

Problem 1: address translation

(1) 0x027c

A. Virtual address format:

13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	0	0	1	1	1	1	1	0	0

B. Address Translation:

VPN	TLB index	TLB tag	TLB hit? (Y/N)	Page fault? (Y/N)	PPN
0x9	0x1	0x2	N	N	0x17

C. Physical address format:

11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	1	1	1	1	1	1	1	0	0

D. Physical memory reference:

Byte offset	Cache index	Cache tag	Cache hit? (Y/N)	Cache byte returned
0x0	0xf	0x17	N	-

(2) 0x03a9

A. Virtual address format:

13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	1	0	1	0	1	0	0	1

B. Address Translation:

VPN	TLB index	TLB tag	TLB hit? (Y/N)	Page fault? (Y/N)	PPN
0xe	0x2	0x3	N	N	0x11

C. Physical address format:

11	10	9	8	7	6	5	4	3	2	1	0
0	1	0	0	0	1	1	0	1	0	0	1

D. Physical memory reference:

Byte offset	Cache index	Cache tag	Cache hit? (Y/N)	Cache byte returned
0x1	0xa	0x11	N	-

(3) 0x0040

A. Virtual address format:

13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0

B. Address Translation:

VPN	TLB index	TLB tag	TLB hit? (Y/N)	Page fault? (Y/N)	PPN
0x1	0x1	0x0	N	Y	-

C. Physical address format:

No value for the page fault.

D. Physical memory reference:

No value for the page fault.

Problem 2: Multi-Level Page Tables

- (1) The number of bit for index in page : 11. ($2^{11} = 2048$)
- (2) The number of page: 2^{53} . ($64 - 11 = 53$)
- (3) The number of PTE in each page: 2^9 . ($2048 / 4 = 2^9$)
- (4) The number of levels: 6. (larger than $\log_2 (2^{53} / 2^9)$)