Advanced Database Systems Final Presentation

Golatac

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Yen-Ju Wu, Chien-Yu Liu, Zilong Zhou

Project Goals

- **75% → Complete the catalog implementation following rest-catalog-open-api.yaml**

  DONE

- **100% → Unit test & Performance evaluation**

  DONE

- 125% → Performance optimization

  DONE?

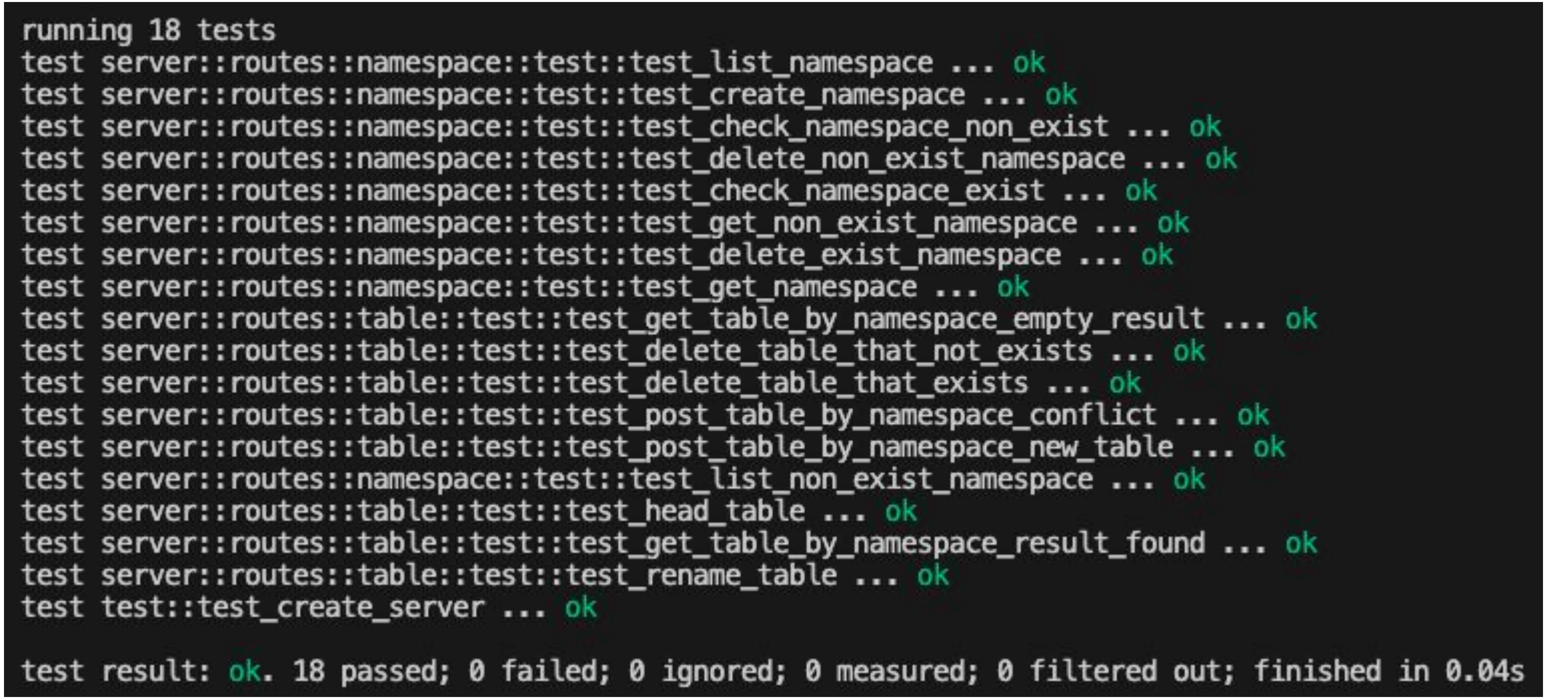
Unit Testing - Namespace

- Namespace
  - list_namespace
    - non_exist (404) / exist (200)
  - create_namespace
    - success (200)
  - get_namespace
    - non_exist (404) / exist (200)
  - check_namespace
    - non_exist (404) / exist (204)
  - delete_namespace
    - non_exist (404) / exist (204)

Unit Testing - Table

- Table
  - get_table_by_namespace
    - empty_result (404) / result_found (200)
  - post_table_by_namespace
    - new_table (200) / conflict (409)
  - delete_table
    - table_exists (204) / table_not_exists (404)
  - head_table
    - table_exists (204) / table_not_exists (404)
  - rename_table
    - (204)

Unit Testing



```
running 18 tests
test server::routes::namespace::test::test_list_namespace ... ok
test server::routes::namespace::test::test_create_namespace ... ok
test server::routes::namespace::test::test_check_namespace_non_exist ... ok
test server::routes::namespace::test::test_delete_non_exist_namespace ... ok
test server::routes::namespace::test::test_check_namespace_exist ... ok
test server::routes::namespace::test::test_get_non_exist_namespace ... ok
test server::routes::namespace::test::test_delete_exist_namespace ... ok
test server::routes::namespace::test::test_get_namespace ... ok
test server::routes::table::test::test_get_table_by_namespace_empty_result ... ok
test server::routes::table::test::test_delete_table_that_not_exists ... ok
test server::routes::table::test::test_delete_table_that_exists ... ok
test server::routes::table::test::test_post_table_by_namespace_conflict ... ok
test server::routes::table::test::test_post_table_by_namespace_new_table ... ok
test server::routes::namespace::test::test_list_non_exist_namespace ... ok
test server::routes::table::test::test_head_table ... ok
test server::routes::table::test::test_get_table_by_namespace_result_found ... ok
test server::routes::table::test::test_rename_table ... ok
test test::test_create_server ... ok

test result: ok. 18 passed; 0 failed; 0 ignored; 0 measured; 0 filtered out; finished in 0.04s
```

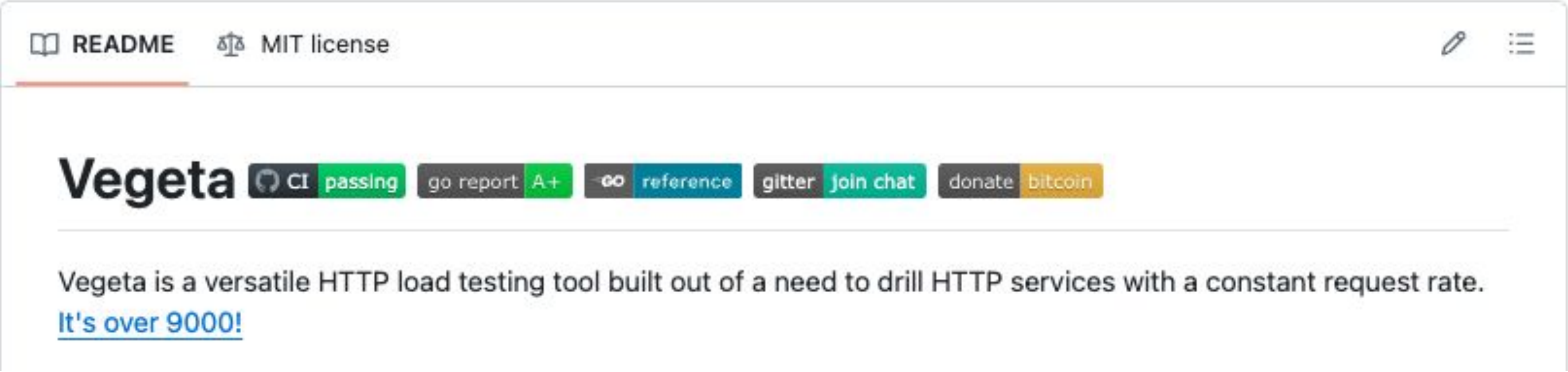
Assessment

- Pros
  - Modularity and Encapsulation
  - Serve http requests strictly following rest-catalog-open-api.yaml
  - Robust Error Handling based on Iceberg

- Need more work
  - Higher unit test coverage & integration tests
  - Performance optimizations

Benchmark Results

- Key performance metrics: **Latency**
- Framework: Vegeta, which is a HTTP load testing tool



Vegeta

Vegeta is a versatile HTTP load testing tool built out of a need to drill HTTP services with a constant request rate. It's over 9000!

Benchmark Design

- Single endpoint stress tests
  - get_table
  - list_table
  - get_namespace
  - list_namespace

- Multiple random endpoints stress test
  - get_randomized_table

Benchmark Settings

- AWS EC2 Instance
  - C5.2xlarge
  - Image: ubuntu
  - 8 vCPU
  - 16 GiB Memory
  - 20 GiB Disk

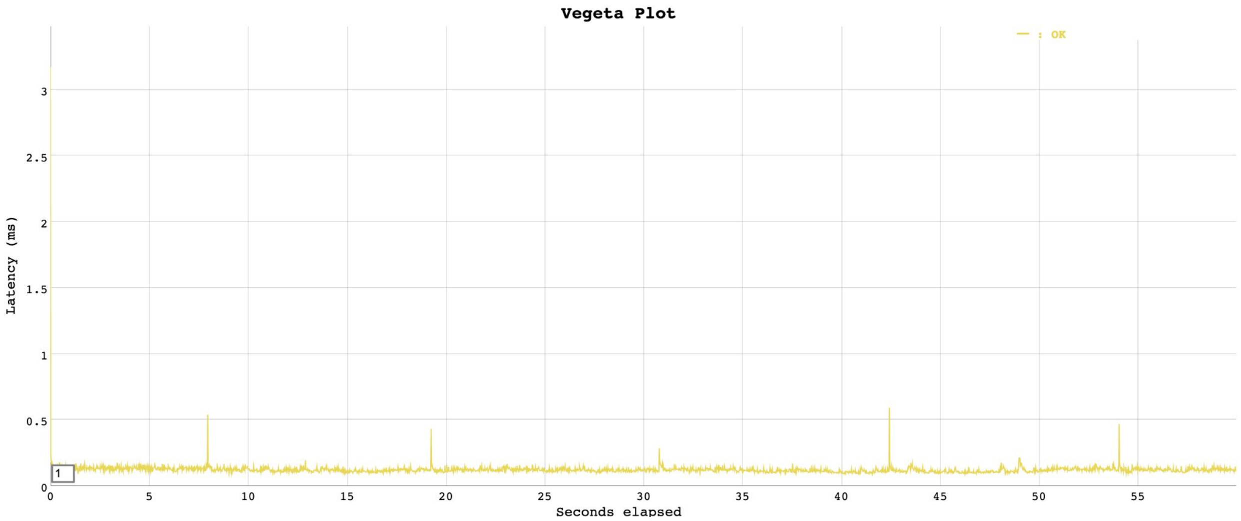
- Parameters
  - Empty Metadata
  - Number of namespaces: 100
  - Number of tables: 10000
  - Request rate: 50 per second
  - Duration: 60 seconds

Amazon EC2

Single endpoint – get_table

Latencies

- min: 91.112μs
- mean: 122.644μs
- 50: 118.992μs
- 90: 139.968μs
- 95: 147.852μs
- 99: 168.578μs
- max: 3.172ms

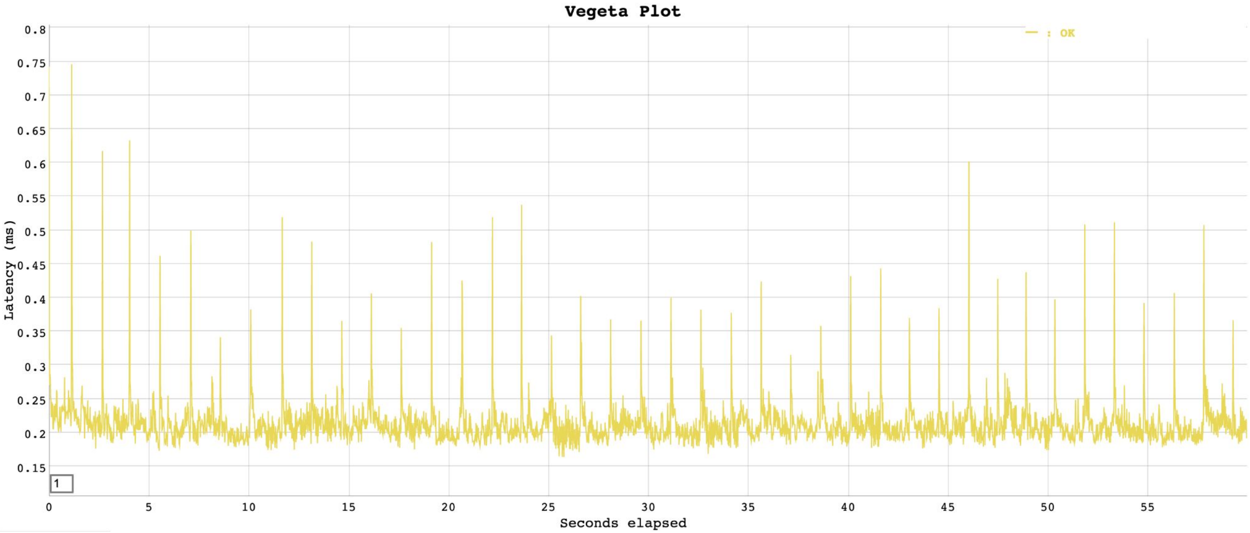


Throughput (RPS): 13281.55

Single endpoint – list_table

Latencies

- min: 163.798μs
- mean: 213.732μs
- 50: 208.01μs
- 90: 237.749μs
- 95: 253.864μs
- 99: 382.017μs
- max: 746.229μs

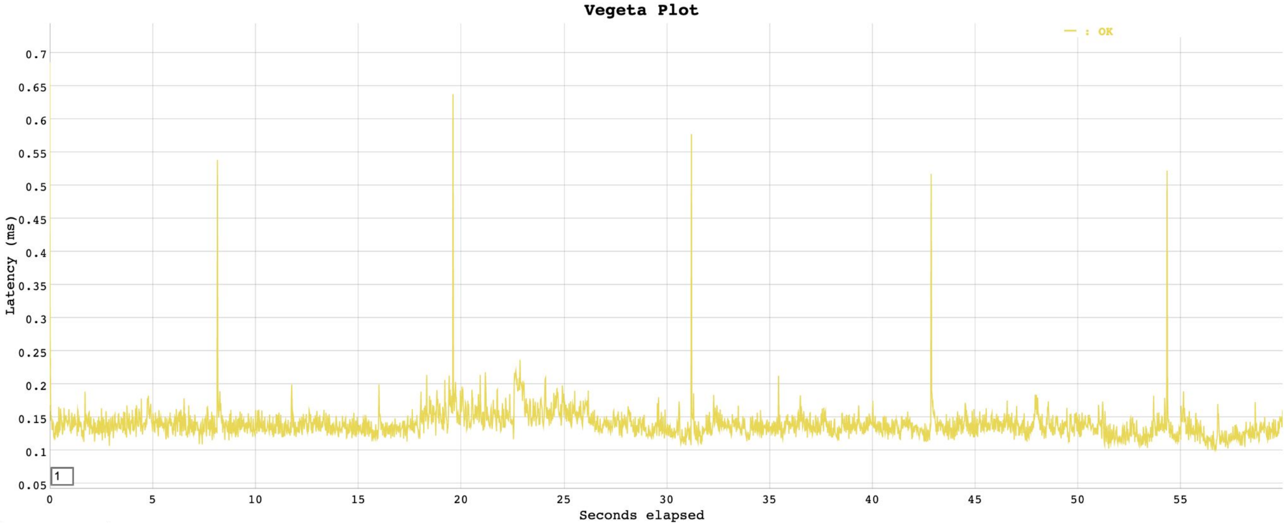


Throughput (RPS): 12824.26

Single endpoint – get_namespace

Latencies

- min: 100.617µs
- mean: 139.855µs
- 50: 136.852µs
- 90: 158.902µs
- 95: 170.513µs
- 99: 200.55µs
- max: 685.701µs

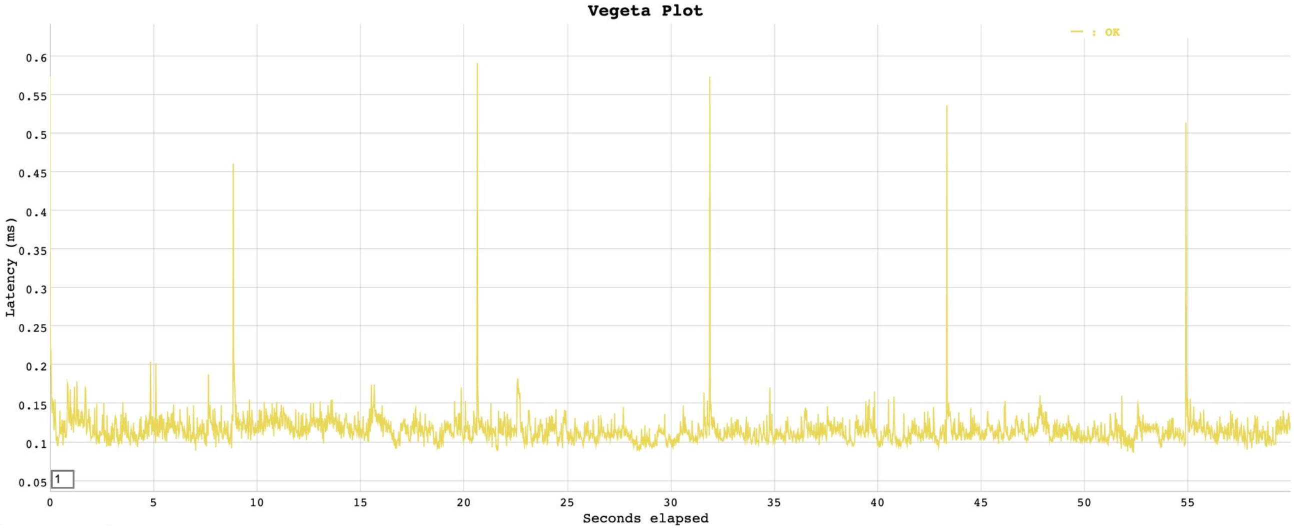


Throughput (RPS): 7470.60

Single endpoint – list_namespace

Latencies

- min: 86.401µs
- mean: 116.493µs
- 50: 113.343µs
- 90: 132.67µs
- 95: 140.342µs
- 99: 169.723µs
- max: 590.968µs

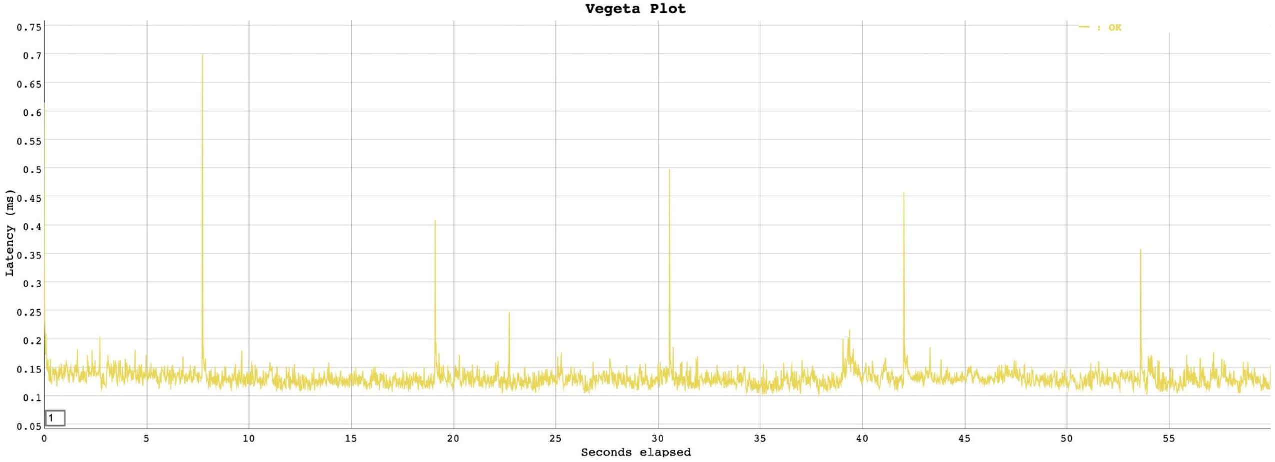


Throughput (RPS): 13641.37

Single endpoint – get_randomized_table

Latencies

- min: 102.25µs
- mean: 132.332µs
- 50: 130.002µs
- 90: 147.739µs
- 95: 155.26µs
- 99: 176.419µs
- max: 699.689µs



Throughput (RPS): 12966.11

Benchmark Insights

- P99
  - < 1ms, lower than network latency
- Mean Latency
  - The "List table's result" benchmark test has the highest mean latency at approximately 213.732µs
  - The "Get table's result" benchmark test has the lowest mean latency at approximately 122.644 µs
- Latency deviation
  - In all stress tests, the 95th percentile latency remains within a 20% deviation from the mean latency

Future Work

- Performance optimizations
- Support of optional fields in schema according to other teams' needs
- Documentation / Comments
- Consistent coding style

Thank You