RAID 5 – Parity Checking

RAID 5 - Block level striping, parity interleaved
Striping unit is 1 block: block1 -> disk1, block2 -> block2, block3 -> block3, etc.
Blocks of stripes written at same time!
Transfer rate = $(N - 1)$ * transfer rate of one disk

Only partial redundancy!
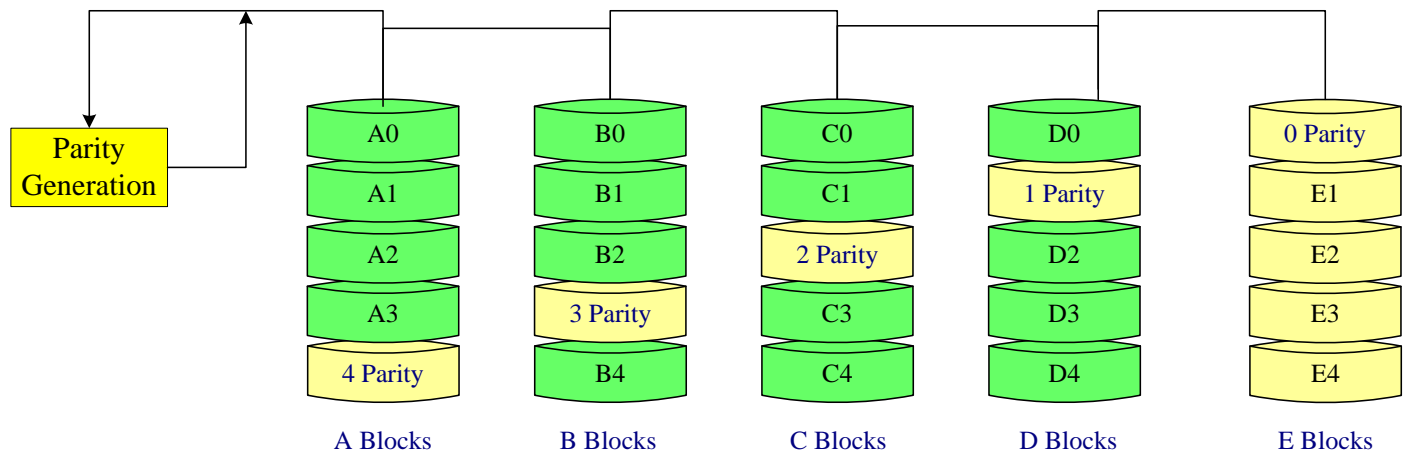Parity information dispersed round-robin among all disks
Same redundancy overhead as level 3, = $1 / N$ %
Hey! *Block striping can* mean that every disk is NOT involved in a (small) request
Parallel reads and writes *can* occur, depends on which disks store involved blocks
- For error detection, rather than full redundancy
- Each stripe unit has an extra parity stripe
- Parity stripes are distributed

RAID Level 5: Parity Checking

Parity Generation	A Blocks	B Blocks	C Blocks	D Blocks	E Blocks
	A0	B0	C0	D0	0 Parity
	A1	B1	C1	1 Parity	E1
	A2	B2	2 Parity	D2	E2
	A3	3 Parity	C3	D3	E3
	4 Parity	B4	C4	D4	E4

RAID 5 Read/Write

Read: parallel stripes read from multiple disks
- Good performance

Write: 2 reads + 2 writes
- Read old data stripe; read parity stripe (2 reads)
- XOR old data stripe with new data stripe
- XOR result into parity stripe
- Write new data stripe and new parity stripe (2 writes)

RAID 1 vs RAID 5
- o   Reads:
- o   RAID 1 (mirroring):
    - o   always offers parallel reads

RAID 5:
- o   Can only sometimes offer parallel reads
- o   Depends on where the needed blocks are
- o   Two read requests that require blocks on the same disk must be serialized

- o   Writes:

RAID 1:
- o   Mirroring) must complete two writes before request returns
- o   Granularity of serialization can be smaller than a file
- o   Can't do parallel writes

RAID 5:
- o   Typically does read-modify-write to re-compute parity
- o   HP AutoRAID uses combo of read-modify-write and LFS !
- o   Can't do parallel writes either

Redundancy Overhead:
- o   RAID 1 = full redundancy, storage capacity reduced by 50%
- o   RAID 5 = partial redundancy, storage capacity reduced by $1/N$%