Search Head Clustering – Basics To Best Practices

Manu Jose, Yuan Xu

Sr. Software Engineer, Splunk

.conf2016

splunk>

Disclaimer

During the course of this presentation, we may make forward looking statements regarding future events or the expected performance of the company. We caution you that such statements reflect our current expectations and estimates based on factors currently known to us and that actual events or results could differ materially. For important factors that may cause actual results to differ from those contained in our forward-looking statements, please review our filings with the SEC. The forward-looking statements made in the this presentation are being made as of the time and date of its live presentation. If reviewed after its live presentation, this presentation may not contain current or accurate information. We do not assume any obligation to update any forward looking statements we may make. In addition, any information about our roadmap outlines our general product direction and is subject to change at any time without notice. It is for informational purposes only and shall not, be incorporated into any contract or other commitment. Splunk undertakes no obligation either to develop the features or functionality described or to include any such feature or functionality in a future release.

Agenda

- What Is Search Head Clustering?
- Cluster Operation
- Scalability And High Availability
- Configuration Management

Search Head Clustering

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

MISSION CRITICAL ENTERPRISE

Business Benefits Of SHC

Horizontal Scaling

Consistent User Experience

Always-on Search Services

Easy to add / manage premium contents (apps)

SHC – How Does It Work?

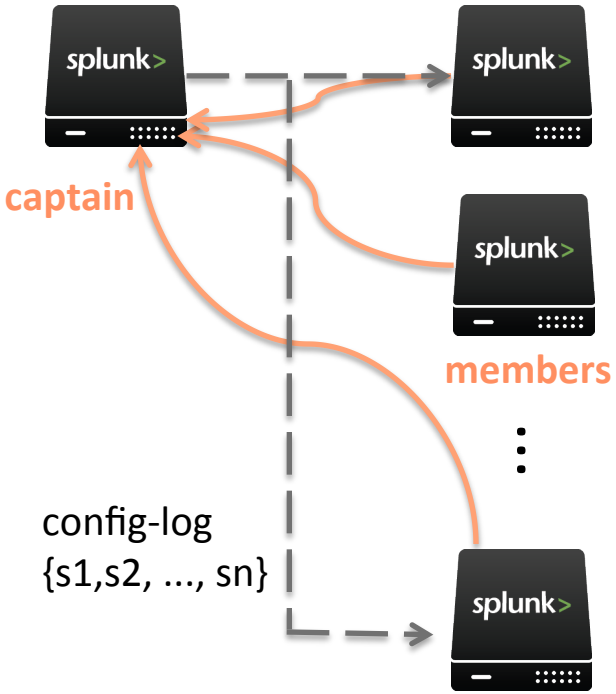
1. Group search heads into a cluster (Horizontal scaling)

2. Captain gets elected dynamically (No Single point failure)

3. User created reports/dashboards automatically replicated to other search heads (Consistent Configuration)

Deploy A Cluster

Search Head Cluster Bring up

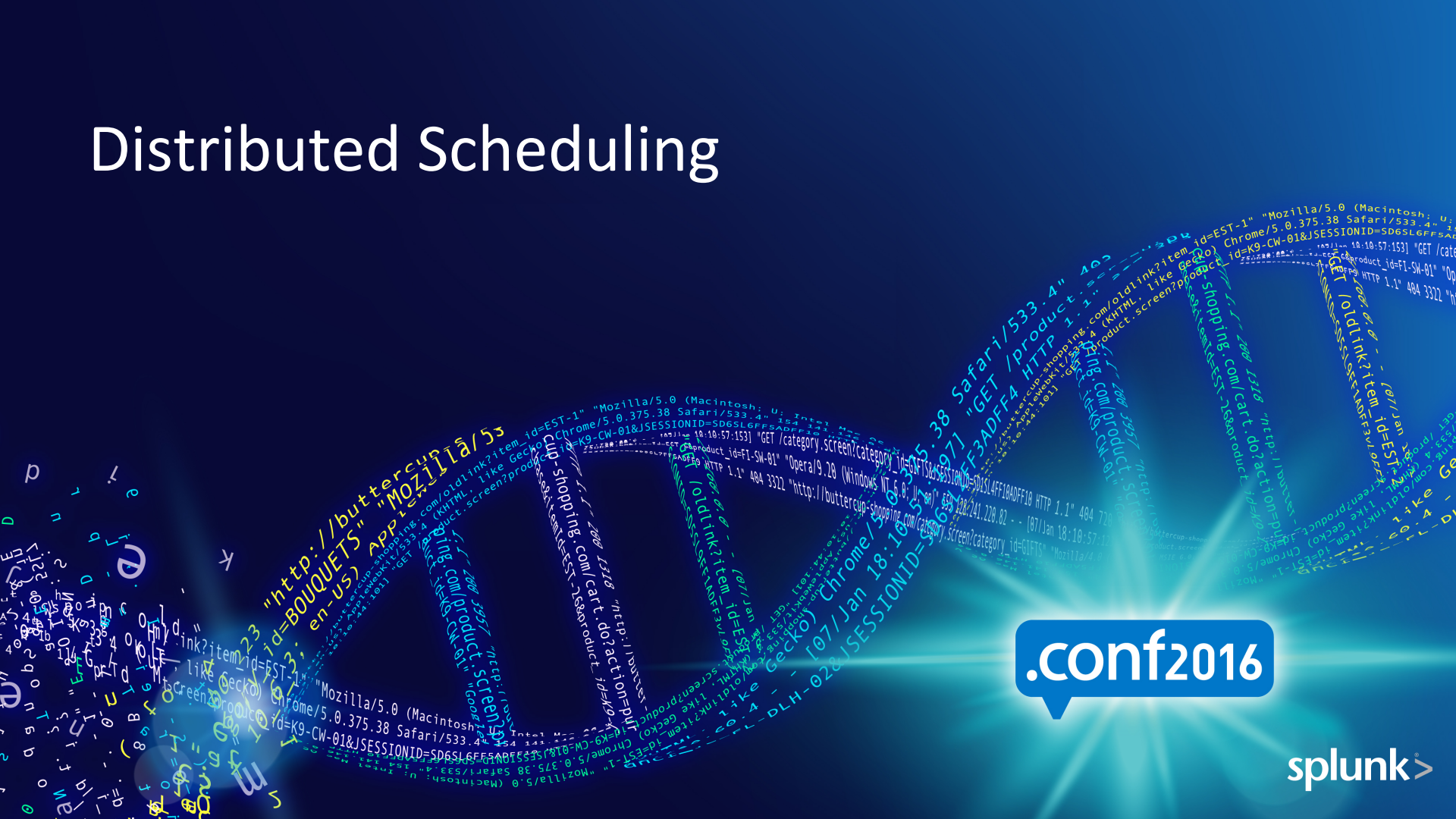


- Bootstrap captain
- Bring-up members
- Captain establishes authority
- Members join/register
- CLI based cluster scale/shrink

Best Practices

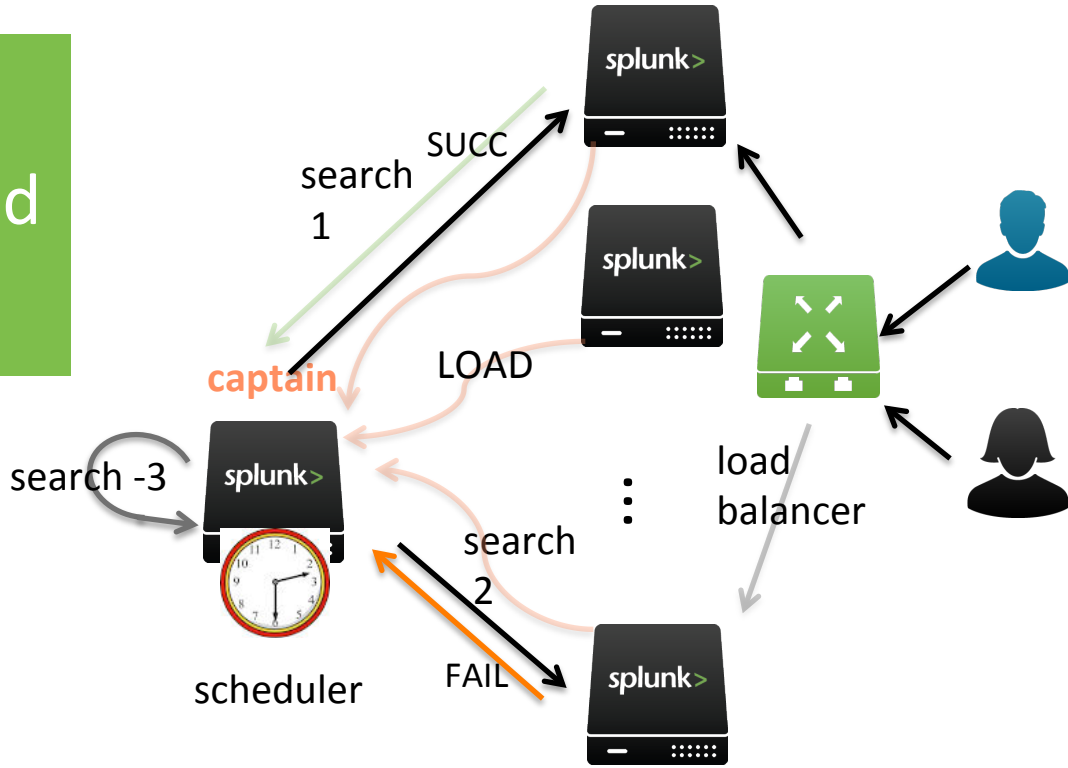
- Add only fresh instances, if a node is re-purposed use "*Splunk clean all*"
- HA requires a minimum of 3 nodes
- All search heads on homogenous hardware and at same version
- Number of instances >= replication_factor
- Admin needs to manually do "*Splunk remove shcluster-member*" on captain to remove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

Distributed Scheduling



Job Scheduling Orchestration

- Captain is job scheduler
- Eliminates job-server need
- Load-based heuristic



Details

- 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

Search Results Primer

$SPLUNK_HOME/var/run/splunk/dispatch/scheduler__admin__search_mysearch_at_1410708600_345

sourcetype = access_combined | stats count by clientip

reduce

map

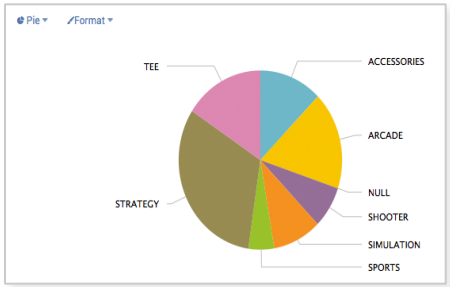
stream results

Search - HEAD

indexers

other names

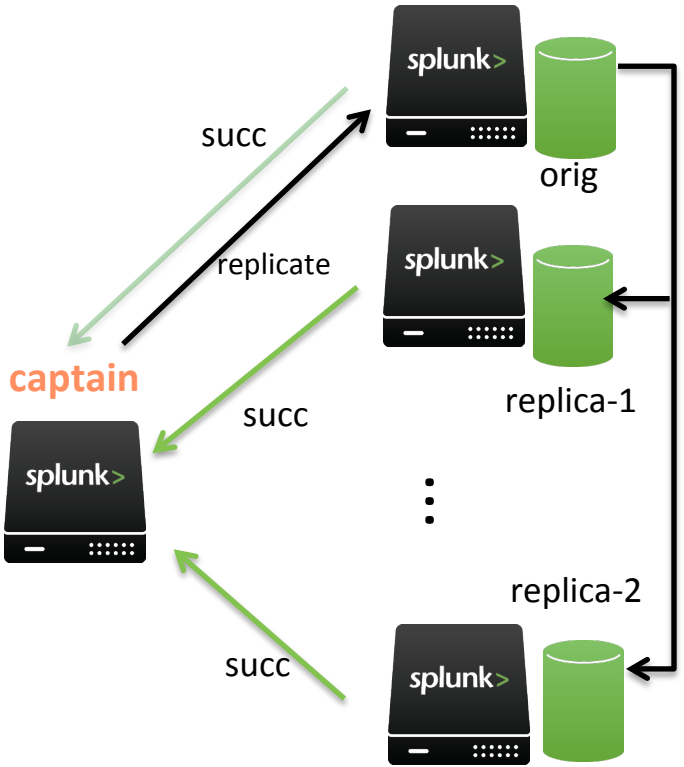
1. Search results
2. Search artifact
3. Dispatch directory
4. SID



Dispatch dir needs to be replicated to multiple nodes to tolerate node failures

Artifact Replication

- Captain orchestrates replication
- Default replication_factor=3
- Success failure ack'd to captain
- Asynch replicate on proxy
- Replication policy enforced by fixups



Good To Know

- 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

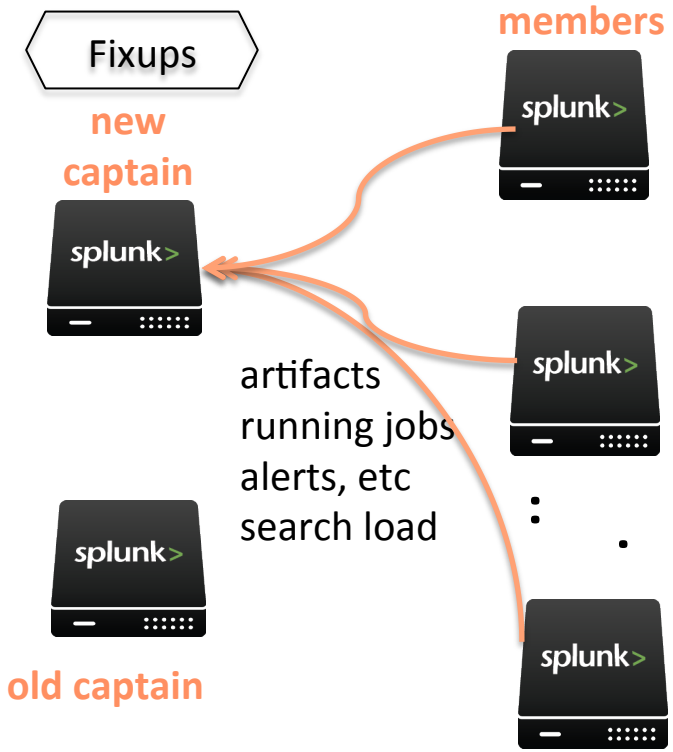
Centralized Cluster State

- 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

High Availability Of Cluster

Dynamic Captain & Auto Failover

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



Stable 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

Configuration Management

Goal

- Consistent user experience across all search heads
- Changes made on one member are reflected on all members

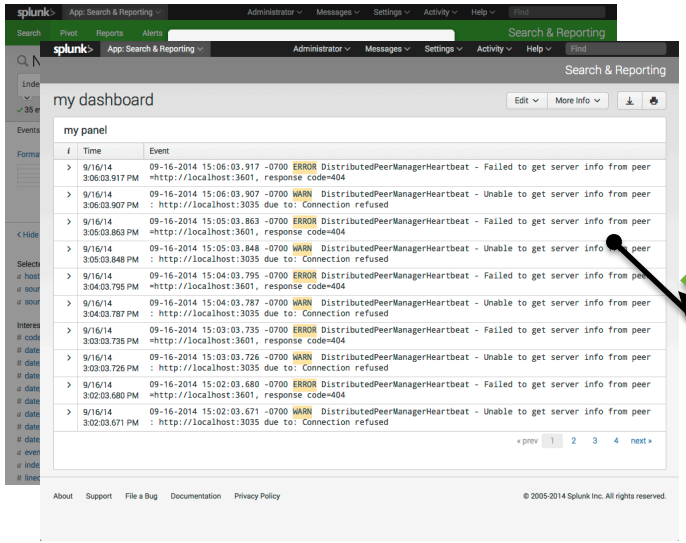
Configuration Changes

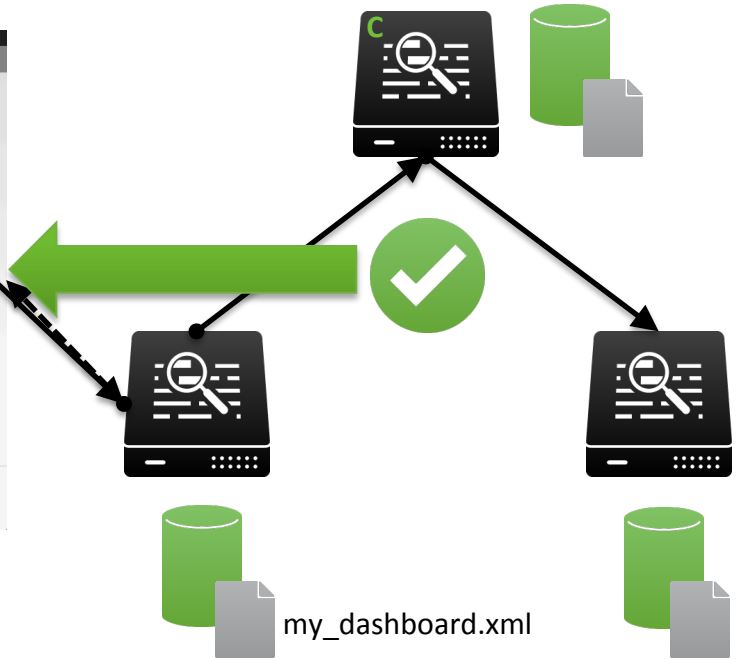
- Users customize search and UI configurations via Web/CLI/REST
  - save report
  - add panel to dashboards
  - create field extraction
- Administrators modify system configurations
  - configure forwarding
  - deploy centralized authentication (e.g. LDAP)
  - install entirely new apps

Search And UI Configurations

- Changes to search and UI configurations are replicated across the search head cluster automatically
- Goal: eventual consistency

Conf Replication - Workflow



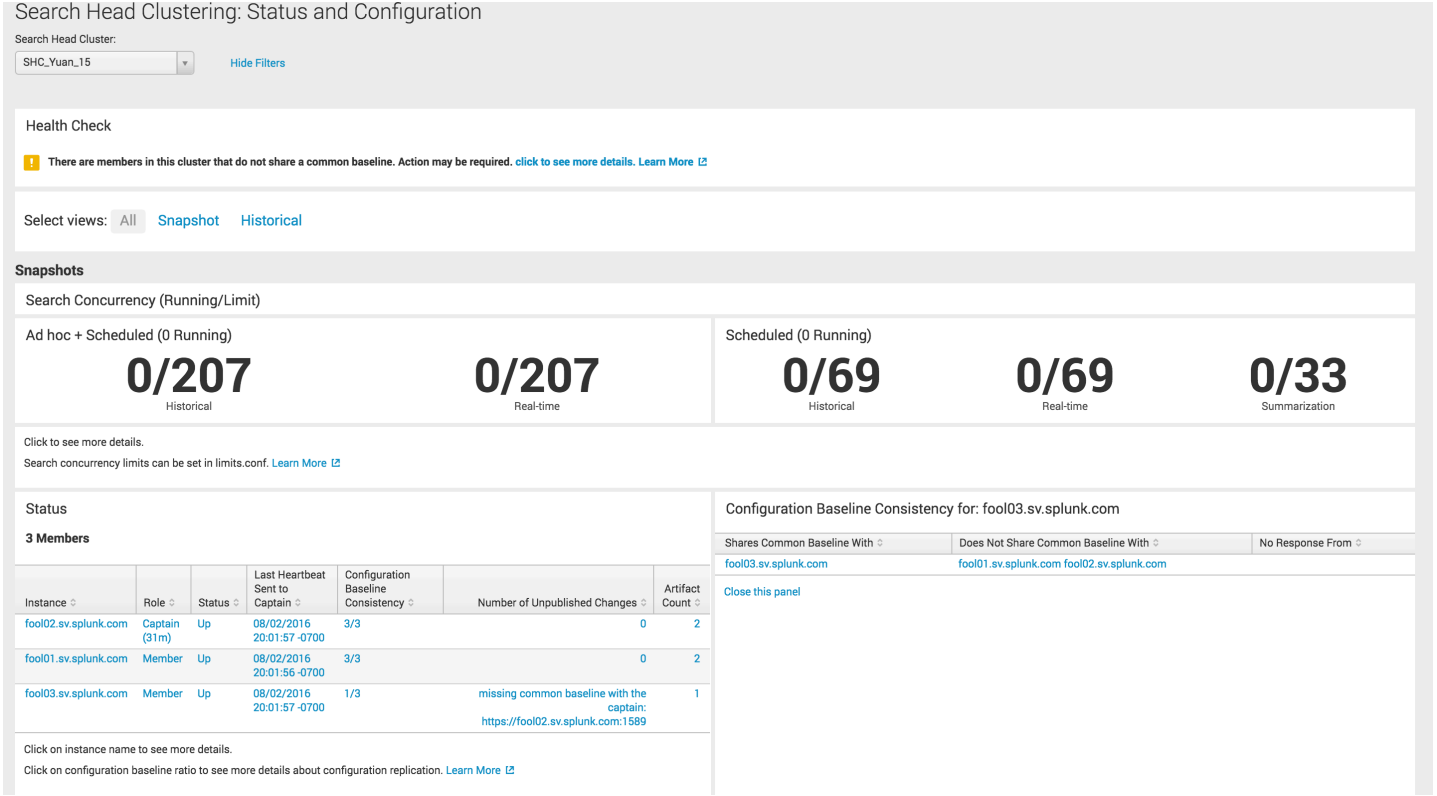


Conf Replication Progress

```
Captain:
                    dynamic_captain : 1
                    elected_captain : Tue Aug  9 10:27:23 2016
                                 id : 61A55EA5-FDB6-496D-B8CC-E4205DDCE9DF
                   initialized_flag : 1
                              label : yxu-mbp15-node3
                           mgmt_uri : https://localhost:9089
                min_peers_joined_flag : 1
                 rolling_restart_flag : 0
                   service_ready_flag : 1

Members:
        yxu-mbp15-node1
                              label : yxu-mbp15-node1
            last_conf_replication : Tue Aug  9 15:16:43 2016
                           mgmt_uri : https://localhost:11089
                     mgmt_uri_alias : https://yxu-mbp15:11089
                             status : Up
        yxu-mbp15-node3
                              label : yxu-mbp15-node3
                           mgmt_uri : https://localhost:9089
                     mgmt_uri_alias : https://yxu-mbp15:9089
                             status : Up
        yxu-mbp15-node2
                              label : yxu-mbp15-node2
            last_conf_replication : Tue Aug  9 15:16:43 2016
                           mgmt_uri : https://localhost:8089
                     mgmt_uri_alias : https://yxu-mbp15:8089
                             status : Up
```

Conf Replication - Health Check

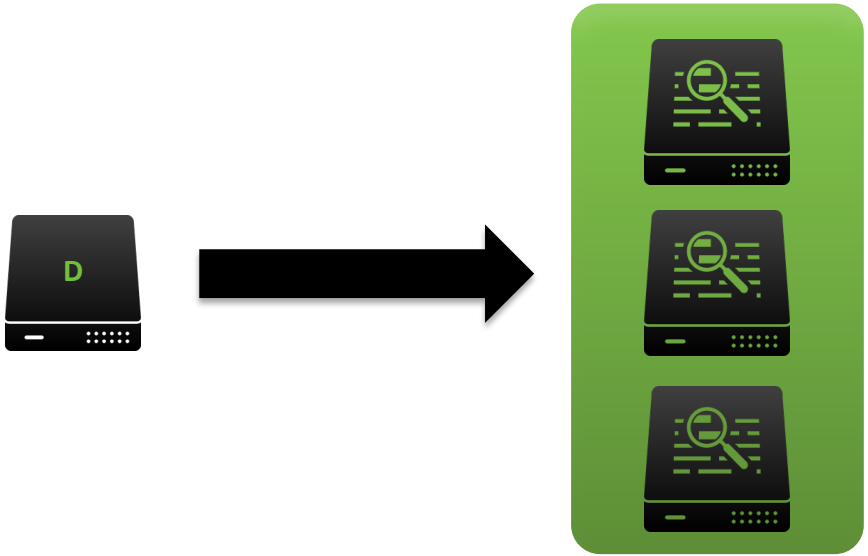


System Configurations

- 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



THANK YOU

splunk>