Workload Management

To Achieve Efficient Resource Utilization

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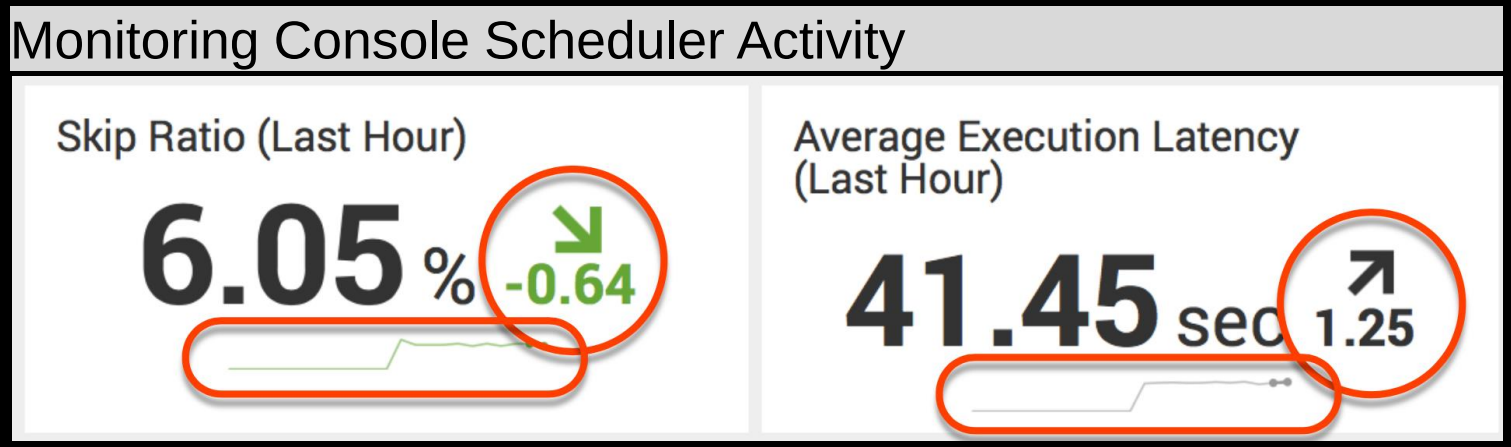
Workload Management

How does it help ?

Challenges

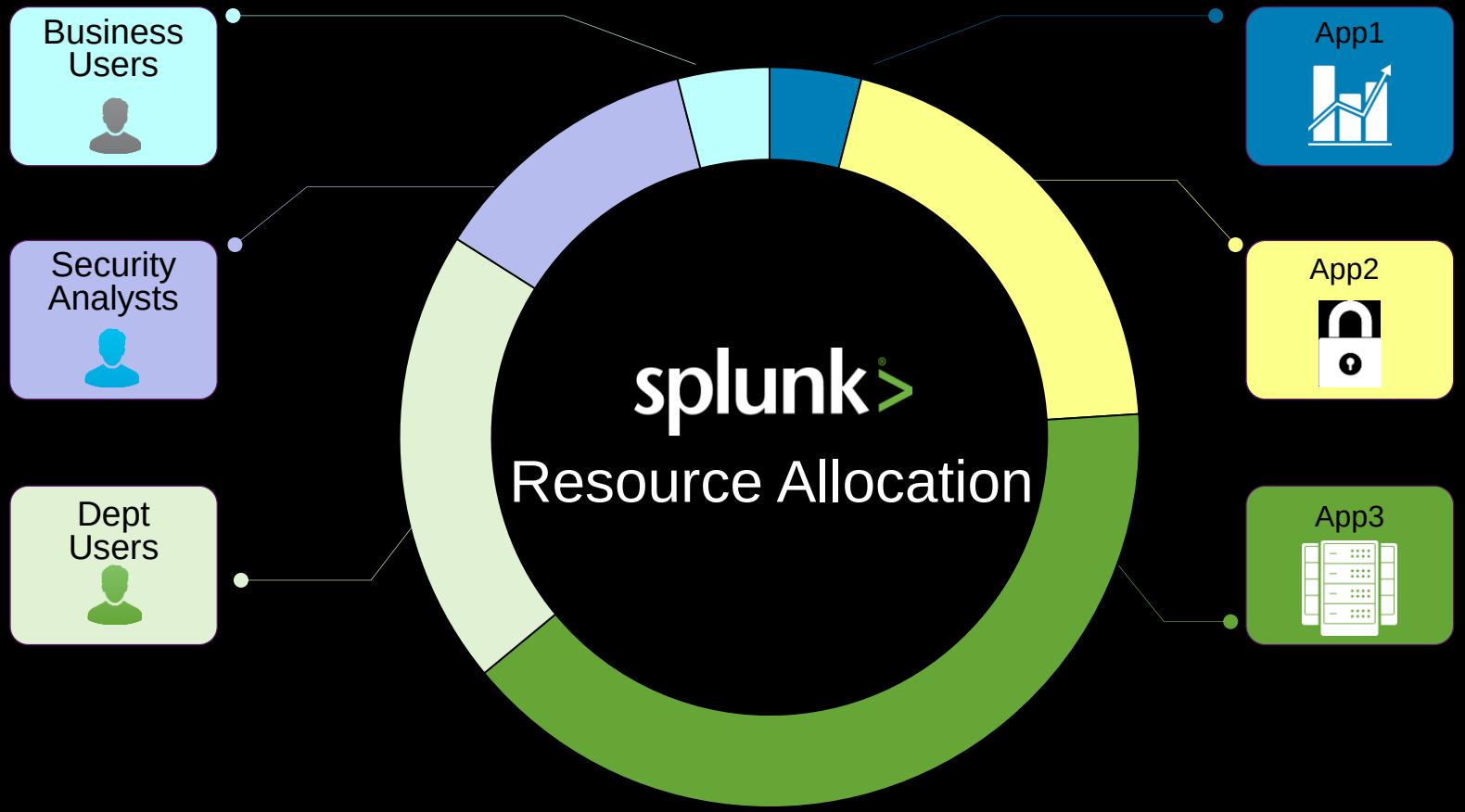
Unpredictability in search execution



- New users run wildcard searches, all-time searches, real time searches
- Users/apps running wildcard or expensive searches
- Resource utilization goes through the roof and impacts other users
- High search load impacts data ingestion lag and fails to fire alerts in time

Resource Allocation

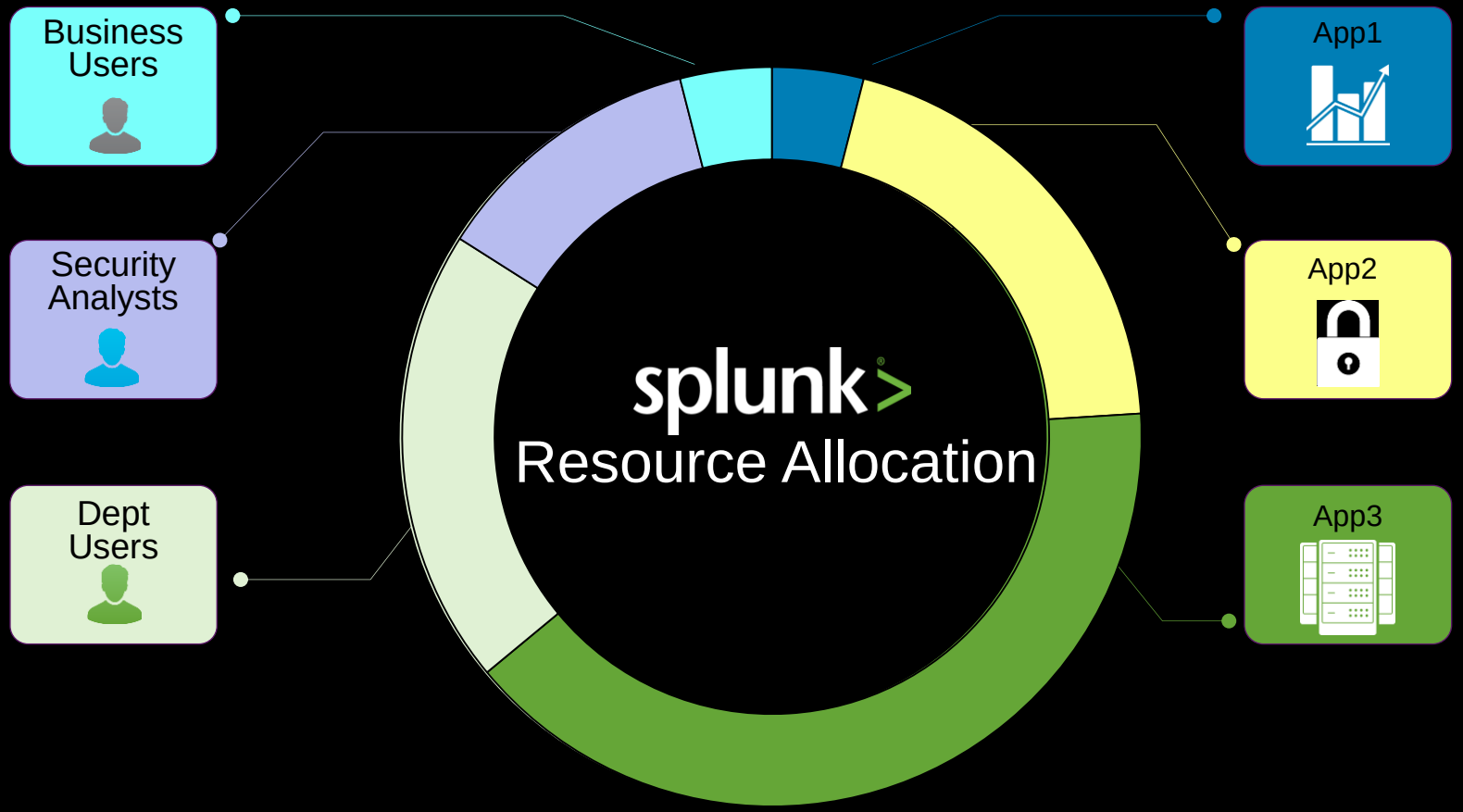
Lack of control to align resource allocation with business priorities



App Priority	User Priority
App1	Business users
App2	Security Analysts
App3	Dept Users

Resource Contention

No guardrails over excessive resource usage



App Priority	User Priority
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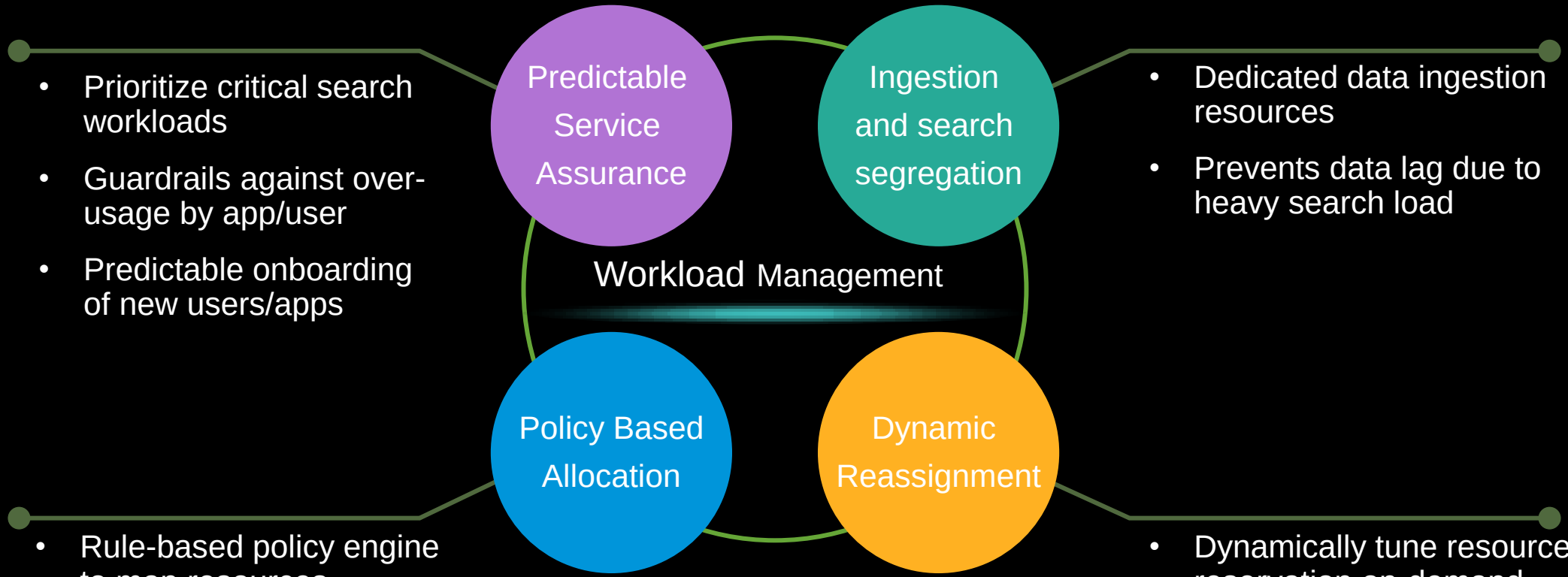
Workload Management

Aligns resource allocation with business priorities



- Prioritize critical search workloads
- Guardrails against over-usage by app/user
- Predictable onboarding of new users/apps

- Dedicated data ingestion resources
- Prevents data lag due to heavy search load

- Rule-based policy engine to map resources
- Resource assignment based on apps/roles

- Dynamically tune resource reservation on-demand
- Admin delegation through capabilities

Workload Pools and Rules

Policy Based Assignment of Resources

Workload Pools	CPU	Memory	Workload Rules/Policy
Search High	35%	35%	App=App1 Role=BusinessUser
Search Medium	20%	20%	App=App2 Role=SecAnalyst
Search Low	15%	15%	App=App3 Role=DeptUsers
Default Ingest	30%	30%	

App Priority	User Priority
App1	Business users
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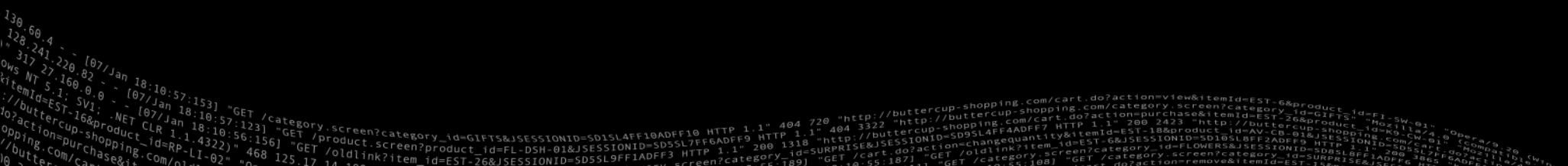

Workload Management

Control over resource allocation and enforced guardrails

App Priority	User Priority
App1	Business users
App2	Security Analysts
App3	Dept Users

Workload Pools	CPU	Memory	Workload Rules/Policy
Search High	35%	35%	App=App1 Role=BusinessUser
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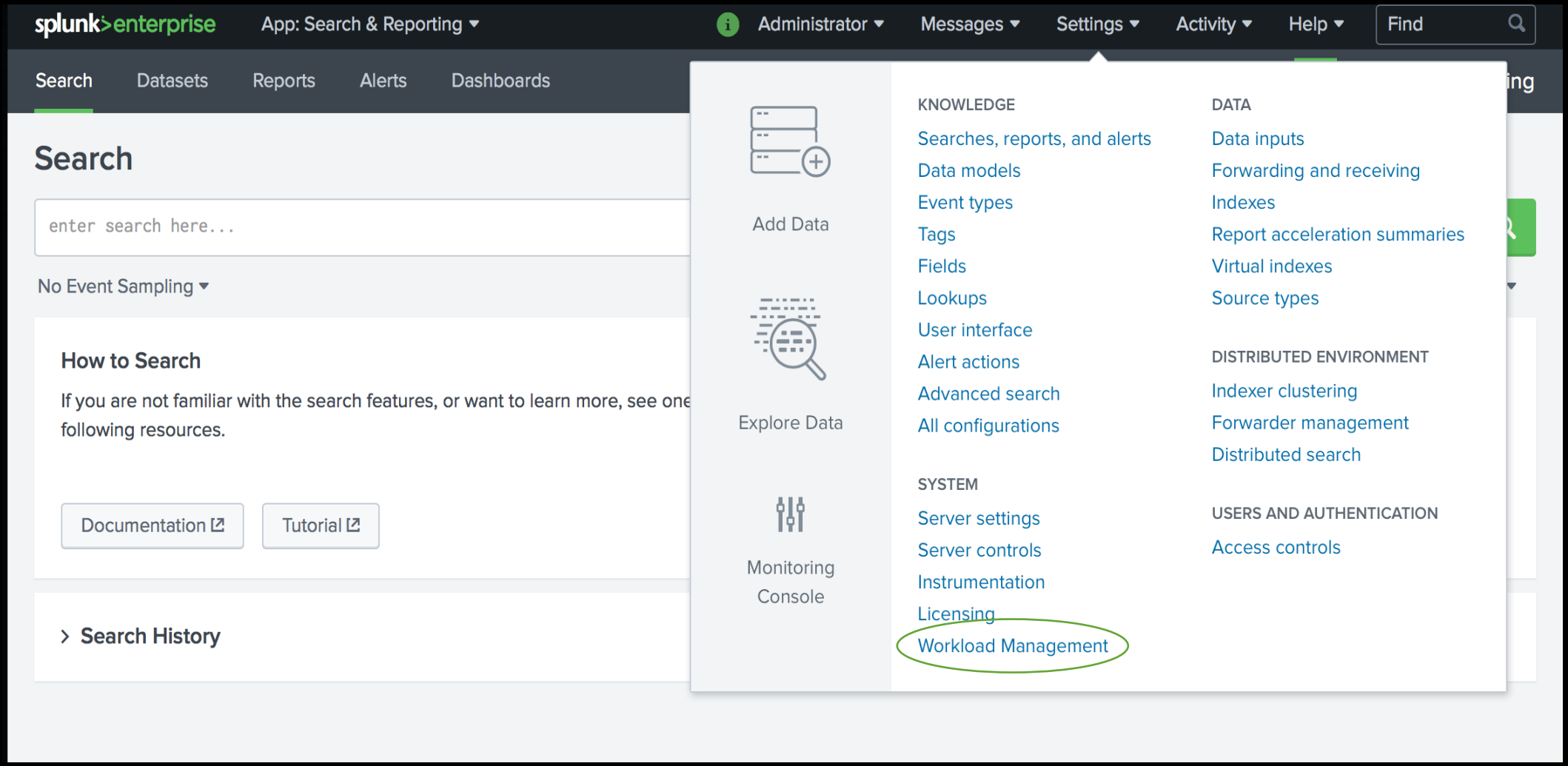
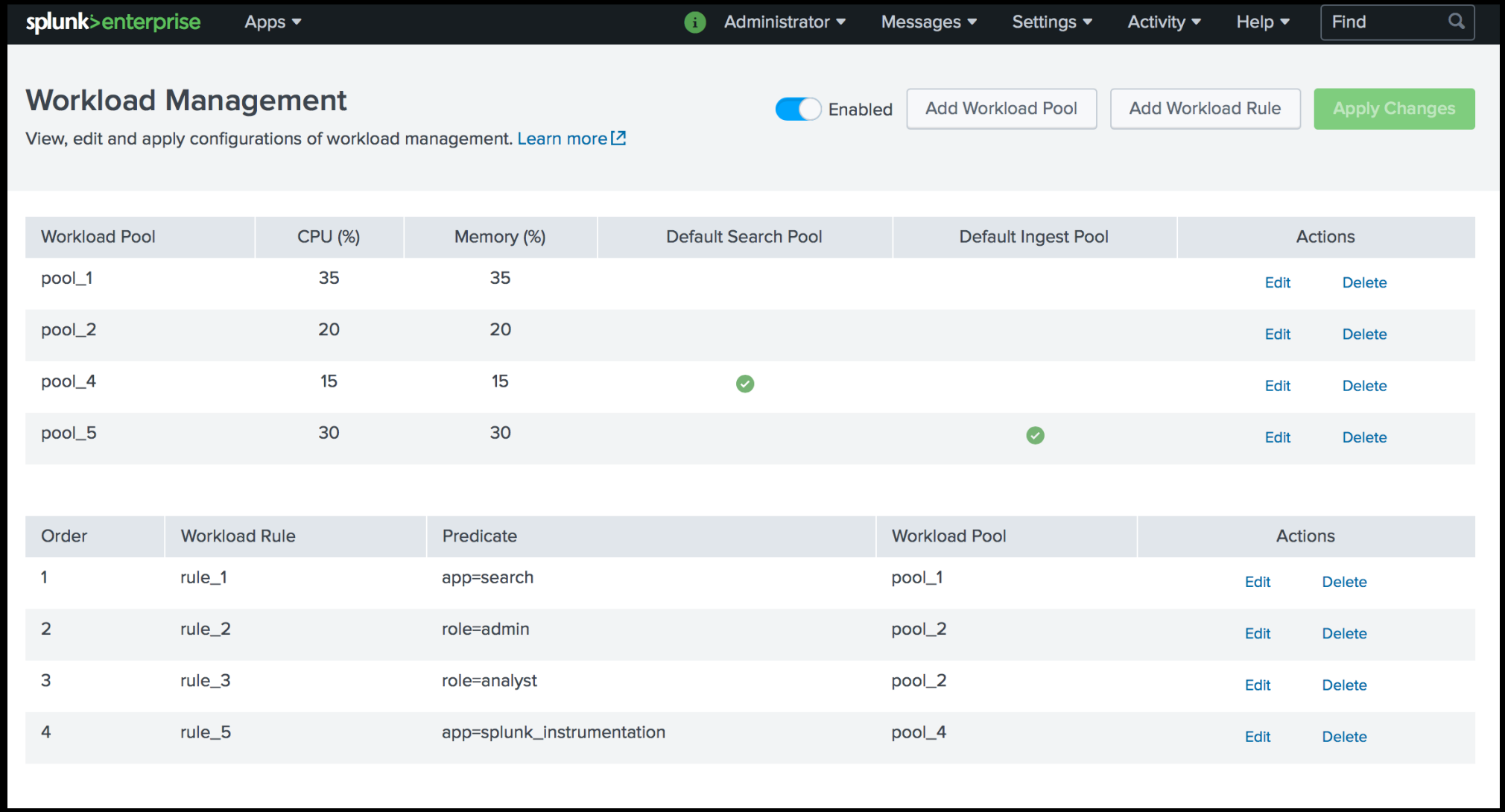
Search Low	15%	15%	App=App3 Role=DeptUsers
Default Ingest	30%	30%	

Workload Management (Admin)



Workload Management (Admin)



Configuration Files

workload_pools.conf

```
[workload_pool:pool_1]
cpu_weight = 25
mem_weight = 25

[workload_pool:pool_2]
cpu_weight = 20
mem_weight = 20

[workload_pool:pool_4]
cpu_weight = 15
mem_weight = 15

[workload_pool:pool_5]
cpu_weight = 30
mem_weight = 30

[general]
default_pool = pool_4
enabled = 1
ingest_pool = pool_5
```

workload_rules.conf

```
[workload_rule:rule_1]
predicate = app=search
workload_pool = pool_1

[workload_rule:rule_2]
predicate = role=admin
workload_pool = pool_2

[workload_rule:rule_3]
predicate = role=analyst
workload_pool = pool_2

[workload_rules_order]
rules = workload_rule:rule_1,workload_rule:rule_2,workload_rule
:rule_3,workload_rule:rule_5
rules_number = 4

[workload_rule:rule_5]
predicate = app=splunk_instrumentation
workload_pool = pool_4
```

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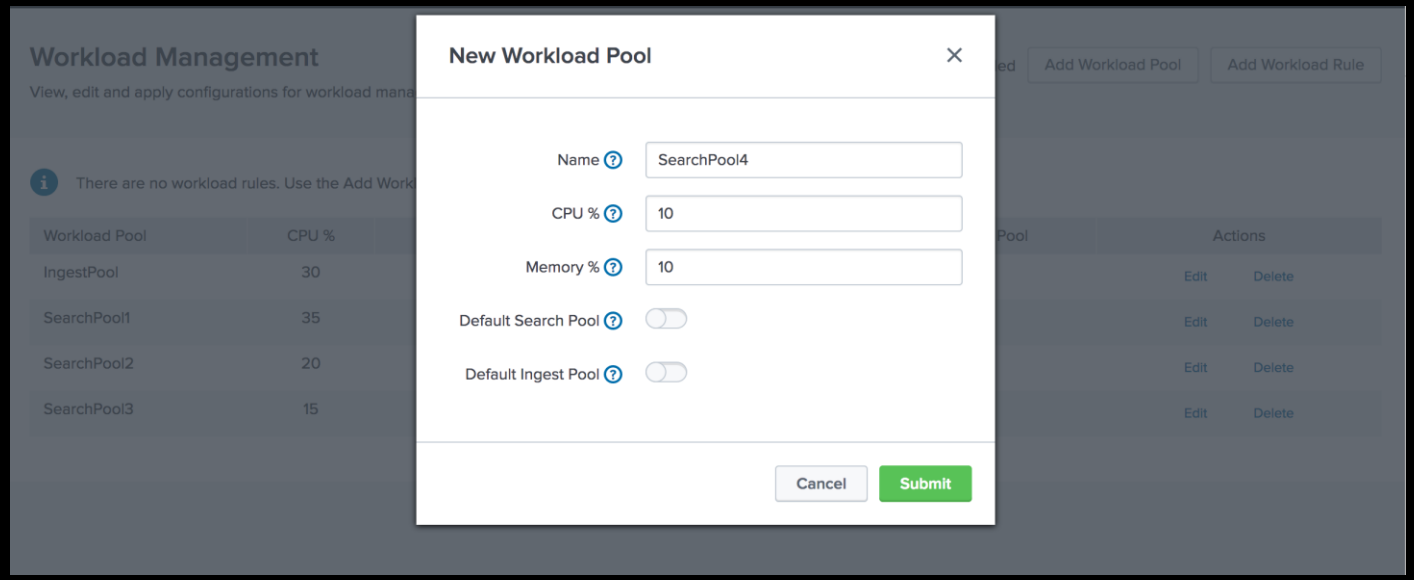
Workload Management: Pool Creation

Workload Pools

- CPU/Memory resource pools
- Specify allocation of CPU and memory resources
- Indicate ingest or search pool



First Version

- One ingest pool
- Multiple Search Pools

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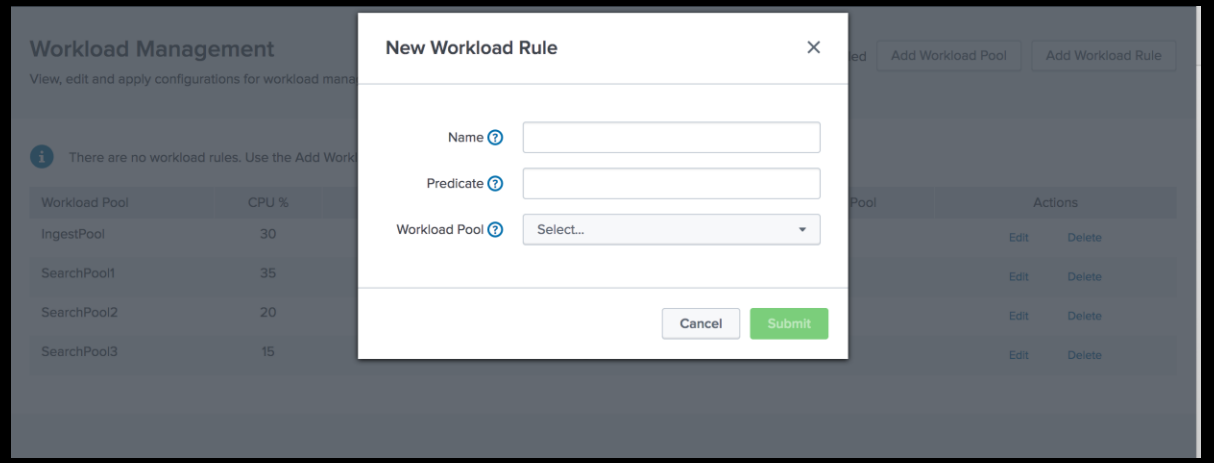
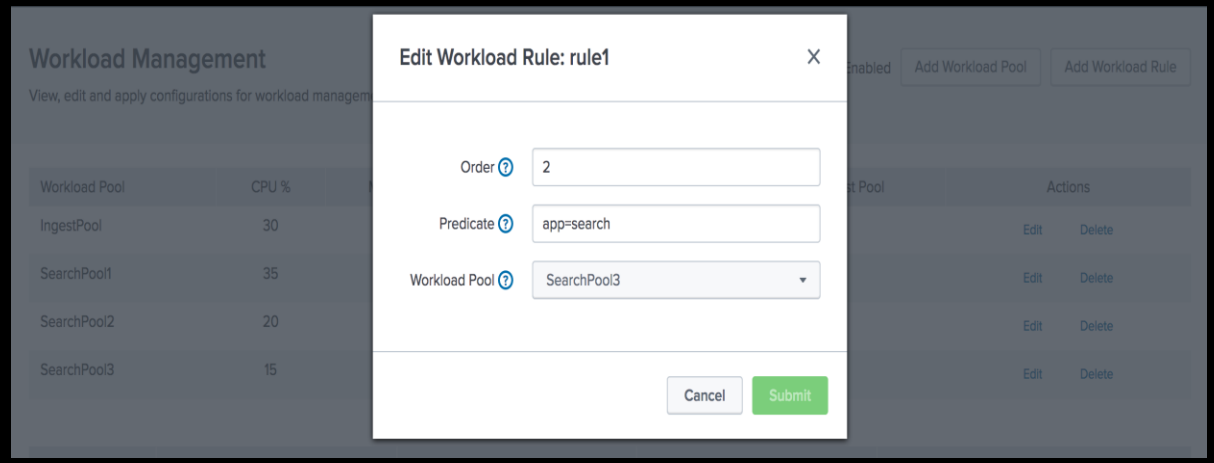
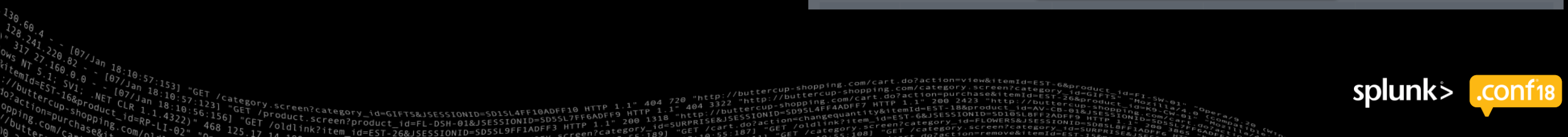
Workload Management: Rule Creation

Workload Rules:

- Determines assignment of pools based on custom rules
- Rules can be specified on an app, role or user basis
- Rules order determines rule precedence
- Provision to provide more complex rules going forward







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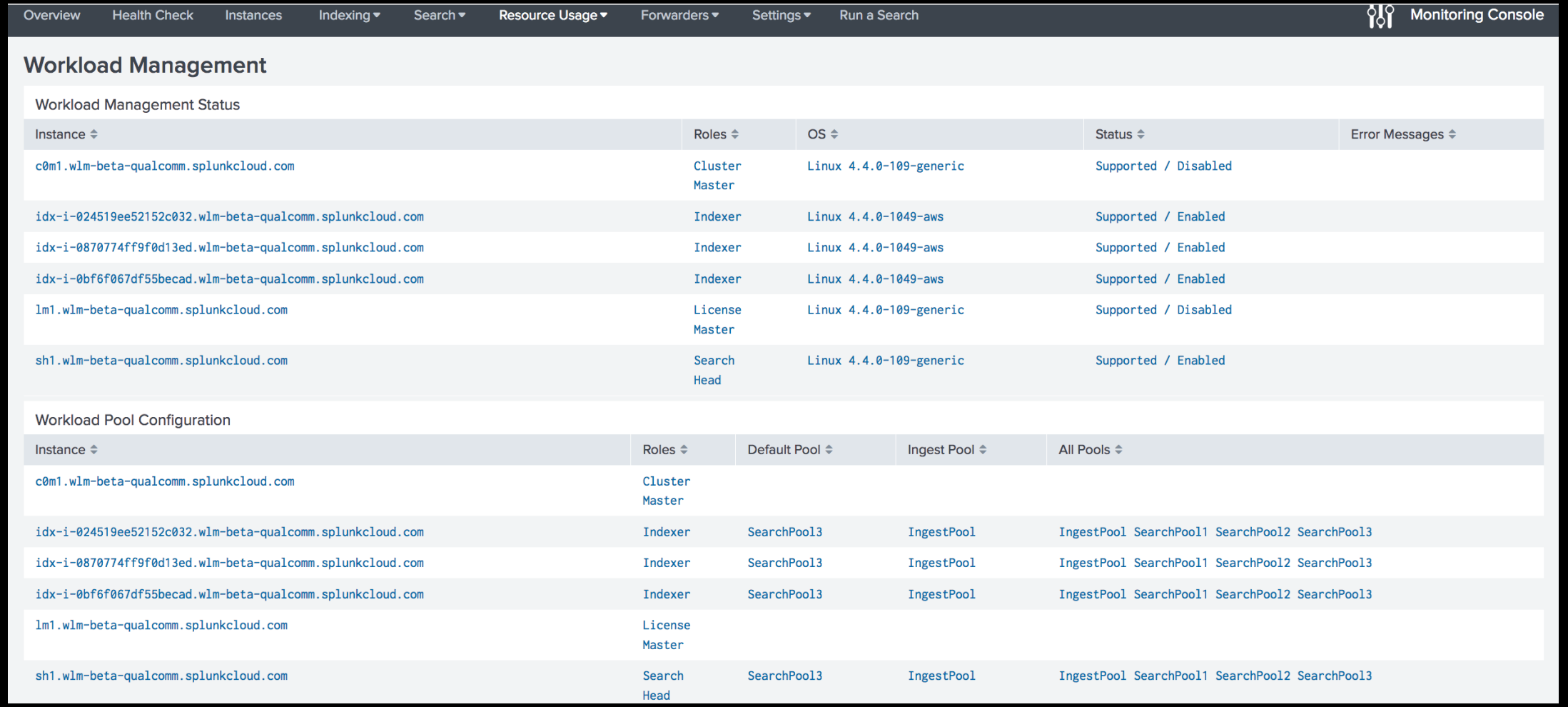
Monitoring

Monitor workload management status and resource usage



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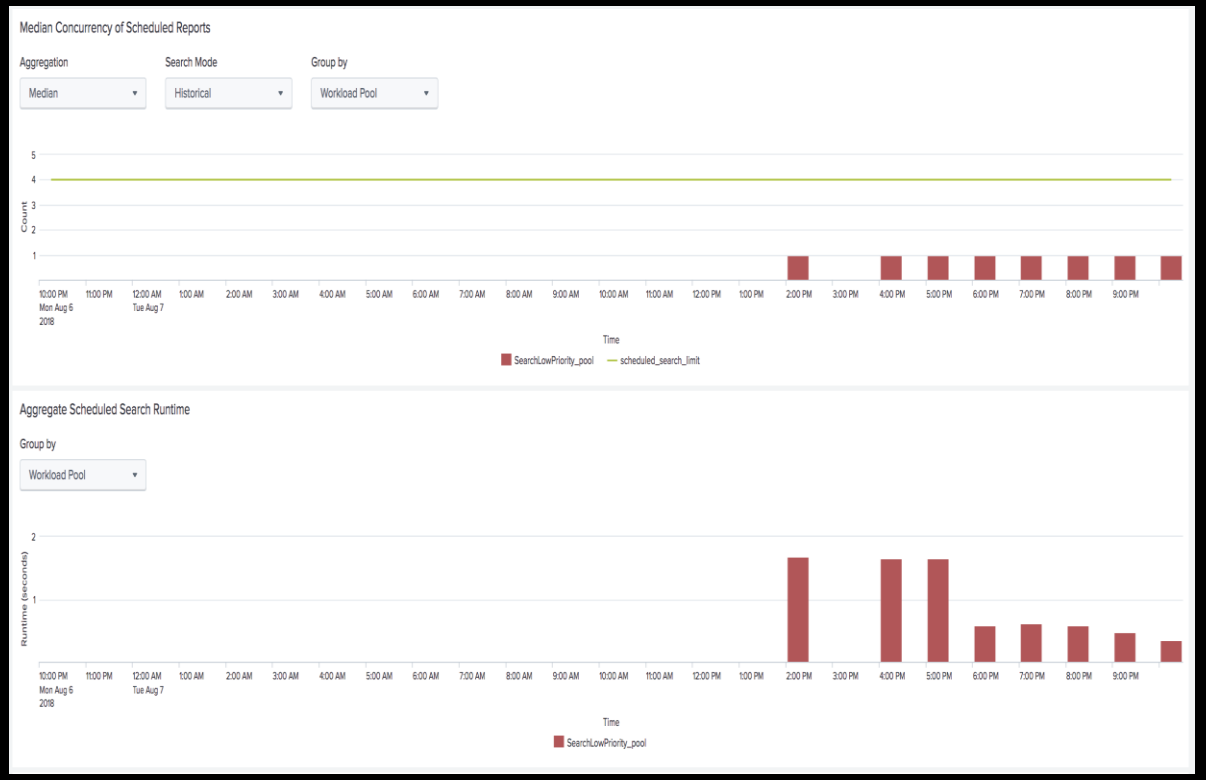
Monitor Search and Scheduler Activity

Using New Workload Pools Filter



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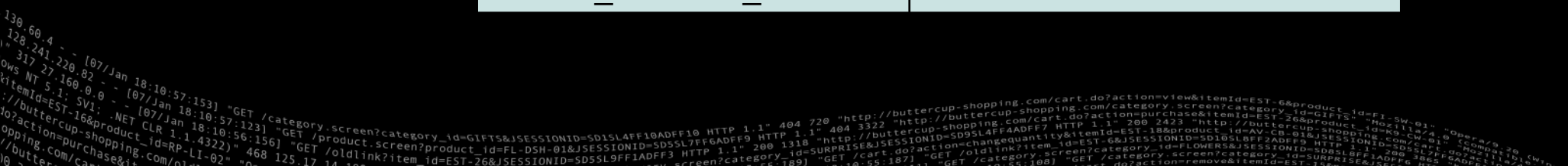
Dynamic Reassignment

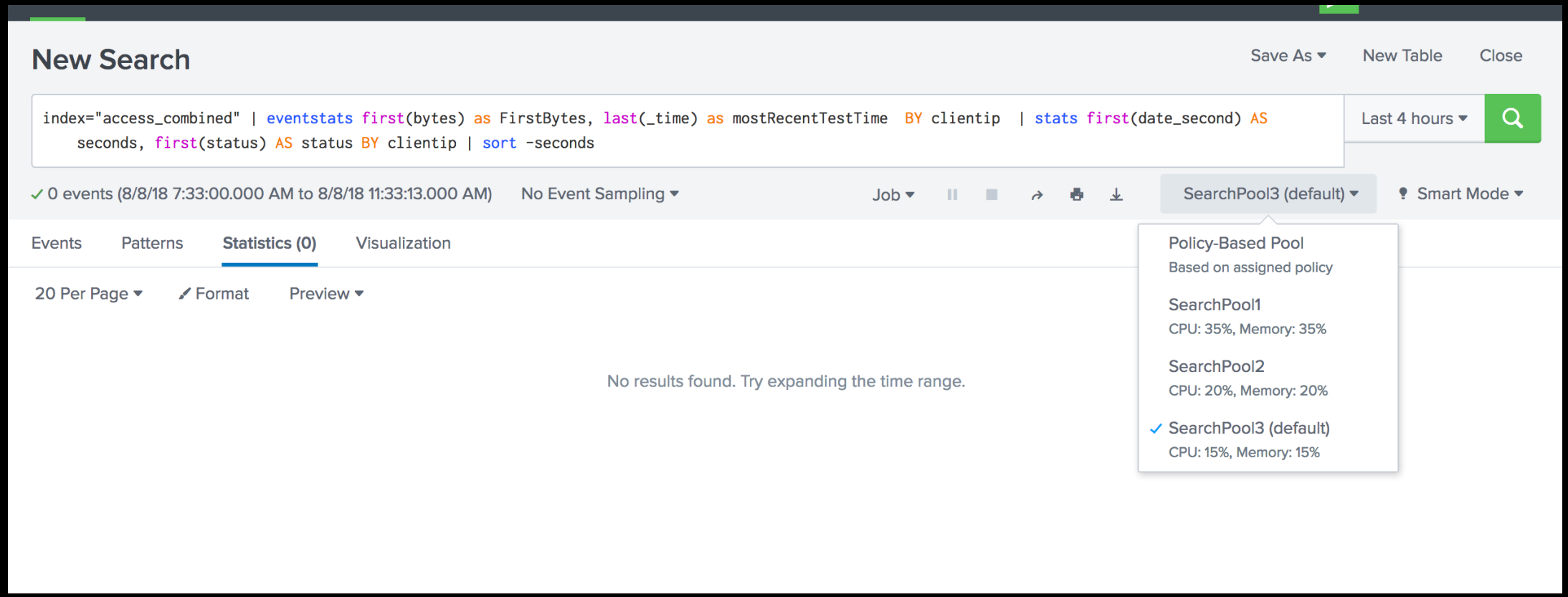
On-demand Reassignment of workload pool

- Available through capabilities
- Allows power users to use higher/lower priority workload pools on-demand
- Available to ad-hoc and scheduled searches

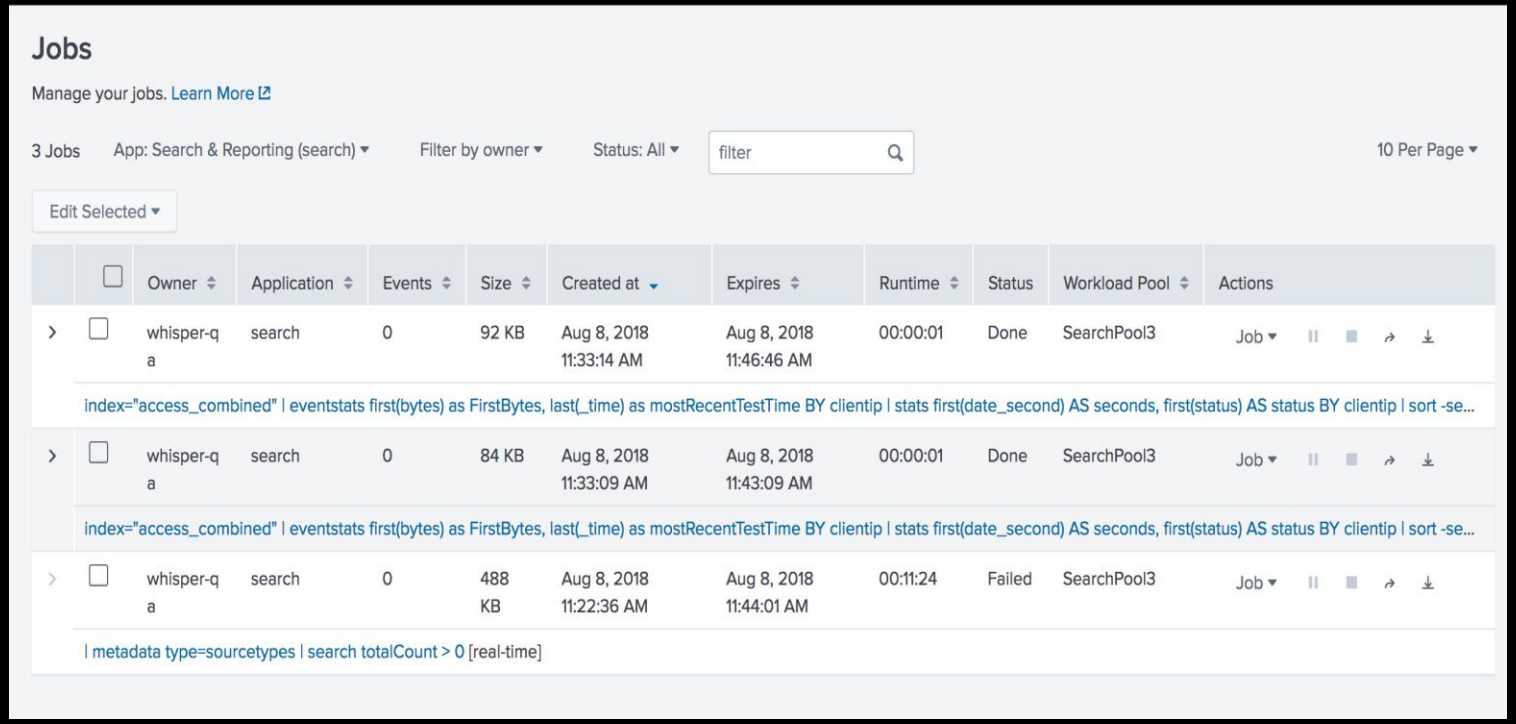
Capability	Actions
edit_workload_pools	Create/Modify Workload Pools
list_workload_pools	List Workload Pools
select_workload_pools	Select Workload Pools
edit_workload_rules	Create/Modify Workload Rules
list_workload_rules	List Workload Rules

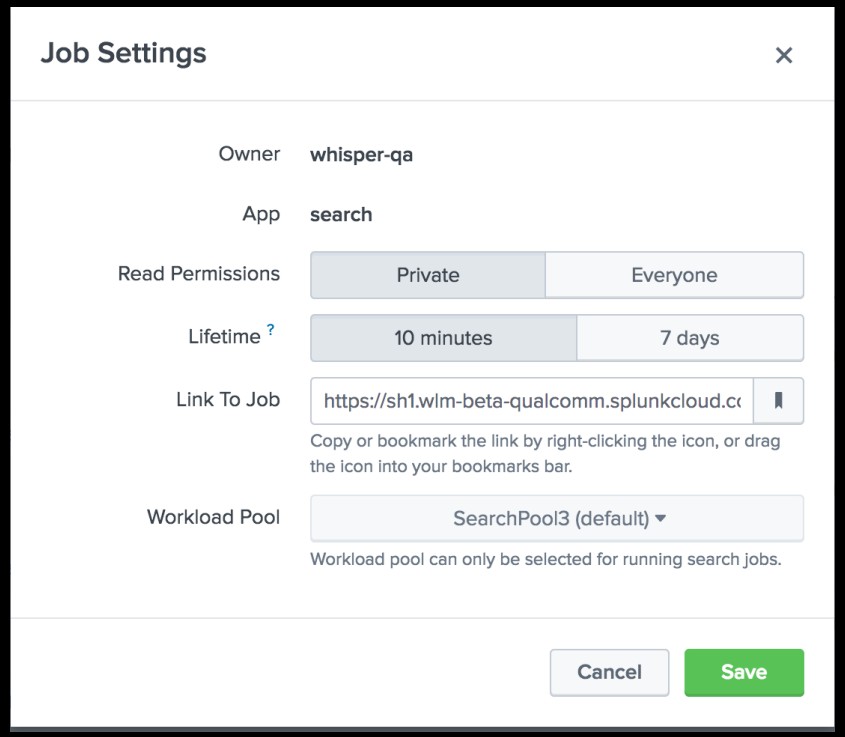


Dynamic Pool Selection: Ad-hoc Searches



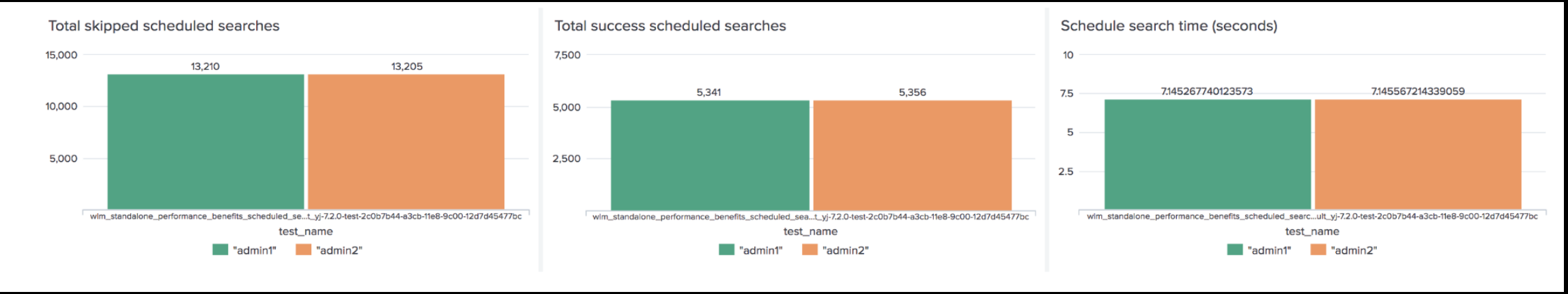
Dynamic Pool Selection: Scheduled Searches



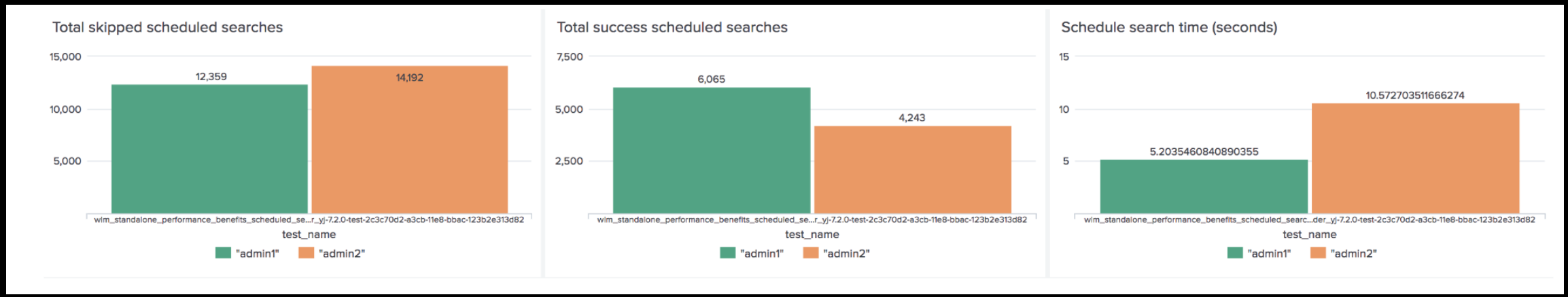


Scheduled Search Behavior across Workload Pools

- WLM Disabled



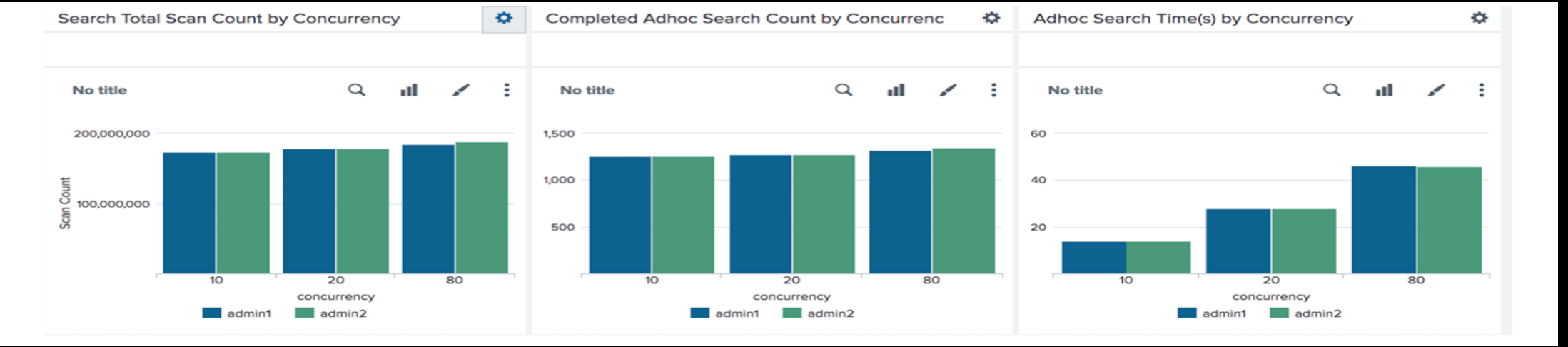
- WLM Enabled



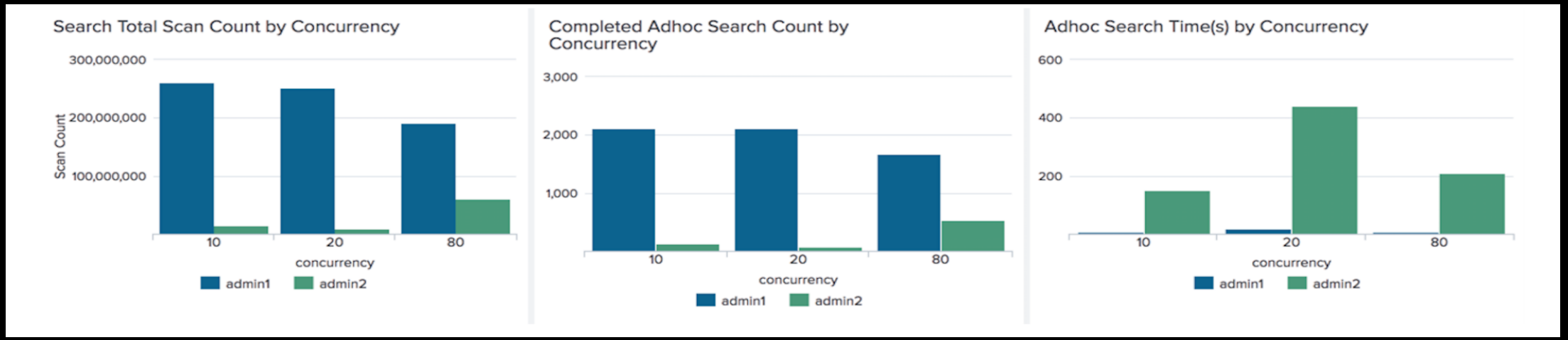
- Scheduled searches run faster in higher resource workload pool
- Fewer skipped searches in higher resource workload pool
- Higher number of successfully scheduled searches in higher resource workload pool

Ad-hoc Search Behavior across Workload Pools

- WLM Disabled



- WLM Enabled



- Ad-hoc searches run faster in higher resource workload pool
- Higher number of successfully completed ad-hoc searches by concurrency in higher resource workload pool

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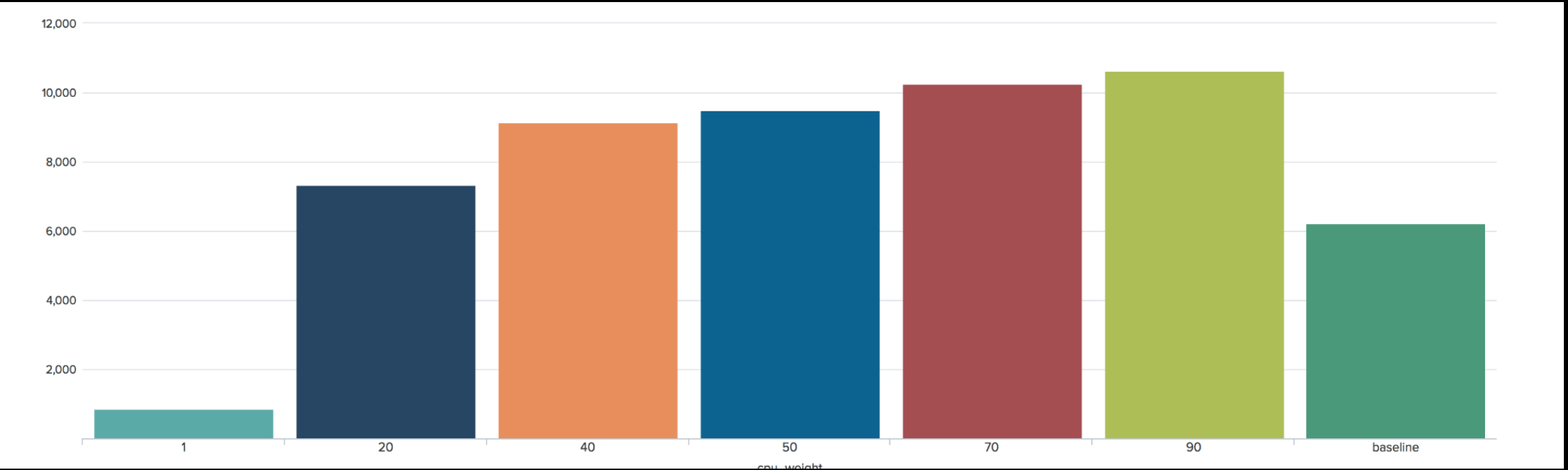
Ingest Behavior across Workload Pools



- Increased ingest throughput under CPU load for higher resource workload pool
- Throughput will be affected if resources are under-provisioned for Ingest pool
- Parallel ingestion pipeline sets can help achieve better performance with sufficient resource allocation for Ingest workload pool

Deep Dive

Setup, Configuration and Diagnostics

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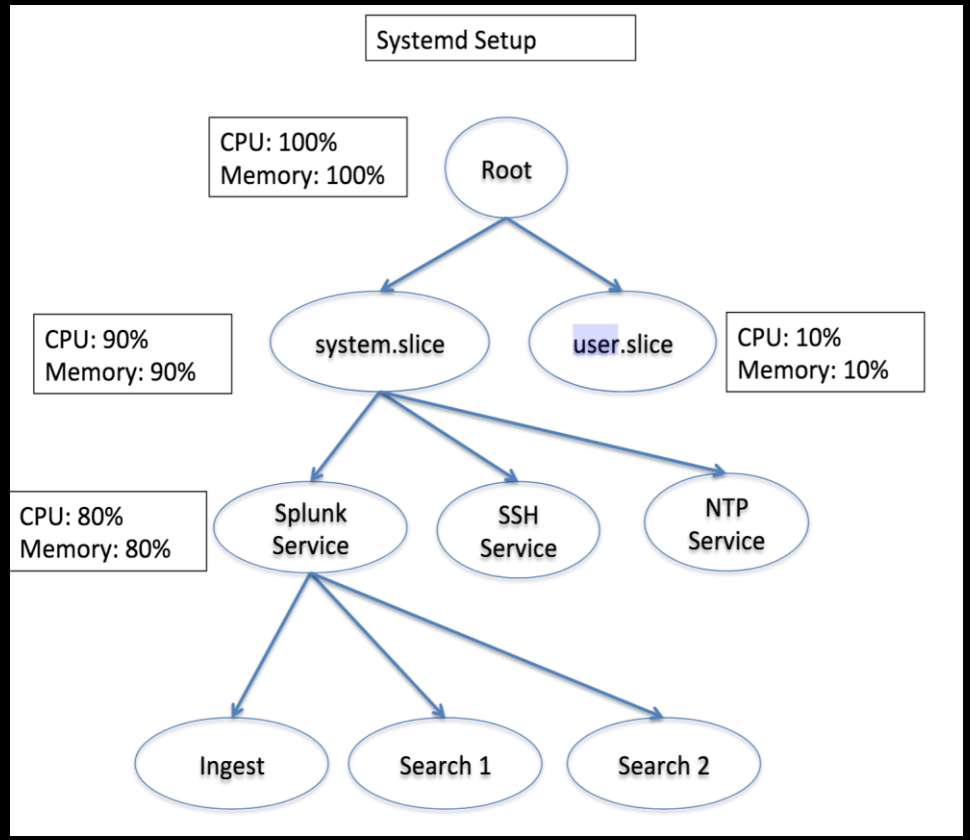
Setup

- Systemd
  - Create a systemd unit file in /etc/systemd/system/systemd.service
    - Sample unit file available in the docs
  - Run ”systemctl daemon-reload” to reload the unit file
  - Run splunk start. This starts splunkd as a systemd service.
  - Verify that splunkd is running as a systemd service
    systemctl status SPLUNK_SERVER_NAME.service



- Assign CPU for “splunk” cgroup
  - Total system CPU shares in /sys/fs/cgroup/cpu/cpu.shares
  - Set CPU in
    - /sys/fs/cgroup/cpu/system.slice to 9126
    - /sys/fs/cgroup/cpu/system.slice/splunkd.service /cpu.shares to 9126

- Assign physical memory for “splunk” cgroup
  - Total system physical memory from /proc/meminfo
  - Set Memory in
    - /sys/fs/cgroup/memory/memory.limit_in_bytes to100% of total physical memory
    - /sys/fs/cgroup/memory/system.slice/memory.limit_in_bytes tp 90% of total physical memory
    - /sys/fs/cgroup/memory/system.slice/splunkd.service/memory.limit_in_bytes to 80% of physical memory

Sample Unit File

```
[Service]
Restart=always
Type=simple
ExecStart=/root/rdimri/splunk/bin/splunk _internal_launch_under_systemd --accept-license --no-prompt --answer-yes --seed-passwd changeme
Delegate=true

#Splunk defines successful exit codes other than 0 to indicate special exit scenarios which are
#used by splunk operations like rolling-restart, offline etc.
SuccessExitStatus=51 52
RestartPreventExitStatus=51
RestartForceExitStatus=52

#On some systemd installations, systemd does not create cgroups for memory and cpu controller under system.slice
#rather it runs process under root cgroups, we can force systemd to create cgroups under system.slice by specifying
#MemoryLimit and CPUShares, please look at description below.
MemoryLimit=100G
CPUShares=1024

#If you want to run splunk as non-root user uncomment the following four lines.
PermissionsStartOnly=true
User=splunk
Group=splunk
ExecStartPost=/bin/bash -c "chown -R <USER Specified above>:<GROUP of User> /sys/fs/cgroup/cpu/system.slice/%n"
ExecStartPost=/bin/bash -c "chown -R <USER Specified above>:<GROUP of User> /sys/fs/cgroup/memory/system.slice/%n"
```

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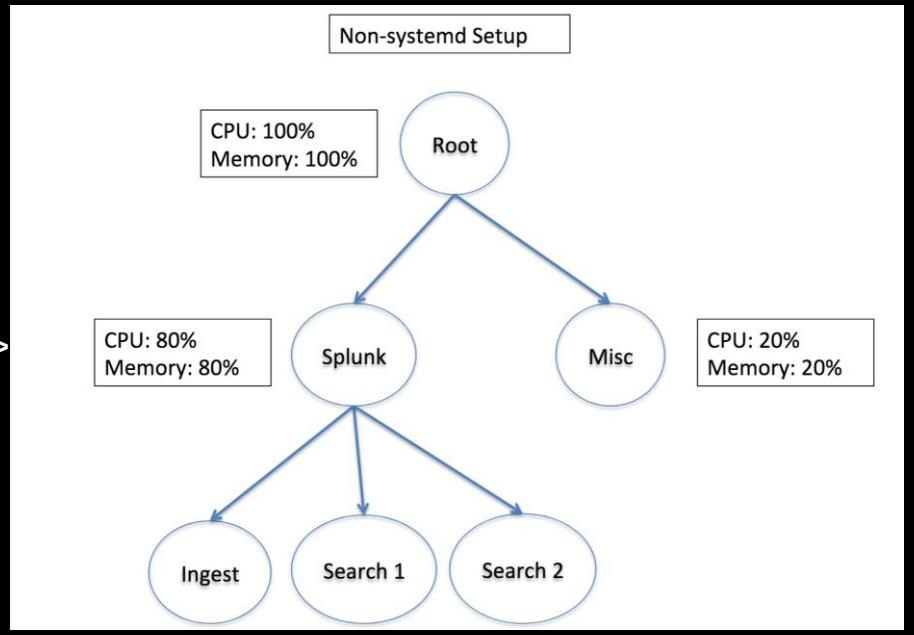
Setup

- Non-Systemd (Initd)
  - Set splunk root cgroup in workload_pools.conf
    [general]
    workload_pool_base_dir_name = splunk
  - Create cpu and memory cgroups
    - sudo mkdir /sys/fs/cgroup/cpu/<workload_pool_base_dir_name>
    - sudo mkdir /sys/fs/cgroup/memory/<workload_pool_base_dir_name>
    - sudo chown -R ${USER} /sys/fs/cgroup/cpu/<workload_pool_base_dir_name>
    - sudo chown -R ${USER} /sys/fs/cgroup/memory/<workload_pool_base_dir_name>
- Assign CPU for “splunk” cgroup
  - Total system CPU shares in /sys/fs/cgroup/cpu/cpu.shares
  - Set CPU in /sys/fs/cgroup/cpu/splunk/cpu.shares (80% of total cpu)
- Assign physical memory for “splunk” cgroup
  - Total system physical memory from /proc/meminfo
  - Set Memory in /sys/fs/cgroup/memory/splunk/memory.limit_in_bytes (80% of physical memory)



Configuration

- On a search head, perform the below steps through UI/CLI/REST
  - Create workload groups
  - Create workload rules
  - Enable workload Management
  - Check workload management status
    - splunk show workload-management-status
  - If search head is part of a search head cluster, changes are propagated to the other cluster members

- Indexer Cluster Configuration
  - Copy workload_pools.conf from search head to the CM
    - CM location: $SPLUNK_HOME/etc/master-apps/_cluster/local directory
  - Execute CM bundle push from the CM

Interaction with Existing Search Quota Settings

- Existing search quota and scheduler priority changes continue to be applied along with Splunk Workload Management.
- Workload management does not attempt to override the settings described below.

Setting Name	Configuration File	Description	Default Value
srchJobsQuota	authorize.conf	Max number of concurrent historical searches by role	3
cumulativeSrchJobsQuota	authorize.conf	Max number of concurrent historical searches for all members of role	N/A
base_max_searches	limits.conf	Constant to add to max no of searches as a factor of CPUs	6
max_searches_per_cpu	limits.conf	Max number of concurrent historical searches per CPU	1
schedule_priority	savedsearches.conf	Raises scheduling priority of a search. Can have value: default, higher, highest.	default

Key Takeaways

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3. First level bullets should be sentence case, 28pt

Q&A

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Thank You

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