Lucene Performance Workshop

Thinking Lucene ◥ Think Lucid.

Intro

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- About the speaker and Lucid Imagination
- Agenda
  - Lucene and performance
  - Lucid Gaze for Lucene: UI and API
  - Key statistics
  - Examples
  - Q & A session

Lucene and performance

- Perceived performance issues can have different causes
- Classic JVM problems, classic solutions
  - heap size
  - garbage collection
  - stack size
  - HotSpot
- Lucene/Search-related issues: beyond JVM tuning
  - Indexing performance: indexing too slow, strange slowdowns during indexing
  - Search performance: search too slow in general, or for certain types of queries

Common Lucene performance issues

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- Indexing:
  - Too many segments being created
  - Too many Token-s / TokenStream-s
  - Too many Documents / Fields
- Searching:
  - Too many IndexReader-s / IndexSearcher-s
  - High RAM usage of IndexReader
  - Slow response times for certain queries
- Application-level logging may not be up to the task
- Profiler is too low-level and too intrusive
- We need a lightweight probe to peek at vital Lucene statistics

Lucid Gaze for Lucene (LG4L)

Target audience and applications

- Tool for developers
- Performance monitoring
- Statistics collection
- Drop-in replacement for lucene-core-2.4.1.jar

Available information

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Statistics (per time unit):

- IndexReader / IndexWriter:
  - Number of documents and fields retrieved / created
  - Number of IndexWriter / IndexReader / Directory instances created
    - And the number of live instances!
  - Memory consumption of IndexWriter / IndexReader instances
- Analysis:
  - Number of Analyzers / TokenFilters / Tokenizers
  - Number of TokenStream-s and Token-s
- Search:
  - Number of searches and their average time
  - Number of opened IndexSearcher-s
- Storage:
  - Number of Lucene Directory instances created

Available information: metrics

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Lists and histograms

- Count and a list of `Analyzer`, `Tokenizer`, `TokenFilter` instances
- `Directory` implementations
- Top-N queries:
  - Queries with largest numbers of hits
  - Queries that took longest to execute

- All this data is available as log, persistent DB and through the API

In-memory and RRD storage

Retaining historical values of collected statistics

- In-memory
  - No files, no configuration hassles
  - Concise overview periodically written to log (optional)
  - Uses Java logging
- RRD (Round-Robin Database)
  - Persistent round-robin database
    - Single database of a constant size
    - E.g. hourly, daily, weekly, monthly, yearly statistics
  - Suitable for long-term monitoring
  - Many more metrics and statistics tracked
  - Can be accessed concurrently from other applications

Configuration

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Java properties or gaze.properties

- List of properties supplied as `-Dlucid.gaze...`
- gaze.properties on classpath
- Configurability:
  - Turning on/off selected monitors
  - Producing debug output
  - Using in-memory or RRD log retention
  - Configuring RRD archives (to scale historical data over different periods)

API

Facade with static methods: LuceneCore

- Programmatic access to all statistics groups
- Retrieve top-N queries
- Retrieving additional metrics (e.g. histograms of analyzers, tokenizers, directory implementations, tracking of IndexReader / IndexWriter instances and their memory consumption)
- Enabling / disabling monitors
- Resetting statistics (useful for creating snapshots)

Example: indexing performance tuning

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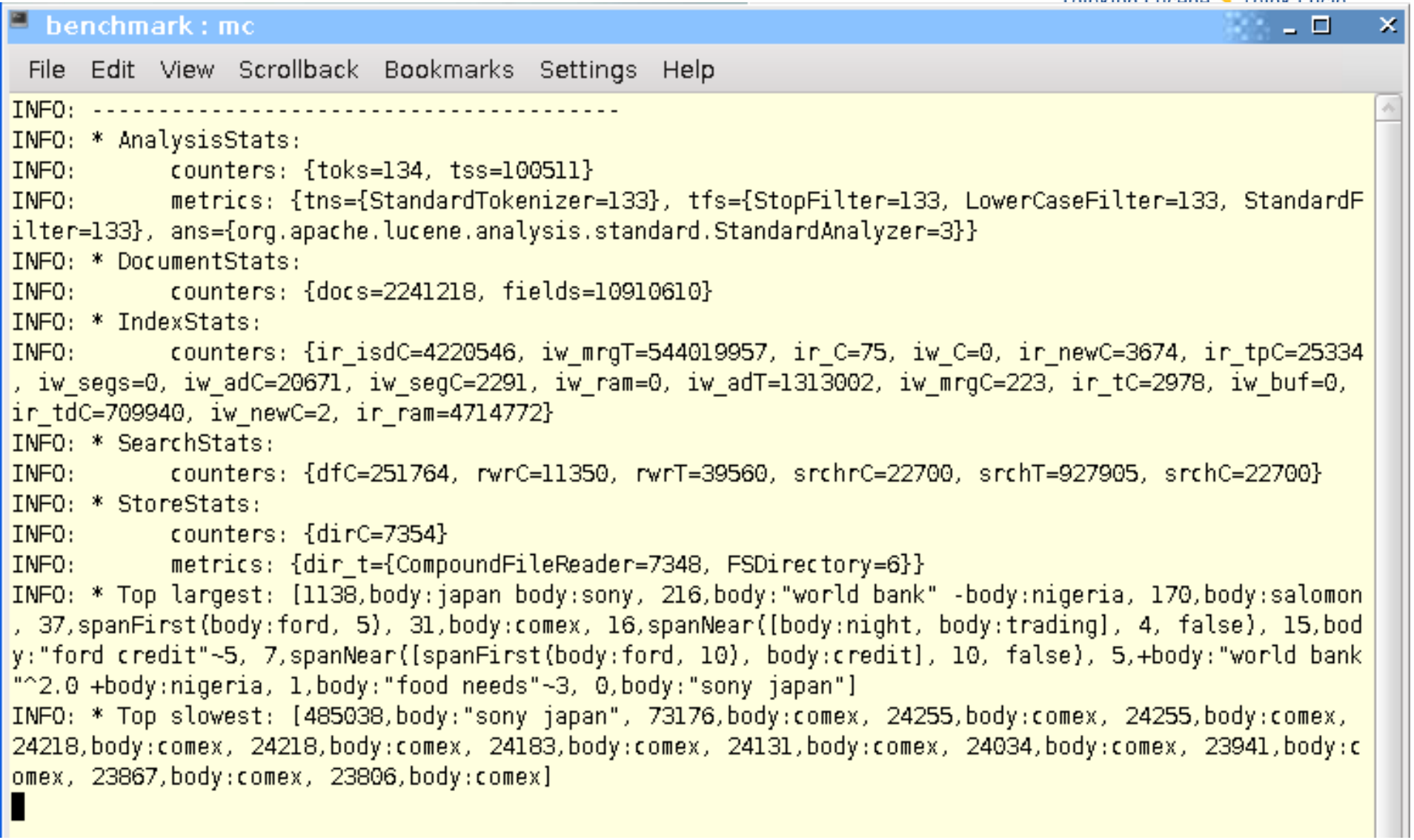
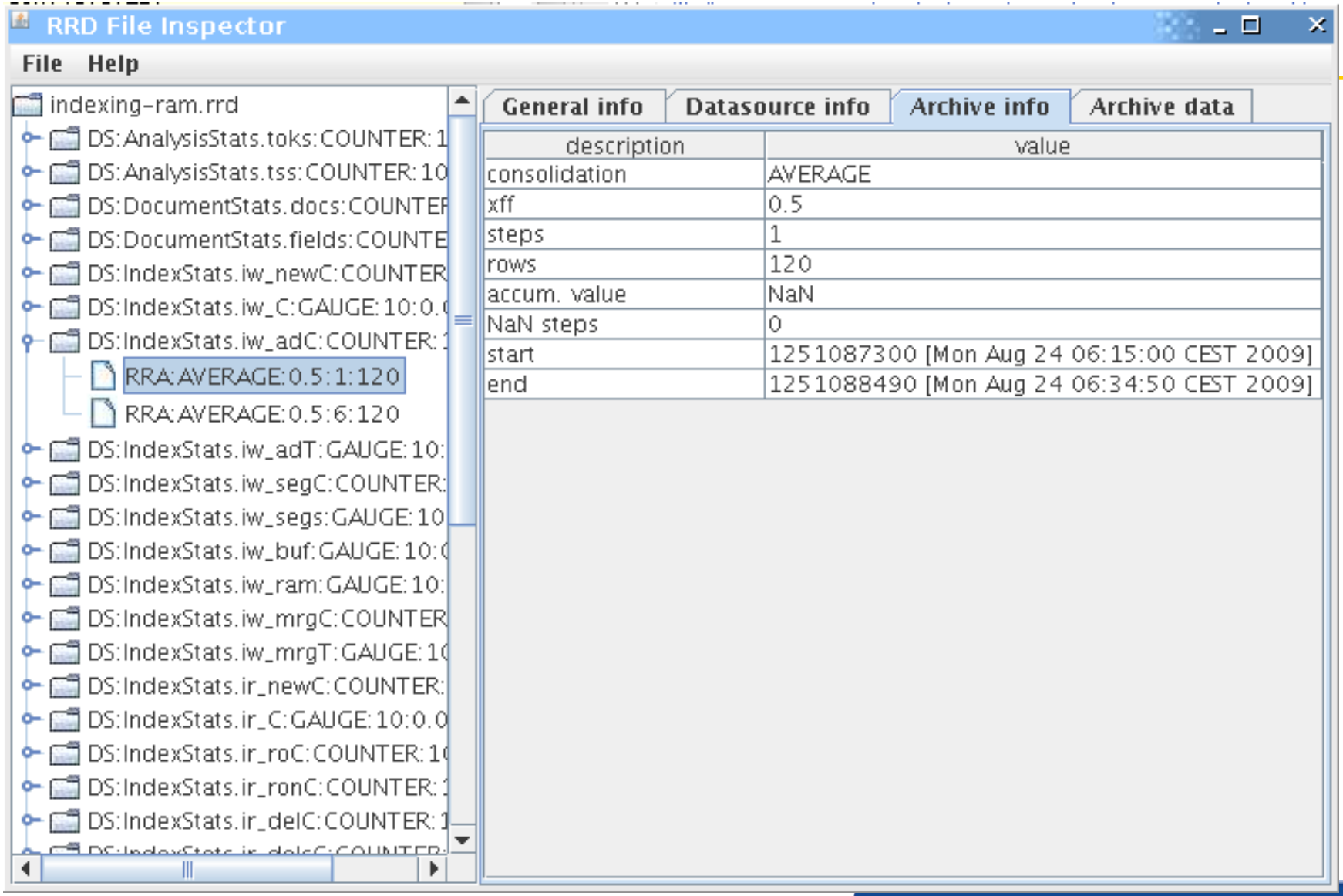
Based on the contrib/benchmark suite

- Test impact of number of buffered docs
- Other interesting observations
  - Number of documents / fields
  - Number of tokens / token streams
  - Number of IndexReader / Directory instances
  - Number of IndexSearchers

Example: console output



Example: RRD Inspector



RRD Inspector (2)

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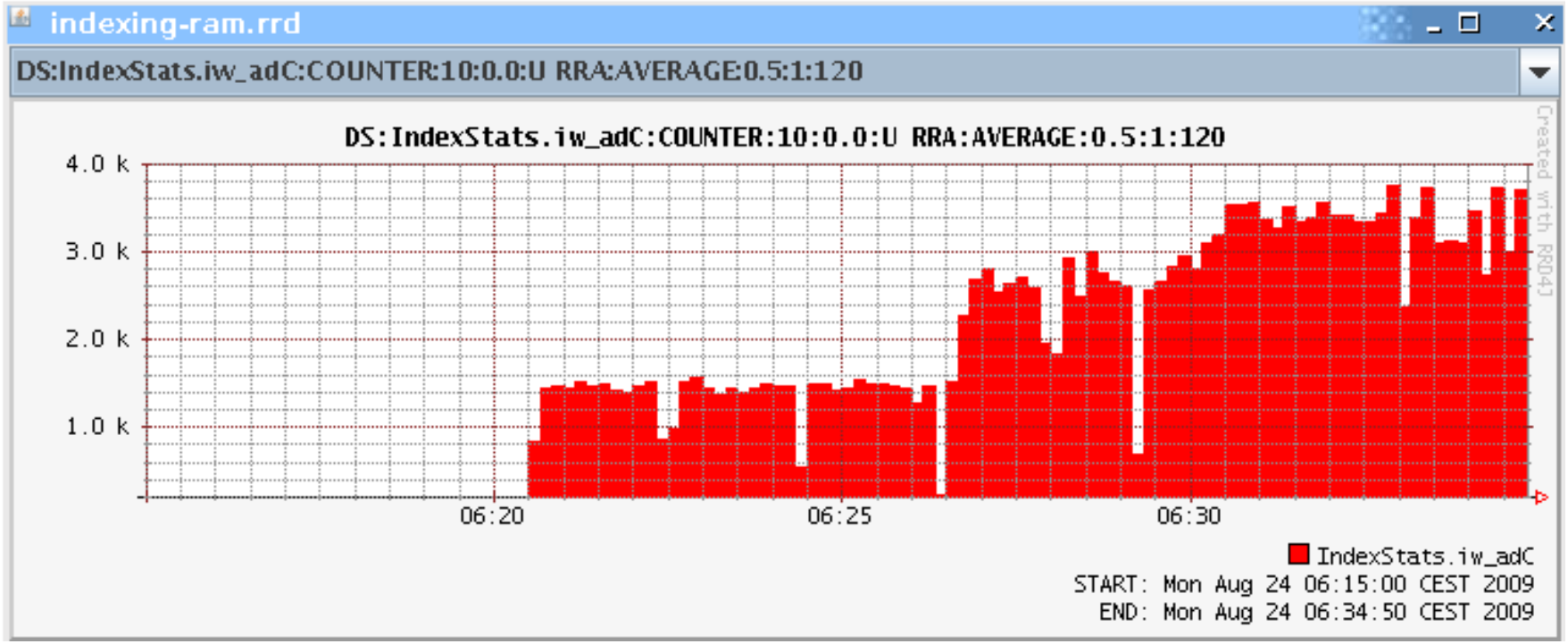

RRD Inspector (3)

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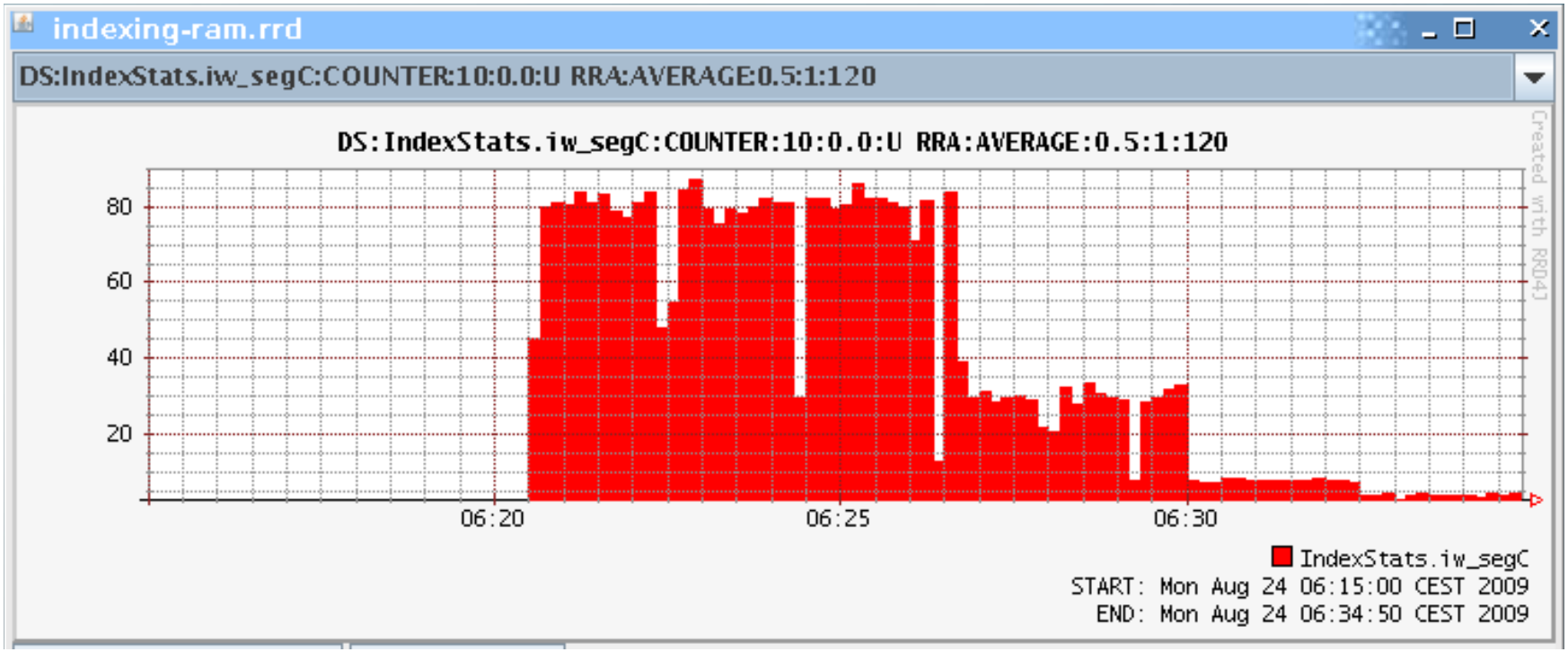

Performance impact of performance monitoring

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Overhead of using LG4L

- Benchmarks (in contrib/benchmark) slower by ~10-15% on average, memory consumption higher by ~10%
- Remember: you can turn off some monitors!

Conclusions

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- Lucene can perform fantastically
  - ... but it can't outmaneuver sub-optimal design or weak configuration
- LG4L helps to understand the causes of poor performance
  - Insight into high-level statistics that relate to Lucene API
  - Round-robin database for tracking historical data
  - LG4L is lightweight!

Q & A

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Download and documentation:

- http://www.lucidimagination.com/Downloads/LucidGaze-for-Lucene

Example: LG4L with Solr

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```
INFO: * AnalysisStats:
INFO:   counters: {toks=258}
INFO:   metrics: {tns={=2, WhitespaceTokenizer=8},
tfs={WordDelimiterFilter=8, StopFilter=8, SynonymFilter=8, LowerCaseFilter=8,
EnglishPorterFilter=8},
ans={org.apache.solr.schema.IndexSchema$SolrQueryAnalyzer=1,
org.apache.solr.analysis.TokenizerChain=6,
org.apache.solr.schema.FieldType$DefaultAnalyzer=13,
org.apache.lucene.analysis.WhitespaceAnalyzer=1,
org.apache.solr.schema.IndexSchema$SolrIndexAnalyzer=1}}
INFO: * DocumentStats:
INFO:   counters: {docs=1, fields=20}
INFO: * IndexStats:
INFO:   counters: {ir_isdC=1, ir_C=4, iw_C=0, ir_newC=7, ir_tpC=12,
iw_segs=0, iw_buf=0, ir_tdC=10, ir_ram=1343504, iw_ram=0}
INFO: * SearchStats:
INFO:   counters: {dfC=11, rwrC=3, rwrT=30265, srchrC=14, srchT=90133076,
srchC=6}
INFO: * StoreStats:
INFO:   counters: {dirC=8}
INFO:   metrics: {dir_t={FSDirectory=8}}
```

… but of course you should use LucidGaze for Solr instead!