Repository performance tuning

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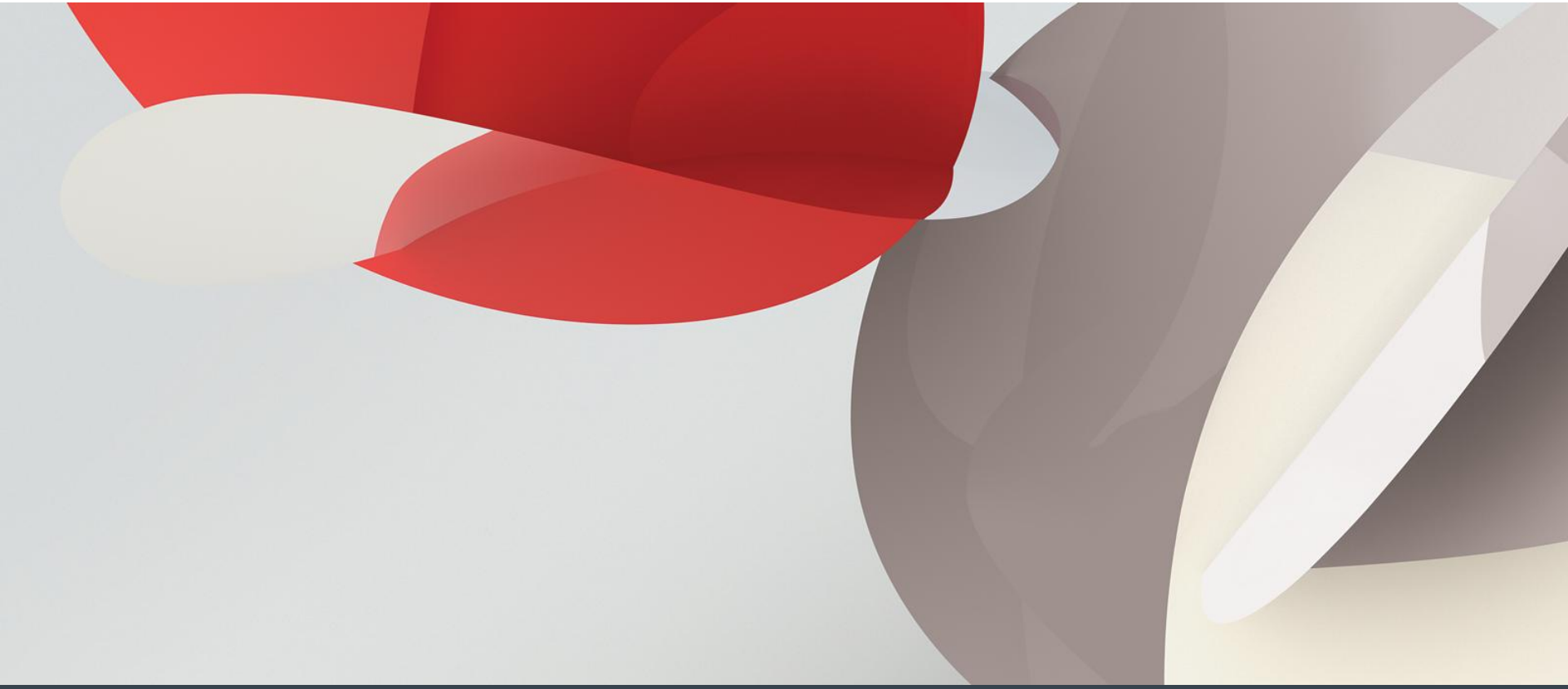


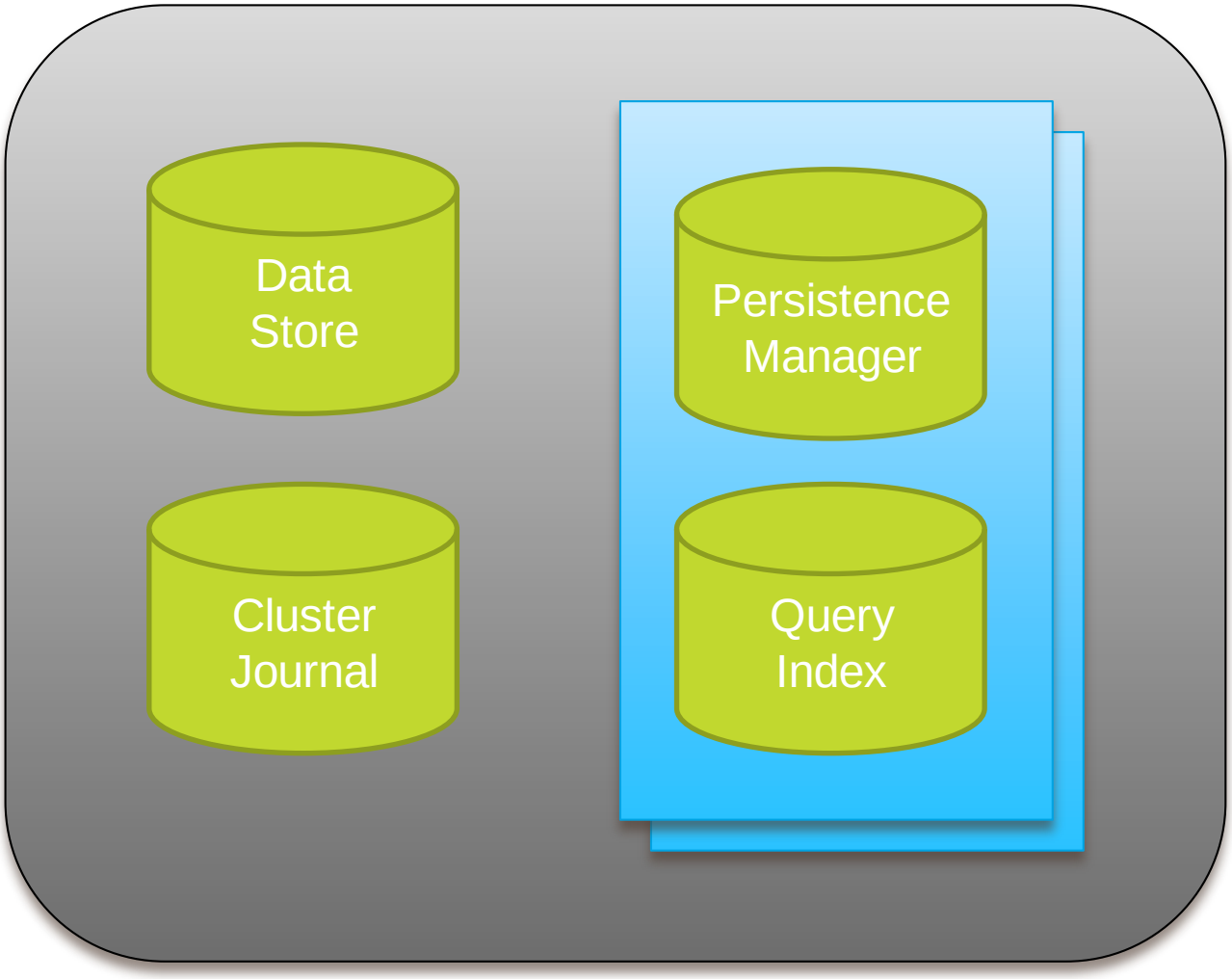
Agenda

- Performance tuning steps
- Repository internals
- Basic content access
- Batch processing
- Clustering
- Query performance
- Full text indexing
- Questions and answers

Performance tuning steps

- Step 1: Identify the symptom
  - Create a test case that consistently measures current performance
  - Define the performance target if current level unacceptable
  - Make sure that the test case and the target performance are really relevant
- Step 2: Identify the cause
  - Main suspects: Hardware, Repository, Application, Client
  - Revise the test case until the problem no longer occurs;
    for example: Selenium, JMeter, JUnit, Iometer
- Step 3: Identify/implement possible solutions
  - Change content, configuration, code or upgrade hardware
- Step 4: Verify results
  - If target not reached, iterate the process or revise the goal

Repository internals



Data Store

- Content-addressed storage for large binary properties
  - Arbitrarily sized binary streams
  - Addressed by MD5 hash
  - String properties not included, use UTF-8 to map to binary
- Fast delivery of binary content
  - Read directly from disk
  - Can also be read in ranges
- Improved write throughput
  - Multiple uploads can proceed concurrently (within hardware limits)
  - Cheap copies
- Garbage collection used to reclaim disk space
- Logically shared by the entire cluster

Cluster Journal

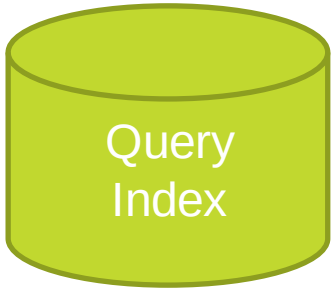
- Journal of all persisted changes in the repository
  - Content changes
  - Namespace, nodetype registrations, etc.
- Used to keep all cluster nodes in sync
  - Observation events to all cluster nodes (see JackrabbitEvent.isExternal)
  - Search index updates
  - Internal cache invalidation
- Old events need to be discarded eventually
  - No notable performance impact, just extra disk space
  - Keep events for the longest possible time a node can be offline without getting completely recreated
- Logically shared by the entire cluster
  - Writes synchronized over the entire cluster

Persistence Manager

- Identifier-addressed storage for nodes and properties
  - Each node has a UUID, even if not mix:referenceable
  - Essentially a key-value store, even when backed by a RDBMS
  - Also keeps track of node references
- Bundles as units of content
  - Bundle = UUID, type, properties, child node references, etc.
  - Only large binaries stored elsewhere in the data store
  - Designed for balanced content hierarchies, avoid too many child nodes
- Atomic updates
  - A save() call persists the entire transient space as a single atomic operation
- One PM per workspace (and one for the shared version store)
  - Logically (often also physically) shared across a cluster

Query Index

- Inverse index based on Apache Lucene
  - Flexible mapping from terms to node identifiers
  - Special handling for the path structure
- Mostly synchronous index updates
  - Long full text extraction tasks handled in background
  - Other cluster nodes will update their indexes at next cluster sync
- Everything indexed by default
  - Indexing configuration for tweaking functionality, performance and disk usage
- One index per workspace (and one for the shared version store)
  - Not shared across a cluster, indexes are local to each cluster node
- See http://wiki.apache.org/jackrabbit/Search#Search_Configuration



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Basic content access

- Very fast access by path and ID
  - Underlying storage addressed by ID, but path traversal is in any case needed for ACL checks
- Relevant caches:
  - Path to ID map (internal structure, not configurable)
  - Item state caches (automatically balanced, configurable for special cases)
  - Bundle cache (default fairly low, increase for large deployments)
  - Also some PM-specific options (TarPM index, etc.)
- Caches optimized for a reasonably sized active working set
  - typical web access pattern: handful of key resources and a long tail of less frequently accessed content, few writes
- Performance hit especially when updating nodes with lots of child nodes
- FineGrainedISMLocking for concurrent, non-overlapping writes

Example: Bundle cache configuration

```
<!-- In …/repository/worspaces/${wsp.name}/workspace.xml -->
<Workspace …>

  <PersistenceManager class="…">
    <param name="bundleCacheSize" value="8"/>
  </PersistenceManager>

</Workspace>
```

Batch processing

- Two issues: read and write
- Reading lots of content
  - Tree traversal the best approach, but will flood caches
  - Schedule for off-peak times
  - Add explicit delay (used by the garbage collectors)
  - Use a dedicated cluster node for batch processing
- Writing lots of content (including deleting large subtrees)
  - The entire transient space is kept in memory and committed atomically
  - Split the operation to smaller pieces
  - Save after every ~1k nodes
  - Leverage the data store if possible

Clustering

- Good for horizontally scaling reads
  - Practically zero overhead on read access
- Not so good for heavy concurrent writes
  - Exclusive lock over the whole cluster
  - Direct all writes to a single master node
  - Leverage the data store
- Note the cluster sync interval for query consistency, etc.
  - Session.refresh() can be used to force a cluster sync

Query performance

- What's really fast?
  - Constraints on properties, node types, full text
  - Typically O(n) where n is the number of results, vs. the total number of nodes
- What's pretty fast?
  - Path constraints
- What needs some planning?
  - Constraints on the child axis
  - Sorting, limit/offset
  - Joins
- What's not yet available?
  - Aggregate queries (COUNT, SUM, DISTINCT, etc.)
  - Faceting

Join engine

```
SELECT a.* FROM [nt:unstructured] AS a JOIN [nt:unstructured] AS b
  <PersistenceManager class="…">
    <param name="bundleCacheSize" value="8"/>
  </PersistenceManager>

</Workspace>
```

Indexing configuration

- Default configuration
  - Index all non-binary properties
  - Index binary jcr:data properties (think nt:file/nt:resource)
  - Full text extraction support for all major document formats
  - Full text extraction from images, packages, etc. is explicitly disabled
  - CQ5 / WEM comes with default aggregate indexing rules for cq:Pages, etc.
- Why change the configuration?
  - Reduce the index size (by default almost as large as the PM)
  - Enable features like aggregate indexes
  - Assign boost values for selected properties to improve search result relevance

Indexing configuration

- How to change the configuration?
  - indexing_configuration.xml file in the workspace directory
  - Referenced by the indexingConfiguration option in the workspace.xml file
  - See http://wiki.apache.org/jackrabbit/IndexingConfiguration
- Example:

```
<?xml version="1.0"?>
<!DOCTYPE configuration SYSTEM
    "http://jackrabbit.apache.org/dtd/indexing-configuration-1.0.dtd">
<configuration xmlns:jcr="http://www.jcp.org/jcr/1.0"
                    xmlns:nt="http://www.jcp.org/jcr/nt/1.0">
  <aggregate primaryType="nt:file">
    <include>jcr:content</include>
  </aggregate>
</configuration>
```

Question and Answers


Adobe