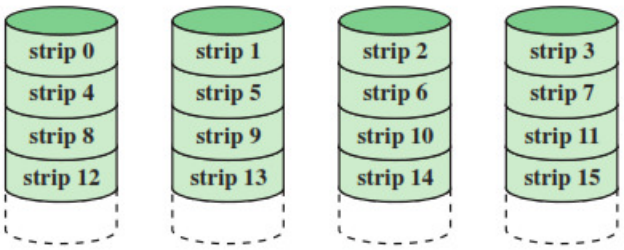
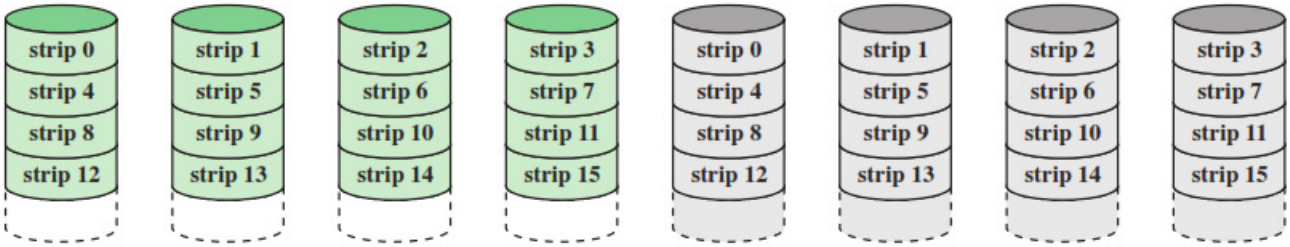
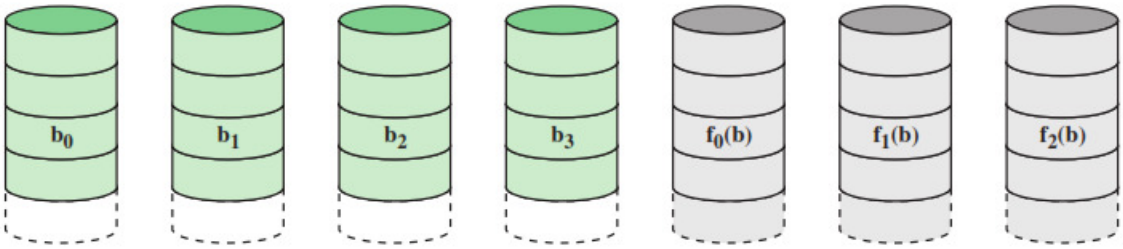


(a) RAID 0 (non-redundant)

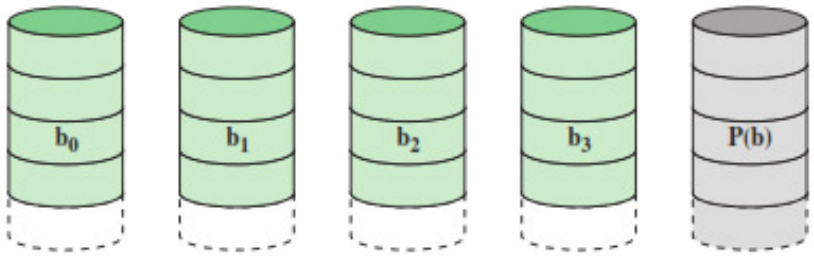


(b) RAID 1 (mirrored)

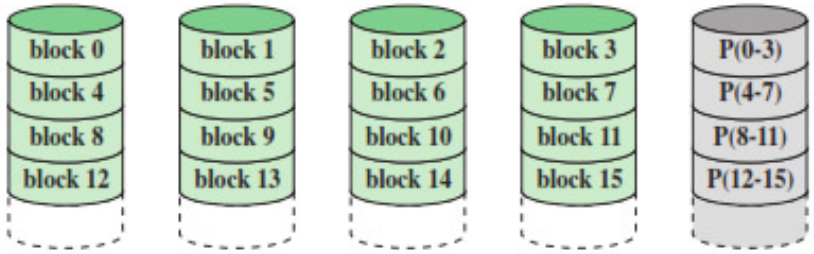


(c) RAID 2 (redundancy through Hamming code)

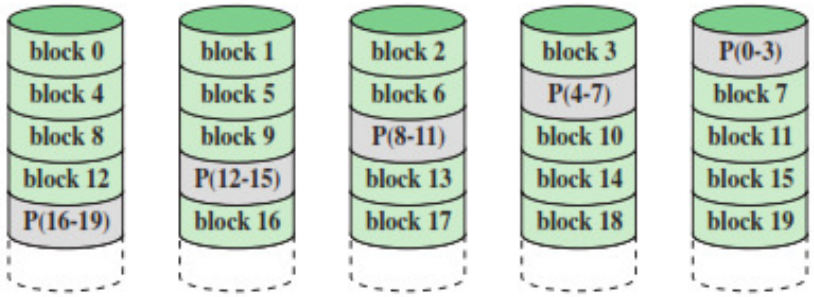
Figure 6.8 RAID Levels (page 1 of 2)



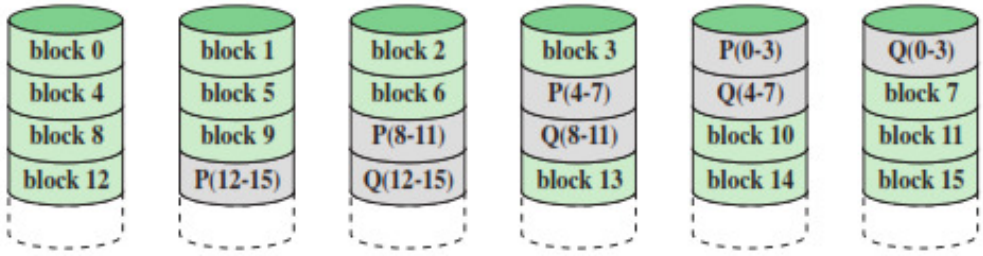
(d) RAID 3 (bit-interleaved parity)



(e) RAID 4 (block-level parity)



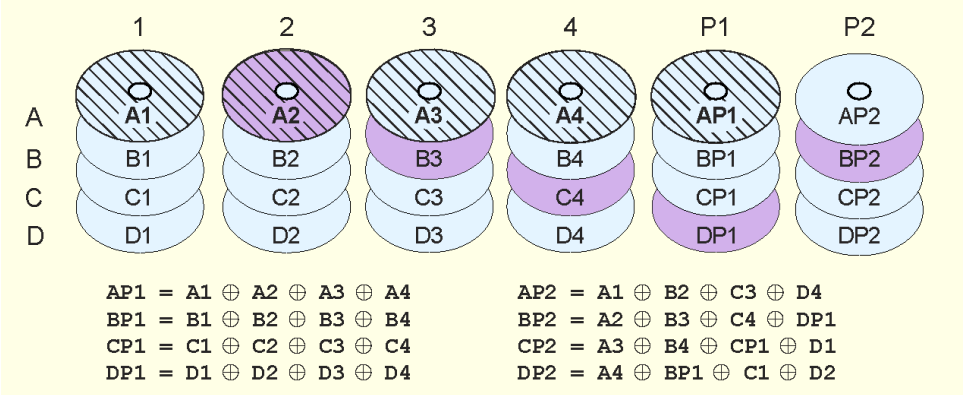
(f) RAID 5 (block-level distributed parity)

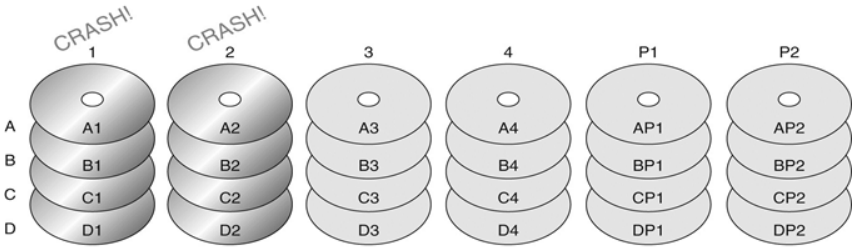


(g) RAID 6 (dual redundancy)

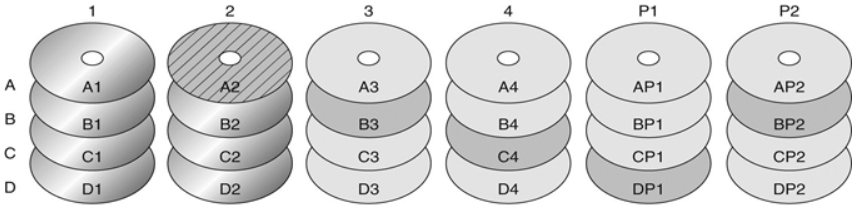
Figure 6.8 RAID Levels (page 2 of 2)

Double parity RAID (RAID DP) employs pairs of over-lapping parity blocks that provide linearly independent parity functions.



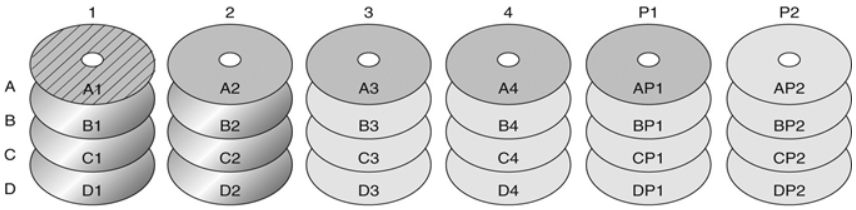


a. A catastrophic crash occurs. Two drives affected. Both drives are replaced.



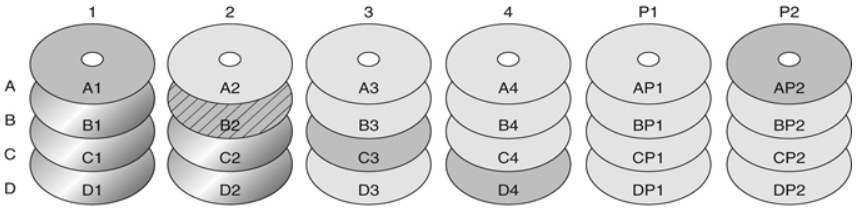
b. Platter A2 is restored using the equation:

$$A2 = B3 \oplus C4 \oplus DP1 \oplus BP2$$



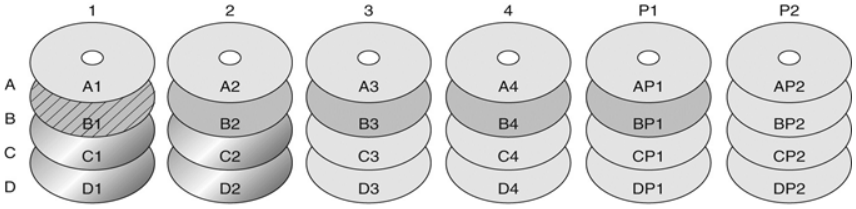
c. Platter A1 is restored using the equation:

$$A1 = A2 \oplus A3 \oplus A4 \oplus AP1$$



d. Platter B2 is restored using the equation:

$$B2 = A1 \oplus C3 \oplus D4 \oplus AP2$$



e. Platter B1 is restored using the equation:

$$B1 = B2 \oplus B3 \oplus B4 \oplus BP1$$

RAID Level	Description	Reliability	Throughput	Pro and con
0	Block interleave data striping	Worse than single disk	Very good	Least cost, no protection
1	Data mirrored on second identical set	Excellent	Better than single disk on reads, worse on writes	Excellent protection, high cost
2	Bit interleave data striping with Hamming code	Good	Very good	Good performance, high cost, not used in practice
3	Bit interleave data striping with parity disk	Good	Very good	Good performance, reasonable cost
4	Block interleave data striping with one parity disk	Very good	Much worse on writes as single disk, very good on reads	Reasonable cost, poor performance, not used in practice
5	Block interleave data striping with distributed parity	Very good	On writes not as good as single disk, very good on reads	Good performance, reasonable cost
6	Block interleave data striping with dual error protection	Excellent	On writes much worse than single disk, very good on reads	Good performance, reasonable cost, complex to implement
10	Mirrored disk striping	Excellent	Better than single disk on reads, not as good as single disk on writes	Good performance, high cost, excellent protection
DP	Block interleave data striping with dual parity disks	Excellent	Better than single disk on reads, not as good as single disk on writes	Good performance, reasonable cost, excellent protection