RDU Batch Processing Tuning

Introduction

This technical note describes recommended settings for the RDU tuning parameters. These settings can significantly improve server performance and robustness under adverse conditions such as lease query time outs or delays in other external interactions. The first recommended tuning involves reducing the default value of transaction flushing delay. The second tuning involves reducing the lease query number of retries and time out values.

Prerequisites

Readers of this document should have knowledge of the following:

- BACC Architecture
- BACC Administration
- Batch Queuing in RDU Tech Note

Hardware and Software Versions

The information in this document is based on the software and hardware versions below.

- Software - BACC 2.6

The tuning parameter values recommended in this document are the default values starting with release 2.7.1.

Batch Transaction Flushing Delay

An update batch is considered completed by BACC when the transaction has been flushed to database log storage system. BACC implements a group commit mechanism, which buffers transactions committing at around the same time for joint flushing to disk.

This provides a performance boost by leveraging fixed overhead of flushing. To implement group commit mechanism, BACC uses a flushing algorithm which delays transactions if there is a considerable concurrent load.

By default, the maximum delay introduced by flusher is 2 seconds. Under normal conditions the algorithm results in a small transaction delay of 50-100 msec with a benefit of higher throughput. However, under two scenarios, the delay can be as large as 2 seconds unnecessarily. These conditions are:

- Large number of aborting update transactions due some recurring failures or
- Larger number of long duration transactions from update batches.

Long duration transactions can be caused delay in batch processing due to wait incurred in any of its execution stages. For example, it could be caused by publishing extensions, lease query due to CNR server not being available or a network issue causing time outs or longer interactions between RDU and DPE/CNR.

Under the above conditions, the flusher delays transactions waiting to flush unnecessarily because it expects other concurrent transactions to commit soon, which they don't do. When this behavior kicks in, it causes a delay for any update transaction – long or short. Additionally, since BACC thread pools used to process transactions can be exhausted making the system appear unresponsive under these circumstances.

BACC can be tuned to guarantee that flushing delay does not exceed a short interval of time. Cisco recommends the following setting in "rdu.properties" file:

/db/flush/delay/max=25

After this setting, the RDU must be restarted. This property will guarantee that flusher delay is no more than 25 msec. This provides sufficient to achieve high throughput of transactions.

Lease Query Time Out

BACC performs lease queries to CNR servers when requested by API client in IpDevice.getAllForIPAddress() and IPDevice.getDeviceDetails() calls. This is read-only batches. Additionally, BACC performs lease queries in update batches with Activation flag set to AUTOMATIC. In this mode, BACC looks up device IP by MAC address in order to issue SNMP request to device to cause it to reboot and subsequently obtain new configuration.

When CNR server is not reachable (due to network problem, server reload or server overloading), BACC will perform 3 retries and wait 1000 msec for time out of each request. This combines to a 4 second overall time out, which is unnecessarily large. Under normal conditions lease query should take no more than 50-100 msec.

The large time out for lease query means that under adverse conditions, BAC will be holding batches longer before they time out. This may result in starvation of processing threads because they are tied waiting for a time out. Additionally, this may result in long duration transaction, causing unnecessarily long flusher delays. Thread starvation and flusher delay will make the system appear less responsive under these adverse conditions.

BACC can be tuned for a shorter lease query time out, which would help it deal with adverse conditions much better. Cisco recommends the following settings to be added to the “rdu.properties” file:

/cnrQuery/retries=1

/cnrQuery/timeout=500

After this setting, the RDU must be restarted. Note that flusher and lease query settings can (and recommended to) be applied together, which would require just one RDU reboot.

The change settings will result in a combined timeout of 1 second for lease queries, which is sufficient. Shorter lease query time out means that BACC resources are released faster resulting in higher throughout when time outs occur.

Performance Benchmark

Cisco has carried out extensive performance benchmark tests with and without recommended settings to assess their impact under various conditions. We observed that normal-mode performance was materially unchanged, while performance under adverse conditions has significantly improved with the recommended settings.

Below we provide results of a comparison test under adverse conditions. In this test, we used a database with 30 million device records (77GB size) stored on a RAID array. The test simulated sustained load of 50 concurrent IPDevice.changeClassOf Service() API calls with "AUTOMATIC" activation mode. 3000 batches were executed in each test. The database was warmed up for the test by pre-executing the test once. Significantly, the test bed was configured in a way that resulted in lease query time out for every batch. The results below are with BACC 2.6.2.4 release.

Test	Results	Notes
Original performance	6 batches/sec 8072 msec avg response time	The response time was larger than 4 seconds due to flusher delay and thread pool starvation caused by long batches.
With the following settings: /db/flush/delay/max=25	12 batches/sec 4126 msec avg response time	The response time was as expected here because we are forcing lease query time. By default, the total time out is 4 seconds.
With the following settings: /cnrQuery/retries=1 /cnrQuery/timeout=500 /db/flush/delay/max=25	43 batches /sec 1131 msec avg response time	The response time was as expected here because we are forcing lease query time out of 1 second.

Note the significant improvement in the last test under these adverse conditions of activation time out. In different tests, we observed that execution of concurrent short-

duration transactions (for example without activation) that are combined with above load, also shows dramatic improvements. The results confirmed the significant advantages afforded by the deploying BACC with parameter tunings recommended in this note. The system can be much more resilient to adverse conditions with these tunings.

References

- BACC 2.6 Administrator's Guide