Flexible Caching and Replication: dCaches in Data Lakes

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WLCG’s Data Lakes research

- WLCG trying to optimize storage cost
- R&D push into “Data Lakes” — outcome is open
- We want to hear your perspective!
What is already known

- Very little concrete information
  - R&D project in its early stages
  - Early discussion at Joint WLCG & HSF Workshop in Napoli, March 2018 (https://indico.cern.ch/event/658060/)
- Concepts so far seem not very well aligned with industry’s understanding of Data Lakes
What is already known

• QoS supposed to become more and more important
  – Policies push data to slower, cheaper, archival-grade QoS classes
  – Usage pushes data to faster, more expensive, throughput-focused QoS classes
What is already known

• Networking supposed to become more important
  • more distribution of data across sites
  • talk about remote reads over WAN
• Cost balance between storage and networking cost?
dCache in distributed setups

- Some distributed instances already running
  - NDGF Tier 1 (tape at any site, reading from location, writing distributed across sites)
  - Great Lakes Tier 2 (no tape, both reads and writes are local, remote reads trigger replication)
- Why are those not considered Data Lakes?
Distributed dCaches: Existing Features

- Support for diverse protocols
- Support HSM connectivity
- Pools may run different major versions
- Choose preferred write location depending on IP (location) or directory path (if requested)
- Prefer ‘local’ read access if data locally available
- Replication
  - Both on-demand and manually triggered
  - Permanent, data protection, location adjustment
Distributed dCaches: Missing Features

- All data servers must be dCache pools
- No locality preference / network topology awareness for internal communication
- No central/dCache way to update whole setup
- No operation if consistency can’t be guaranteed (CAP theorem)
Architectures

Thinking about three possible architectures:

1. Distributed dCaches (already existing)
2. dCache as part of a federated storage system
3. dCache as part of a caching system
1. Distributed dCache

- dCache servers (and services) connected by WAN instead of LAN
- Share admin workload
- May use less resources
2. dCache as part of a Federation

Instance 1  Instance 2  Instance 3  Instance 4

Central access gateway

WAN links
3. dCache in a cache hierarchy

- Base site (your favorite storage)
- Cache-site
- cache warm-up
Questions and Discussion

Architecture
- Which one will be chosen for WLCG?

Transfer
- Protocols
- Management

Security
- Responsibilities
- Methods

Management
- What remains for local sites?
- What's needed for local sites?
Next steps

- Big question: How will the R&D effort turn out?
- We’ll support what admins in WLCG need
- CERN representatives from several levels will come to Hamburg for discussions right after this workshop
Data Lake concepts:
Discussion