Data Integrity Control

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Problem Statement

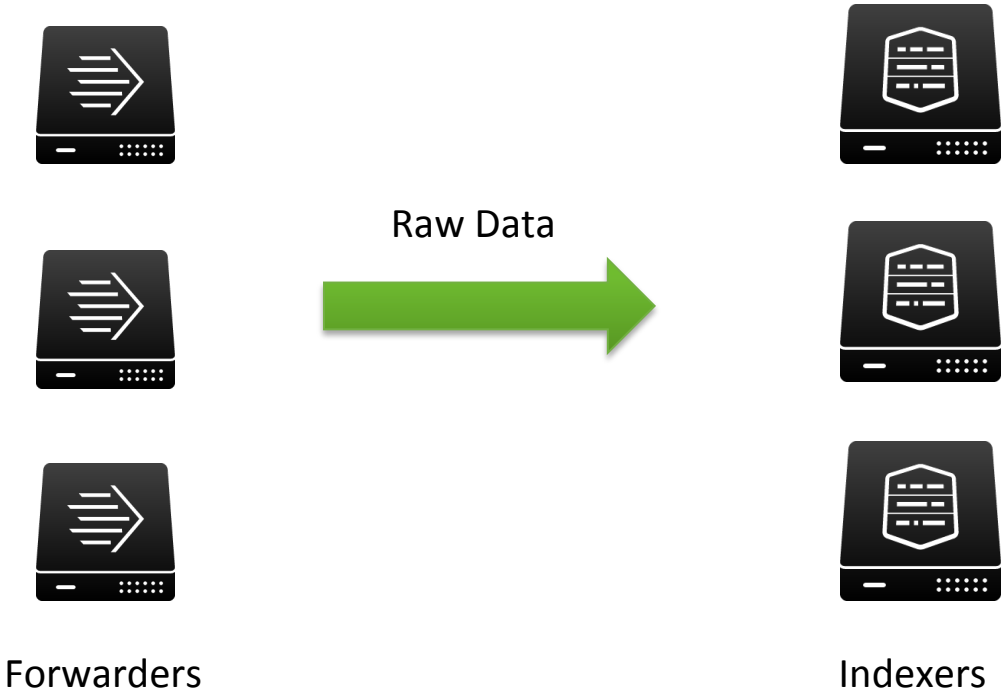
- As Splunk moves up higher in value chain and becomes a single source of truth for all machine data, Its important to provide a mechanism to verify & safeguard the integrity of the indexed data

- Typical use cases are:
  - To be able to prove the integrity of the data for auditing & legal purposes
  - To be able to check the integrity of the indexed raw-data on demand, say after any unforeseen activities like intrusion etc.

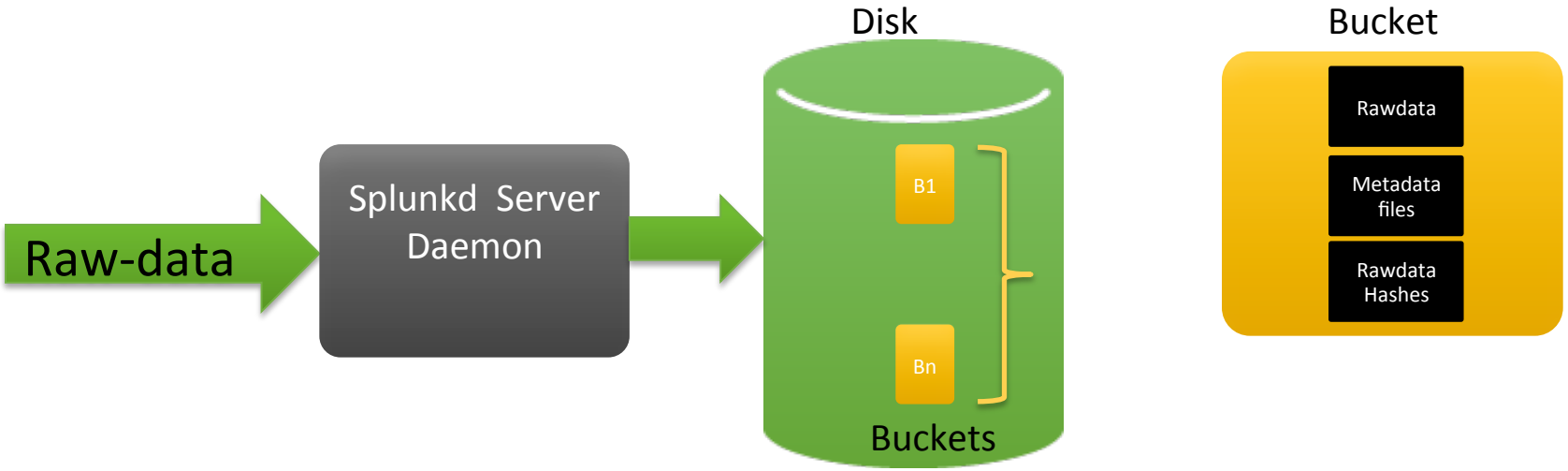
Goals

- Provide a mechanism to check the integrity of indexed raw-data
- Build a basic acceptable framework into the product so that customers can later configure/extend it as per their needs
- Make it work in a distributed environments (with indexer clustering)
- Keep it simple & easy to understand

Topology



At Indexer


Raw-data
Splunkd Server Daemon
Disk
B1
Bn
Buckets
Bucket
Rawdata
Metadata files
Rawdata Hashes

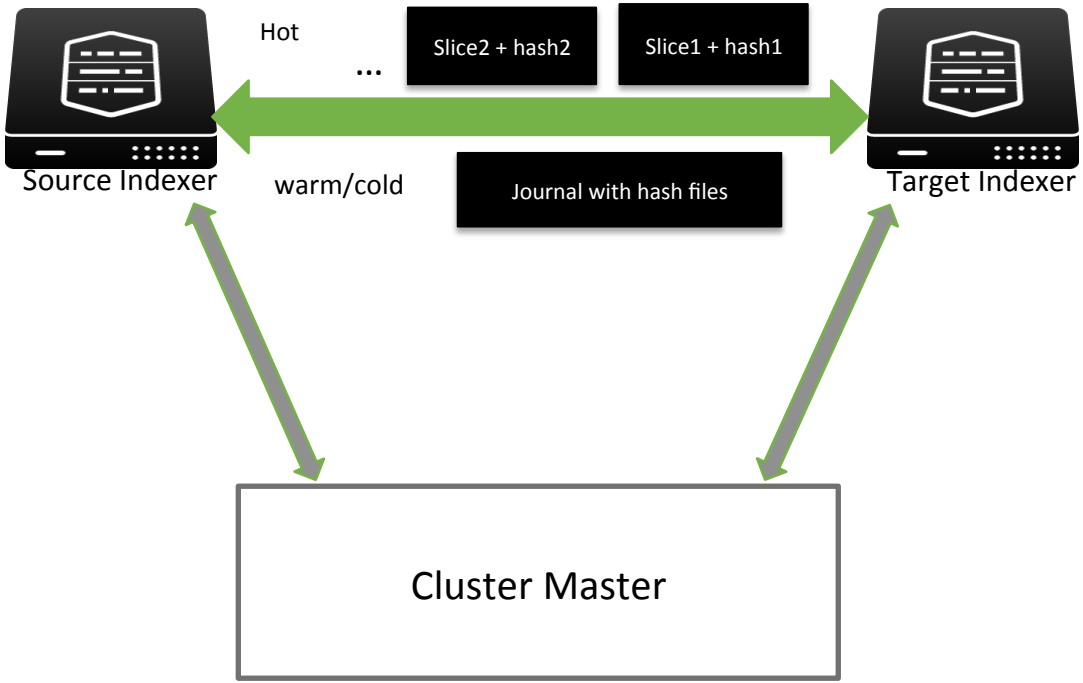
How it Works

- Splunk buckets are comprised of a unit of data called “Slice”
- Each slice is compressed & written to the journal as it comes
- When you turn on this feature, We compute a SHA256 hash on each compressed and write it to the disk (journal & external hash file called l1Hashes_BucketId_guid.dat.tmp) as it comes
- When bucket gets rolled from hot to warm, we finalize hash files:
  - We compute a hash of all hashes in l1Hashes & write it to l2Hash file
  - We rename l1Hashes_bucketID_guid.dat.tmp to l1Hashes_bucketID_guid.dat
- From this point, we don’t write to the bucket/hash files anymore

In Indexer Cluster

- In case of indexer clustering, Hot replication happens slice by slice
- If this feature is turned on, we replicate (slice + hash) as one data unit & the targets will start building up the hash files just like source
- In the case of warm/cold replications, we just replicate hash files along with the journal for the Data Integrity control enabled buckets
- In short, underlying framework takes care of hash replication

Cluster Topology



How to Enable/Disable

- indexes.conf Has a new global setting “enableDataIntegrityControl” which defaults to false
- So, this feature is disabled by default for all indexes
- Below is how you turn on this feature for a given index, say index1:
  [index1]
  enableDataIntegrityControl=true
- In indexer cluster environment, the recommended way to turn ON this feature is by pushing a bundle from cluster master (using apply cluster-bundle command)
- This setting doesn’t require a restart (reloadable)

Checking Integrity

- If you want to check the integrity of a bucket/index at an Indexer, just run below CLI:
  - splunk check-integrity –bucketPath <path_to_bucket>
  - splunk check-integrity –index <index_name>
- Integrity check happens in a separate process so that it won't create any direct impact on splunkd process
- The way this works is:
  - We first validate the l1Hashes file against l2Hash file
  - If the above step succeeds, we go ahead & validate rawdata slice by slice
- On integrity check failures, splunk provides bucket & the slice number which got tampered with

Performance Metrics

Feature ON/OFF	Dataset	Time to index	Time to verify	Notes
OFF	50 GB	38.18 Mins		Local indexing
ON	50 GB	39.03 Mins	21.25 Mins	Local Indexing
OFF	200 GB	169.5 Mins	-	4 UF->Indexer
ON	200 GB	174 Mins	112.39	4 UF->Indexer
OFF	400 GB	344.72	-	8 UF->1 Indexer
ON	400 GB	352.96	235.46	8 UF->1 Indexer

- Based on the above numbers from our performance team, there is no much CPU overhead when we index data with Data Integrity Control enabled
- These numbers are generated with a max throughput rate of ~25MB per sec that a splunk indexer can handle

Hardware Used

Below is the hardware configuration on which performance testing was done:

- HP DL380G8
- Intel(R) Xeon(R) CPU E5-2650 0 @ 2.00GHz
  - 32cores with Hyper Threading
- 5 x 146Gb SAS 15k RPM raids in RAID-10
- 64GB RAM

Disk Overhead

- For Every slice, we store a hash which is of 32 bytes in length
- For a default slice size of 128 KB (defined by indexes.conf's rawdataChunkSize), we need ~250 KB of extra disk space to store hashes
- Below is the equation:
  - 100 GB / 128 KB = 7812 slices, 7812 * 32 = 249.9 KB
- This holds true for replicated bucket copies in indexer cluster

Securing the Hashes

- By default, splunk writes the hashes to the rawdata directory of every bucket.
- For extra layer of security, customers can backup a copy of hash files when the bucket gets rolled from hot->warm, this can be scriptable.
- Note: Bucket's hash file names are unique for a given index. During backups, you can just store all hash files of an index in one folder.

Migration

- In case of clustering, All the Indexers & Cluster Master should be running 6.3+. Same applies even for standalone instance (6.3+)
- Deals with any new data that is being indexed after turning ON the feature.

Few Points

- Hash computation & storage happens at index time.
- For inflight data coming from forwarders, we trust SSL.
- This is an initial version of the feature and can be extended based on the feedback from the users.

Team

Special thanks to the team members:

- Mustafa Ahamed – Product Manager
- Mitch Blank & Sundar Vasan – Mentors
- Tanusree Sen – QA
- Tameem Anwar – Performance

Q&A

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THANK YOU

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