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Jens Dittrich

Hard Disk Failures

official vendor claims (data sheet):

1,000,000 to 1,500,000 hours *mean time to failure (MTTF)*

~0.88% *annualized failure rate (AFR)*

in reality:

2-4% AFR

up to 13% on some systems

Redundant Array of Inexpensive Disks (RAID)

motivation:

be able to survive one or multiple disk failures

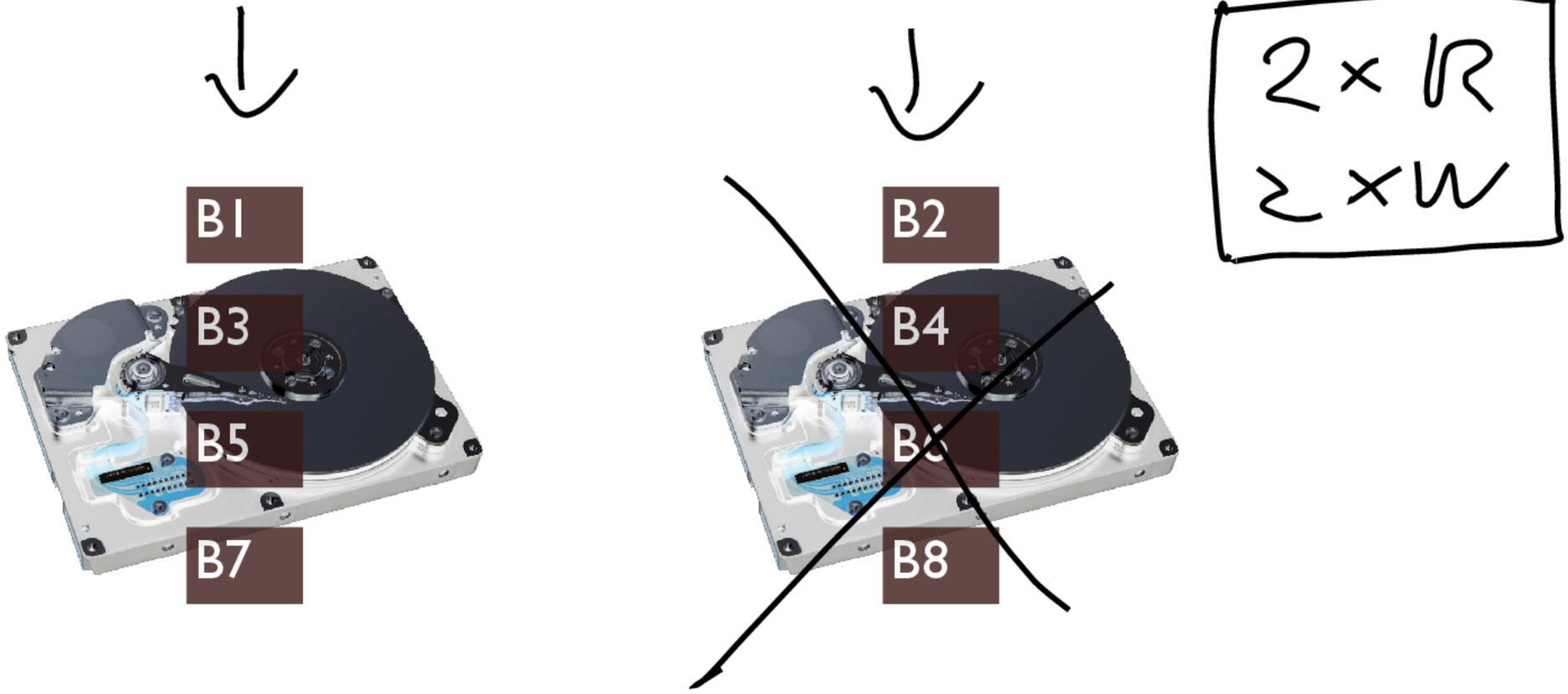
core idea:

multiple cheap disks

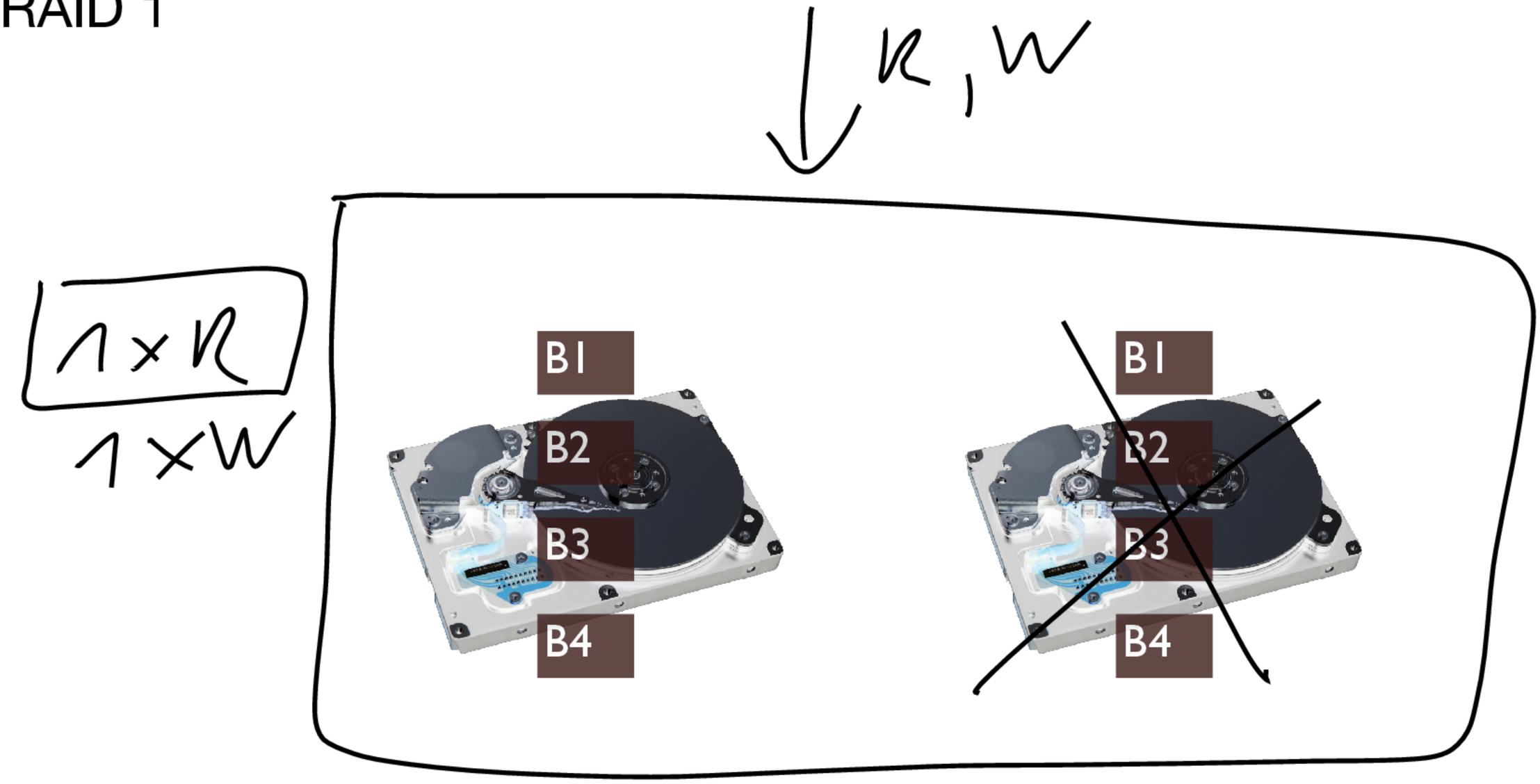
store data redundantly

=> different RAID levels: different degrees of redundancy/performance

RAID 0

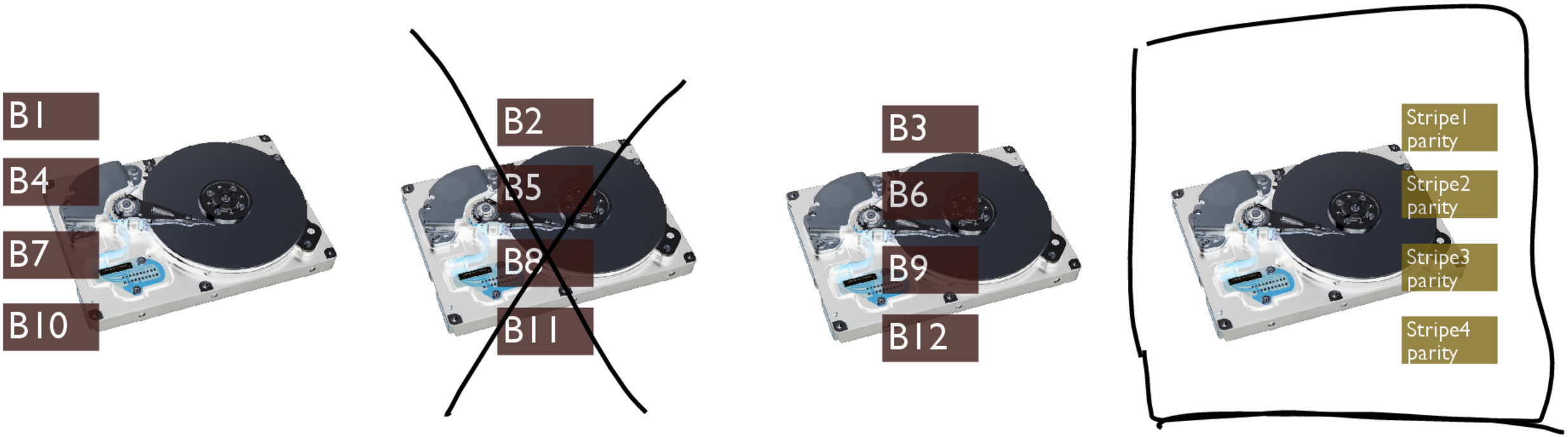


RAID 1



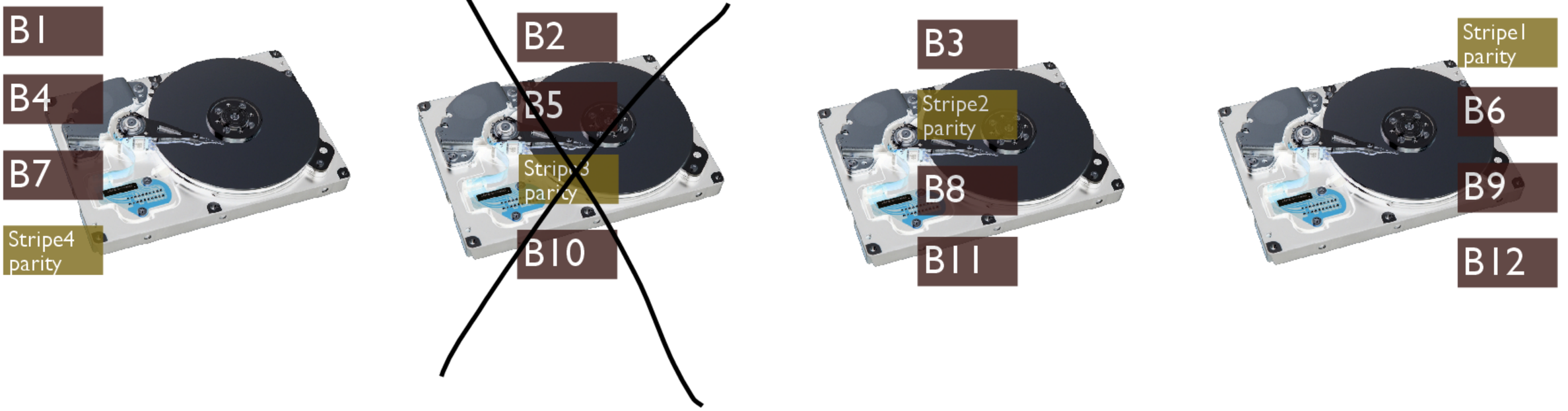
RAID 4

B1 xor B2 xor B3 = stripe 1 parity

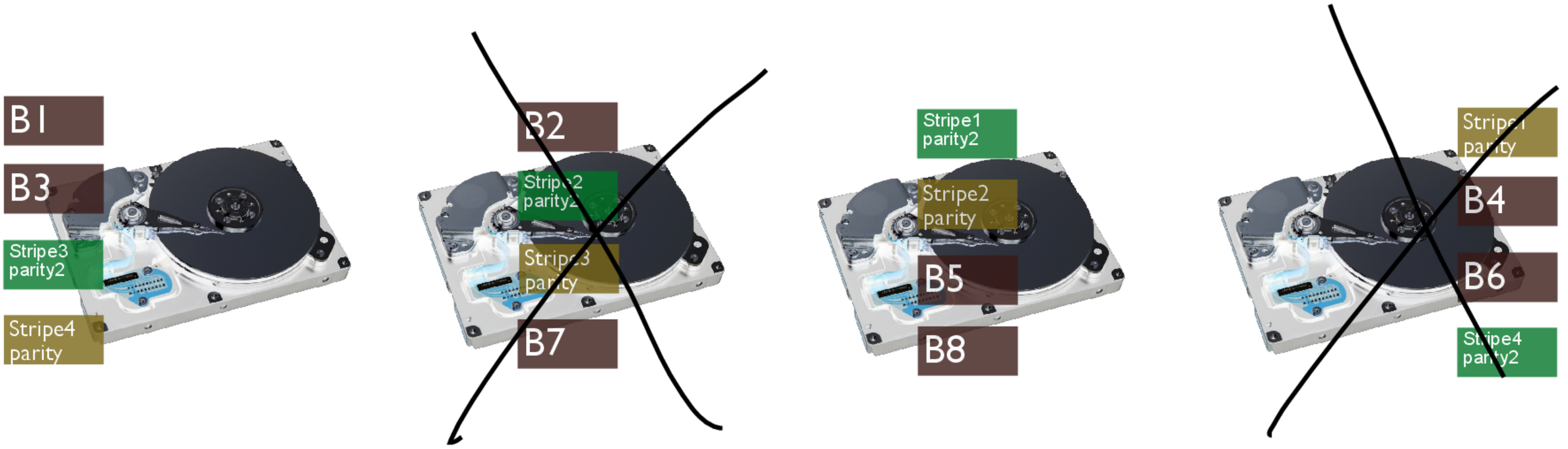


B8 = B7 xor B9 xor stripe 3 parity

RAID 5


B1
B4
B7
Stripe4 parity
B2
B5
B10
B3
Stripe2 parity
B8
B11
Stripe1 parity
B6
B9
B12

RAID 6


B1
B3
Stripe3
parity2
Stripe4
parity
B2
Stripe2
parity2
Stripe3
parity
B7
Stripe1
parity2
Stripe2
parity
B5
B8
Stripe1
parity
B4
B6
Stripe4
parity2

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hard disk failure rates as reported in:

Disk failures in the real world:
What does an MTTF of 1,000,000 hours mean to you?
Bianca Schroeder, Garth A. Gibson
FAST'07