Multilevel page table (RISC-V)

- One-level page table would be $2^{20} \times 4 = 4\text{MiB}$, much of it unused
- Page table represented as a tree
  - compacts the structure
  - each section of page table fits into a page = $2^{12} = 4\text{KiB} = \text{PAGESIZE}$
  - $\text{PTESIZE} = 4$ bytes
  - supervisor address protection and translation (satp) register hold the base of the tree in the physical page number (ppn) field
- First PTE lookup address = $\text{satp.ppn} \times \text{PAGESIZE} + \text{VPN}[1] \times \text{PTESIZE}$
- If $X=1$ or $R=1$ it’s a superpage (where $\text{VPN}[0]=0$ and $\text{PPN}[0]=0$) else lookup address = $\{\text{PPN}[1],\text{PPN}[0]\} \times \text{PAGESIZE} + \text{VPN}[0] \times \text{PTESIZE}$
- More translation levels for a 64-bit machine