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Provisioning of data locality for HEP analysis workflows

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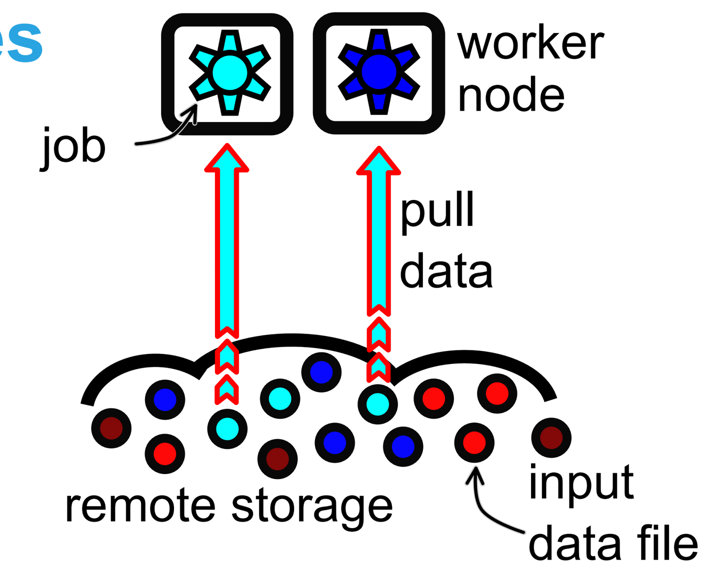
Introduction

Increasing input/output in HEP analyses

- Heavily increasing amount of data
- Fast processing of huge datasets required

Current HEP computing approach

- Dedicated network storage at WLCG Tiers
- Batch farms provide CPUs for processing



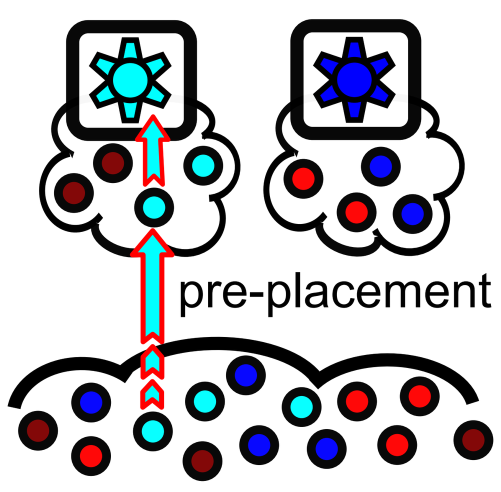
Data transfers limited by network

- Shared transfer capacity
- Low CPU efficiency

Optimization

- Caching of input data
- Transparent integration into batch system

Coordinated Caching



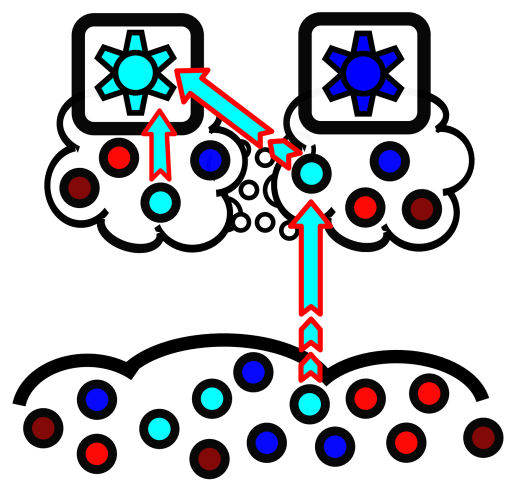
- Shared metadata
- Strong data locality on cache node
- Few, highly performant devices (SSDs)
- Job and data scheduling at node level

Advantages

- Good horizontal and vertical scalability
- Independent of infrastructure
- Customisability of jobs and data locality
- High throughput rates

Distributed Caching

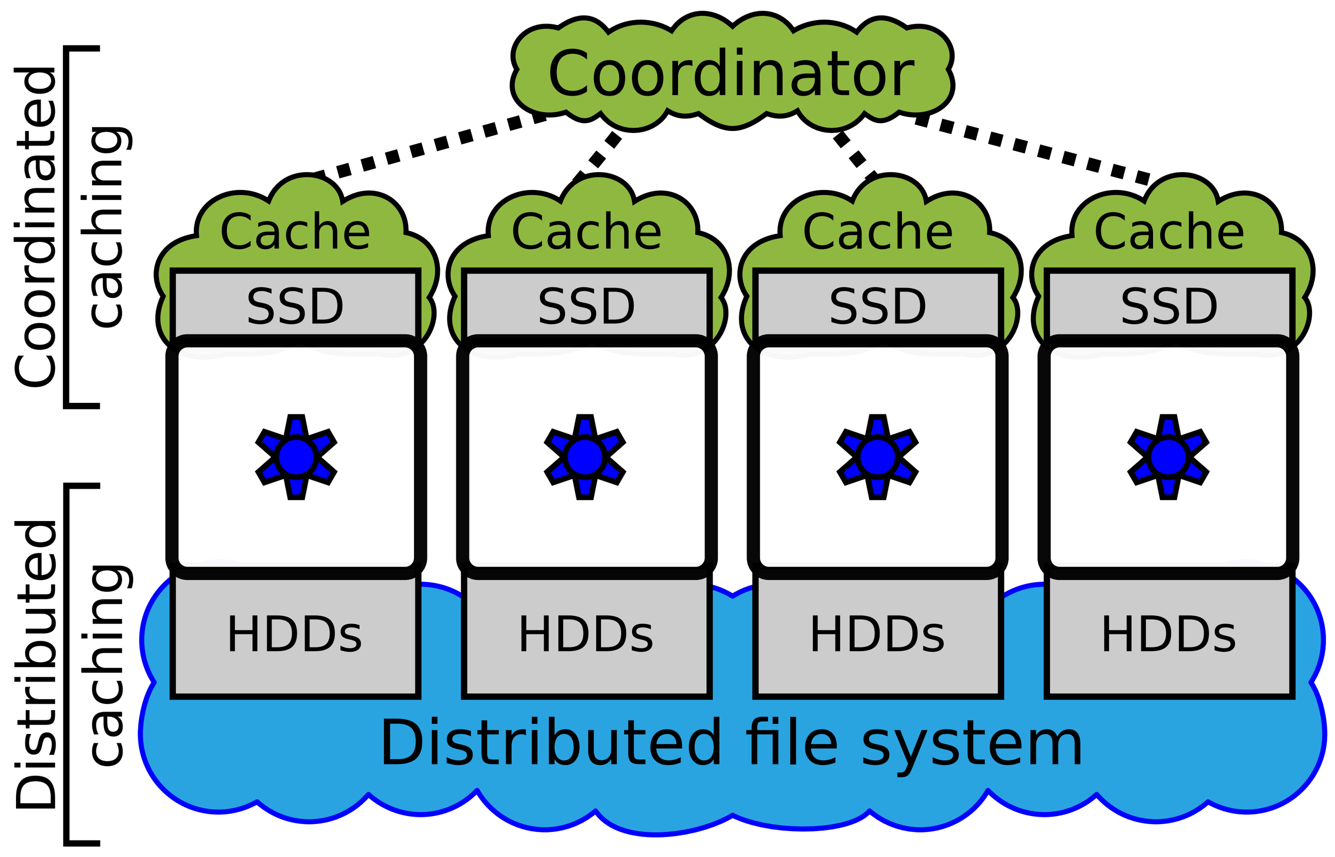
- Shared data
- Weak data locality for all nodes
- Many, low performant devices (HDDs)
- Job and data scheduling at cluster level



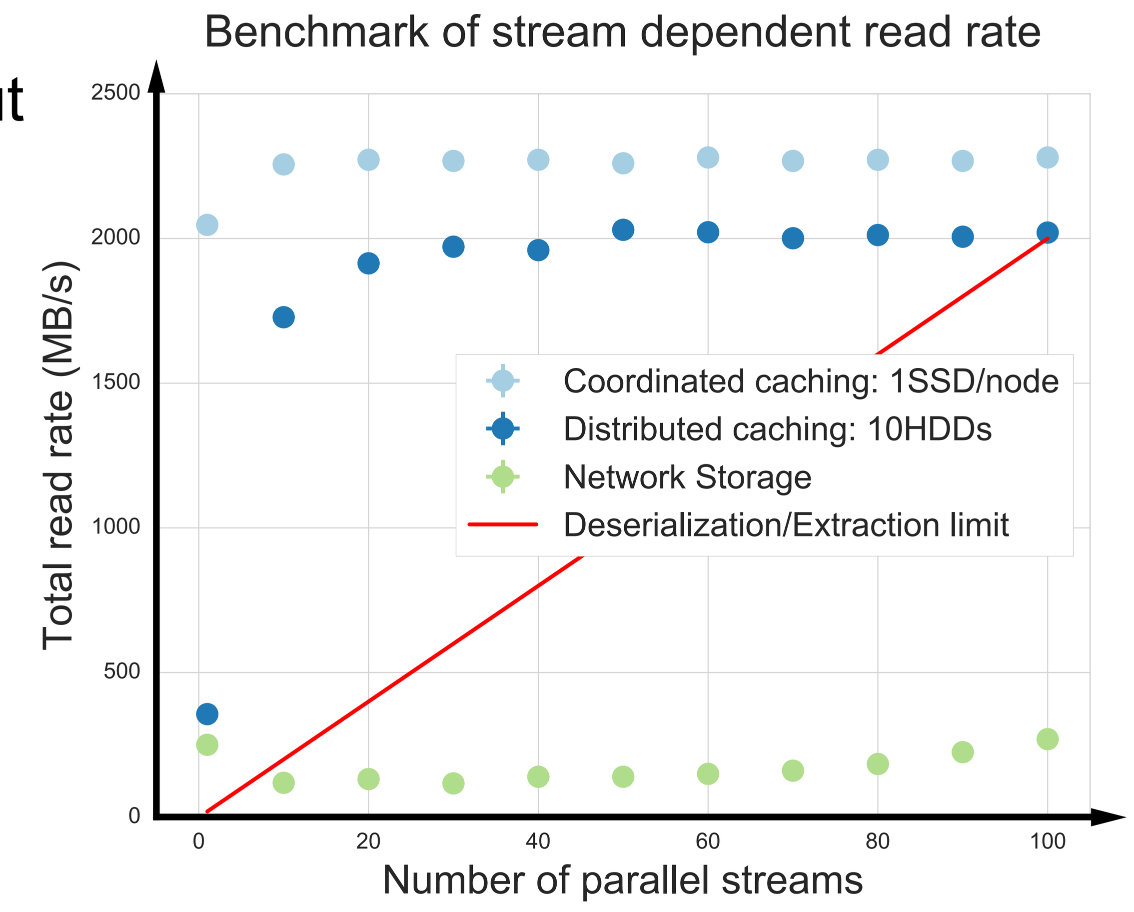
Advantages

- Good vertical scalability
- Exploit static infrastructure, especially interconnection
- Straightforward scheduling of jobs and data locality
- Large cache volume

Prototype and Benchmarks



- Highly improved throughput
- Improved CPU efficiency for I/O dependent jobs
- Coordinated SSD caches easily scalable
- Large distributed HDD cache feasible
- Utilization of network versus local resources efficient adjustable



Conclusion

- Data locality is essential to process large HEP datasets within short cycles
- Limited processing rate at ~20 MB/s/core due to extraction and deserialization of input data files
- Both caching methods achieve this limit and enable fast analyses
- Improvement of caching approach to optimize future analyses workflows