

Today: Why Fixed-Sized Blocks?

- Today's Learning Outcomes
 - Define sparse file
 - Identify the design considerations that lead us to focus on file representations using collections of fixed-size blocks
 - Explain how we can decouple allocation units from layout policies

Recall

- We pick a block size (some multiple of a sector).
- All files are composed of some number of these fixed-size blocks.

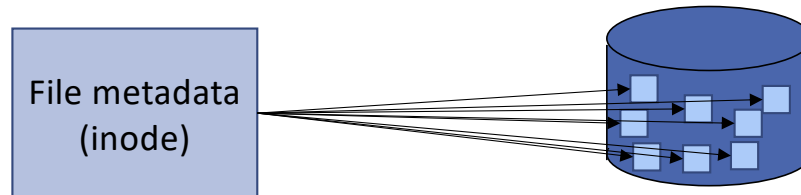
How much metadata does it require? **One disk address per block**

How is internal fragmentation? **Depends on how large the block is.**

Performance? **Could be bad if blocks are scattered!**

How is external fragmentation? **There is none!**

Any other problems? **If the file were really large, the metadata could get big**



Allocating in Individual blocks looks poor

- One disk address per block of metadata
- If the blocks are scattered all over the disk, performance would be terrible.
- If the file were large, the metadata become large too.

Things we didn't consider

- POSIX says that you create files by simply writing bytes to them; files grow dynamically.
 - Extent-based allocation is not well-matched to this model.
- Some files are **sparse**
 - Files can have holes in them:



- Examples:
 - Virtual Machine images (their size reflects the total size of the virtual disk, even if that disk is empty)
 - When programs “drop core” -- core files have many unused spaces
- Extent-based files must typically allocate disk space for the entire file

Key Insight

- We can allocate individual blocks, but we can still try to allocate them contiguously or near each other to achieve the **performance of extents** with the **flexibility of fixed-size blocks**.
- We can **decouple** the **unit of allocation** from **where we allocate** these units on the disk.
- Key questions:
 - How do we structure metadata to represent fixed-block allocation efficiently?
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 - How do we manage the disk to facilitate good block layout?
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Key Insight

- We can allocate blocks a block at a time, but we can still try to allocate them contiguously or near each other to achieve the **performance of extents** with the **flexibility of fixed-size blocks**.
- We can decouple the unit of allocation from where we allocate these units on the disk.
- Key questions:
 - How do we structure metadata to represent fixed-block allocation efficiently?
 - **Next class**
 - How do we manage the disk to facilitate good block layout?
 - **Next week**