Splunk Data Lifecycle
Determining When And Where To Roll Data

Jeff Champagne  |  Splunk Staff Architect

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Who’s This Dude?

Jeff Champagne
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Staff Architect

- Started with Splunk in the fall of 2014
- Former Splunk customer in the Financial Services Industry
- Lived previous lives as a Systems Administrator, Engineer, and Architect
- Loves Skiing, traveling, photography, and a good Sazerac
Am I In The Right Place?
You’ll find this session helpful if…

Target Audience: Splunk Admins

- You should have *some* experience administering Splunk
  - It’s okay if you’re a n00b
- Questions you might have…
  - How should I setup my storage strategy?
  - How can I keep my data longer without using as much disk space?
  - Are there ways to archive my data?
  - Can I do things to improve search performance?
What Will I Learn?

Agenda

- Brief Explanation: How Splunk stores data
- Bucket Rolling
  - Hot/Warm
  - Cold
  - Frozen / Delete / Thawing
- Archiving: Data Roll
- Storage Savings: TSIDX Reduce
- Managing Retention
- Impact of Index Clustering
- Data Model Accelerations
How Splunk Stores Data

A Primer...
How Are Events Stored?

Buckets, Indexes, and Indexers

Events → Buckets → Indexes → Indexers
How Are Events Stored?
We’ve got options…

- **Hot**
  - [homePath]

- **Warm**
  - [homePath]

- **Cold**
  - [coldPath]

- **Frozen**
  - [coldToFrozenDir] -or- [coldToFrozenScript]

- **Data Roll**
  - [vix.provider] -and- [vix.input.x.path]

- **TSIDX Reduce**

- **Delete**

- **Searchable**
  - (but slower)
How Are Events Stored?
What's enabled out of the box?

- Hot
- Warm
- Cold

Searchable

[homePath]
[coldPath]
Hot/Warm Storage

I’m too hot (hot damn)
Make a dragon wanna retire man
Hot/Warm Storage

How is it used?

- New data lives here
  - Hot & Warm buckets

<table>
<thead>
<tr>
<th>Conf File</th>
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<tbody>
<tr>
<td>Parameter</td>
<td>[&lt;index name&gt;]</td>
</tr>
<tr>
<td></td>
<td>homePath = $SPLUNK_DB/$_index_name/db</td>
</tr>
</tbody>
</table>

- At least 1 hot bucket per index, per indexer
  - Additional hot buckets will be created…
    - For each parallel ingestion pipeline
    - When quarantine buckets are needed
Hot/Warm Storage

How is it used?

- Buckets roll from Hot to Warm when...
  - We get too many hot buckets \([\text{maxHotBuckets}]\)

You don’t typically need to edit the following ones...

- DON’T UNLESS YOU’RE TOLD TO
  - The timespan of a bucket gets too large
  - A hot bucket hasn’t received data in a while
  - Bucket metadata files have grown too large
  - There is an index clustering replication error

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<tr>
<td>Parameter</td>
<td>[&lt;index name&gt;]</td>
</tr>
<tr>
<td></td>
<td>maxHotBuckets = 3</td>
</tr>
<tr>
<td></td>
<td>maxHotSpanSecs = 7776000 (90 days)</td>
</tr>
<tr>
<td></td>
<td>maxHotIdleSecs = 0 (disabled)</td>
</tr>
<tr>
<td></td>
<td>maxMetaEntries = 1000000 (1M lines)</td>
</tr>
</tbody>
</table>
Hot/Warm Storage

Requirements

800+

IOPS
Hot/Warm Storage
I/O Requirements

▶ IOPS
  • 800+ IOPS for Standard Workloads
  • 1200+ IOPS for Heavy Workloads
    • Enterprise Security
    • High search concurrency
  • Do yourself a favor and use SSD

▶ Sustained I/O per indexer simultaneously
  • All indexers search at the same time
  • Important if you’re using a SAN

▶ Measured using Bonnie++
  • IOPS = Random Seeks
  • *nix only (sorry Windows)
  • New test suite is coming
  • There’s an app for that: https://splunkbase.splunk.com/app/3002/

▶ Block Storage
  • We DO NOT support NFS/NAS for Hot/Warm volumes
    • Common filesystems: EXT4 or XFS
Cold Storage

Champagne on Ice
Cold Storage
How is it used?

- Historical data goes here
  - Cold buckets

- Allows older data to be kept on slower (cheaper) storage
  - Older events are typically searched less often
  - Slower performance may be more acceptable

- Buckets roll from Warm to Cold when...
  - We have too many Warm buckets

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</tr>
<tr>
<td></td>
<td>coldPath = $SPLUNK_DB/$_index_name/coldb</td>
</tr>
<tr>
<td></td>
<td>maxWarmDBCount = 300</td>
</tr>
</tbody>
</table>
Cold Storage
Requirements

- IO Performance
  - Lower IOPS can be tolerated with the expectation of slower search
  - Don’t go below 350 IOPS
    - Remember: Sustained IO across all indexers
- Additional storage platforms are supported
  - NAS/NFS
Frozen Storage

Let it go, let it go…
Frozen Storage

Ice Ice, Baby

- No longer searchable
  - Keep data in Cold as long as you can

- Data rolls from Cold to Frozen when...
  - The total size of the index (Hot+Warm+Cold) grows too large
  - The oldest event in a bucket exceeds a specific age

- Default freezing process
  - TSIDX file is removed
  - Bucket is copied to a destination you specify
  - Splunk no longer manages the data – You’re in charge!

- Custom freezing process
  - You provide a custom script

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| Parameter   | [<index name>]
               | maxTotalDataSizeMB = |
               | frozenTimePeriodInSecs = |
               | coldToFrozenDir = |
               | coldToFrozenScript = |
               | thawedPath = |
Thawing Data
Bringing data back from the deep freeze

Manual Process

• Copy frozen buckets to thawed path [thawedPath]
• Use the rebuild command to re-index the data
  - CLI command
• http://docs.splunk.com/Documentation/Splunk/latest/Indexer/Restorearchiveddata

Re-Indexing

• Does not count against your license
• Takes time
  • Use the same estimates for indexing new data
  • Example: A reference indexer can index 300GB/day
Delete

Let's just dump it all…
Delete
When do we delete?

- If don’t setup freezing, we will delete
  - [coldToFrozenDir]
  - [coldToFrozenScript]

- Data is deleted when...
  - The total size of the index (Hot+Warm+Cold) grows too large [maxTotalDataSizeMB]
  - The oldest event in a bucket exceeds a specific age [frozenTimePeriodInSecs]
Splunk Data Roll

Rollin’ Rollin’ Rollin’
Keep Those Buckets Rollin’
Splunk Data Roll
How does this work?

- Enabled per index
  - Doesn’t have to be all or nothing

- Buckets are archived to HDFS once the oldest event reaches a specific age
  - `vix.output.buckets.older.than = <seconds>`
  - Hadoop and AWS EMR+S3 are supported

- Virtual indexes are created to reference the archived data
  - Unified search can seamlessly search across native and virtual indexes
    - `vix.unified.search.cutoff_sec = <seconds>`
  - Some overlap between what is stored in Splunk & HDFS
    - Data is still searchable while archiving
    - Unified search ensures no duplicate results
If you already have HDFS deployed and are experienced with Hadoop
  • Data roll can help reduce Splunk storage costs
  • Use Splunk Bucket Reader to search archived data without Splunk
Don’t use Data Roll if you don’t already use HDFS
  • You can deploy Splunk in a similar manner to achieve cost savings

Searching data natively in Splunk will be faster

Dense searches on HDFS will have the best performance
  • Data in HDFS is indexed on-the-fly
    • Sparse searches will be slower
TSIDX Reduce

Put your buckets on a diet
TSIDX Reduce
How does it work?

- Lexicon is removed from the TSIDX file
- All searches become brute-force searches
  - Every event in a bucket is read from disk and filtered in memory

The overall structure of a TSIDX file has been simplified for illustrative purposes.
TSIDX Reduce
How much storage do I save?

- Anywhere between 30% - 70% smaller buckets
  - Example: 1GB bucket would decrease in size between 350MB – 700MB

**Typical savings is 60% - 70%**

- Size reduction depends on data cardinality
  - More unique values = better disk savings
    - Numerical data
    - Large lexicons
  - `merged_lexicon.lex` gives an idea of potential reduction

![Diagram showing storage reduction](image-url)
TSIDX Reduce
How do I enable it?

- Can be enabled per-Index
- Warm and Cold buckets can be reduced
- Splunk UI
  - Settings > Indexes > Select an Index

```
<table>
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| Parameter      | `<index name>`
| enableTsidxReduction = true
| timePeriodInSecBeforeTsidxReduction = `<seconds>` |
```
TSIDX Reduce
When would I use this?

- Historical/Archive data

**Do NOT use TSIDX reduce on frequently searched data**

- Dense searches
  - Return a large percentage (10% or more) of matching events from a bucket
  - Largely unaffected by TSIDX reduce

- Sparse searches
  - Needle in the haystack style searches
  - Significantly affected by TSIDX reduce
  - 3-10X slower
  - Depends on the volume of data searches
Retention

How long does this stuff stay around?
Retention IS NOT managed across indexers

Each indexer will manage data retention independently

- Data may age faster on one indexer than another
  - Data imbalance
  - Uneven disk utilization

Avoid forcing bucket rolling

- Creates small buckets
- Impacts search performance
- Can impact index clustering
Retention

When do we roll data?

- Hot
- Warm
- Cold
- Frozen

# of Buckets
Age
Size on disk

TSIDX Reduce
Delete
Data Roll
In general, Splunk will compress raw data by 50%.

\[
\text{<Daily Ingest>} \times 0.5 = \text{Daily size on disk} \times \text{<days of retention>} = \text{Total storage needed}
\]

- We have an app for that: [http://splunk-sizing.appspot.com/](http://splunk-sizing.appspot.com/)

![Diagram showing the compression of raw data and storage requirements.](image-url)
Calculating Retention
Splunk Volumes

► Hot/Warm Volume
  • Frequently searched data should be here
  • Most customer searches are over the last 48hrs of data
  Rarely will you need >14 days of hot/warm
  • Find your “typical” search range

```
index=_audit action=search info=completed is_realtime=0
```

► Cold Volume
  • All data that isn't in Hot/Warm
  • Consider keeping data in Cold vs. rolling to frozen
    • Much easier to manage
  • Consider using TSIDX reduce to conserve more disk space
    • Factor reduced buckets into storage planning
Control retention for all indexes that reference the volume

- Allows you to consume a defined storage amount across multiple indexes

Oldest bucket in the volume is deleted/frozen when defined size is exceeded

- Take care when placing indexes in the same volume
- "Noisy" indexes can cause older data to be deleted

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| Parameter      | [volume:<volume name>]
|                | path =
|                | maxVolumeDataSizeMB =
|                | [<index name>]
|                | homePath = volume:<volume name>/$_index_name/db
|                | coldPath = volume:<volume name>/$_index_name/colddb |
Index Clustering
Index Clustering
How does it affect my data strategy?

▶ Retention is **not** managed cluster-wide

**Each indexer handles retention independently**

- Pay attention to disk utilization
  - Monitoring Console > Indexing > Indexes and Volumes > Indexes and Volumes: Deployment
  - Buckets may be deleted/archived from an indexer faster than others
- Use cluster rebalance when necessary

▶ Freezing Data

- Frozen buckets are not fixed-up
  - [http://docs.splunk.com/Documentation/Splunk/latest/Indexer/Bucketsandclusters#How_the_cluster_handles_frozen_buckets](http://docs.splunk.com/Documentation/Splunk/latest/Indexer/Bucketsandclusters#How_the_cluster_handles_frozen_buckets)
- Splunk does **not** de-duplicate data when freezing/thawing
- You must de-dupe buckets using the `<localid>` in the folder path
Index Clustering
How does it affect my data strategy?

▶ Capacity Planning
• Replication policy will affect disk utilization
  • Search Factor = Splunk Index (TSIDX File)
  • Replication Factor = Raw Data
• Use the sizing app: [http://splunk-sizing.appspot.com/](http://splunk-sizing.appspot.com/)

![Diagram of disk utilization](image)
Data Model Accelerations
Planning for performance

A pre-summarized set of fields defined by a Data Model
• Typically much smaller than the source index
• Only accelerate the data you will search often (Summary Range)
  • http://docs.splunk.com/Documentation/Splunk/latest/Knowledge/Aboutsummaryindexing#Data_model_acceleration

Storage
• Keep your summaries in the Hot/Warm volume for best performance
  • Be aware of storage impact

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<tr>
<td></td>
<td>tstatsHomePath =</td>
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Data Model Accelerations

Capacity Planning

▶ Retention
  • Summary is deleted when the oldest event exceeds the summary range
  • Summaries cannot be kept longer than the raw data

▶ Sizing
  • Depends on your data model definition
    • # of fields
    • Cardinality of data (# of unique values)
  • Run your own tests to get size estimates
    – Settings > Data Models
  • Enterprise Security
    • Daily Ingest * 3.4 = 1 year of accelerations
      – http://docs.splunk.com/Documentation/ES/latest/Install/Datamodels#Data_model_acceleration_storage_and_retention
Data Lifecycle Recap

Hot

Warm

Cold

Frozen

Data Roll

TSIDX Reduce

Delete

[homePath]

[coldPath]

[coldToFrozenDir] -or- [coldToFrozenScript]

[vix.provider] -and- [vix.input.x.path]
Questions?

Help me help you
Thank You

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