
DATABASE

CSE3103 : Database

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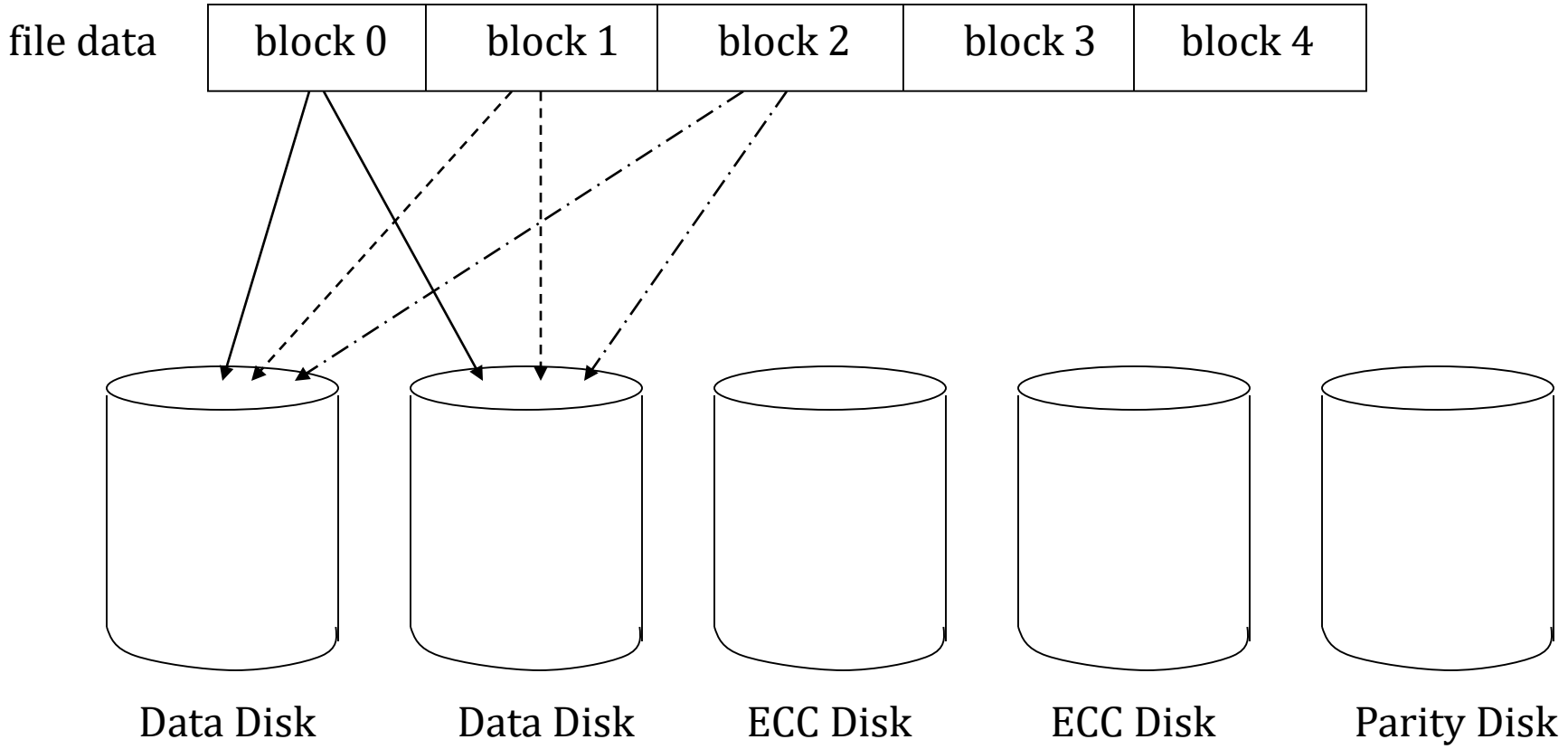
RAID Level-2

- Stripes data across disks similar to Level-0
  - difference is data is bit interleaved instead of block interleaved
- Uses ECC to monitor correctness of information on disk
- Multiple disks record the ECC information to determine which disk is in fault
- A parity disk is then used to reconstruct corrupted or lost data

RAID Level-2


file data
block 0
block 1
block 2
block 3
block 4
Data Disk
Data Disk
ECC Disk
ECC Disk
Parity Disk

RAID Level-2

- Reconstructing data
  - assume data striped across eight disks
  - correct data: 10011010
  - parity: 0
  - data read: 10011110
  - if we can determine that disk 2 is in error
  - just use read data and parity to know which bit to flip

RAID Level-2

- Requires fewer disks than Level-1 to provide redundancy
- Still needs quite a few more disks
  - for 10 data disks need 4 check disks plus parity disk
- Big problem is performance
  - must read data plus ECC code from other disks
  - for a write, have to modify data, ECC, and parity disks
- Another big problem is only one read at a time
  - while a read of a single block can be done in parallel
  - multiple blocks from multiple files can’t be read because of the bit-interleaved placement of data

RAID Level-3

- One big problem with Level-2 are the disks needed to detect which disk had an error
- Modern disks can already determine if there is an error
  - using ECC codes with each sector
- So just need to include a parity disk
  - if a sector is bad, the disk itself tells us, and use the parity disk to correct it

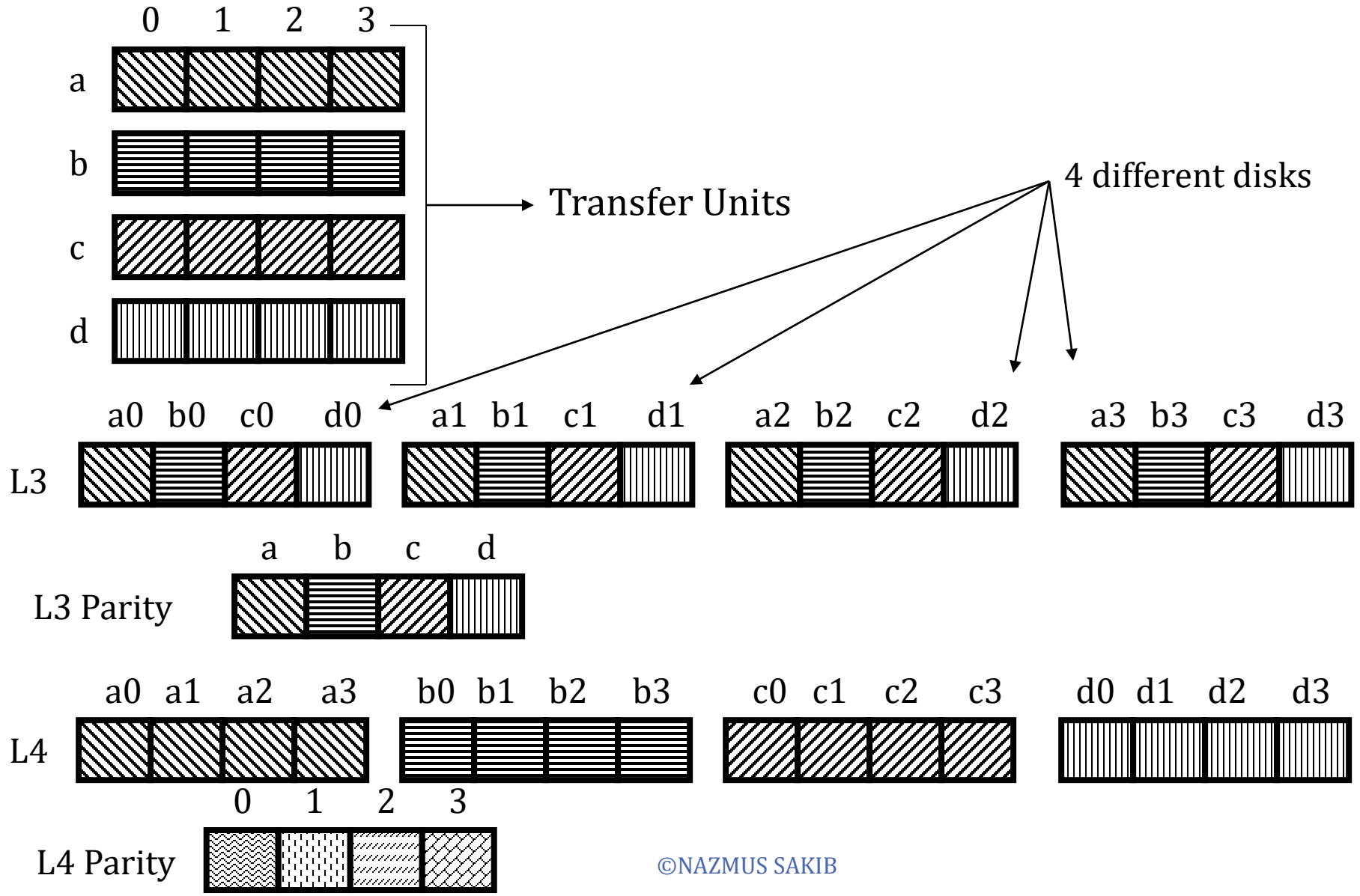
RAID Level-4

- Big problem with Level-2 and Level-3 is the bit interleavening
  - to access a single file block of data, must access all the disks
  - allows good parallelism for a single access but doesn't allow multiple I/O's
- Level-4 interleaves file blocks
  - allows multiple small I/O's to be done at once

RAID Level-4

- Still use a single disk for parity
- Now the parity is calculated over data from multiple blocks
  - Level-2,3 calculate it over a single block
- If an error detected, need to read other blocks on other disks to reconstruct data

Level-4 vs. Level-2,3



RAID Level-4

- Reads are simple to understand
  - want to read block A, read it from disk 0
  - if there is an error, read in blocks B,C, D, and parity block and calculate correct data
- What about writes?
  - it looks like a write still requires access to 4 data disks to recalculate the parity data
  - not true, can use the following formula
    - new parity = (old data xor new data) xor old parity
  - a write requires 2 reads and 2 writes

RAID Level-4

- Doing multiple small reads is now faster than before
- However, writes are still very slow
  - this is because of calculating and writing the parity blocks
- Also, only one write is allowed at a time
  - all writes must access the check disk so other writes have to wait


data
distributed
database
DBMS
parallel
shared
system
architecture
network
processing
systems
DBMSs
Distributed
access
centralized
performance
processors
memory
DDBMS
multiple
sites
site
nothing
computer
applications
Parallel
processor
may
single
disk
Shared
technology
computers
number
local
sometimes
large
require
physically
users
fragments
typically
provide
decentralized
logically
stored
application
Database
bottleneck
interconnection
Figure
administered
organizational
management
transparent
Management
control
scalability
approach
improve
distinction
logical
databases
definition
development
nodes
capable
major
also
make
replicated
many
discuss
often
one
split
computing
communication
distribution
reliability
eliminates
fact
across
like
within
machines
makes
dis
user
global
associated
structure
collection
provides
incompatible
way
consists
least
used
partitioned
mode
must
System
directly
com
disks
islands
resources
remote
defined
controlled
based
Date
scalable
architectures
order
referred
operational
independently