How to Waste Time and Money Testing the Performance of a Software Product

David Daly | Lead Engineer -- Performance | @daviddaly44 | https://daviddaly.me/
Core Server / SERVER-16276

Perf degradation in query

Problem

Appears to be a perf degradation caused by commit e8437d34e3e9265c6b3e3ac4a74f8a1df19448

e8437d34e3e9265c6b3e3ac4a74f8a1df19448

<table>
<thead>
<tr>
<th>START</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove.v3.IntNonIdNoIndex</td>
</tr>
<tr>
<td>1 144.28688274368061</td>
</tr>
<tr>
<td>2 1441.1362651578315</td>
</tr>
<tr>
<td>3 142.8492232056933</td>
</tr>
<tr>
<td>END</td>
</tr>
</tbody>
</table>

901.6573578059949

-

22%

1156.9223116204623
 Appears to be a perf degradation caused by commit e8437d34ee9265c6bb3eac4a74f8a1df19448

!!!START!!!
Remove.v3.IntNonIdNoIndex
1 1440.28680274368061
2 1441.1362631578315
4 1424.8497238369633
8 901.6573570859949

!!!END!!!

2783e323051eb5e6e98a4e67934974177f74c2
!!!START!!!
Remove.v3.IntNonIdNoIndex
1 1588.06437930280876
2 1528.9383985954414
4 1512.18813243067
8 1156.9223116284623

!!!END!!!

...
Understand the performance of our software and when it changes.
How NOT to

- Machines with Personality
- Run tests by hand
- Wait until release time
- Have a dedicated team separate from dev

How to

- Automate everything
- Minimize noise
- Involve everyone
- Always be testing
Performance Use Cases

- Detect performance impacting commits (Waterfall)
- Test impact of proposed code change (Patch Test)
- Diagnose performance regressions (Diagnostics, Profiling)
- Release support (how do we compare to previous stable?)
- Add test coverage
- Performance exploration
Performance Use Cases

- Detect performance impacting commits (Waterfall)
- Test impact of proposed code change (Patch Test)
- Diagnose performance regressions (Diagnostics, Profiling)
- **Release support (how do we compare to previous stable?)**
- Add test coverage
- Performance exploration
Detect performance impacting commits (Waterfall)
Performance Testing in Continuous Integration

- Setup a system under test
- Run a workload
- Report the results
- Visualize the result
- Decide (and alert) if the performance changed
- Automate everything/Keep Noise Down
Performance Testing in Continuous Integration

Setup a system under test

Run a workload

Report the results

Visualize the result

Decide (and alert) if the performance changed

Automate everything/Keep Noise Down
Levels

System Level Tests (Sys-perf)
Multi node clusters in the cloud with end to end tests. Expensive ($s and hours), run least frequently

Microbenchmarks
Single-node cpu-bound tests. Dedicated hardware.

Unit Level Performance Tests
Google Benchmark framework. Some dedicated hardware. Least expensive ($s and hours)
The focus for DSI was serving the more complex requirements of end-to-end system performance tests on real clusters, automating every step including provisioning of hardware, and generating consistent, repeatable results.
DSI Goals

- Full end-to-end automation
- Support both CI and manual testing
- Elastic, public cloud infrastructure
- Everything configurable
- All configuration via YAML
- Diagnosability
- Repeatability
DSI Modules

- Bootstrap
- Infrastructure provisioning
- System setup
- Workload setup
- MongoDB setup
- Test Control
- Analysis
- Infrastructure teardown
Configuration Files

```python
1  mongodb_config_file:
2    storage:
3        engine: wiredTiger
4    replication:
5        replSetName: rs0
6  topology:
7     - cluster_type: replset
8        id: rs0
9    mongod:
10       - public_ip: $(infrastructure_provisioning.out.mongod.0.public_ip)
11       - public_ip: $(infrastructure_provisioning.out.mongod.1.public_ip)
12       - public_ip: $(infrastructure_provisioning.out.mongod.2.public_ip)
13  
14  # Meta data about this mongod setup
15  meta:
16     # The list of hosts that can be used in a mongod connection string
17     hosts: $(mongod_setup.topology.0.mongod.0.private_ip):27017
18     hostname: $(mongod_setup.topology.0.mongod.0.private_ip)
19     mongod_url: mongod://$(mongod_setup.meta.hosts)/test?replicaSet=rs0
20  is_replset: true
21
```
```python
1  run:
2    - id: ycsb_load
3        type: ycsb
4        cmd: /bin/ycsb load mongod -s -P ../../../workloadEvergreen -threads 8
5        config_filename: workloadEvergreen
6    workload_config:
7        mongodb.url=$(mongod_setup.meta.mongodb_url)
8        recordcount=5000000
9        workload=com.yahoo.ycsb.workloads.CoreWorkload
10   - id: ycsb_100read
11        type: ycsb
12        cmd: /bin/ycsb run mongod -s -P ../../../workloadEvergreen_100read -threads 32
13        config_filename: workloadEvergreen_100read
14        workload_config:
15        mongodb.url=$(mongod_setup.meta.mongodb_url)
16        recordcount=5000000
17        maxexecutiontime=240
18        workload=com.yahoo.ycsb.workloads.CoreWorkload
19        readproportion=1.0
```
Performance Testing in Continuous Integration

- Setup a system under test
- Run a workload
  - Report the results
  - Visualize the result
- Decide (and alert) if the performance changed
- Automate everything/Keep Noise Down
Performance Testing in Continuous Integration

Setup a system under test

Run a workload

Report the results

Visualize the result

Decide (and alert) if the performance changed

- See ICPE Paper: Change Point Detection in Software Performance Testing (video, slides)

Automate everything/Keep Noise Down
<table>
<thead>
<tr>
<th>Revision</th>
<th>Task</th>
<th>Test</th>
<th>Thread Level</th>
<th>Create Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2s7932a</td>
<td>linkbench</td>
<td>LOAD_LINKS_SULK</td>
<td>max</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>b7909fa</td>
<td>linkbench</td>
<td>DELETE_NODE</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>260617f</td>
<td>linkbench</td>
<td>UPDATE_NODE</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>68dff6</td>
<td>linkbench</td>
<td>ADD_LINK</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>d545406</td>
<td>linkbench</td>
<td>DELETE_LINK</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>853x135</td>
<td>linkbench</td>
<td>Acknowledged</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>2796345</td>
<td>linkbench</td>
<td>ADD_NODE</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>853x135</td>
<td>linkbench</td>
<td>MULTIGET_LINK</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>a7300bf</td>
<td>linkbench</td>
<td>GET_LINKS_LIST</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>2211a7fa</td>
<td>linkbench</td>
<td>UPDATE_LINK</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>a2709e5</td>
<td>linkbench</td>
<td>ADD_LINK</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>2211a7fa</td>
<td>linkbench</td>
<td>DELETE_LINK</td>
<td>Acknowledged</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>688079d</td>
<td>linkbench</td>
<td>Acknowledged</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
<tr>
<td>997f8e9</td>
<td>linkbench</td>
<td>Acknowledged</td>
<td>20</td>
<td>2020-02-17</td>
</tr>
</tbody>
</table>
30% improvement in crud_workloads/*/jtrue (System Performance) - ab2b097, Feb 27

Type: Build Failure
Status: CLOSED
Resolution: Works as Designed

Assignee: David Daly
Reporter: Sviatlana Zuiko

Created: Mar 02 2020 12:00:48 AM GMT-0500
Updated: Apr 06 2020 02:31:22 PM GMT-0400
Resolved: Mar 03 2020 02:07:24 PM GMT-0500

Failing Buildvariants:
- atlas-like-M60
- linux-1-node-replSet
- linux-1-node-replSet-cwrc
- linux-1-node-replSet-fle
- linux-3-node-replSet
- linux-3-node-replSet-nofootcontrol
- linux-3-shard
- linux-shard-lite
- linux-shard-lite-cwrc
- linux-standalone

Failing Tasks:
- bestbuy_agg
- change_streams_throughput
- crud_workloads
- crud_workloads_majority
- industry_benchmarks_wmajority
- linkbench
- misc_workloads
- mixed_writes_replica
- mixed_writes_replica_delay_mixed
- parallel_insert_replica
- parallel_insert_replica_delay_mixed
- refine_shard_key_transaction_stress

Failing Tests:
- 105c_findOne
- 105c_total
- 15c_findOne
- ADD_LINK
- CleanUp-DatabaseOperation.1
- CleanUp-DatabaseOperation.11
- CleanUp-DatabaseOperation.12
- CleanUp-DatabaseOperation.13
- CleanUp-DatabaseOperation.14
- CleanUp-DatabaseOperation.15
- CleanUp-DatabaseOperation.16
- CleanUp-DatabaseOperation.17
- CleanUp-DatabaseOperation.18
- CleanUp-DatabaseOperation.19
- CleanUp-DatabaseOperation.20
- CleanUp-DatabaseOperation.21
- CleanUp-DatabaseOperation.22
- CleanUp-DatabaseOperation.23
- CleanUp-DatabaseOperation.24
- CleanUp-DatabaseOperation.25
- CleanUp-DatabaseOperation.26
- CleanUp-DatabaseOperation.27
- CleanUp-DatabaseOperation.28
- CleanUp-DatabaseOperation.29
- CleanUp-DatabaseOperation.30
- CleanUp-DatabaseOperation.31
- CleanUp-DatabaseOperation.32
- CleanUp-DatabaseOperation.33
- CleanUp-DatabaseOperation.34
- CleanUp-DatabaseOperation.35
- CleanUp-DatabaseOperation.36
- CleanUp-DatabaseOperation.37
- DELETE_LINK
- DeleteAndReinsert-Crud
- DeleteAndReinsert-TotalModificationTime
- MixedWrites-Crud
- MixedWrites-W2InsertOne
- MixedWrites-W3InsertOne
- ParallelInsert-1-Insert_WMajorty
- ParallelInsert-1-Insert_WMajorty_JFalse
- ParallelInsert-256-Insert_WMajorty
- ParallelInsert-256-Insert_WMajorty_JFalse
- ParallelInsert-32-Insert_W1_JTrue
- ParallelInsert-32-Insert_WMajorty
- ParallelInsert-512-Insert_WMajorty
- ParallelInsert-512-Insert_WMajorty_JFalse
- UPDATE_LINK
- count_with_type_predicate-useAgg
- insert_Jfalse_wmajority
- insert_Jtrue
- insert_Jtrue_wmajority
- removemulti_Jfalse_wmajority
- removemulti_Jtrue
- removemulti_Jtrue_wmajority
- updatemulti_Jfalse
- updatemulti_Jtrue
- updatemulti_Jtrue_wmajority
- ycsb_2docs_10MB
- ycsb_50read50update_w_majority
- ycsb_95read5update_w_majority
- ycsb_load

First Failing Revision: ab2b097d21bf8a208ee43321d91c4600b63cc5
Count of Linked Failures: 0
Release support
Can we release?

How is the performance?
Compared to the last release.

How many open issues are there?
Are they getting fixed? Are they stuck?

Do we have coverage for new features?
<table>
<thead>
<tr>
<th>Tickets</th>
<th>Build</th>
<th>Storage Engine</th>
<th>Task</th>
<th>Test</th>
<th>Threads</th>
<th>Trend</th>
<th>Avg And Self</th>
<th>Ops/Sec</th>
<th>Baseline</th>
<th>Outlier</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF-16493</td>
<td>Linux Shard Lite Cluster</td>
<td>wiredTiger</td>
<td>bestbuy_query</td>
<td>find_project_6_sort_indexed_skip_limit_1-n-...</td>
<td>16</td>
<td></td>
<td></td>
<td>3,843.22</td>
<td>53.53</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Shard Lite Cluster</td>
<td>wiredTiger</td>
<td>bestbuy_query</td>
<td>find_project_6_sort_indexed_skip_limit_1-n-...</td>
<td>32</td>
<td></td>
<td></td>
<td>3,541.37</td>
<td>56.14</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Shard Lite Cluster</td>
<td>wiredTiger</td>
<td>bestbuy_query</td>
<td>find_project_6_sort_indexed_skip_limit_1-n-...</td>
<td>1</td>
<td></td>
<td></td>
<td>265.03</td>
<td>6.98</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 1-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>265.93</td>
<td>42.62</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>306.47</td>
<td>44.57</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>8</td>
<td></td>
<td></td>
<td>294.10</td>
<td>42.95</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>8</td>
<td></td>
<td></td>
<td>1,670.07</td>
<td>258.90</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>8</td>
<td></td>
<td></td>
<td>1,583.28</td>
<td>246.83</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_skip_limit_1-useAgg</td>
<td>8</td>
<td></td>
<td></td>
<td>1,571.15</td>
<td>249.91</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>1,410.1</td>
<td>35.95</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 1-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_limit-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>1,375.7</td>
<td>36.58</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_limit-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>1,379.7</td>
<td>36.58</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>change_streams_multi_mongos</td>
<td>15_to_max_latency</td>
<td>60</td>
<td></td>
<td></td>
<td>18.00</td>
<td>-67.00</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>change_streams_multi_mongos</td>
<td>15_to_avg_latency</td>
<td>60</td>
<td></td>
<td></td>
<td>-9.36</td>
<td>-32.78</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>removeMulti_true</td>
<td>128</td>
<td></td>
<td></td>
<td>41,593.55</td>
<td>12,680.29</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 1-Node RepSet</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>25,629.31</td>
<td>8,280.55</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_project-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_project-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_agg</td>
<td>find_project-useAgg</td>
<td>1</td>
<td></td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>24,753.25</td>
<td>8,359.81</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone Audit</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>24,050.33</td>
<td>8,263.95</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone Audit</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>31,788.53</td>
<td>10,998.14</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux Standalone Audit</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>removeMulti_true</td>
<td>128</td>
<td></td>
<td></td>
<td>30,916.08</td>
<td>13,112.03</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet (Flow Control off)</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>insert_true</td>
<td>128</td>
<td></td>
<td></td>
<td>23,621.79</td>
<td>8,667.00</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 1-Node RepSet</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>removeMulti_true</td>
<td>128</td>
<td></td>
<td></td>
<td>28,191.03</td>
<td>10,578.08</td>
<td></td>
</tr>
<tr>
<td>BF-16493</td>
<td>Linux 3-Node RepSet</td>
<td>wiredTiger</td>
<td>crud_workloads</td>
<td>removeMulti_true</td>
<td>128</td>
<td></td>
<td></td>
<td>27,018.13</td>
<td>10,399.26</td>
<td></td>
</tr>
<tr>
<td>Tickets</td>
<td>Build</td>
<td>Storage Engine</td>
<td>Task</td>
<td>Test</td>
<td>Threads</td>
<td>Ratio</td>
<td>Trend</td>
<td>Avg And Sel</td>
<td>Ops/Sec</td>
<td>Baseline</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
<td>------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>334</td>
<td></td>
<td>295.93</td>
<td>42.62</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>1020</td>
<td></td>
<td>306.47</td>
<td>44.57</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 3-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>1020</td>
<td></td>
<td>294.10</td>
<td>42.95</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>8</td>
<td>1070</td>
<td></td>
<td>1,670.07</td>
<td>258.90</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>8</td>
<td>1,534</td>
<td></td>
<td>1,583.28</td>
<td>246.83</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 3-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>8</td>
<td>1220</td>
<td></td>
<td>1,571.15</td>
<td>249.91</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>1272</td>
<td></td>
<td>141.01</td>
<td>35.95</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 3-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>1272</td>
<td></td>
<td>137.76</td>
<td>35.78</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>1272</td>
<td></td>
<td>137.76</td>
<td>35.78</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project-useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project-useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 3-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project-useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project-useAgg</td>
<td>1</td>
<td>0.05</td>
<td></td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_useAgg</td>
<td>8</td>
<td>1,220</td>
<td></td>
<td>397.23</td>
<td>175.92</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>32.21</td>
<td></td>
<td>32.21</td>
<td>15.05</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>112</td>
<td></td>
<td>31.32</td>
<td>14.77</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>112</td>
<td></td>
<td>31.32</td>
<td>14.77</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>112</td>
<td></td>
<td>31.32</td>
<td>14.77</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>33.8</td>
<td></td>
<td>33.8</td>
<td>16.87</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>33.8</td>
<td></td>
<td>33.8</td>
<td>16.87</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>0.03</td>
<td></td>
<td>0.03</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>0.03</td>
<td></td>
<td>0.03</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>8</td>
<td>176</td>
<td></td>
<td>176</td>
<td>168.74</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_project_useAgg</td>
<td>1</td>
<td>171</td>
<td></td>
<td>10.96</td>
<td>6.41</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_skip_lmt_1-useAgg</td>
<td>1</td>
<td>162</td>
<td></td>
<td>40.25</td>
<td>27.98</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_lmt-useAgg</td>
<td>8</td>
<td>154</td>
<td></td>
<td>129.13</td>
<td>83.75</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_lmt-useAgg</td>
<td>8</td>
<td>154</td>
<td></td>
<td>129.13</td>
<td>83.75</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 1-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_sort_indexed_skip_lmt_1-u...</td>
<td>1</td>
<td>0.43</td>
<td></td>
<td>0.43</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux 3-Node ReplSet</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_sort_indexed_skip_lmt_1-u...</td>
<td>1</td>
<td>0.43</td>
<td></td>
<td>0.43</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>BF-16543...</td>
<td>Linux Standalone</td>
<td>wiredTiger</td>
<td>bestbuy_egg</td>
<td>fnd_sort_indexed_skip_lmt_1-u...</td>
<td>1</td>
<td>0.43</td>
<td></td>
<td>0.43</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Tickets</td>
<td>Build</td>
<td>Storage Engine</td>
<td>Task</td>
<td>Test</td>
<td>Threads</td>
<td>Ratio</td>
<td>Trend</td>
<td>Avg And Sel</td>
<td>Ops/Sec</td>
<td>Baseline</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>------------------</td>
<td>-----------------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
<td>-------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 1-Node RepSet</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>512</td>
<td>66</td>
<td></td>
<td></td>
<td>11,207.37</td>
<td>17,243.92</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_update</td>
<td>128</td>
<td>66</td>
<td></td>
<td></td>
<td>6,995.12</td>
<td>9,025.59</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_delete</td>
<td>128</td>
<td>67</td>
<td></td>
<td></td>
<td>6,148.19</td>
<td>9,229.85</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_insert</td>
<td>128</td>
<td>67</td>
<td></td>
<td></td>
<td>6,325.22</td>
<td>9,432.75</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_total</td>
<td>128</td>
<td>67</td>
<td></td>
<td></td>
<td>25,321.50</td>
<td>37,688.13</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_update</td>
<td>256</td>
<td>66</td>
<td></td>
<td></td>
<td>5,765.67</td>
<td>8,463.71</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>128</td>
<td>67</td>
<td></td>
<td></td>
<td>6,652.98</td>
<td>9,999.95</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_delete</td>
<td>256</td>
<td>69</td>
<td></td>
<td></td>
<td>6,990.00</td>
<td>9,613.60</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_insert</td>
<td>256</td>
<td>70</td>
<td></td>
<td></td>
<td>6,123.10</td>
<td>8,744.62</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_total</td>
<td>256</td>
<td>70</td>
<td></td>
<td></td>
<td>24,582.06</td>
<td>35,000.83</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_update</td>
<td>64</td>
<td>70</td>
<td></td>
<td></td>
<td>6,227.59</td>
<td>8,845.76</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_delete</td>
<td>64</td>
<td>70</td>
<td></td>
<td></td>
<td>6,399.61</td>
<td>9,079.15</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_total</td>
<td>64</td>
<td>71</td>
<td></td>
<td></td>
<td>26,524.43</td>
<td>37,508.51</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_insert</td>
<td>64</td>
<td>71</td>
<td></td>
<td></td>
<td>8,708.54</td>
<td>9,426.89</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_update</td>
<td>512</td>
<td>72</td>
<td></td>
<td></td>
<td>6,561.84</td>
<td>7,474.54</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>64</td>
<td>72</td>
<td></td>
<td></td>
<td>7,188.69</td>
<td>9,954.51</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>256</td>
<td>73</td>
<td></td>
<td></td>
<td>6,702.89</td>
<td>9,176.91</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>512</td>
<td>74</td>
<td></td>
<td></td>
<td>5,734.85</td>
<td>7,797.00</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>512</td>
<td>75</td>
<td></td>
<td></td>
<td>5,908.47</td>
<td>7,861.12</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>256</td>
<td>75</td>
<td></td>
<td></td>
<td>11,493.03</td>
<td>15,274.04</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>256</td>
<td>75</td>
<td></td>
<td></td>
<td>23,614.48</td>
<td>31,063.06</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>512</td>
<td>77</td>
<td></td>
<td></td>
<td>35,081.91</td>
<td>35,326.46</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_findOne</td>
<td>4</td>
<td>78</td>
<td></td>
<td></td>
<td>3,644.84</td>
<td>3,372.23</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_delete</td>
<td>4</td>
<td>80</td>
<td></td>
<td></td>
<td>2,191.08</td>
<td>2,730.81</td>
</tr>
<tr>
<td>BF-16443,...</td>
<td>Linux 3-Shard Cluster</td>
<td>wiredTiger</td>
<td>mixed_workloads</td>
<td>mixed_update</td>
<td>4</td>
<td>80</td>
<td></td>
<td></td>
<td>2,075.37</td>
<td>2,584.97</td>
</tr>
</tbody>
</table>
Humans in the loop

Periodically review everything. (Weekly, Monthly)

• Is everything important ticketed?

• Are the top issues being worked?

• Surface trade-offs that need to be addressed (e.g., New Feature X makes everything else 3% slower)

Put people on the hard parts, then see what can be automated next.
Ongoing Work
Work with Us

We have real world problems and would love to work with the community

- **Noise Reduction work**
- Dbtest.io: “Automated System Performance Testing at MongoDB”
- ICPE Paper: “The Use of Change Point Detection to Identify Software Performance Regressions in a Continuous Integration System” (video)

Our code is open source: signal-processing-algorithms, infrastructure code

Our regression environment is open, and the platform is open source

Our performance data is not open source, but we’re working to share it with academics
Thank you