Cold Storage Data Archives: More Than Just a Bunch of Tapes

Bunjamin Memishi, Raja Appuswamy, and Marcus Paradies



Knowledge for Tomorrow



Data-intensive sciences

high data volume generation



Radio Astronomy, etc.



Data-intensive sciences

high data volume generation



Radio Astronomy, etc.

Storage

• private infrastructure





Data-intensive sciences

• high data volume generation



Storage

private vs. public infrastructure







Data-intensive sciences

• high data volume generation



Storage

private vs. public infrastructure





The problem is, what to store and where?



Data analysis

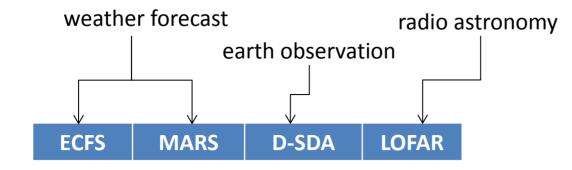


Data analysis

weather forecast radio astronomy earth observation

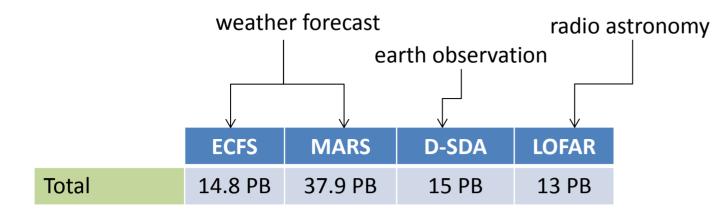


Data analysis



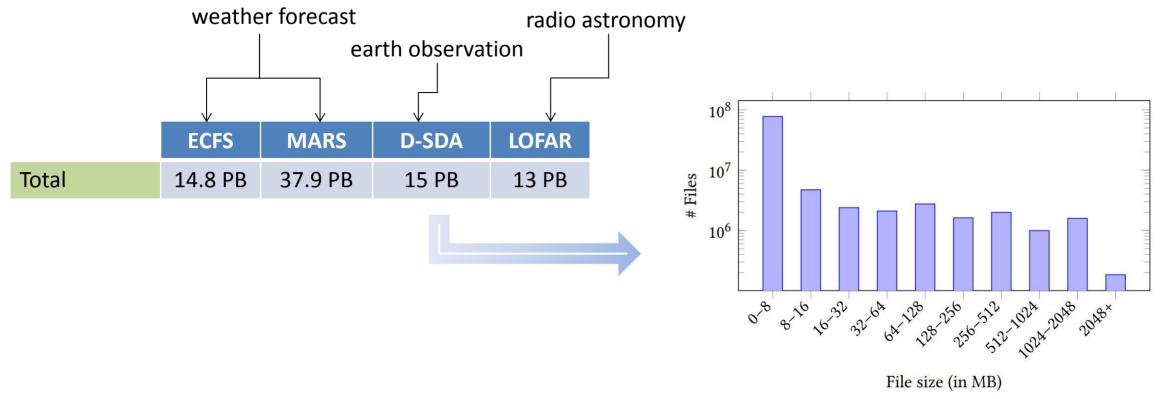


Data analysis: Volume





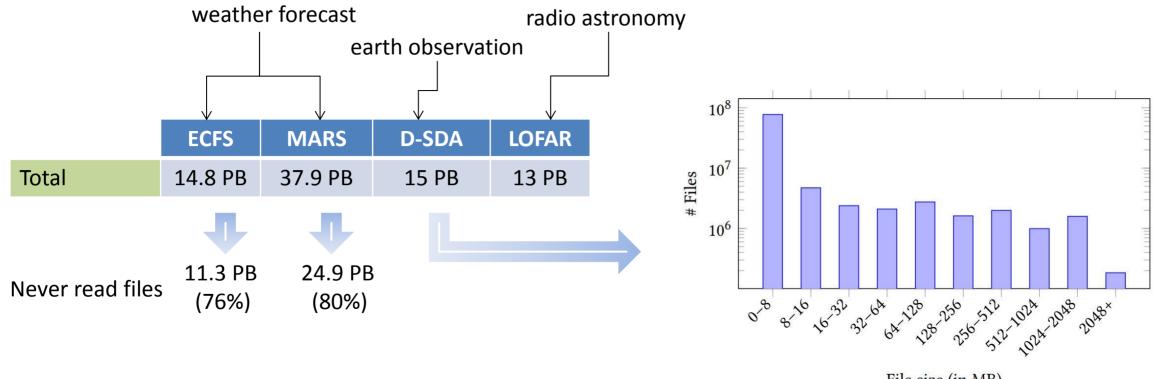
Data analysis: Volume, Variety



File size distribution: Main D-SDA product library



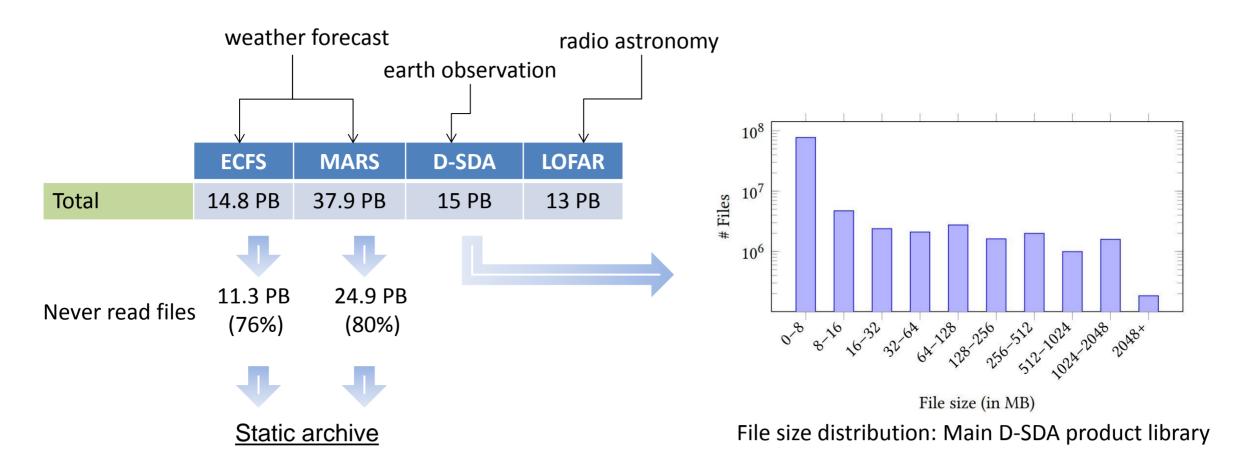
Data analysis: Volume, Variety, Liveliness



File size (in MB) File size distribution: Main D-SDA product library

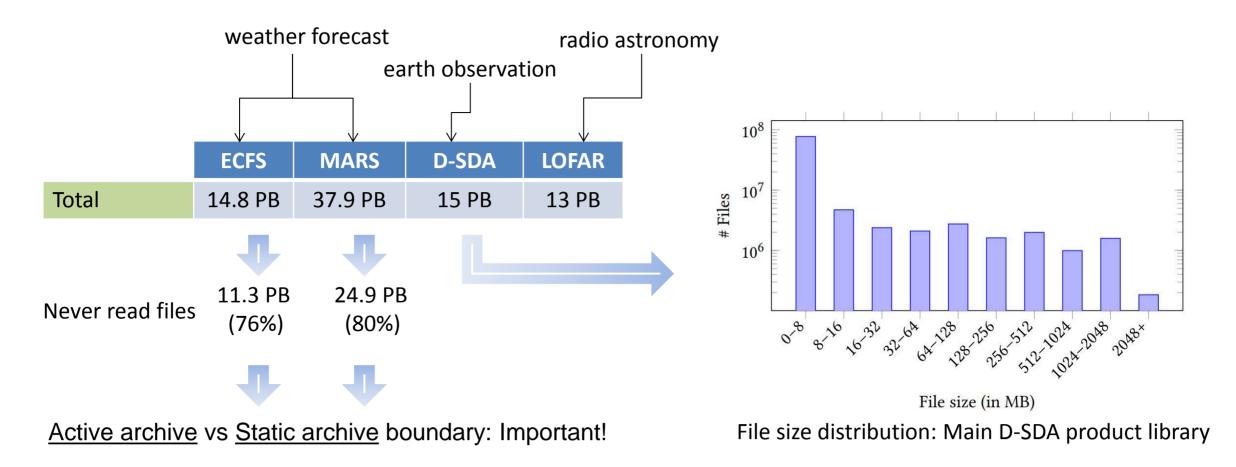


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Deployment analysis





At public cloud offerings, generally, 3 types of storage classes

- deep archival
- nearline archival
- online service



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Azure use case

	Storage (GB/Month)	Retrieval (per GB)	Latency
Azure Archival Blob (deep)	\$0.0045	\$0.02	Several hours
Azure Cool Blob (nearline)	\$0.0334	\$0.01	61.4 ms
Azure Hot Blob (online)	\$0.0422	\$0	5.3 ms



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Storage vs. Retrieval cost

• Important implications for deploying scientific applications in a public cloud



Deployment analysis





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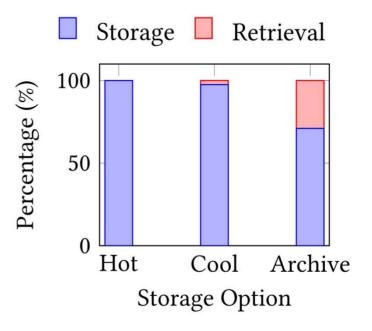




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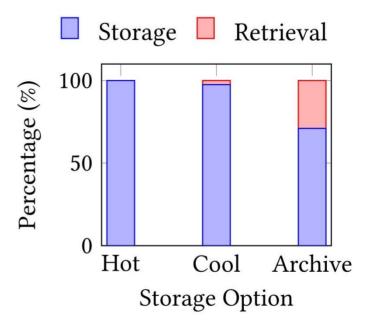




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Archival blob store

• Data retrieval – 30% of the overall costs

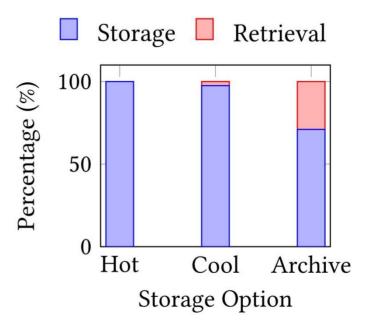




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Active archive migration

• storage is no longer the only concerning cost



Deployment analysis







Cost added-values

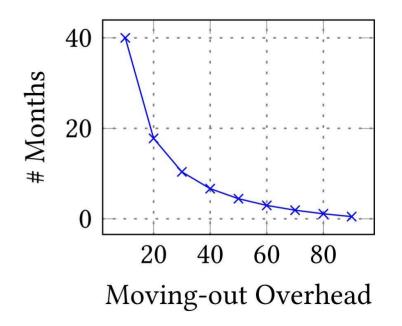
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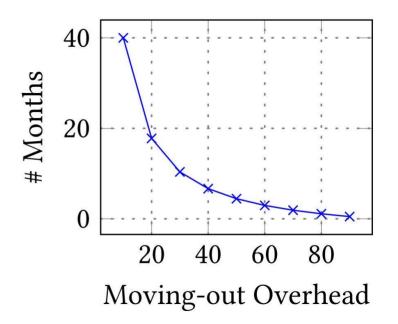




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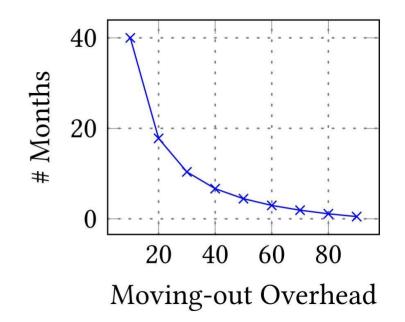


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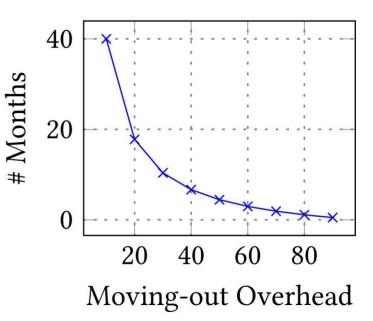


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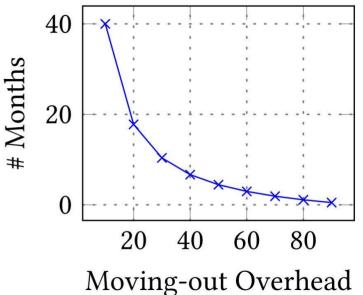


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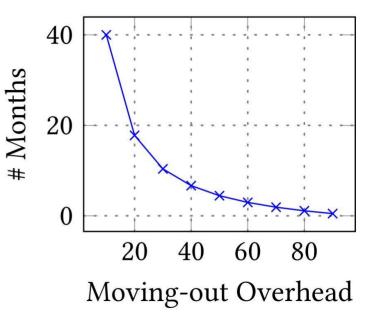
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Once migrated, not easy to return in-house, or move to another provider





Deployment analysis







Private Infrastructure





Private Infrastructure



Public Infrastructure





Private Infrastructure



Public Infrastructure



Hybrid Infrastructure











Two-tier, hybrid cloud infrastructure seems more appropriate

• 1 copy locally, 1+ copy in cloud







- 1 copy locally, 1+ copy in cloud
- eliminate data retrieval overheads







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- eliminate data retrieval overheads
- perform data scrubbing on local copy







- 1 copy locally, 1+ copy in cloud
- eliminate data retrieval overheads
- perform data scrubbing on local copy
- solve vendor lock-in problem







Active Archive—Polystore

 active archives (and not just performance-sensitive analytics), an interesting candidate for adopting polystore architecture





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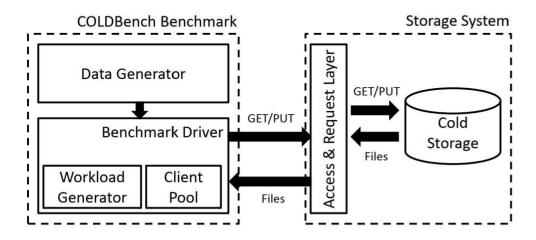
 for private storage infrastructures, important to having simulation, configuration tools, benchmarking, full-system monitoring tools



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A Cold Storage Benchmark



Provisioning & Configuring Data Archives

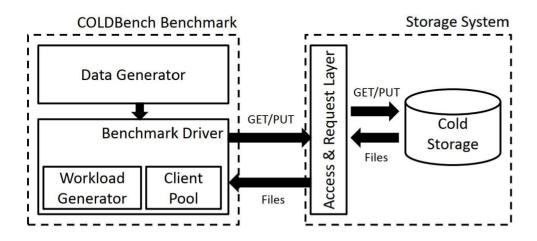
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A Cold Storage Benchmark



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Archive Profiling & Monitoring

 current methodologies, inappropriate and time-consuming, due to complexity and privacy



To summarize

Cold storage data archives, a fundamental building block for scientific application domains

Data archive analysis of three application domains

• weather forecast (ECFS, MARS), earth observation (D-SDA), radio astronomy (LOFAR)

A hybrid two-tier approach of a private/public cold storage infrastructure, most promising for a reasonable cost/performance trade-off

Several areas need further exploration: scientific data archival – not just a storage problem





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