Azure TuKano
Cloud Computing Systems 2024/25

Project Assignment #1 - Azure PaaS

Jakub Smuga (71848),
Konrad Korus (71846),

Lisbon, 2024/25

1. Tomcat Deployment

To run the TuKano application using Tomcat, there were some changes needed to adopt solution to Tomcat environment

- Change to Jakarta Application, what involved changes in TukanoRestServer
- Create WEB-INF folder with required configuration
- Add correct dependencies and change Javax dependencies to Jakarta

These steps allowed us to run the project locally using Tomcat and deploy the project to the cloud, where it also runs using Tomcat server.

2. Azure Blob Storage

Previous solution for storing blobs included class `FilesystemStorage` which implemented `BlobStorage` interface. Change to Azure Blob Storage required another class that implements the mentioned interface and can connect to the cloud. New class, `AzureClientStorage`, handles connection and operations on Azure Blob Storage like reading, writing or deleting blobs using `com.azure.storage.blob` library to interact with Azure.

Thanks to sharing the same interface, change required only using different storage object from:

```
storage = new FilesystemStorage();
```

to:

```
storage = new AzureClientStorage();
```

3. CosmosDB for PostgreSQL

At the outset, it is important to mention that we decided not to use Cosmos DB for PostgreSQL, as we were uncertain about our ability to utilize a paid solution. Instead, we chose the free version of SQL Server and created a SQL database within it. The functionality and implementation remain identical to those of SQL, so this alternative solution should not impact the final result.

The implementation was largely provided, with only a few adjustments made: updating the connection parameters in the Hibernate configuration, renaming the "users" table (to avoid overlap with the SQL database), and modifying the firewall rules for the SQL Server in Azure. Also we fixed some errors in SQL queries. The implementation is provided in classes: `JavaUsersForSQL` and `JavaShortsForSQL`.

4. CosmosDB for NoSQL

In our CosmosDB for NoSQL implementation, we created a `CosmosDBLayer` class to manage connections to an Azure Cosmos DB container. This layer provides essential operations—such as querying, inserting, updating, and deleting items—supported by built-in error handling.

Since NoSQL databases do not allow direct connections between containers, we needed to create separate queries for each container. This design allows each container to manage its data independently, enabling operations involving multiple containers without

inter-container relationships.

We encountered challenges with JSON-formatted responses from custom queries. To simplify data extraction, we introduced specific POJO (Plain Old Java Object) models, which capture and extract necessary values from JSON responses, improving data handling and ensuring accurate results. The NoSQL solution is implemented in classes such as `JavaUsers` and `JavaShorts`.

To switch between databases, we use a boolean variable in the app's configuration. Based on its value, the application can use different database implementations as required.

5. Redis Cache

To implement caching data in `Azure Cache for Redis`, we created the class `RedisJedisPool` utilizing `redis.clients.jedis` library to connect with Azure service. Above mentioned classes provide methods for getting items from cache, inserting items to cache or deleting items from cache. It is later on utilized in different places in the system to store data in the cache. Solution is created using generic types and is prepared to operate with any class.

Caching is implemented in a very similar way in both users and shorts. After an item is successfully created in the database, its copy is also saved in Redis Cache. When a client is trying to access a certain item, firstly it is being checked if it's in the cache. In that situation the application returns an item stored in cache without needing to make a query to the database. If an item is absent in cache, then the application makes a query to find it in the database. When a user wants to remove an item, the application tries to remove an item from the database. If the operation succeeds, the item is also removed from cache.

In cache we could only hold small objects like users or shorts and not blobs, because cache has very limited memory and is expensive in excessive usage. It could be possible to implement Client-side caching with redis, which is rather new technology, but our current library `Jedis` doesn't support this feature yet.

Application mostly benefits from caching records of users, as they are very often queried with other resources.

6. Counting Views

Views counter is represented by additional columns in the shorts table. When a download blob endpoint is called, http request is asynchronously sent to Azure Functions. It has blob id stored as a query parameter, from which function knows which counter it should increment. The `blobFunctionTukano` connects to the database and increments the counter of the correct short. In the function, exceptions related to database have been handled and logs necessary for debugging purposes have been implemented. As counter is being embedded in a short model, it is also being returned with other short information.

Azure Functions are a good solution for this problem, because they scale automatically, handling spikes in traffic smoothly without needing to manage infrastructure.

Comparison between databases and caching data

Below test shows how caching affects performance, as well as the performance differences between using a PostgreSQL database and a Cosmos NoSQL database.

The results presented in the table below are mean values from successful requests, measured in milliseconds (ms). All tests were executed on app and resources deployed to West Europe location. It's worth noting that all values are very small, so any internet issues or temporary downtimes can have a significant impact on them.

	SQL with cache [ms]	SQL without cache [ms]	NOSQL with cache [ms]	NOSQL without cache [ms]
Post User	295.7	280.4	270.9	56.6
Get User	45.9	142.3	46.2	68.8
Post Short	1174	339.4	960.7	110
Get Shorts	189.5	279.7	238.3	192.8
*User register	257	239.6	81.1	54.3
*Upload shorts	198.8	216.3	138.2	95.3
*Realistic flow	246.1	322.6	253.5	276.1
*User delete	423.8	388.9	330.1	277.2

* Scenarios marked with a star are additional tests provided with the assignment

Implementing cache has a positive impact on result, when querying users or with provided realistic flow, because values are faster available in redis cache than in any other database. In uploading scenarios caching may cause a little additional work to do for the application, because it needs to insert values in two different places. Based on the results, we can also conclude that NoSQL requests are generally speaking faster than SQL requests.
Using cache values is not always possible and a good example is getting all shorts for the user or getting all users with username with a certain pattern. In those situations, cache is obsolete since we need to get all of them from the database anyway.
Given these findings, the most effective solution for this type of application appears to be a NoSQL database paired with caching, as it offers optimal performance for rapid data retrieval and updates.

Appendix: Artillery Test Results

SQL with cache

Post User

http.codes.200: 50
http.downloaded_bytes: 291
http.request_rate: 10/sec
http.requests: 50
http.response_time:
  min: 186
  max: 1282
  mean: 295.7
  median: 237.5
  p95: 596
  p99: 1224.4
http.response_time.2xx:
  min: 186
  max: 1282
  mean: 295.7
  median: 237.5
  p95: 596
  p99: 1224.4
http.responses: 50
vusers.completed: 50
vusers.created: 50
vusers.created_by_name.TuKanoRegister: 50
vusers.failed: 0
vusers.session_length:
  min: 187.6
  max: 1283.5
  mean: 298.2
  median: 237.5
  p95: 596
  p99: 1224.4

Get User

http.codes.200: 50
http.downloaded_bytes: 4439
http.request_rate: 9/sec
http.requests: 50
http.response_time:
  min: 41
  max: 90
  mean: 45.9
  median: 44.3

```
  p95: ...................................................................... 50.9
  p99: ...................................................................... 56.3
http.response_time.2xx:
  min: ...................................................................... 41
  max: ...................................................................... 90
  mean: ..................................................................... 45.9
  median: ................................................................... 44.3
  p95: ...................................................................... 50.9
  p99: ...................................................................... 56.3
http.responses: ............................................................ 50
vusers.completed: .......................................................... 50
vusers.created: ............................................................ 50
vusers.created_by_name.TuKanoGetUsers: ..................................... 50
vusers.failed: ............................................................. 0
vusers.session_length:
  min: ...................................................................... 42.9
  max: ...................................................................... 106.8
  mean: ..................................................................... 48.1
  median: ................................................................... 46.1
  p95: ...................................................................... 55.2
  p99: ...................................................................... 57.4
```

Post Short

```
http.codes.200: ............................................................ 50
http.downloaded_bytes: ..................................................... 11650
http.request_rate: ......................................................... 17/sec
http.requests: ............................................................. 50
http.response_time:
  min: ...................................................................... 300
  max: ...................................................................... 2446
  mean: ..................................................................... 1174
  median: ................................................................... 1200.1
  p95: ...................................................................... 2276.1
  p99: ...................................................................... 2416.8
http.response_time.2xx:
  min: ...................................................................... 300
  max: ...................................................................... 2446
  mean: ..................................................................... 1174
  median: ................................................................... 1200.1
  p95: ...................................................................... 2276.1
  p99: ...................................................................... 2416.8
http.responses: ............................................................ 50
plugins.metrics-by-endpoint./rest/shorts/user1?pwd=pass1.codes.200: ........... 50
plugins.metrics-by-endpoint.response_time./rest/shorts/user1?pwd=pass1:
  min: ...................................................................... 300
  max: ...................................................................... 2446
  mean: ..................................................................... 1174
  median: ................................................................... 1200.1
  p95: ...................................................................... 2276.1
  p99: ...................................................................... 2416.8
vusers.completed: .......................................................... 50
vusers.created: ............................................................ 50
vusers.created_by_name.TuKanoPostShort: .................................... 50
vusers.failed: ............................................................. 0
vusers.session_length:
  min: ...................................................................... 301.6
  max: ...................................................................... 2448.5
  mean: ..................................................................... 1178.4
  median: ................................................................... 1200.1
```

p95: 2276.1
p99: 2416.8

Get Short

http.codes.200: 50
http.downloaded_bytes: 337550
http.request_rate: 18/sec
http.requests: 50
http.response_time:
  min: 175
  max: 232
  mean: 189.5
  median: 190.6
  p95: 198.4
  p99: 202.4
http.response_time.2xx:
  min: 175
  max: 232
  mean: 189.5
  median: 190.6
  p95: 198.4
  p99: 202.4
http.responses: 50
vusers.completed: 50
vusers.created: 50
vusers.created_by_name.TuKanoGetShorts: 50
vusers.failed: 0
vusers.session_length:
  min: 176.9
  max: 244.4
  mean: 191.3
  median: 190.6
  p95: 202.4
  p99: 206.5

User Register

http.codes.200: 600
http.downloaded_bytes: 47137
http.request_rate: 6/sec
http.requests: 600
http.response_time:
  min: 42
  max: 496
  mean: 257
  median: 232.8
  p95: 468.8
  p99: 478.3
http.response_time.2xx:
  min: 42
  max: 496
  mean: 257
  median: 232.8
  p95: 468.8
  p99: 478.3
http.responses: 600
plugins.metrics-by-endpoint./rest/users/.codes.200: 200
plugins.metrics-by-endpoint./rest/users/{{ userId }}?pwd={{ pwd }}.codes.200: .. 400
plugins.metrics-by-endpoint.response_time./rest/users/:

```
min: ....................................................................... 225
max: ....................................................................... 290
mean: ..................................................................... 235.8
median: .................................................................. 232.8
p95: ....................................................................... 252.2
p99: ....................................................................... 273.2
plugins.metrics-by-endpoint.response_time./rest/users/{{ userId }}?pwd={{ pwd }}:
min: ....................................................................... 42
max: ....................................................................... 496
mean: ..................................................................... 267.6
median: .................................................................. 96.6
p95: ....................................................................... 468.8
p99: ....................................................................... 487.9
vusers.completed: ............................................................ 200
vusers.created: ............................................................. 200
vusers.created_by_name.TuKanoWholeUserFlow: .................................. 200
vusers.failed: ............................................................... 0
vusers.session_length:
min: ....................................................................... 706.6
max: ....................................................................... 829.7
mean: ..................................................................... 778.7
median: .................................................................. 772.9
p95: ....................................................................... 788.5
p99: ....................................................................... 820.7
```

Upload Shorts

```
http.codes.200: ............................................................. 30
http.codes.204: ............................................................. 30
http.downloaded_bytes: ...................................................... 7706
http.request_rate: .......................................................... 6/sec
http.requests: .............................................................. 60
http.response_time:
min: ....................................................................... 53
max: ....................................................................... 968
mean: ..................................................................... 198.8
median: .................................................................. 273.2
p95: ....................................................................... 308
p99: ....................................................................... 468.8
http.response_time.2xx:
min: ....................................................................... 53
max: ....................................................................... 968
mean: ..................................................................... 198.8
median: .................................................................. 273.2
p95: ....................................................................... 308
p99: ....................................................................... 468.8
http.responses: ............................................................. 60
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.204: .............. 30
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.200: . 30
plugins.metrics-by-endpoint.response_time./rest/blobs/{{ blobUrl }}:
min: ....................................................................... 53
max: ....................................................................... 968
mean: ..................................................................... 100.8
median: .................................................................. 57.4
p95: ....................................................................... 120.3
p99: ....................................................................... 308
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}?pwd={{ pwd }}:
min: ....................................................................... 267
max: ....................................................................... 465
```

```
  mean: .................................................................. 296.8
  median: ............................................................... 284.3
  p95: ...................................................................... 308
  p99: ................................................................... 441.5
vusers.completed: ............................................................. 30
vusers.created: ............................................................... 30
vusers.created_by_name.Upload short: ........................................... 30
vusers.failed: ................................................................. 0
vusers.session_length:
  min: ................................................................... 335.6
  max: .................................................................. 1305.3
  mean: .................................................................. 411.1
  median: ............................................................... 354.3
  p95: ...................................................................... 596
  p99: ...................................................................... 608
```

Realistic Flow

There occurred some problems with this test and not all requests passed correctly, but because of little time after getting those tests, we couldn't properly debug this scenario.

```
errors.Cannot read properties of undefined (reading 'ownerId'): ............... 8
http.codes.200: .............................................................. 11
http.codes.204: ............................................................... 4
http.codes.403: ............................................................... 4
http.codes.404: ............................................................... 3
http.downloaded_bytes: ....................................................... 77
http.request_rate: ......................................................... 3/sec
http.requests: ............................................................... 22
http.response_time:
  min: ..................................................................... 180
  max: ..................................................................... 397
  mean: .................................................................. 249.3
  median: ............................................................... 198.4
  p95: ................................................................... 383.8
  p99: ................................................................... 391.6
http.response_time.2xx:
  min: ..................................................................... 180
  max: ..................................................................... 397
  mean: .................................................................. 246.1
  median: ............................................................... 198.4
  p95: ................................................................... 391.6
  p99: ................................................................... 391.6
http.response_time.4xx:
  min: ..................................................................... 182
  max: ..................................................................... 342
  mean: .................................................................. 256.1
  median: ............................................................... 219.2
  p95: ................................................................... 333.7
  p99: ................................................................... 333.7
http.responses: .............................................................. 22
plugins.metrics-by-endpoint./rest/shorts/{{ shortId }}/{{ userId }}/likes?pw... 3
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}.cod... 10
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/followers?pwd={{ pwd }... 1
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/shorts.codes.403: ........ 4
plugins.metrics-by-endpoint./rest/shorts/{{ userId1 }}/{{ userId2 }}/followe... 4
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ shortId }}/{{ userId }}/likes?pwd={{ pwd }}:
  min: ..................................................................... 332
  max: ..................................................................... 342
  mean: .................................................................. 336.7
```

```
  median: ................................................................ 333.7
  p95: ...................................................................... 333.7
  p99: ...................................................................... 333.7
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}:
  min: ...................................................................... 180
  max: ..................................................................... 210
  mean: .................................................................... 193.3
  median: ................................................................ 190.6
  p95: ...................................................................... 202.4
  p99: ...................................................................... 202.4
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/followers?pwd={{ pwd }}:
  min: ...................................................................... 203
  max: ..................................................................... 203
  mean: .................................................................... 203
  median: ................................................................ 202.4
  p95: ...................................................................... 202.4
  p99: ...................................................................... 202.4
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/shorts:
  min: ...................................................................... 182
  max: ..................................................................... 218
  mean: .................................................................... 195.8
  median: ................................................................ 186.8
  p95: ...................................................................... 198.4
  p99: ...................................................................... 198.4
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId1 }}/{{ userId2 }}/followers?pwd={{ pwd }}:
  min: ...................................................................... 379
  max: ..................................................................... 397
  mean: .................................................................... 389
  median: ................................................................ 383.8
  p95: ...................................................................... 391.6
  p99: ...................................................................... 391.6
vusers.completed: ........................................................ 22
vusers.created: ............................................................ 30
vusers.created_by_name.Download short: ........................................ 8
vusers.created_by_name.Follow user: ........................................... 4
vusers.created_by_name.Get User Follows: ...................................... 1
vusers.created_by_name.Get User's Shorts: ..................................... 4
vusers.created_by_name.Like short: ............................................ 3
vusers.created_by_name.View feed: ............................................. 10
vusers.failed: ............................................................. 8
vusers.session_length:
  min: ...................................................................... 189.3
  max: ..................................................................... 406.9
  mean: .................................................................... 260.4
  median: ................................................................ 210.6
  p95: ...................................................................... 391.6
  p99: ...................................................................... 399.5
```

Delete Users

```
http.codes.200: ............................................................ 200
http.downloaded_bytes: .................................................... 22370
http.request_rate: ........................................................ 2/sec
http.requests: ............................................................ 200
http.response_time:
  min: ...................................................................... 407
  max: ..................................................................... 449
  mean: .................................................................... 423.8
  median: ................................................................ 424.2
```

```
    p95: ...................................................................... 432.7
    p99: ...................................................................... 441.5
http.response_time.2xx:
    min: ...................................................................... 407
    max: ...................................................................... 449
    mean: ..................................................................... 423.8
    median: ................................................................... 424.2
    p95: ...................................................................... 432.7
    p99: ...................................................................... 441.5
http.responses: ............................................................. 200
vusers.completed: ........................................................... 200
vusers.created: ............................................................. 200
vusers.created_by_name.TuKanoDeleteUserFlow: ................................ 200
vusers.failed: .............................................................. 0
vusers.session_length:
    min: ...................................................................... 408.8
    max: ...................................................................... 470.3
    mean: ..................................................................... 426.8
    median: ................................................................... 424.2
    p95: ...................................................................... 441.5
    p99: ...................................................................... 450.4
```

SQL without cache

Post User

```
http.codes.200: ............................................................. 50
http.downloaded_bytes: ...................................................... 291
http.request_rate: .......................................................... 7/sec
http.requests: .............................................................. 50
http.response_time:
    min: ...................................................................... 54
    max: ...................................................................... 70
    mean: ..................................................................... 56.6
    median: ................................................................... 56.3
    p95: ...................................................................... 63.4
    p99: ...................................................................... 64.7
http.response_time.2xx:
    min: ...................................................................... 54
    max: ...................................................................... 70
    mean: ..................................................................... 56.6
    median: ................................................................... 56.3
    p95: ...................................................................... 63.4
    p99: ...................................................................... 64.7
http.responses: ............................................................. 50
vusers.completed: ........................................................... 50
vusers.created: ............................................................. 50
vusers.created_by_name.TuKanoRegister: ...................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
    min: ...................................................................... 55.5
    max: ...................................................................... 89.8
    mean: ..................................................................... 59.3
    median: ................................................................... 57.4
    p95: ...................................................................... 67.4
    p99: ...................................................................... 74.4
```

Get User

```
http.codes.200: ............................................................. 50
http.downloaded_bytes: ...................................................... 4439
http.request_rate: .......................................................... 10/sec
```

```
http.requests: ............................................................. 50
http.response_time:
  min: ....................................................................... 47
  max: ....................................................................... 352
  mean: ..................................................................... 68.8
  median: .................................................................. 49.9
  p95: ....................................................................... 228.2
  p99: ....................................................................... 262.5
http.response_time.2xx:
  min: ....................................................................... 47
  max: ....................................................................... 352
  mean: ..................................................................... 68.8
  median: .................................................................. 49.9
  p95: ....................................................................... 228.2
  p99: ....................................................................... 262.5
http.responses: ........................................................... 50
vusers.completed: ....................................................... 50
vusers.created: ........................................................... 50
vusers.created_by_name.TuKanoGetUsers: ......................................... 50
vusers.failed: ............................................................... 0
vusers.session_length:
  min: ....................................................................... 48.5
  max: ....................................................................... 366
  mean: ..................................................................... 70.9
  median: .................................................................. 51.9
  p95: ....................................................................... 232.8
  p99: ....................................................................... 267.8
```

Post Short

```
http.codes.200: ........................................................... 50
http.downloaded_bytes: ........................................................ 11646
http.request_rate: .......................................................... 17/sec
http.requests: ............................................................. 50
http.response_time:
  min: ....................................................................... 94
  max: ....................................................................... 343
  mean: ..................................................................... 110
  median: .................................................................. 98.5
  p95: ....................................................................... 127.8
  p99: ....................................................................... 237.5
http.response_time.2xx:
  min: ....................................................................... 94
  max: ....................................................................... 343
  mean: ..................................................................... 110
  median: .................................................................. 98.5
  p95: ....................................................................... 127.8
  p99: ....................................................................... 237.5
http.responses: ........................................................... 50
plugins.metrics-by-endpoint./rest/shorts/user1?pwd=pass1.codes.200: ............ 50
plugins.metrics-by-endpoint.response_time./rest/shorts/user1?pwd=pass1:
  min: ....................................................................... 94
  max: ....................................................................... 343
  mean: ..................................................................... 110
  median: .................................................................. 98.5
  p95: ....................................................................... 127.8
  p99: ....................................................................... 237.5
vusers.completed: ....................................................... 50
vusers.created: ........................................................... 50
```

```
vusers.created_by_name.TuKanoPostShort: ......................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ...................................................................... 95.7
  max: ...................................................................... 344.7
  mean: ..................................................................... 111.9
  median: ................................................................... 100.5
  p95: ...................................................................... 133
  p99: ...................................................................... 247.2
```

Get Short

```
http.codes.200: ............................................................ 50
http.downloaded_bytes: ..................................................... 112550
http.request_rate: ......................................................... 17/sec
http.requests: ............................................................. 50
http.response_time:
  min: ...................................................................... 185
  max: ...................................................................... 221
  mean: ..................................................................... 192.8
  median: ................................................................... 190.6
  p95: ...................................................................... 210.6
  p99: ...................................................................... 210.6
http.response_time.2xx:
  min: ...................................................................... 185
  max: ...................................................................... 221
  mean: ..................................................................... 192.8
  median: ................................................................... 190.6
  p95: ...................................................................... 210.6
  p99: ...................................................................... 210.6
http.responses: ............................................................ 50
vusers.completed: .......................................................... 50
vusers.created: ............................................................ 50
vusers.created_by_name.TuKanoGetShorts: ......................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ...................................................................... 185.9
  max: ...................................................................... 232.3
  mean: ..................................................................... 194.7
  median: ................................................................... 190.6
  p95: ...................................................................... 210.6
  p99: ...................................................................... 214.9
```

User Register

```
http.codes.200: ............................................................ 600
http.downloaded_bytes: ..................................................... 47137
http.request_rate: ......................................................... 6/sec
http.requests: ............................................................. 600
http.response_time:
  min: ...................................................................... 46
  max: ...................................................................... 121
  mean: ..................................................................... 54.3
  median: ................................................................... 54.1
  p95: ...................................................................... 58.6
  p99: ...................................................................... 76
http.response_time.2xx:
  min: ...................................................................... 46
  max: ...................................................................... 121
```

```
  mean: ......................................................... 54.3
  median: ...................................................... 54.1
  p95: .......................................................... 58.6
  p99: .......................................................... 76
http.responses: ............................................. 600
plugins.metrics-by-endpoint./rest/users/.codes.200: ........................... 200
plugins.metrics-by-endpoint./rest/users/{{ userId }}?pwd={{ pwd }}.codes.200: .. 400
plugins.metrics-by-endpoint.response_time./rest/users/:
  min: .......................................................... 50
  max: .......................................................... 113
  mean: ......................................................... 56
  median: ...................................................... 55.2
  p95: .......................................................... 59.7
  p99: .......................................................... 76
plugins.metrics-by-endpoint.response_time./rest/users/{{ userId }}?pwd={{ pwd }}:
  min: .......................................................... 46
  max: .......................................................... 121
  mean: ......................................................... 53.5
  median: ...................................................... 53
  p95: .......................................................... 58.6
  p99: .......................................................... 71.5
vusers.completed: ........................................... 200
vusers.created: ............................................. 200
vusers.created_by_name.TuKanoWholeUserFlow: ................................... 200
vusers.failed: .............................................. 0
vusers.session_length:
  min: .......................................................... 153.4
  max: .......................................................... 262
  mean: ......................................................... 168.6
  median: ...................................................... 165.7
  p95: .......................................................... 179.5
  p99: .......................................................... 232.8
```

Upload Shorts

```
http.codes.200: ............................................. 30
http.codes.204: ............................................. 30
http.downloaded_bytes: ...................................... 7654
http.request_rate: .......................................... 7/sec
http.requests: .............................................. 60
http.response_time:
  min: .......................................................... 51
  max: .......................................................... 481
  mean: ......................................................... 95.3
  median: ...................................................... 98.5
  p95: .......................................................... 117.9
  p99: .......................................................... 308
http.response_time.2xx:
  min: .......................................................... 51
  max: .......................................................... 481
  mean: ......................................................... 95.3
  median: ...................................................... 98.5
  p95: .......................................................... 117.9
  p99: .......................................................... 308
http.responses: ............................................. 60
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.204: .............. 30
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.200: . 30
plugins.metrics-by-endpoint.response_time./rest/blobs/{{ blobUrl }}:
  min: .......................................................... 51
  max: .......................................................... 481
```

```
mean: .................................................. 87.1
median: ................................................ 57.4
p95: ..................................................... 147
p99: ..................................................... 308
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}?pwd={{ pwd }}:
min: ..................................................... 97
max: ..................................................... 119
mean: .................................................. 103.5
median: ................................................ 102.5
p95: ..................................................... 111.1
p99: ..................................................... 113.3
vusers.completed: ................................................. 30
vusers.created: ................................................... 30
vusers.created_by_name.Upload short: .............................. 30
vusers.failed: ..................................................... 0
vusers.session_length:
min: ..................................................... 159
max: ..................................................... 630.4
mean: .................................................. 202.7
median: ................................................ 169
p95: ..................................................... 290.1
p99: ..................................................... 441.5
```

Realistic Flow

```
errors.Cannot read properties of undefined (reading 'ownerId'): ............... 5
http.codes.200: ................................................ 15
http.codes.204: ................................................ 5
http.codes.403: ................................................ 3
http.codes.404: ................................................ 2
http.downloaded_bytes: ........................................ 81
http.request_rate: ........................................... 4/sec
http.requests: ................................................ 25
http.response_time:
min: ..................................................... 142
max: ..................................................... 423
mean: .................................................. 276
median: ................................................ 290.1
p95: ..................................................... 347.3
p99: ..................................................... 368.8
http.response_time.2xx:
min: ..................................................... 142
max: ..................................................... 423
mean: .................................................. 276.1
median: ................................................ 290.1
p95: ..................................................... 368.8
p99: ..................................................... 368.8
http.response_time.4xx:
min: ..................................................... 201
max: ..................................................... 328
mean: .................................................. 275.6
median: ................................................ 290.1
p95: ..................................................... 320.6
p99: ..................................................... 320.6
http.responses: ............................................... 25
plugins.metrics-by-endpoint./rest/shorts/{{ shortId }}/{{ userId }}/likes?pw... 2
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}.cod... 15
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/shorts.codes.403: ........ 3
plugins.metrics-by-endpoint./rest/shorts/{{ userId1 }}/{{ userId2 }}/followe... 5
```

plugins.metrics-by-endpoint.response_time./rest/shorts/{{ shortId }}/{{ userId }}/likes?pwd={{ pwd }}:
  min: 291
  max: 322
  mean: 306.5
  median: 290.1
  p95: 290.1
  p99: 290.1
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}:
  min: 244
  max: 423
  mean: 304.8
  median: 308
  p95: 368.8
  p99: 368.8
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/shorts:
  min: 201
  max: 328
  mean: 255
  median: 237.5
  p95: 237.5
  p99: 237.5
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId1 }}/{{ userId2 }}/followers?pwd={{ pwd }}:
  min: 142
  max: 301
  mean: 189.8
  median: 147
  p95: 214.9
  p99: 214.9
vusers.completed: 25
vusers.created: 30
vusers.created_by_name.Download short: 4
vusers.created_by_name.Follow user: 5
vusers.created_by_name.Get Short Likes: 1
vusers.created_by_name.Get User's Shorts: 3
vusers.created_by_name.Like short: 2
vusers.created_by_name.View feed: 15
vusers.failed: 5
vusers.session_length:
  min: 149.2
  max: 429.9
  mean: 285.7
  median: 295.9
  p95: 354.3
  p99: 368.8

Delete Users

http.codes.204: 200
http.downloaded_bytes: 0
http.request_rate: 2/sec
http.requests: 200
http.response_time:
  min: 240
  max: 535
  mean: 277.2
  median: 252.2
  p95: 424.2
  p99: 507.8
http.response_time.2xx:
  min: 240

```
  max: ............................................................ 535
  mean: .......................................................... 277.2
  median: ........................................................ 252.2
  p95: ............................................................ 424.2
  p99: ............................................................ 507.8
http.responses: ................................................. 200
vusers.completed: ............................................... 200
vusers.created: ................................................. 200
vusers.created_by_name.TuKanoDeleteUserFlow: ................... 200
vusers.failed: .................................................. 0
vusers.session_length:
  min: ........................................................... 240.9
  max: ........................................................... 538.9
  mean: .......................................................... 280.1
  median: ........................................................ 257.3
  p95: ........................................................... 424.2
  p99: ........................................................... 507.8
```

NOSQL without cache

Post User

```
http.codes.200: ................................................. 50
http.downloaded_bytes: .......................................... 291
http.request_rate: .............................................. 10/sec
http.requests: .................................................. 50
http.response_time:
  min: ........................................................... 137
  max: ........................................................... 1724
  mean: .......................................................... 280.4
  median: ........................................................ 186.8
  p95: ........................................................... 713.5
  p99: ........................................................... 1495.5
http.response_time.2xx:
  min: ........................................................... 137
  max: ........................................................... 1724
  mean: .......................................................... 280.4
  median: ........................................................ 186.8
  p95: ........................................................... 713.5
  p99: ........................................................... 1495.5
http.responses: ................................................. 50
vusers.completed: ............................................... 50
vusers.created: ................................................. 50
vusers.created_by_name.TuKanoRegister: .......................... 50
vusers.failed: .................................................. 0
vusers.session_length:
  min: ........................................................... 138.1
  max: ........................................................... 1726.1
  mean: .......................................................... 282.6
  median: ........................................................ 186.8
  p95: ........................................................... 727.9
  p99: ........................................................... 1495.5
```

Get User

```
http.codes.200: ................................................. 50
http.downloaded_bytes: .......................................... 4439
http.request_rate: .............................................. 10/sec
```

```
http.requests: ............................................................. 50
http.response_time:
  min: ....................................................... 135
  max: ....................................................... 182
  mean: ..................................................... 142.3
  median: ................................................... 138.4
  p95: ....................................................... 149.9
  p99: ....................................................... 169
http.response_time.2xx:
  min: ....................................................... 135
  max: ....................................................... 182
  mean: ..................................................... 142.3
  median: ................................................... 138.4
  p95: ....................................................... 149.9
  p99: ....................................................... 169
http.responses: ........................................................... 50
vusers.completed: ......................................................... 50
vusers.created: ........................................................... 50
vusers.created_by_name.TuKanoGetUsers: ......................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ....................................................... 136.6
  max: ....................................................... 195.4
  mean: ..................................................... 144.1
  median: ................................................... 141.2
  p95: ....................................................... 153
  p99: ....................................................... 169
```

Post Short

```
http.codes.200: ............................................................ 50
http.downloaded_bytes: ...................................................... 11645
http.request_rate: .......................................................... 17/sec
http.requests: ............................................................. 50
http.response_time:
  min: ....................................................... 280
  max: ....................................................... 919
  mean: ..................................................... 339.4
  median: ................................................... 327.1
  p95: ....................................................... 354.3
  p99: ....................................................... 376.2
http.response_time.2xx:
  min: ....................................................... 280
  max: ....................................................... 919
  mean: ..................................................... 339.4
  median: ................................................... 327.1
  p95: ....................................................... 354.3
  p99: ....................................................... 376.2
http.responses: ........................................................... 50
plugins.metrics-by-endpoint./rest/shorts/user1?pwd=pass1.codes.200: ............ 50
plugins.metrics-by-endpoint.response_time./rest/shorts/user1?pwd=pass1:
  min: ....................................................... 280
  max: ....................................................... 919
  mean: ..................................................... 339.4
  median: ................................................... 327.1
  p95: ....................................................... 354.3
  p99: ....................................................... 376.2
vusers.completed: ......................................................... 50
vusers.created: ........................................................... 50
vusers.created_by_name.TuKanoPostShort: ........................................ 50
```

vusers.failed: 0
vusers.session_length:
  min: 281.1
  max: 921.4
  mean: 341.6
  median: 327.1
  p95: 368.8
  p99: 383.8

Get Short

http.codes.200: 50
http.downloaded_bytes: 112550
http.request_rate: 17/sec
http.requests: 50
http.response_time:
  min: 265
  max: 322
  mean: 279.7
  median: 278.7
  p95: 295.9
  p99: 308
http.response_time.2xx:
  min: 265
  max: 322
  mean: 279.7
  median: 278.7
  p95: 295.9
  p99: 308
http.responses: 50
vusers.completed: 50
vusers.created: 50
vusers.created_by_name.TuKanoGetShorts: 50
vusers.failed: 0
vusers.session_length:
  min: 266.6
  max: 333.8
  mean: 281.5
  median: 278.7
  p95: 295.9
  p99: 308

User Register

http.codes.200: 600
http.downloaded_bytes: 47137
http.request_rate: 6/sec
http.requests: 600
http.response_time:
  min: 135
  max: 434
  mean: 239.6
  median: 186.8
  p95: 391.6
  p99: 407.5
http.response_time.2xx:
  min: 135
  max: 434
  mean: 239.6

```
  median: ................................................................ 186.8
  p95: ...................................................................... 391.6
  p99: ...................................................................... 407.5
http.responses: ............................................................ 600
plugins.metrics-by-endpoint./rest/users/.codes.200: ........................... 200
plugins.metrics-by-endpoint./rest/users/{{ userId }}?pwd={{ pwd }}.codes.200: .. 400
plugins.metrics-by-endpoint.response_time./rest/users/:
  min: ...................................................................... 180
  max: ...................................................................... 244
  mean: ..................................................................... 191
  median: ................................................................ 186.8
  p95: ...................................................................... 198.4
  p99: ...................................................................... 223.7
plugins.metrics-by-endpoint.response_time./rest/users/{{ userId }}?pwd={{ pwd }}:
  min: ...................................................................... 135
  max: ...................................................................... 434
  mean: ................................................................... 263.8
  median: ................................................................ 190.6
  p95: ...................................................................... 391.6
  p99: ...................................................................... 407.5
vusers.completed: ......................................................... 200
vusers.created: ........................................................... 200
vusers.created_by_name.TuKanoWholeUserFlow: ............................... 200
vusers.failed: .............................................................. 0
vusers.session_length:
  min: .................................................................... 701.5
  max: .................................................................... 818.5
  mean: ................................................................... 726.1
  median: ................................................................. 727.9
  p95: .................................................................... 742.6
  p99: .................................................................... 757.6
```

Upload Shorts

```
http.codes.200: ............................................................ 30
http.codes.204: ............................................................ 30
http.downloaded_bytes: ................................................... 7727
http.request_rate: ....................................................... 6/sec
http.requests: ............................................................ 60
http.response_time:
  min: ...................................................................... 53
  max: .................................................................... 1018
  mean: ................................................................... 216.3
  median: ................................................................. 314.2
  p95: .................................................................... 340.4
  p99: .................................................................... 368.8
http.response_time.2xx:
  min: ...................................................................... 53
  max: .................................................................... 1018
  mean: ................................................................... 216.3
  median: ................................................................. 314.2
  p95: .................................................................... 340.4
  p99: .................................................................... 368.8
http.responses: ........................................................... 60
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.204: .............. 30
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.200: . 30
plugins.metrics-by-endpoint.response_time./rest/blobs/{{ blobUrl }}:
  min: ...................................................................... 53
  max: .................................................................... 1018
```

```
  mean: ................................................................. 101.7
  median: .............................................................. 56.3
  p95: ................................................................... 106.7
  p99: ................................................................... 284.3
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}?pwd={{ pwd }}:
  min: ................................................................... 315
  max: .................................................................. 368
  mean: ................................................................. 330.9
  median: .............................................................. 327.1
  p95: ................................................................... 340.4
  p99: ................................................................... 340.4
vusers.completed: ............................................. 30
vusers.created: ............................................... 30
vusers.created_by_name.Upload short: ........................... 30
vusers.failed: ............................................... 0
vusers.session_length:
  min: ................................................................... 376.5
  max: .................................................................. 1422.5
  mean: ................................................................. 445.8
  median: .............................................................. 399.5
  p95: ................................................................... 468.8
  p99: ................................................................... 620.3
```

Realistic Flow

```
errors.Cannot read properties of undefined (reading 'ownerId'): ................ 10
http.codes.200: ................................................... 10
http.codes.204: ................................................... 2
http.codes.403: ................................................... 4
http.codes.404: ................................................... 4
http.downloaded_bytes: ........................................ 73
http.request_rate: ............................................ 4/sec
http.requests: ................................................ 20
http.response_time:
  min: ................................................................... 271
  max: .................................................................. 501
  mean: ................................................................. 307.9
  median: .............................................................. 284.3
  p95: ................................................................... 478.3
  p99: ................................................................... 478.3
http.response_time.2xx:
  min: ................................................................... 278
  max: .................................................................. 501
  mean: ................................................................. 322.6
  median: .............................................................. 284.3
  p95: ................................................................... 478.3
  p99: ................................................................... 478.3
http.response_time.4xx:
  min: ................................................................... 271
  max: .................................................................. 298
  mean: ................................................................. 285.8
  median: .............................................................. 284.3
  p95: ................................................................... 290.1
  p99: ................................................................... 290.1
http.responses: ............................................... 20
plugins.metrics-by-endpoint./rest/shorts/{{ shortId }}/{{ userId }}/likes?pw... 3
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}.cod... 9
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/followers?pwd={{ pwd }... 1
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/shorts.codes.403: ........ 4
```

```
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/shorts.codes.404: ........ 1
plugins.metrics-by-endpoint./rest/shorts/{{ userId1 }}/{{ userId2 }}/followe...  2
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ shortId }}/{{ userId }}/likes?pwd={{ pwd }}:
  min: ...................................................................... 271
  max: ..................................................................... 290
  mean: .................................................................... 283
  median: ............................................................... 290.1
  p95: ................................................................... 290.1
  p99: ................................................................... 290.1
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}:
  min: ...................................................................... 280
  max: ..................................................................... 309
  mean: ................................................................. 289.9
  median: ............................................................... 284.3
  p95: ................................................................... 295.9
  p99: ................................................................... 295.9
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/followers?pwd={{ pwd }}:
  min: ...................................................................... 278
  max: ..................................................................... 278
  mean: .................................................................... 278
  median: ............................................................... 278.7
  p95: ................................................................... 278.7
  p99: ................................................................... 278.7
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/shorts:
  min: ...................................................................... 281
  max: ..................................................................... 298
  mean: ................................................................. 287.4
  median: ............................................................... 284.3
  p95: ................................................................... 290.1
  p99: ................................................................... 290.1
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId1 }}/{{ userId2 }}/followers?pwd={{ pwd }}:
  min: ...................................................................... 483
  max: ..................................................................... 501
  mean: .................................................................... 492
  median: ............................................................... 478.3
  p95: ................................................................... 478.3
  p99: ................................................................... 478.3
vusers.completed: ............................................................ 20
vusers.created: ............................................................. 30
vusers.created_by_name.Download short: ........................................ 6
vusers.created_by_name.Follow user: .......................................... 2
vusers.created_by_name.Get Short Likes: ...................................... 4
vusers.created_by_name.Get User Follows: ..................................... 1
vusers.created_by_name.Get User's Shorts: .................................... 5
vusers.created_by_name.Like short: ........................................... 3
vusers.created_by_name.View feed: ............................................ 9
vusers.failed: .............................................................. 10
vusers.session_length:
  min: .................................................................. 279.6
  max: .................................................................. 533.2
  mean: ................................................................. 324.3
  median: ............................................................... 295.9
  p95: ................................................................... 487.9
  p99: ................................................................... 487.9
```

Delete Users

```
http.codes.200: ............................................................ 200
```

```
http.downloaded_bytes: ....................................................... 22370
http.request_rate: ........................................................... 2/sec
http.requests: ............................................................... 200
http.response_time:
  min: ....................................................... 365
  max: ....................................................... 471
  mean: ...................................................... 388.9
  median: .................................................... 383.8
  p95: ....................................................... 424.2
  p99: ....................................................... 450.4
http.response_time.2xx:
  min: ....................................................... 365
  max: ....................................................... 471
  mean: ...................................................... 388.9
  median: .................................................... 383.8
  p95: ....................................................... 424.2
  p99: ....................................................... 450.4
http.responses: ............................................................. 200
vusers.completed: ........................................................... 200
vusers.created: ............................................................. 200
vusers.created_by_name.TuKanoDeleteUserFlow: ................................. 200
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ....................................................... 368.4
  max: ....................................................... 474
  mean: ...................................................... 392.1
  median: .................................................... 383.8
  p95: ....................................................... 432.7
  p99: ....................................................... 450.4
```

NOSQL with cache

Post User

```
http.codes.200: ............................................................. 50
http.downloaded_bytes: ...................................................... 291
http.request_rate: .......................................................... 10/sec
http.requests: .............................................................. 50
http.response_time:
  min: ....................................................... 90
  max: ....................................................... 1236
  mean: ...................................................... 270.9
  median: .................................................... 96.6
  p95: ....................................................... 982.6
  p99: ....................................................... 1085.9
http.response_time.2xx:
  min: ....................................................... 90
  max: ....................................................... 1236
  mean: ...................................................... 270.9
  median: .................................................... 96.6
  p95: ....................................................... 982.6
  p99: ....................................................... 1085.9
http.responses: ............................................................. 50
vusers.completed: ........................................................... 50
vusers.created: ............................................................. 50
vusers.created_by_name.TuKanoRegister: ...................................... 50
vusers.failed: .............................................................. 0
```

vusers.session_length:
- min: 92.4
- max: 1237.4
- mean: 273.1
- median: 98.5
- p95: 982.6
- p99: 1085.9

Get User

http.codes.200: 50
http.downloaded_bytes: 4439
http.request_rate: 10/sec
http.requests: 50
http.response_time:
- min: 42
- max: 73
- mean: 46.2
- median: 44.3
- p95: 55.2
- p99: 59.7

http.response_time.2xx:
- min: 42
- max: 73
- mean: 46.2
- median: 44.3
- p95: 55.2
- p99: 59.7

http.responses: 50
vusers.completed: 50
vusers.created: 50
vusers.created_by_name.TuKanoGetUsers: 50
vusers.failed: 0
vusers.session_length:
- min: 44.1
- max: 81.6
- mean: 49
- median: 47
- p95: 59.7
- p99: 77.5

Post Short

http.codes.200: 50
http.downloaded_bytes: 11646
http.request_rate: 18/sec
http.requests: 50
http.response_time:
- min: 136
- max: 2351
- mean: 960.7
- median: 1022.7
- p95: 1720.2
- p99: 2231

http.response_time.2xx:
- min: 136
- max: 2351
- mean: 960.7
- median: 1022.7

```
  p95: ...................................................................... 1720.2
  p99: ...................................................................... 2231
http.responses: ............................................................. 50
plugins.metrics-by-endpoint./rest/shorts/user1?pwd=pass1.codes.200: ........... 50
plugins.metrics-by-endpoint.response_time./rest/shorts/user1?pwd=pass1:
  min: ...................................................................... 136
  max: ...................................................................... 2351
  mean: ..................................................................... 960.7
  median: ................................................................... 1022.7
  p95: ...................................................................... 1720.2
  p99: ...................................................................... 2231
vusers.completed: ........................................................... 50
vusers.created: ............................................................. 50
vusers.created_by_name.TuKanoPostShort: ..................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ...................................................................... 147.2
  max: ...................................................................... 2352.2
  mean: ..................................................................... 962.5
  median: ................................................................... 1022.7
  p95: ...................................................................... 1720.2
  p99: ...................................................................... 2231
```

Get Short

```
http.codes.200: ............................................................. 50
http.downloaded_bytes: ...................................................... 447800
http.request_rate: .......................................................... 17/sec
http.requests: .............................................................. 50
http.response_time:
  min: ...................................................................... 229
  max: ...................................................................... 260
  mean: ..................................................................... 238.3
  median: ................................................................... 237.5
  p95: ...................................................................... 247.2
  p99: ...................................................................... 257.3
http.response_time.2xx:
  min: ...................................................................... 229
  max: ...................................................................... 260
  mean: ..................................................................... 238.3
  median: ................................................................... 237.5
  p95: ...................................................................... 247.2
  p99: ...................................................................... 257.3
http.responses: ............................................................. 50
vusers.completed: ........................................................... 50
vusers.created: ............................................................. 50
vusers.created_by_name.TuKanoGetShorts: ..................................... 50
vusers.failed: .............................................................. 0
vusers.session_length:
  min: ...................................................................... 230.1
  max: ...................................................................... 261.2
  mean: ..................................................................... 240.6
  median: ................................................................... 237.5
  p95: ...................................................................... 252.2
  p99: ...................................................................... 262.
```

User Register

```
http.codes.200: ............................................................. 600
http.downloaded_bytes: ...................................................... 47137
```

```
http.request_rate: ............................................................ 6/sec
http.requests: ............................................................. 600
http.response_time:
  min: ...................................................................... 40
  max: ...................................................................... 358
  mean: ..................................................................... 81.1
  median: ................................................................... 96.6
  p95: ...................................................................... 102.5
  p99: ...................................................................... 111.1
http.response_time.2xx:
  min: ...................................................................... 40
  max: ...................................................................... 358
  mean: ..................................................................... 81.1
  median: ................................................................... 96.6
  p95: ...................................................................... 102.5
  p99: ...................................................................... 111.1
http.responses: ............................................................ 600
plugins.metrics-by-endpoint./rest/users/.codes.200: ............................ 200
plugins.metrics-by-endpoint./rest/users/{{ userId }}?pwd={{ pwd }}.codes.200: .. 400
plugins.metrics-by-endpoint.response_time./rest/users/:
  min: ...................................................................... 92
  max: ...................................................................... 358
  mean: ..................................................................... 99.7
  median: ................................................................... 96.6
  p95: ...................................................................... 102.5
  p99: ...................................................................... 162.4
plugins.metrics-by-endpoint.response_time./rest/users/{{ userId }}?pwd={{ pwd }}:
  min: ...................................................................... 40
  max: ...................................................................... 180
  mean: ..................................................................... 71.8
  median: ................................................................... 54.1
  p95: ...................................................................... 102.5
  p99: ...................................................................... 111.1
vusers.completed: .......................................................... 200
vusers.created: ............................................................ 200
vusers.created_by_name.TuKanoWholeUserFlow: ................................ 200
vusers.failed: ............................................................. 0
vusers.session_length:
  min: ...................................................................... 234.1
  max: ...................................................................... 535.4
  mean: ..................................................................... 250.9
  median: ................................................................... 247.2
  p95: ...................................................................... 262.5
  p99: ...................................................................... 320.6
```

Upload Shorts

```
http.codes.200: ............................................................ 30
http.codes.204: ............................................................ 30
http.downloaded_bytes: ..................................................... 7667
http.request_rate: ......................................................... 7/sec
http.requests: ............................................................. 60
http.response_time:
  min: ...................................................................... 52
  max: ...................................................................... 475
  mean: ..................................................................... 138.2
  median: ................................................................... 141.2
  p95: ...................................................................... 284.3
  p99: ...................................................................... 376.2
http.response_time.2xx:
```

```
  min: ............................................................ 52
  max: ........................................................... 475
  mean: ......................................................... 138.2
  median: ....................................................... 141.2
  p95: ........................................................... 284.3
  p99: ........................................................... 376.2
http.responses: .............................................. 60
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.204: .............. 30
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.200: . 30
plugins.metrics-by-endpoint.response_time./rest/blobs/{{ blobUrl }}:
  min: ............................................................ 52
  max: ........................................................... 475
  mean: ........................................................... 83.1
  median: ......................................................... 56.3
  p95: ........................................................... 104.6
  p99: ........................................................... 376.2
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}?pwd={{ pwd }}:
  min: ........................................................... 137
  max: ........................................................... 364
  mean: ......................................................... 193.3
  median: ....................................................... 183.1
  p95: ........................................................... 257.3
  p99: ........................................................... 284.3
vusers.completed: ............................................ 30
vusers.created: .............................................. 30
vusers.created_by_name.Upload short: .......................... 30
vusers.failed: ............................................... 0
vusers.session_length:
  min: ......................................................... 198.9
  max: ......................................................... 671.2
  mean: ........................................................ 289.1
  median: ...................................................... 267.8
  p95: ......................................................... 424.2
  p99: ......................................................... 550.1
```

Realistic Flow

```
errors.Cannot read properties of undefined (reading 'ownerId'): ............... 6
http.codes.200: .............................................. 17
http.codes.204: .............................................. 1
http.codes.403: .............................................. 3
http.codes.404: .............................................. 5
http.downloaded_bytes: ....................................... 344
http.request_rate: ........................................... 4/sec
http.requests: ............................................... 26
http.response_time:
  min: .......................................................... 20
  max: ......................................................... 564
  mean: ........................................................ 239
  median: ...................................................... 237.5
  p95: ......................................................... 432.7
  p99: ......................................................... 441.5
http.response_time.2xx:
  min: .......................................................... 54
  max: ......................................................... 439
  mean: ........................................................ 253.5
  median: ...................................................... 242.3
  p95: ......................................................... 432.7
  p99: ......................................................... 432.7
http.response_time.4xx:
```

```
min: ....................................................................... 20
max: ....................................................................... 564
mean: ................................................................... 206.5
median: ................................................................ 194.4
p95: ...................................................................... 202.4
p99: ...................................................................... 202.4
http.responses: ............................................................ 26
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.204: .............. 1
plugins.metrics-by-endpoint./rest/blobs/{{ blobUrl }}.codes.403: .............. 1
plugins.metrics-by-endpoint./rest/shorts/{{ shortId }}/{{ userId }}/likes?pw... 4
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}.cod... 15
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}/shorts.codes.403: ........ 2
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.200: . 1
plugins.metrics-by-endpoint./rest/shorts/{{ userId }}?pwd={{ pwd }}.codes.404: . 1
plugins.metrics-by-endpoint./rest/users/.codes.200: ........................... 1
plugins.metrics-by-endpoint.response_time./rest/blobs/{{ blobUrl }}:
  min: ....................................................................... 20
  max: ....................................................................... 54
  mean: ...................................................................... 37
  median: .................................................................. 19.9
  p95: ..................................................................... 19.9
  p99: ..................................................................... 19.9
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ shortId }}/{{ userId }}/likes?pwd={{ pwd }}:
  min: ...................................................................... 194
  max: ...................................................................... 564
  mean: ................................................................... 289.8
  median: ................................................................ 198.4
  p95: .................................................................... 202.4
  p99: .................................................................... 202.4
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/feed?pwd={{ pwd }}:
  min: ...................................................................... 227
  max: ...................................................................... 439
  mean: ................................................................... 284.3
  median: ................................................................ 242.3
  p95: .................................................................... 432.7
  p99: .................................................................... 432.7
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}/shorts:
  min: ...................................................................... 184
  max: ...................................................................... 198
  mean: ..................................................................... 191
  median: ................................................................ 183.1
  p95: .................................................................... 183.1
  p99: .................................................................... 183.1
plugins.metrics-by-endpoint.response_time./rest/shorts/{{ userId }}?pwd={{ pwd }}:
  min: ....................................................................... 91
  max: ...................................................................... 141
  mean: ..................................................................... 116
  median: ................................................................. 90.9
  p95: ..................................................................... 90.9
  p99: ..................................................................... 90.9
plugins.metrics-by-endpoint.response_time./rest/users/:
  min: ...................................................................... 103
  max: ...................................................................... 103
  mean: ..................................................................... 103
  median: ................................................................ 102.5
  p95: .................................................................... 102.5
  p99: .................................................................... 102.5
vusers.completed: ........................................................... 24
vusers.created: ............................................................. 30
vusers.created_by_name.Download short: ........................................ 6
```

vusers.created_by_name.Get User's Shorts: 2
vusers.created_by_name.Like short: 4
vusers.created_by_name.Register user: 1
vusers.created_by_name.Upload short: 2
vusers.created_by_name.View feed: 15
vusers.failed: 6
vusers.session_length:
  min: 111.3
  max: 572.4
  mean: 273
  median: 247.2
  p95: 441.5
  p99: 468.8

Delete Users

http.codes.204: 200
http.downloaded_bytes: 0
http.request_rate: 2/sec
http.requests: 200
http.response_time:
  min: 286
  max: 651
  mean: 330.1
  median: 295.9
  p95: 507.8
  p99: 518.1
http.response_time.2xx:
  min: 286
  max: 651
  mean: 330.1
  median: 295.9
  p95: 507.8
  p99: 518.1
http.responses: 200
vusers.completed: 200
vusers.created: 200
vusers.created_by_name.TuKanoDeleteUserFlow: 200
vusers.failed: 0
vusers.session_length:
  min: 288.3
  max: 653.5
  mean: 333
  median: 301.9
  p95: 507.8
  p99: 518.1