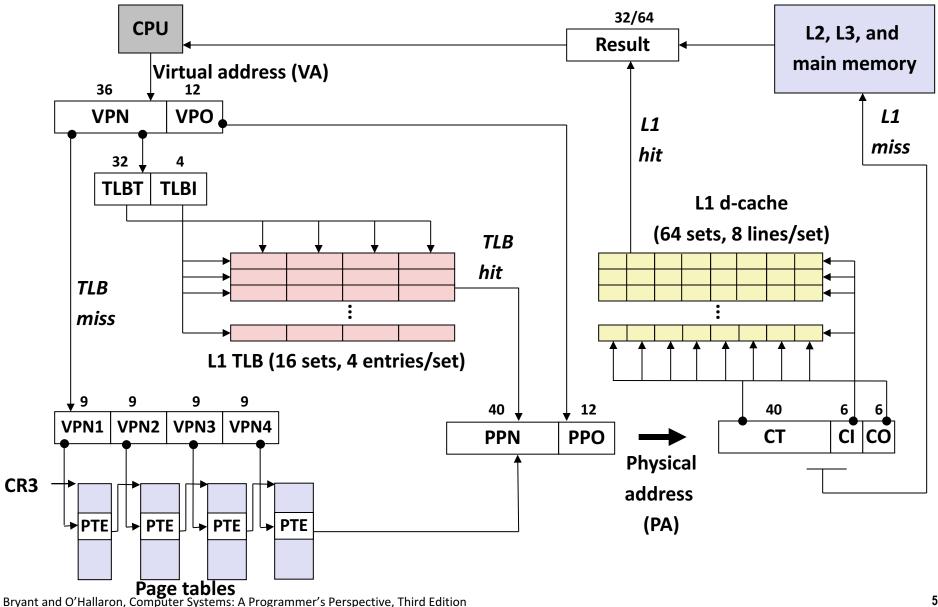
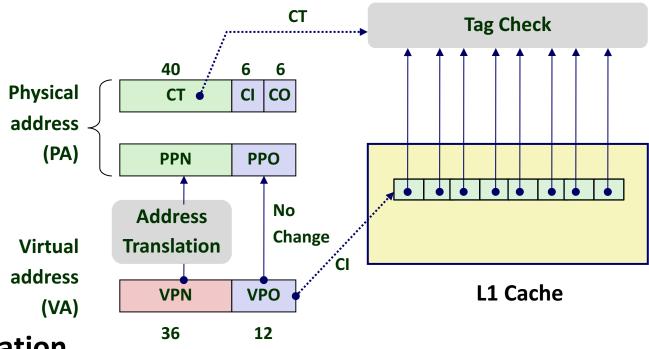
Locate set Cache Read • Check if any line in set has matching tag E = 2^e lines per set • Yes + line valid: hit Locate data starting at offset **Address of word: b** bits t bits s bits $S = 2^s$ sets block tag set index offset data begins at this offset **B-1** tag valid bit B = 2^b bytes per cache block (the data)

End-to-end Core i7 Address Translation



Cute Trick for Speeding Up L1 Access



Observation

- Bits that determine CI identical in virtual and physical address
- Can index into cache while address translation taking place
- Cache carefully sized to make this possible: 64 sets, 64-byte cache blocks
- Means 6 bits for cache index, 6 for cache offset
- That's 12 bits; matches VPO, $PPO \rightarrow$ One reason pages are 2^{12} bits = 4 KB

Virtual Address Space of a Linux Process

