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Search Head Clustering Basics To Best Practices

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Agenda

- What is Search Head Clustering?
- Clustering Internals
- Distributed Scheduling
- Configuration Management
- Bundle Replication
- What's New in SHC

Search Head Clustering Overview

What is Search Head Clustering?

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Search Head Clustering

Ability to group search heads into a cluster in order to provide Highly Available and Scalable search services

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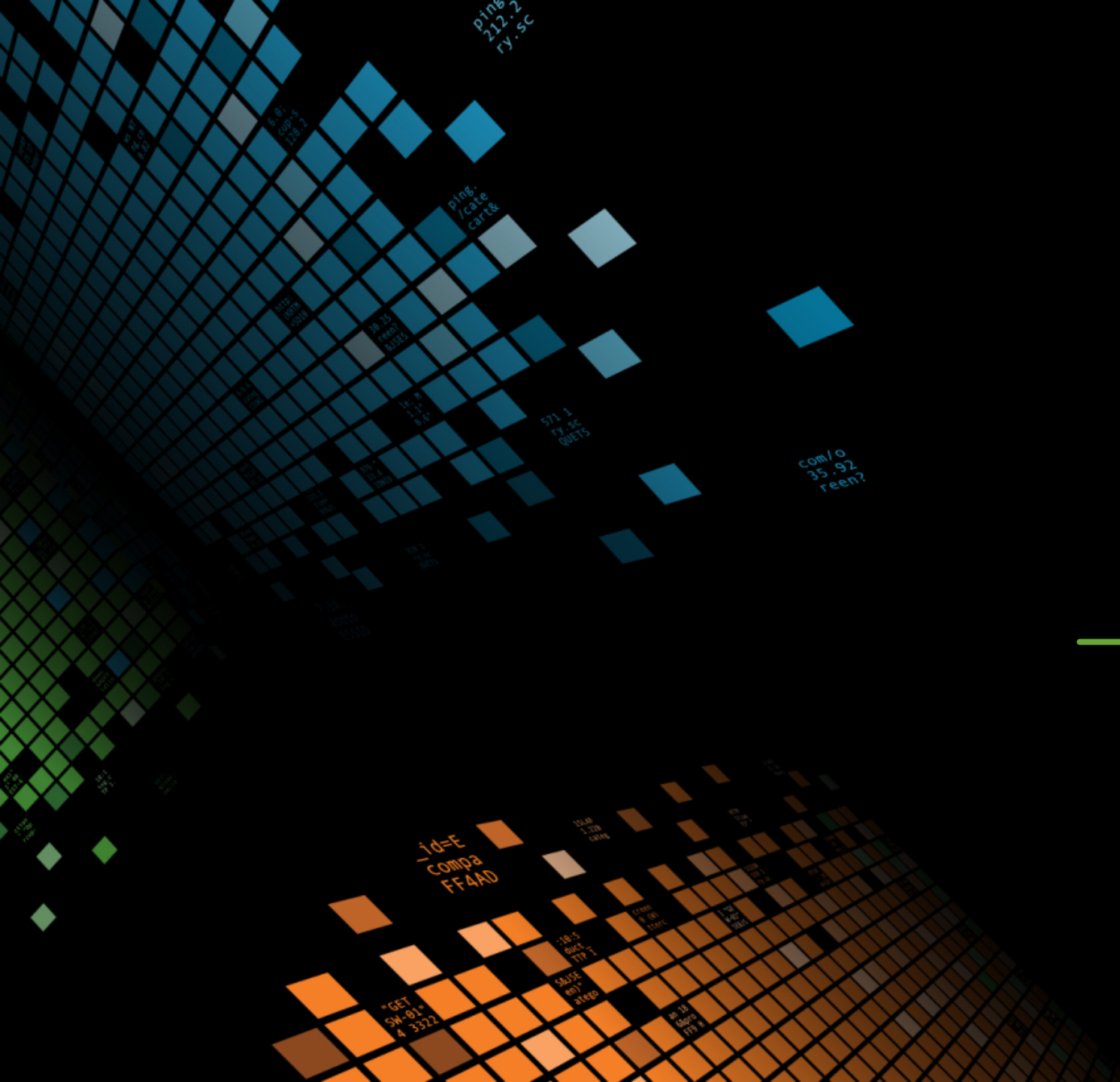
Business Benefits of SHC

Horizontal Scaling

Consistent User Experience

Always-on Search Services

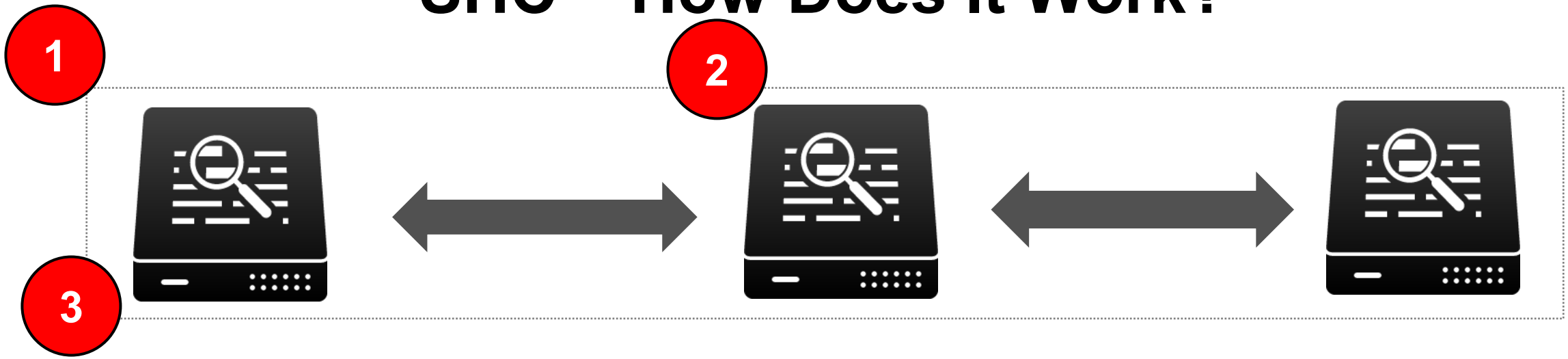
Easy to add / manage premium contents (apps)



Clustering Internals

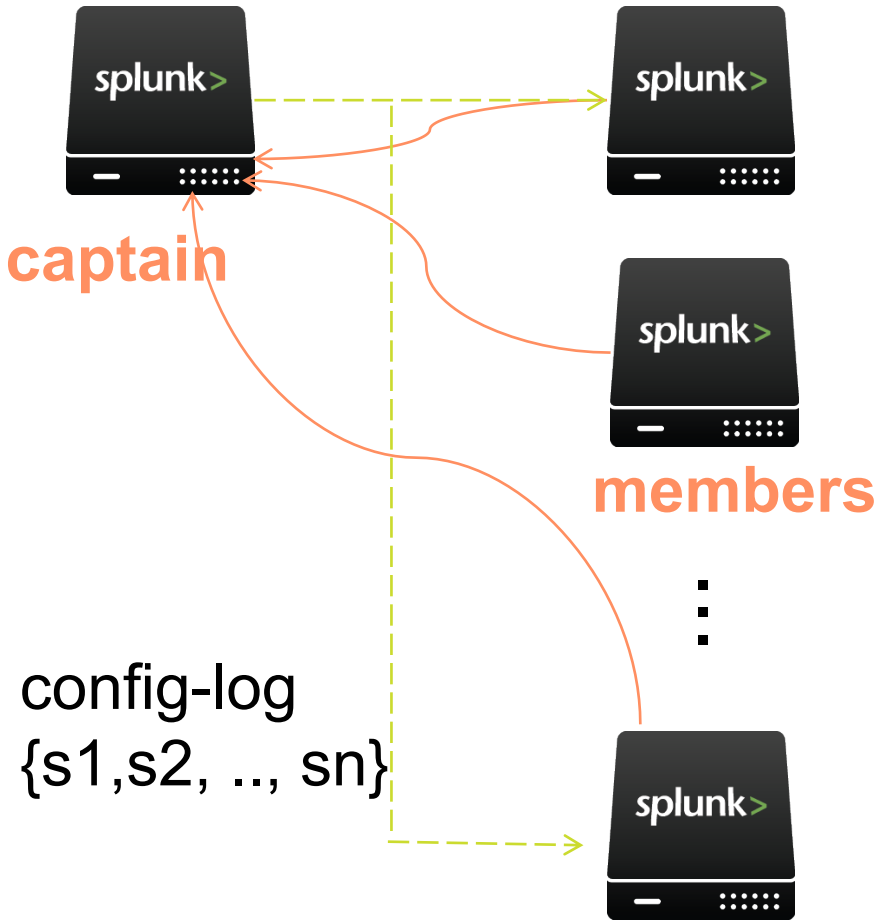
How does SHC work?

SHC – How Does It Work?



1. Group search heads into a cluster (Horizontal scaling)
2. Captain gets elected dynamically (No Single point failure)
3. User created reports/dashboards automatically replicated to other search heads (Consistent Configuration)

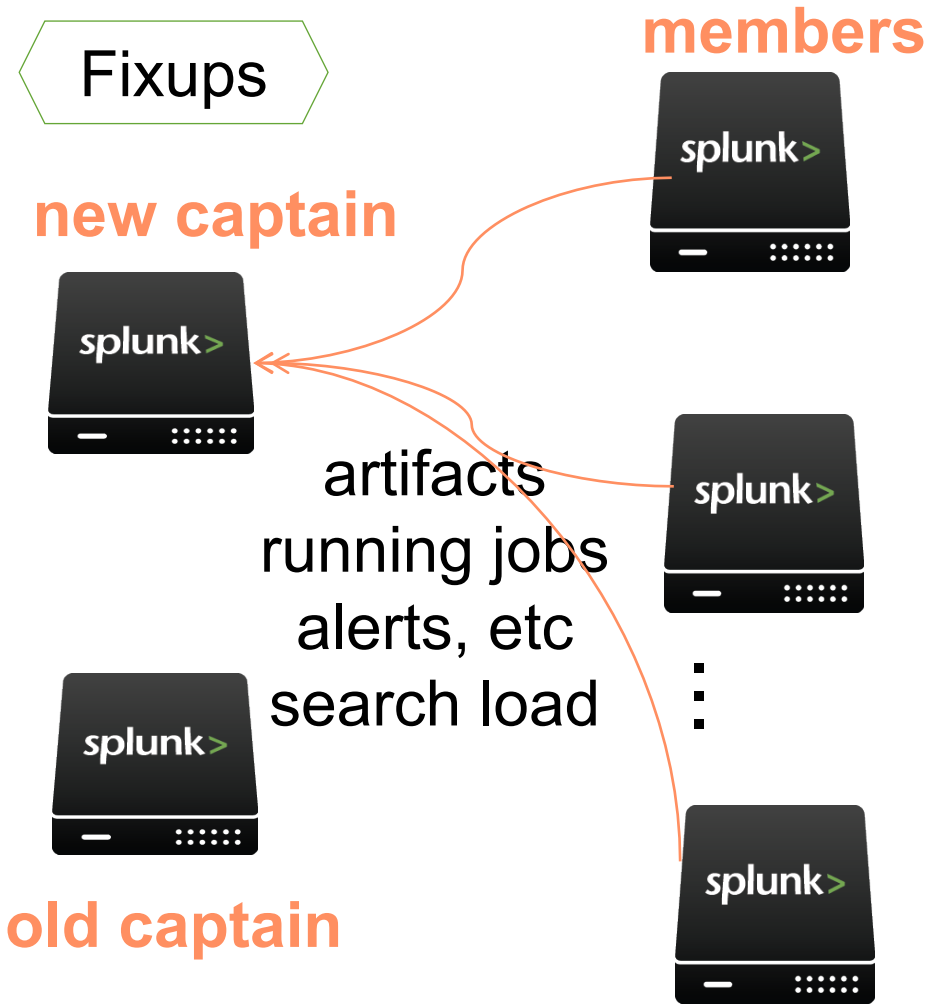
Search Head Cluster Bring Up



1. Bootstrap captain
2. Bring-up members
3. Captain establishes authority
4. Members join/register
5. CLI based cluster scale/shrink

Dynamic Captain & Auto Failover

- Raft Consensus Protocol from Stanford
  - Diego Ongaro & John Osterhout
- SHC uses RAFT for LE and Auto Failover

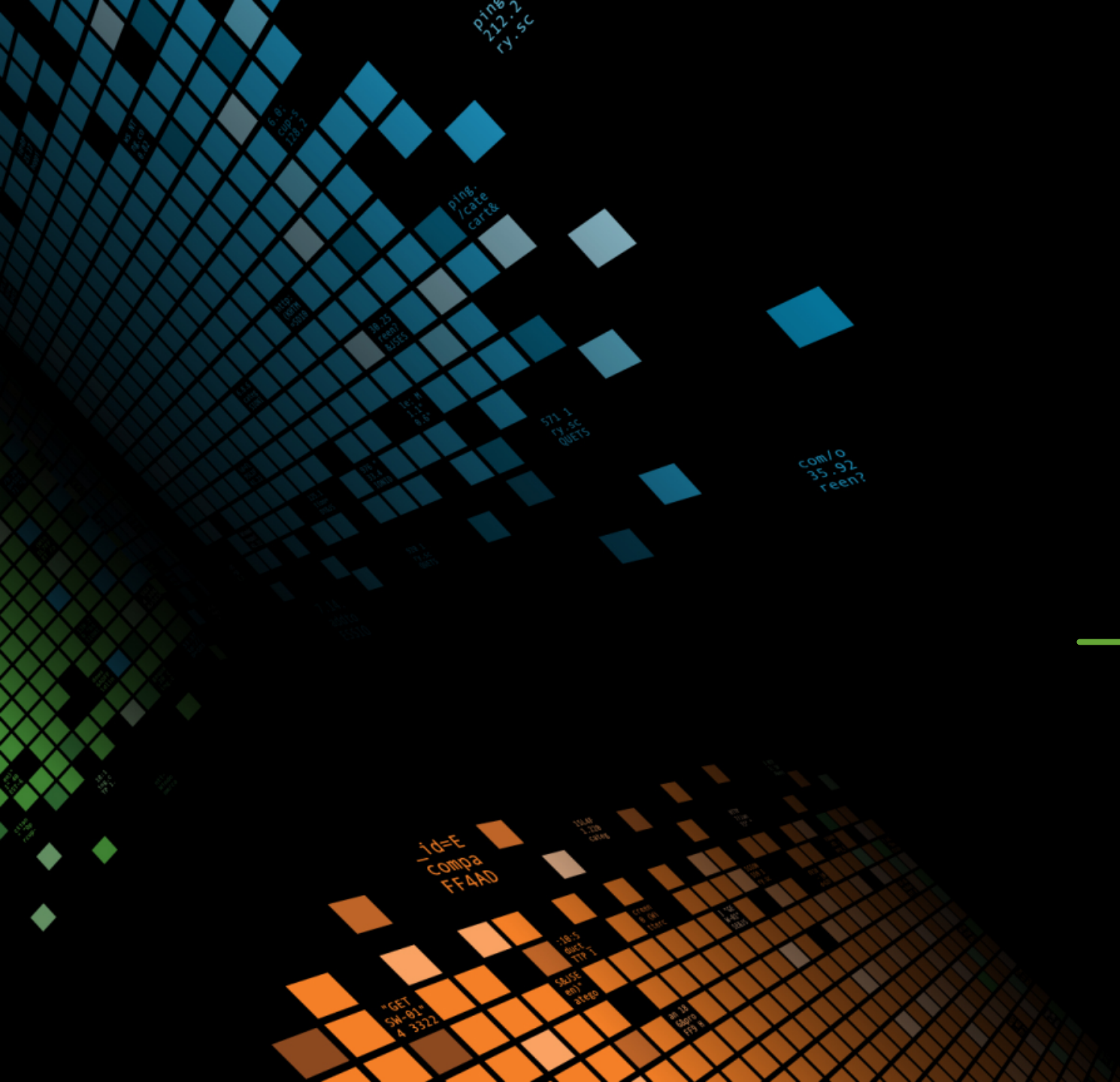


Controlling Captaincy

- Captain Switching should be extremely rare
- Repair a problem by transfer captain without restarts!!!
- Rolling-restart from the captain maintains the node as captain after restarts
- Captain preference added for members
- Disaster Recovery using static captaincy

Best Practices

- Add only fresh instances, if a node is re-purposed use "*splunk clean all*"
- High availability requires a minimum of 3 members
- All search heads on homogenous hardware and at same version
- Number of instances >= replication_factor
- Admin needs to manually do "*splunk remove shcluster-member*" on captain to remove a dead node
- Multi-site clusters to have majority nodes at one site

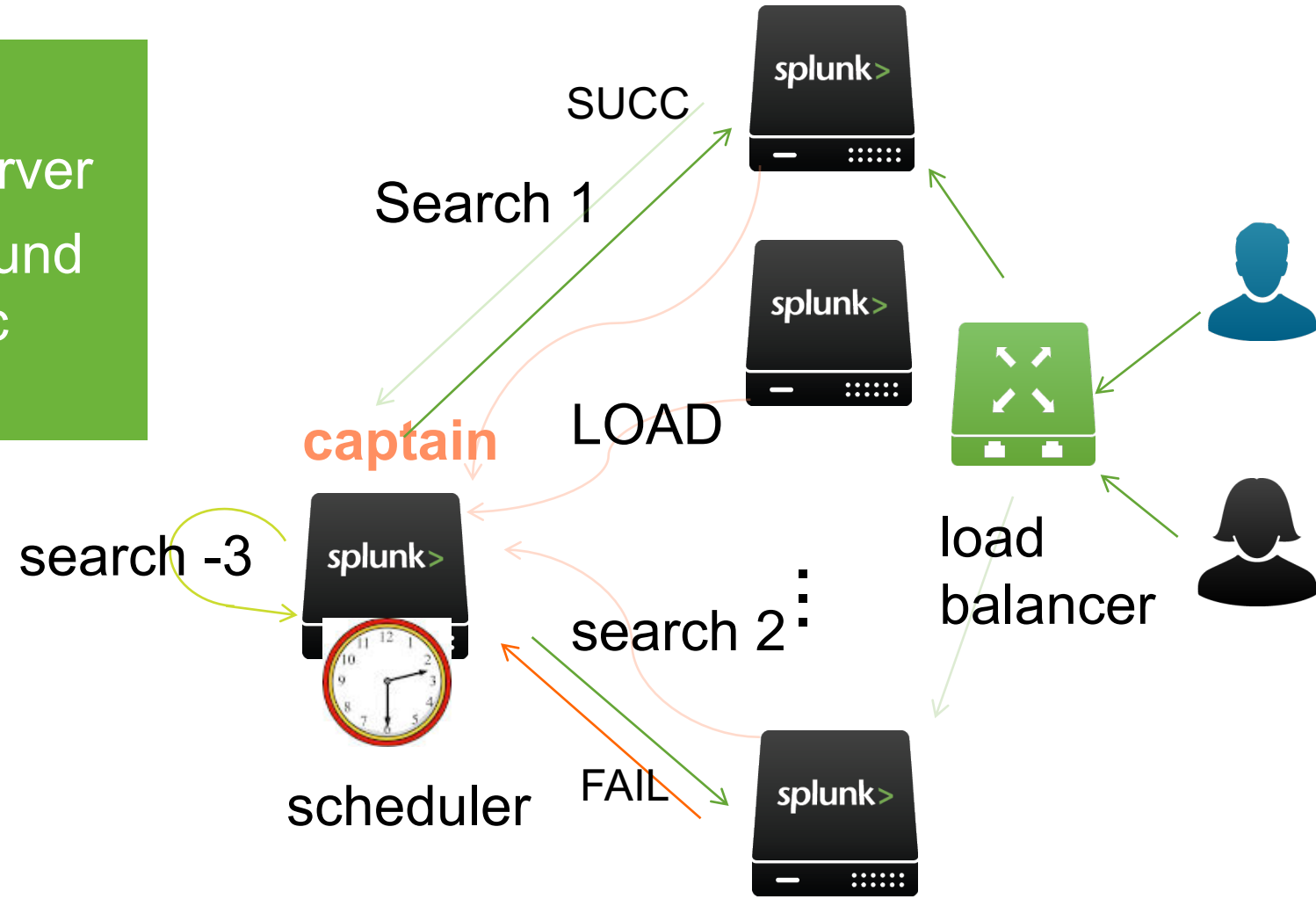


Distributed Scheduling

How jobs are scheduled in SHC?

Job Scheduling Orchestration

- Captain is job scheduler
- Eliminates need for a job-server
- Job distribution based on round robin or load-based heuristic



Job Scheduling

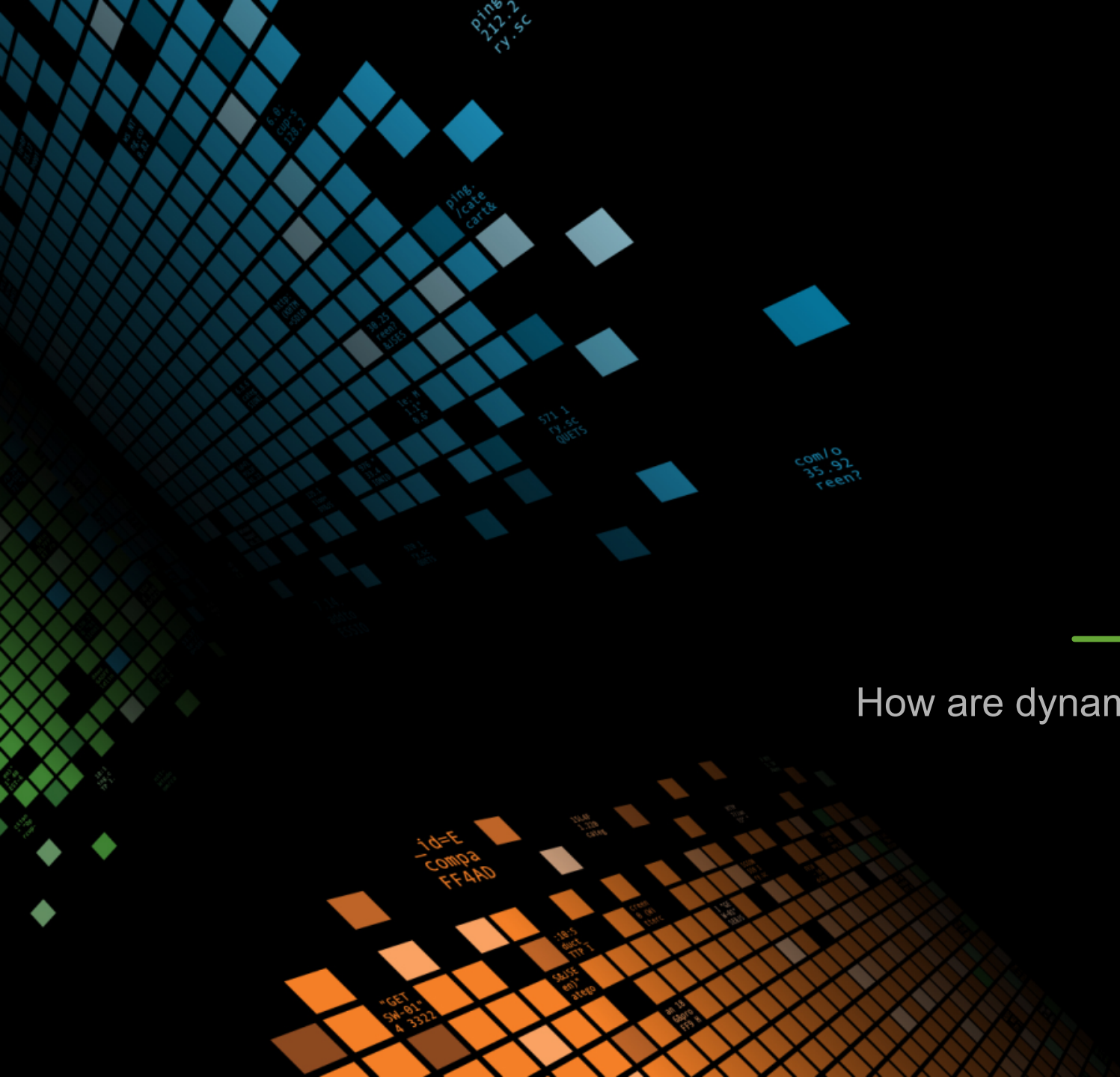
- Auto-failover – New captain becomes scheduler
- captain_is_adhoc_searchhead knob to reduce captain load
- Captain updates RA/DM summaries on indexers.
- Scheduler limits honored across the cluster
- Real time scheduled searches run one instance across cluster
- Centralized user quota Management*

High Availability Of Search Results

- Artifacts are replicated across the SH members
- Adhoc searches are **not** replicated
- At least replication_factor number of nodes should be in UP state for enforcing replication policy
- Replicated directory starts with “rsa_<sid>” in the dispatch directory
- Captain orchestrates reaping of search artifacts from dispatch directory of all members
- An artifact is served based on availability from (1) itself, (2) search originating node, (3) captain

Centralized Cluster State

- Captain maintains a global view of alerts and suppressions and updates the list to all members
- Captain registers all the adhoc searches run in the cluster
- Captain orchestrates reaping of search artifact replicas
- GET /services/search/jobs requests on any member will proxy to captain to get complete jobs



Configuration Management

How are dynamic changes to SHC kept consistent?

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Configuration Files

- **Goals**
  - Consistent user experience across all search heads
  - Changes made on one member are reflected on all members
- Types of Configuration Files
  - custom user content
    - reports
    - dashboards
  - search-time knowledge
    - field extractions
    - event types
    - macros
  - system configurations
    - inputs, forwarding, authentication

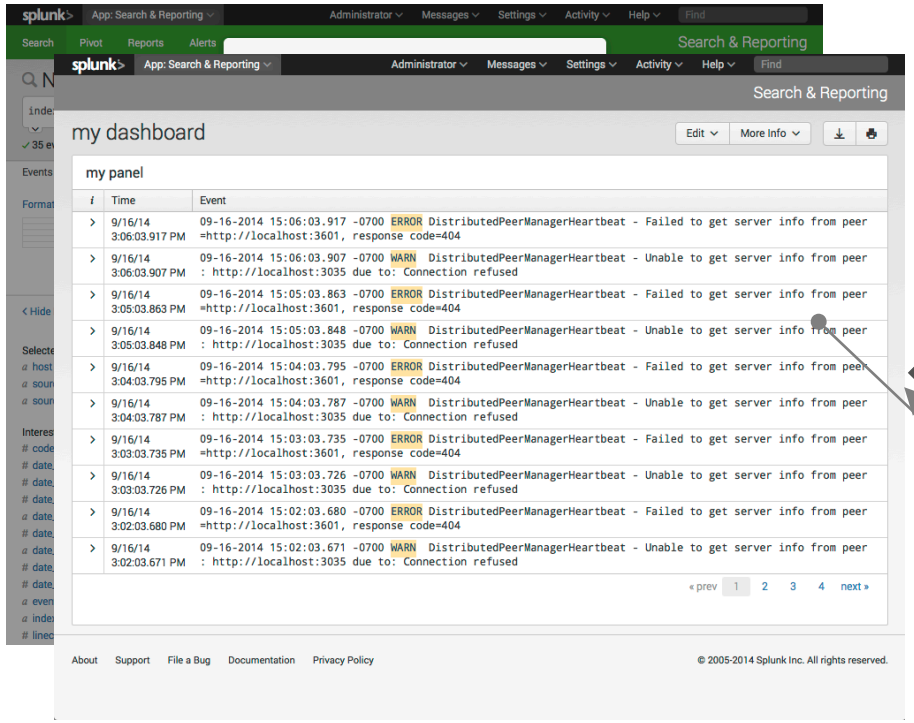
Configuration Changes

- Users customize search and UI configurations via UI/CLI/REST
  - save report
  - add panel to dashboards
  - create field extraction
- Administrators modify system configurations

Search And UI Configurations

- **Goal**: Eventual Consistency
- Changes to search and UI configurations are replicated across the search head cluster automatically

Conf Replication - Workflow



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Conf Replication – Progress Check

- captain keeps track of the conf replication progress of each SHC member

https://localhost:11089	18bc830e3087301900bdf2a30dc1a67bf8318ced: Tue Jul 19 15:32:56 2016
https://localhost:8089	18bc830e3087301900bdf2a30dc1a67bf8318ced: Tue Jul 19 15:32:52 2016
https://localhost:8189	dc4a991d168ae746f27979212253d6fb959fc92c: Fri Jul 1 13:51:05 2016
https://localhost:9089	CaptainDummyOpId: Tue Jul 19 15:32:09 2016

Bundle Replication

How are system-wide changes kept consistent?

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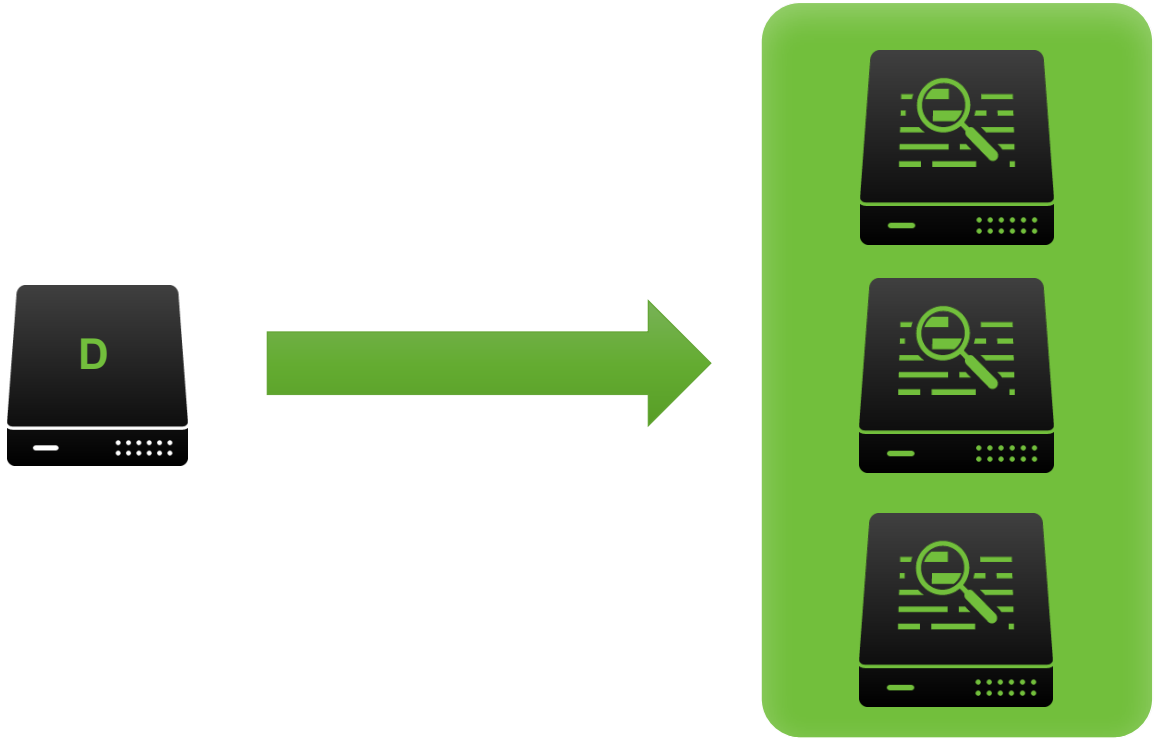
System Configurations

- Recall: only changes to search and UI configurations are replicated across the search head cluster automatically
- Changes to system configurations are **not** replicated automatically because of their high potential impact
- How are system configurations kept consistent, then?

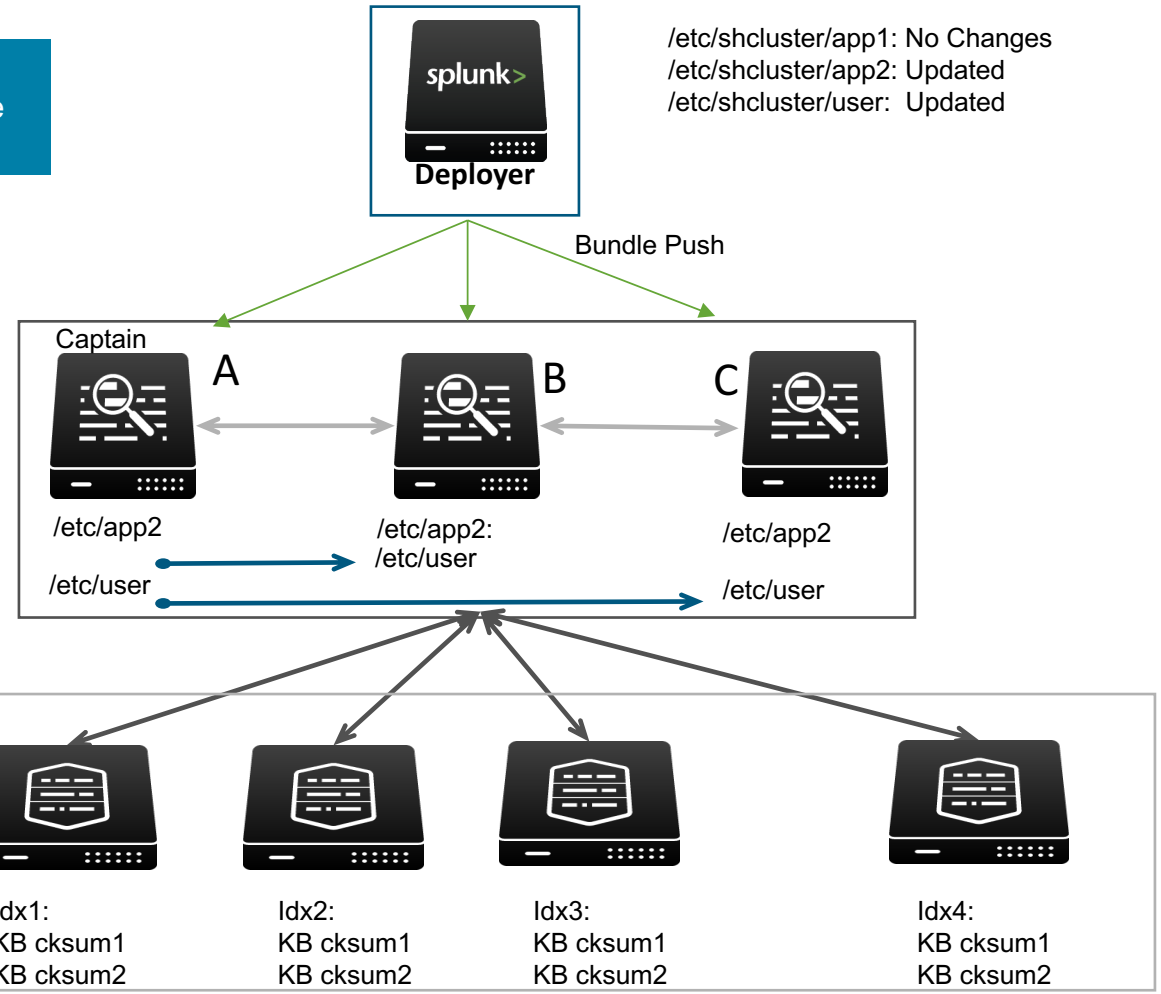
Configuration Deployment

- Deployer: a single, well-controlled instance outside of the cluster
- Configurations should be tested on dev/QA instances prior to deploy



Bundle Push

1 All apps and config are shipped to the SHs in the initial deployer push



2 Only updated apps and updated user config is pushed on subsequent bundle push

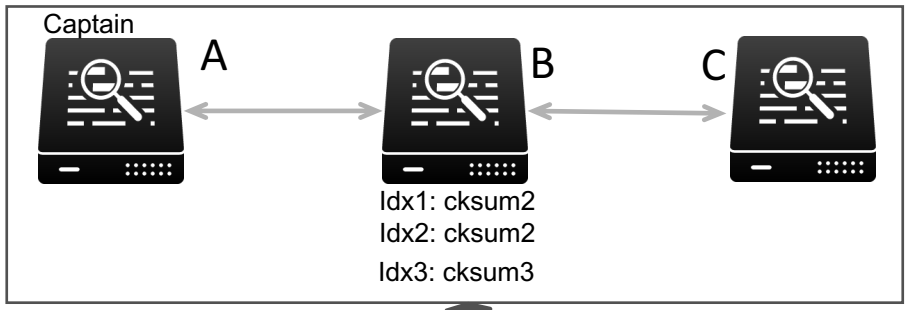
3 App configuration is propagated to all SHC members

4 User configuration is sent to the captain and then replicated to remaining SHC members

5 Periodically, captain checks for new bundles and propagates the bundles to the indexers

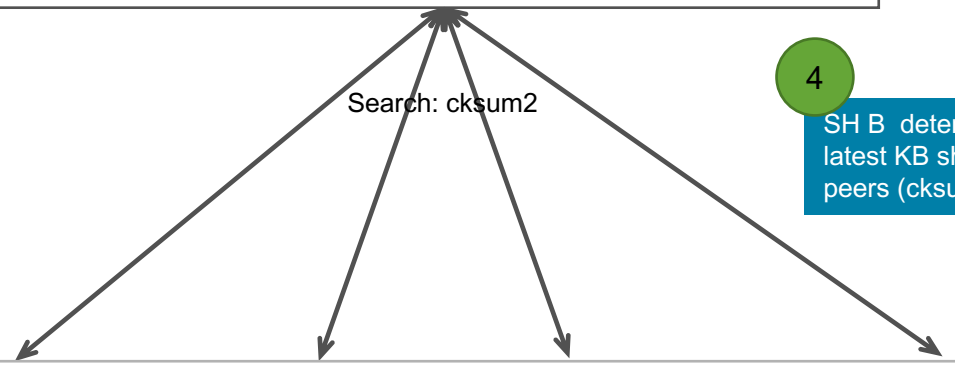
Bundle Replication

1. Each bundle push includes a KB cksum, when it is sent to the indexers



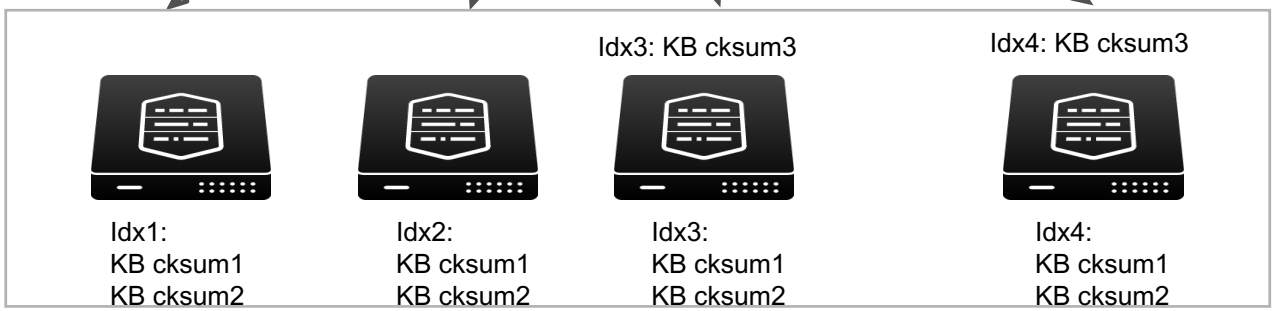
2. SH periodically contacts CM to grab generation and peer set information. It tracks/reads async the latest common knowledge bundle across the peers

3. Captains delegates a scheduled search on SH B



4. SH B determines the latest KB shared across peers (cksum2)

5. If indexers do not have a common bundle
   - Best Effort Search uses common bundle across the the largest subset of indexers and excludes the other indexers
   - Otherwise – a synchronous bundle replication is kicked off prior to search



6. Search request is issued with common bundle checksum (cksum2)

7. Indexers use the knowledge bundle (ckum2) included in search request

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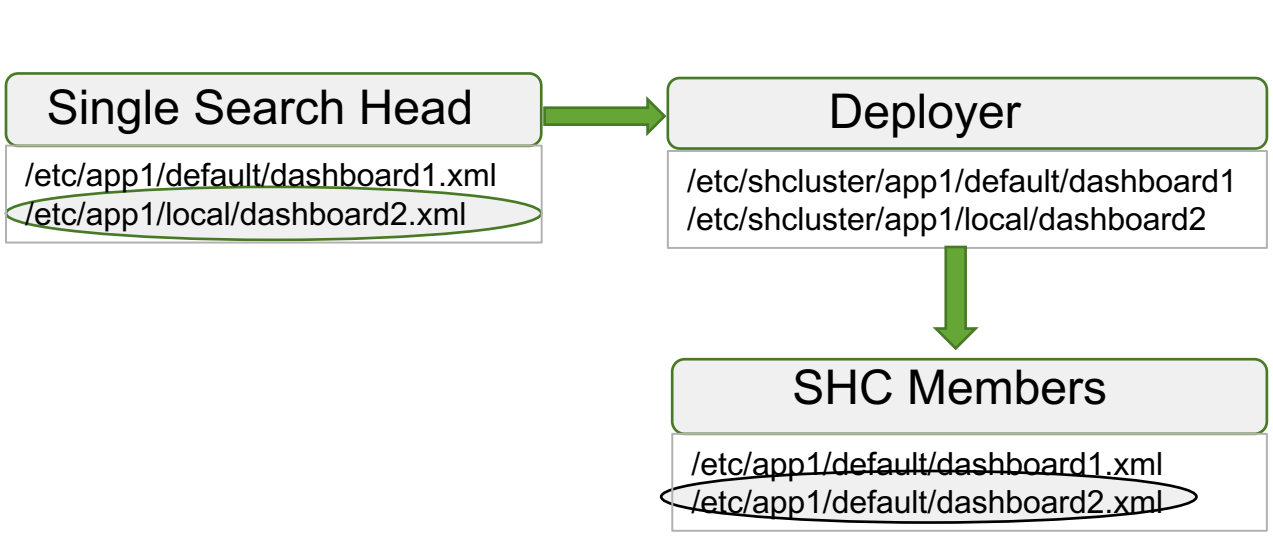
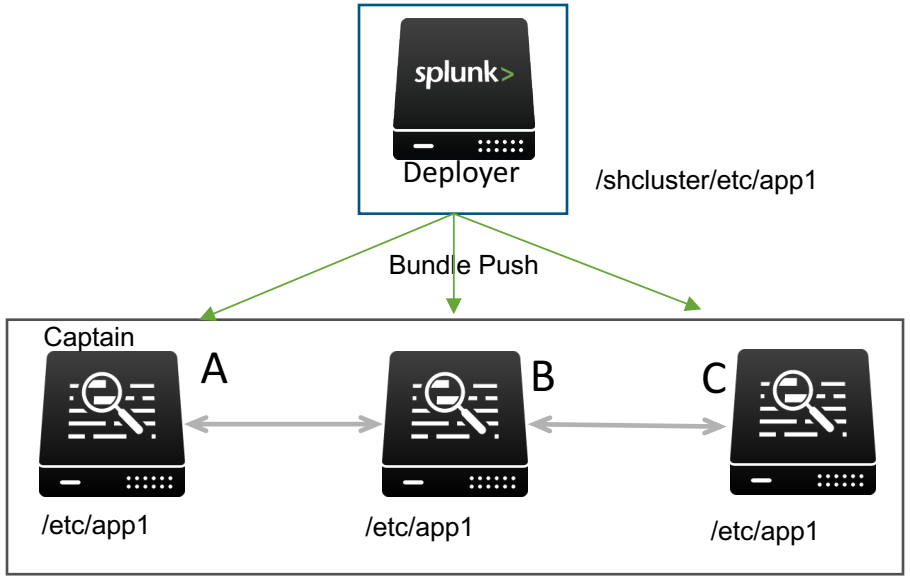
SH->SHC Migration





- Deployer merges default and local app configuration during migration
- Post migration, users cannot perform certain operations on app settings like delete, move or unshare since default settings are immutable by a user
- Tip: Exclude default (ex: search) apps during migration to avoid overwrite. Migrate any custom settings in default apps by moving them to a new app

Recent Additions

What's New in SHC?

6.5

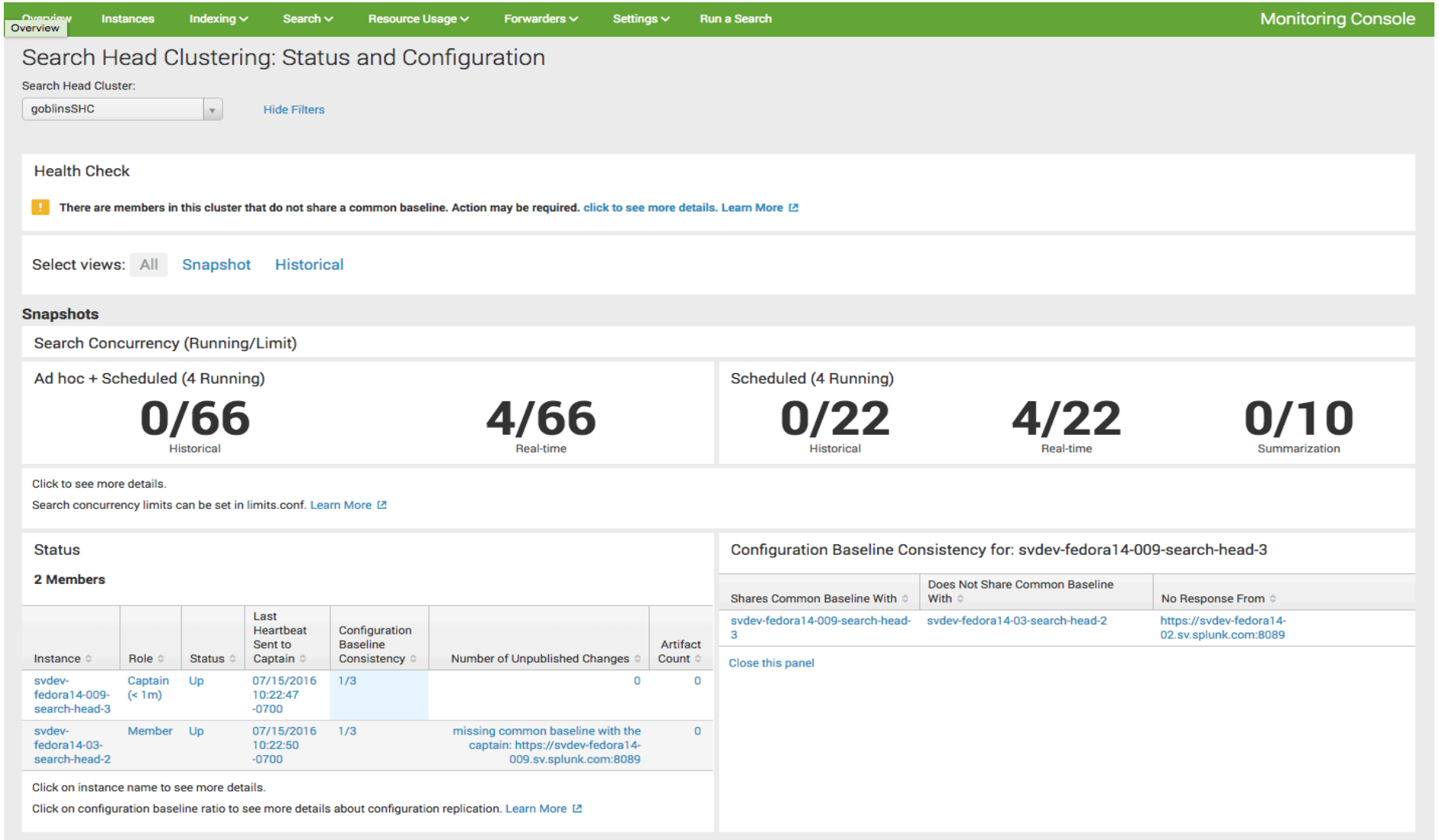
SHC Health Checker

Goal: Improve diagnosability with actionable information

- High level cluster health assessment
- Display node status
  - Captain/member
  - Heartbeat status
  - Uptime
  - Local unpublished conf changes
- Determine conf replication baseline consistentcy
- Expose search concurrency limits (running/capacity)

6.5

Conf Replication - Health Check



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6.6

Resilient Conf Replication

- Higher resiliency to ensure continuous replication of knowledge objects across the SHC members
  - Conf replication failures when JSON string exceeds 512KB
  - Long file path (>255 characters) leading to snapshot creation failure
  - Large lookups files may block configuration push from the members
  - Accelerated baseline match using bloom filters to find the common baseline

- Intelligent captain selection
  - Prevent out-of-sync SHC member from becoming captain

6.6

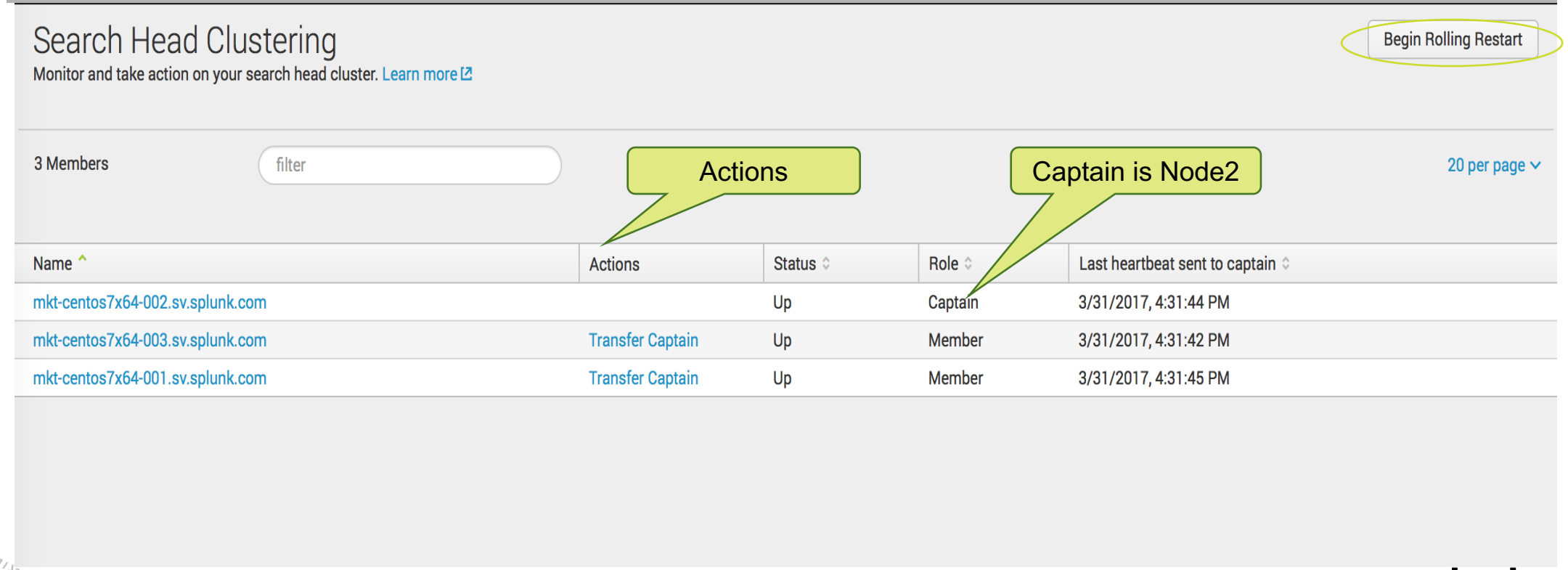
Bundle Push/Replication Improvements

- Delta bundle push to indexers on lookup deletes at runtime
  - Trigger delta bundle replication when conf objects are deleted
- Deployer directs first bundle push to the Captain node
  - Pushing to to captain enables faster bundle push down to the indexers
- Replicate option for lookup replication across SHC members
  - **replicate = true|false** in transforms.conf
    - True: lookup table is replicated to indexers,
    - False: lookup table is only replicated within SHC and not to the indexers
  - Avoids limitation of not replicating outputcsv (used to capture search results)
  - Use outputlookup to create a new csv file and replicate to SH and indexers as needed
  - Target usecase is ESTracker tables, that are replicated to only to SHC members
- Support MV fields in outputlookup

6.6

SHC Manager UI

- New SHC UI available from any of the SHC members
- Enabled only in SHC environments
- Enables admins to run cluster operations (rolling restart, captain transfer)
- More functionality to come in upcoming releases



Key Takeaways

1. SHC provides always-on search services and consistent user experience
2. Enable SHC for horizontal scalability
3. Recent additions: SHC health check (6.5), Increased conf replication resiliency (6.6), SHC manager UI (6.6)

Thank You

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