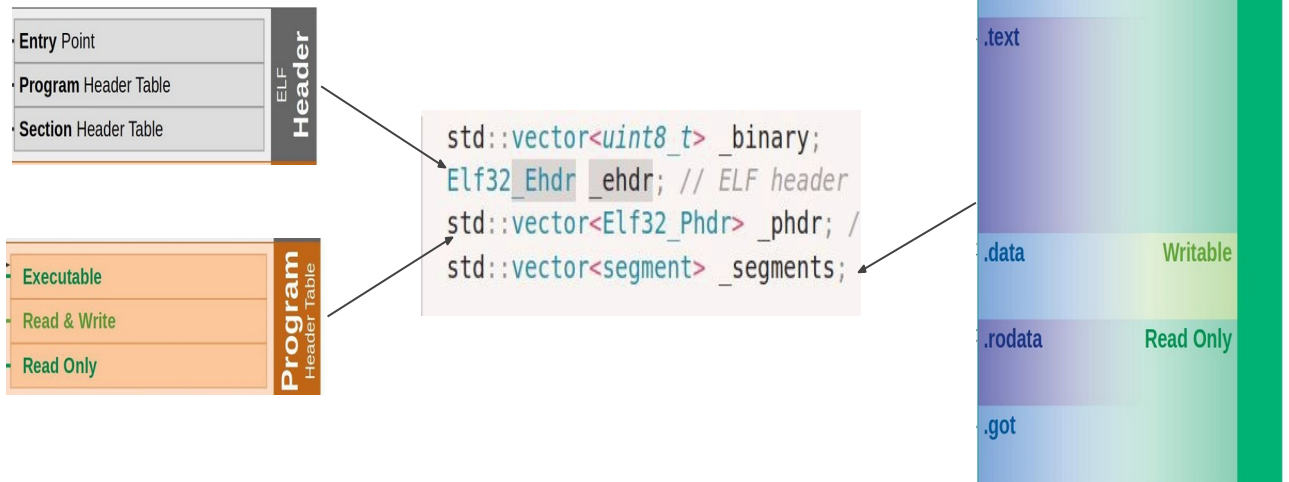


OBJETIVO AL CARGAR BINARIO

memory
_binary
_ehdr
_phdr
_segments

```
00000fe0: 0000 0000 0000 0000 0000 0000 0000 0000 .....#&...
00000ff0: 0000 0000 0000 0000 0000 0000 0000 0000 .....#&...
00001000: 1301 01fe 232e 8100 1304 0102 2326 04fe ....#&...
00001010: 2324 04fe 6f00 4003 b717 0000 1307 0705 #$.o.@.....
00001020: 8327 04fe 9397 2700 b307 f700 83a7 0700 '.....'
00001030: 8327 c4fe b307 f700 2326 f4fe 8327 04fe '.....#&...'
00001040: 9387 1700 2324 f4fe 0327 04fe 9307 3000 ....#$. '.....0.
00001050: e3d4 e7fc 6f00 0000 0000 0000 0100 0000 .....o.....
00001060: 0200 0000 0300 0000 4743 433a 2028 474e .....GCC: (GN
00001070: 5529 2031 312e 312e 3000 412f 0000 0072 U) 11.1.0.A/...r
00001080: 6973 6376 0001 2500 0000 0410 0572 7633 iscv.%.rv3
00001090: 3269 3270 305f 6d32 7030 5f61 3270 305f 2i2p0_m2p0_a2p0_
000010a0: 6632 7030 5f64 3270 3000 0000 0000 0000 f2p0_d2p0.....
000010b0: 0000 0000 0000 0000 0000 0000 0000 0000 .....
000010c0: 0000 0000 0000 0000 0300 0100 0000 0000 .....
000010d0: 5810 0000 0000 0000 0300 0200 0000 0000 X.....
000010e0: 0000 0000 0000 0000 0300 0300 0000 0000 .....
000010f0: 0000 0000 0000 0000 0000 0300 0400 0100 .....
00001100: 0000 0000 0000 0000 0400 f1ff 0d00 0000 .....
00001110: 5810 0000 0000 0000 1000 f1ff 1f00 0000 X.....
00001120: 6810 0000 0000 0000 1000 0200 2f00 0000 h...../...
00001130: 6810 0000 0000 0000 1000 0200 3b00 0000 h.....;...
00001140: 6810 0000 0000 0000 1000 0200 4700 0000 h.....6...
00001150: 0000 0000 5800 0000 1200 0100 4c00 0000 .....X.....L...
00001160: 5810 0000 1000 0000 1100 0200 5200 0000 X.....R...
00001170: 5810 0000 0000 0000 1000 0200 6100 0000 X.....a...
00001180: 6810 0000 0000 0000 1000 0200 6800 0000 h.....h...
00001190: 6810 0000 0000 0000 1000 0200 0061 6464 h......add
000011a0: 5f61 7272 6179 2e63 005f 5f67 6c6f 6261 _array.c._globa
000011b0: 6c5f 706f 696e 7465 7224 005f 5f53 4441 l_pointer$. _SDA
000011c0: 5441 5f42 4547 494e 5f5f 005f 5f42 5353 TA_BEGIN_. _BSS
000011d0: 5f45 4e44 5f5f 005f 5f62 7373 5f73 7461 _END_. _bss_sta
000011e0: 7274 006d 6169 6e00 6172 7261 7900 5f5f rt.main.array._
000011f0: 4441 5441 5f42 4547 494e 5f5f 005f 6564 DATA_BEGIN_. _ed
00001200: 6174 6100 5f65 6e64 0000 2e73 796d 7461 ata._end...symta
00001210: 6200 2e73 7472 7461 6200 2e73 6873 7472 b..strtab..shstr
00001220: 7461 6200 2e74 6578 7400 2e64 6174 6100 tab..text..data.
00001230: 2e63 6f6d 6d65 6e74 002e 7269 7363 762e .comment..riscv.
00001240: 6174 7472 6962 7574 6573 0000 0000 0000 attributes.....
00001250: 0000 0000 0000 0000 0000 0000 0000 0000 .....
00001260: 0000 0000 0000 0000 0000 0000 0000 0000 .....
00001270: 0000 0000 1b00 0000 0100 0000 0600 0000 .....
00001280: 0000 0000 0010 0000 5800 0000 0000 0000 .....X.....
00001290: 0000 0000 0400 0000 0000 0000 2100 0000 .....!.
000012a0: 0100 0000 0300 0000 5810 0000 5810 0000 .....X...X...
000012b0: 1000 0000 0000 0000 0000 0000 0400 0000 .....
000012c0: 0000 0000 2700 0000 0100 0000 3000 0000 .....'.0...
000012d0: 0000 0000 6810 0000 1200 0000 0000 0000 .....h.....
000012e0: 0000 0000 0100 0000 0100 0000 3000 0000 .....0...
000012f0: 0300 0070 0000 0000 0000 0000 7a10 0000 ...p...z...
00001300: 3000 0000 0000 0000 0000 0000 0100 0000 0.....
00001310: 0000 0000 0100 0000 0200 0000 0000 0000 .....#&...
```

DUMPEO DEL BINARIO



```
Machine type: 243  
Number of Program Headers: 2  
Entry Point: 0x0  
Segment 0: Type=1, Offset=4096 Bytes, Virtual Address=0x0, Size=88 Bytes  
Segment 1: Type=1, Offset=4184 Bytes, Virtual Address=0x1058, Size=16 Bytes  
Loading segment at 0x0 with size 88 Bytes  
Loading segment at 0x1058 with size 104 Bytes  
Segment 1 at 0x0  
Size: 88 Bytes  
  
0x0: 13 1 1 fe 23 2e 81 0 13 4 1 2 23 26 4 fe  
0x10: 23 24 4 fe 6f 0 40 3 b7 17 0 0 13 87 87 5  
0x20: 83 27 84 fe 93 97 27 0 b3 7 f7 0 83 a7 7 0  
0x30: 3 27 c4 fe b3 7 f7 0 23 26 f4 fe 83 27 84 fe  
0x40: 93 87 17 0 23 24 f4 fe 3 27 84 fe 93 7 30 0  
0x50: e3 d4 e7 fc 6f 0 0 0
```

HORA DE VIRTUALIZAR

31	30	25	24	21	20	19	15	14	12	11	8	7	6	0	
funct7				rs2		rs1	funct3		rd			opcode		Tipo R	
imm[11:0]						rs1	funct3		rd			opcode		Tipo I	
imm[11:5]				rs2		rs1	funct3		imm[4:0]			opcode		Tipo S	
imm[12]	imm[10:5]			rs2		rs1	funct3		imm[4:1]	imm[11]		opcode		Tipo B	
imm[31:12]									rd			opcode		Tipo U	
imm[20]	imm[10:1]			imm[11]		imm[19:12]			rd			opcode		Tipo J	

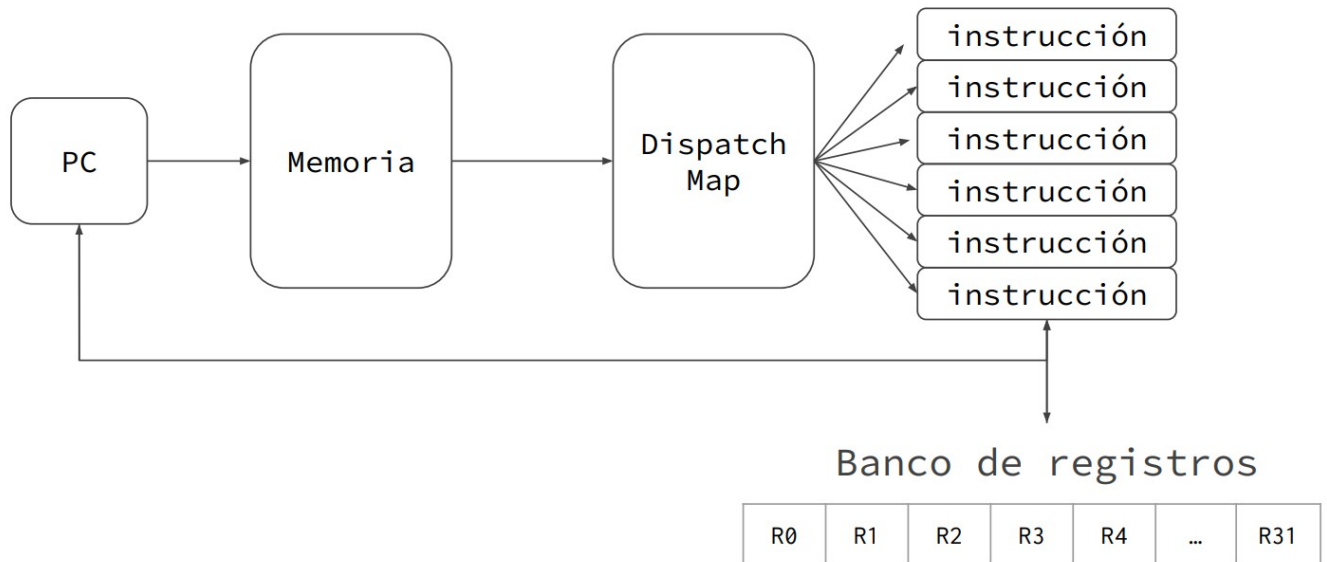
opcode -> Tipo de Instruccion

funct3, funct7 -> Instruccion especifica

DISPATCH MAP

```
std::map<uint8_t, execute_func> dispatch_map = {
    {0b0000011, instrs::load},
    {0b0100011, instrs::store},
    {0b0010011, instrs::alui},
    {0b0110011, instrs::alur},
    {0b0110111, instrs::lui},
    {0b1101111, instrs::jal},
    {0b1100011, instrs::condbranch},
    {0b1100111, instrs::jalr}
};
```


RESULTADO FINAL



ADD ARRAY

```
Instrucion read
Attempt to read in address: 48
Instrucion read
Attempt to read in address: 7ffffe8
Attempt to read in address: 4c
Instrucion read
Attempt to read in address: 50
Instrucion read
Attempt to read in address: 18
Instrucion read
Attempt to read in address: 1c
Instrucion read
Attempt to read in address: 20
Instrucion read
Attempt to read in address: 7ffffe8
Attempt to read in address: 24
Instrucion read
Attempt to read in address: 28
Instrucion read
Attempt to read in address: 2c
Instrucion read
Attempt to read in address: 1064
Attempt to read in address: 30
Instrucion read
Attempt to read in address: 7ffffec
Attempt to read in address: 34
Instrucion read
Attempt to read in address: 38
Instrucion read
Attempt to read in address: 3c
Instrucion read
Attempt to read in address: 7ffffe8
Attempt to read in address: 40
Instrucion read
Attempt to read in address: 44
Instrucion read
Attempt to read in address: 48
Instrucion read
Attempt to read in address: 7ffffe8
Attempt to read in address: 4c
Instrucion read
Attempt to read in address: 50
Instrucion read
Attempt to read in address: 54
Instrucion read
Number of executed instructions: 46
Result in a0 (factorial): 0
Attempt to read in address: 7ffffec
Result on stack (add_array): 6
```

FACTORIAL

```
Attempt to read in address: 7ffffa8
Attempt to read in address: 4c
Instrucion read
Attempt to read in address: 50
Instrucion read
Attempt to read in address: 34
Instrucion read
Attempt to read in address: 38
Instrucion read
Attempt to read in address: 7ffffbc
Attempt to read in address: 3c
Instrucion read
Attempt to read in address: 40
Instrucion read
Attempt to read in address: 44
Instrucion read
Attempt to read in address: 7ffffcc
Attempt to read in address: 48
Instrucion read
Attempt to read in address: 7ffffc8
Attempt to read in address: 4c
Instrucion read
Attempt to read in address: 50
Instrucion read
Attempt to read in address: 34
Instrucion read
Attempt to read in address: 38
Instrucion read
Attempt to read in address: 7ffffdc
Attempt to read in address: 3c
Instrucion read
Attempt to read in address: 40
Instrucion read
Attempt to read in address: 44
Instrucion read
Attempt to read in address: 7ffffec
Attempt to read in address: 48
Instrucion read
Attempt to read in address: 7ffffe8
Attempt to read in address: 4c
Instrucion read
Attempt to read in address: 50
Instrucion read
Attempt to read in address: 74
Instrucion read
Number of executed instructions: 76
Result in a0 (factorial): 120
Attempt to read in address: 7ffffec
Result on stack (add_array): 116
```