Federated Systems

Lecture 12

File Systems

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Today

File Systems

- xfs (Anderson, Dahlin, Neefe, Patterson, Roselli, Wang)
- Frangipani (Thekkath, Mann, Lee)

Topics

- Semantics
- Scalability
- Recovery
- Engineering

Today

- File system as separate from the storage interface
- What should the file system do?
  - What are the clients of the FS?
  - What needs do they have?
  - How to store/manage data?

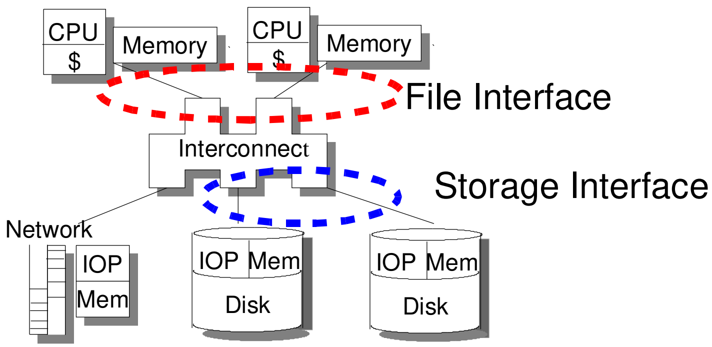
Recall Storage Layers

My program

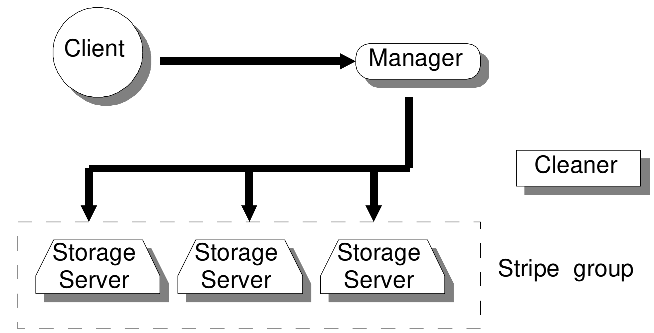
`Read()/Write()`

File System	Directories, files, locks
Buffer Cache	Block–level cache
Storage System	Block–level Storage

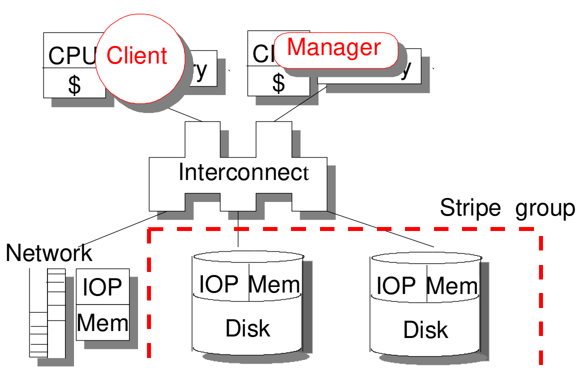
Model Federated Architecture



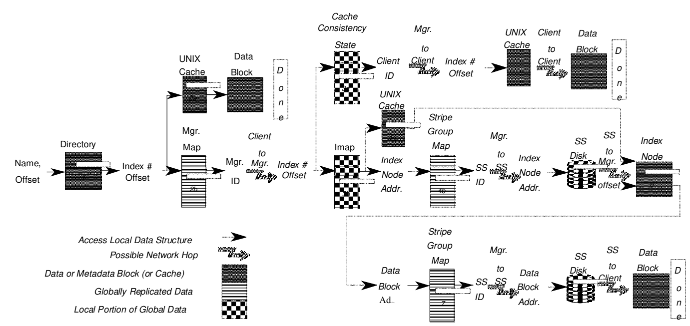
XFS Universe



xFS Fed. Architecture



xFS Dataflow



Frangipanni

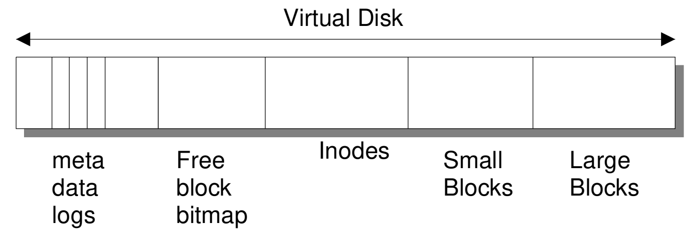
Global FS built using stock FS ideas

- uses per−file locking to reduce contention
- build the FS structures on top of

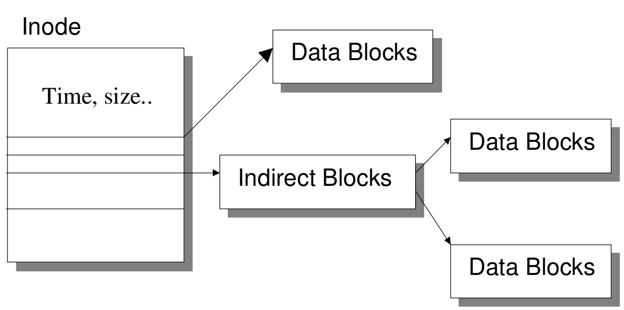
Issues:

- How to partition up disk address space?
- Recovery?
- Co−operation between kernels?

Frangipani Layout



File System Metadata



Scalability

Scalability in the FS context?

- Add resources means FS can grow?
- Human intervention in the FS needed?
- Can the files grow as resources are added?

xFS scalable at the block level

- can use one huge file in a program

Frangipani design limits scalability

- But semantics aren't any worse then regular FS!

Recovery

Frangipani:

- Meta−data logged (just like a regular FS metadata log)
- Detect downed server

xFS:

- layered recovery:
  - Storage servers−> managers −> cleaners
- storage servers first recover locally, then group
- managers use LFS style roll−forward

Engineering

xFS vs. Frangipani

- xFS: Multi−functional partitioning
- Frangipani: pure vertical partitioning

Which one is easier to implement?

- Frangipani’s reliance on petal global block abstraction simplifies design
- xFS’s functional partitioning
- Which style of design is easier to maintain?

Next Week

No reading

Questions for next time:

- Will I/O processors be viable beyond current uses?
- Which architectures (SMP, Cluster, Federated) will be used in which contexts? Why?