

1.

Offset = VA[11:0]

VPN0 = VA[21:12]

VPN1 = VA[31:22]

VPN2 = VA[38:30]

Step 1: Find 1st PTE at PA: [satp.PPN | VPN2]

Step 2: if 1st PTE points to next level of page table:

Find 2nd PTE at PA: [1st PTE.PPN | VPN1]

Step 3: if 2nd PTE points to next level of page table:

Find 3rd PTE at PA: [2nd PTE.PPN | VPN 0]

Step 4: Finally translated PA: [3rd.PPN | Offset]

2.

$2^{(12 \text{ bits} + 9 \text{ bits})} = 2^{21} \text{ bits} = 2048 \text{ KiB} = 2 \text{ MiB}$

3.

$\text{PTE_size} = 4 \text{ KiB} / (2^{10} \text{ entries}) = 4 \text{ B per PTE entry}$

$4 \text{ MiB} = 2^{22} \text{ B}$

3张 level 2, 一张 level 1

4.

page2kva: page 2 kernel virtual address

Step 1: calculate PPN

Step 2: calculate corresponding PA

Step 3: add a VA_PA_offset, convert it into a virtual address mapped in kernel virtual space