

PART 1 - Implementation of Multi-Tiered Toy Store as Microservices

Analysis/Graphs for Part1:

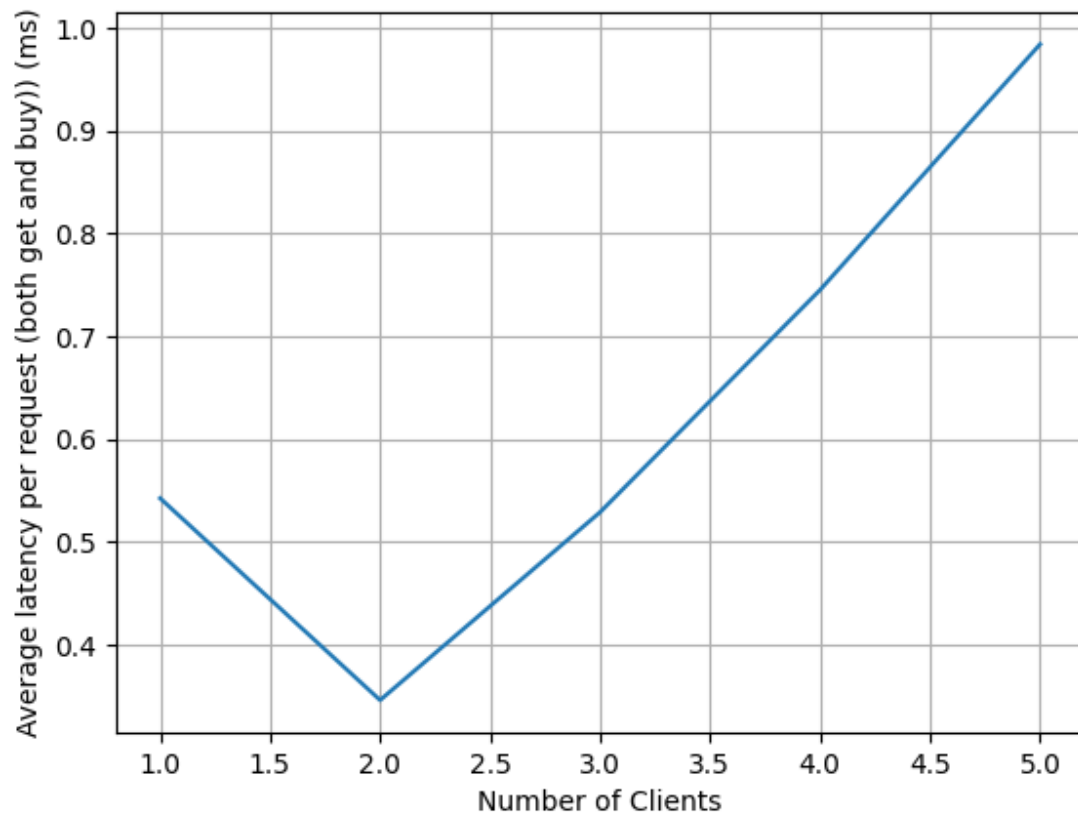


Fig 1(a) - Graph displaying the average latency per request(both get and buy) in milliseconds vs the number of clients that are simultaneously sending the requests to the application without Docker

1 : 0.5426489

2: 0.34635390

3:0.529117632

4: 0.7452321

5: 0.9840838

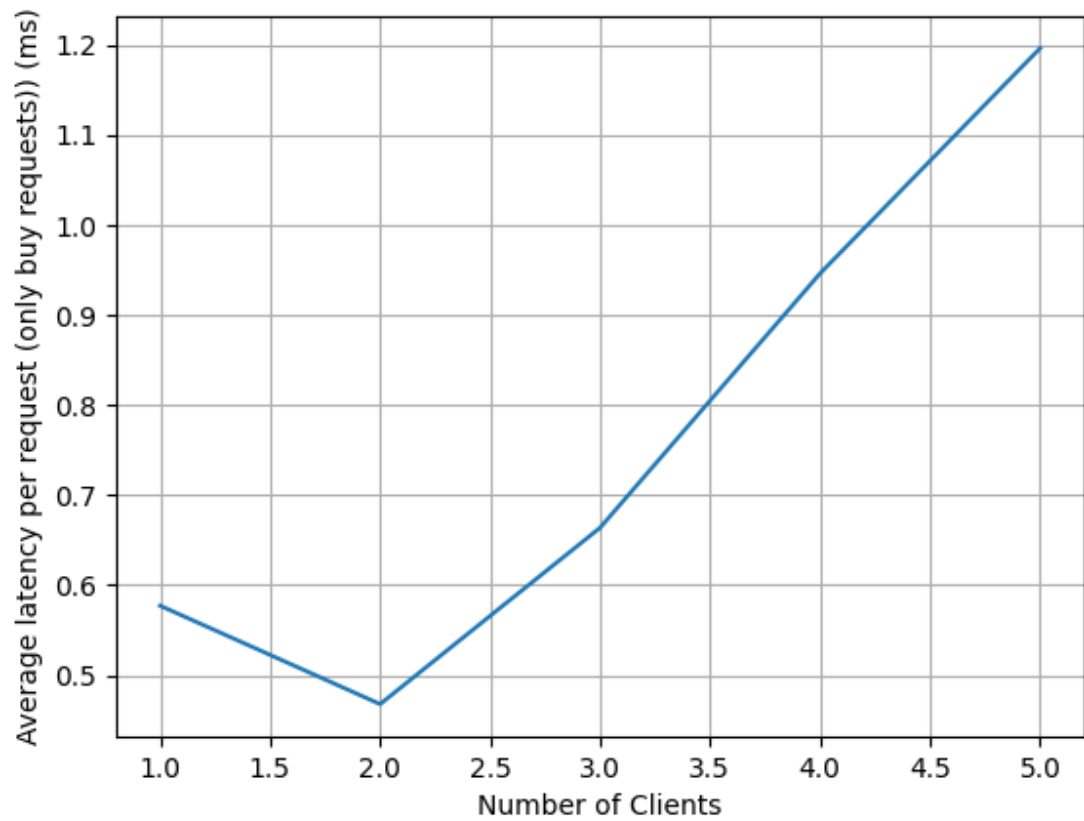


Fig 1(b) - Graph displaying the average latency per request(only buy) in milliseconds vs the number of clients that are simultaneously sending the requests to the application without Docker

1 : 0.5771660

2: 0.46779751

3: 0.663797060

4: 0.9463238

5: 1.1965336

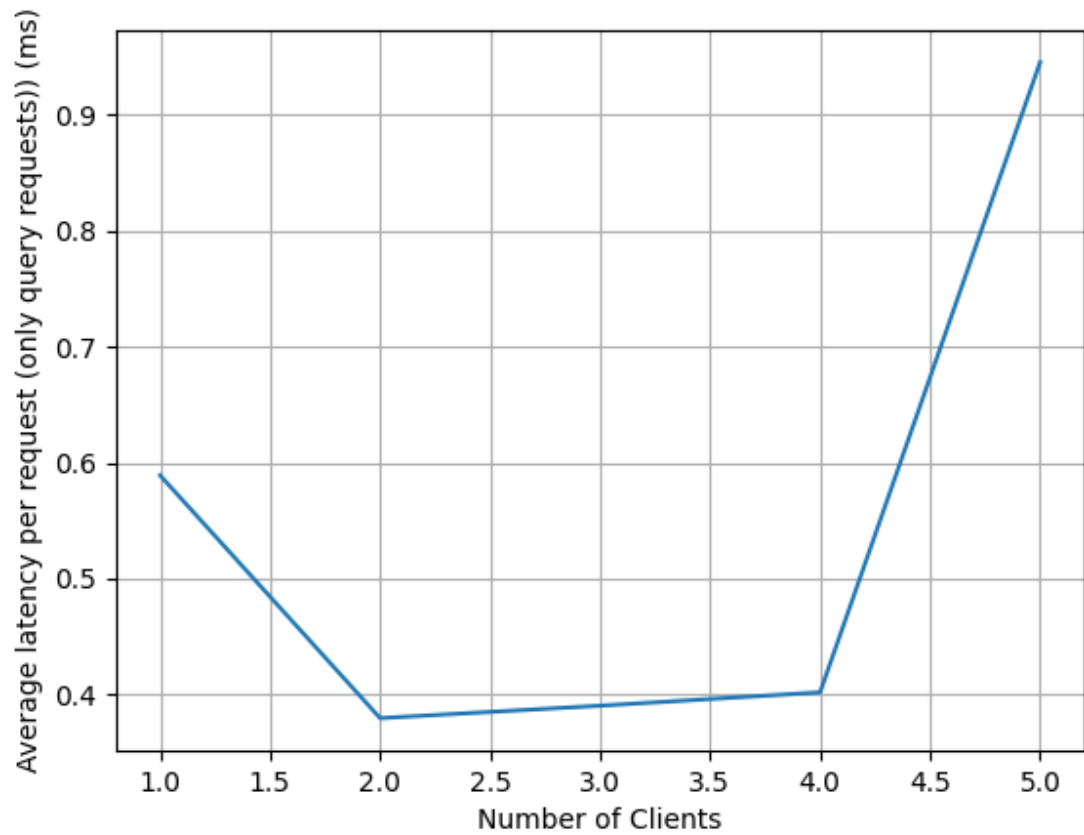


Fig 1(c) - Graph displaying the average latency per request(only query) in milliseconds vs the number of clients that are simultaneously sending the requests to the application without Docker

1 : 0.58903694

2: 0.37994503

3: 0.390636126

4: 0.4021501

5: 0.9448595

PART 2: CONTAINERIZING THE APPLICATION

Analysis/Graphs for Part2 :

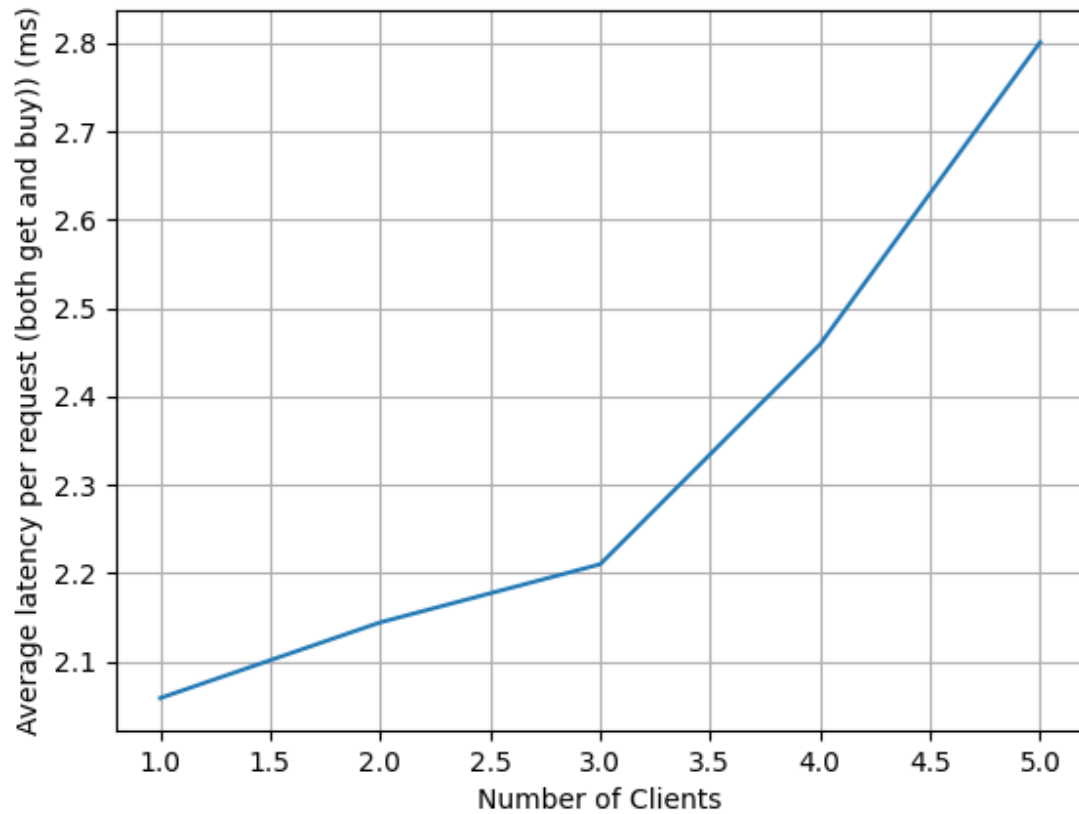


Fig 2(a) - Graph displaying the average latency per request(both get and buy) in milliseconds vs the number of clients that are simultaneously sending the requests to the application with Docker

1: 2.0583319

2: 2.14409112

3: 2.209912141

4: 2.4590796

5: 2.8011693

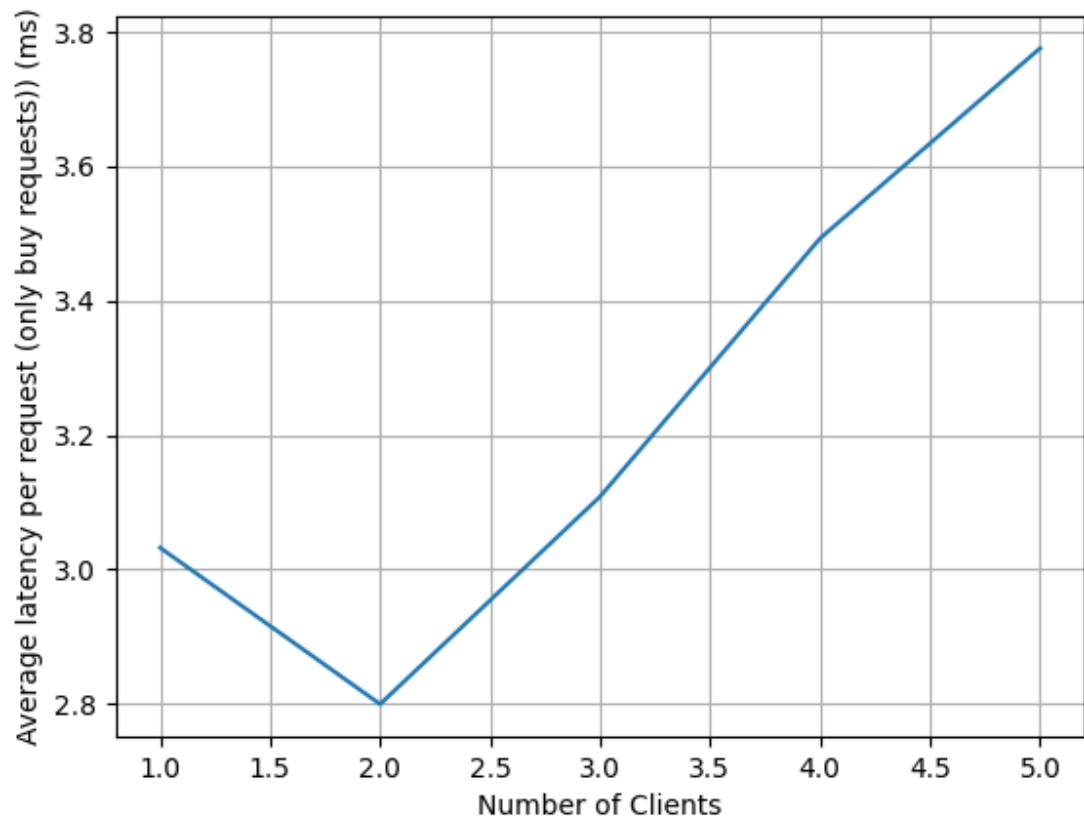


Fig 2(b) - Graph displaying the average latency per request(only buy) in milliseconds vs the number of clients that are simultaneously sending the requests to the application with Docker

1: 3.0321812

2: 2.79929041

3: 3.108393351

4: 3.4928792

5: 3.7760567

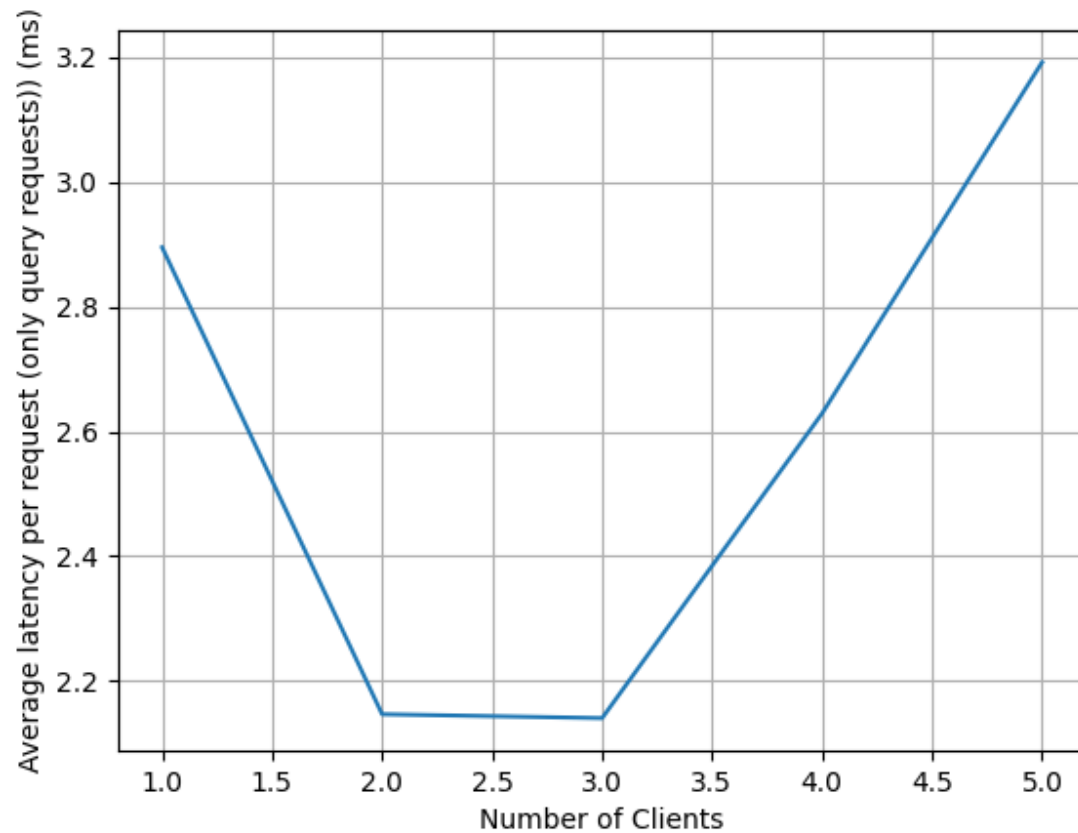


Fig 2(c) - Graph displaying the average latency per request(only query) in milliseconds vs the number of clients that are simultaneously sending the requests to the application with Docker

1: 2.8954648

2: 2.14667558

3: 2.140399614

4: 2.6290786

5: 3.1923193

1. Does the latency of the application change with and without Docker containers? Did virtualization add any overheads?

According to our observations, the average latency of the application without Docker containers is ranging from 0.54ms to 0.98 ms for 5 concurrent clients (see Fig: 1(a) above). The average latency of the application with Docker containers is ranging from 2.14ms to 2.8ms for 5 concurrent clients(see Fig: 1(b) above). We have observed that the application is relatively faster without a Docker container as the application is run on a bare-metal server. Though containers are well-adapted to work with microservices, because of this overhead we are observing relatively high latency of the application with a Docker container.

2. How does the latency of the query compare to buy? Since buy requests involve all three microservices, while query requests only involve two microservices, does it impact the observed latency?

According to our results, we have observed that average latencies of the query and buy requests to the application without Docker container is initially high though the query involves only two microservices. And as the number of requests from clients have increased, the average latencies are lesser for query requests than buy requests.

When the application is run with a Docker container, we have observed that the average latencies for buy requests (ranging from 3.03ms to 3.77ms)is higher than the query requests(ranging from 2.98ms to 3.19ms). As the buy requests involves three microservices(frontend, orders, catalog microservices) and query requests involve only two microservices(frontend, catalog microservices), it's impacting the latencies in both cases(when application is run with and without Docker container).

3. How does the latency change as the number of clients change? Does it change for different types of requests?

Without Docker container :

	Number of clients= 1	Number of clients= 2	Number of clients= 3	Number of clients= 4	Number of clients= 5
Both requests	0.5426489	0.34635390	0.529117632	0.7452321	0.9840838
Only Buy requests	0.5771660	0.46779751	0.663797060	0.9463238	1.1965336
Only Query requests	0.58903694	0.37994503	0.390636126	0.4021501	0.9448595

With Docker container :

	Number of clients= 1	Number of clients= 2	Number of clients= 3	Number of clients= 4	Number of clients= 5
Both requests	2.0583319	2.14409112	2.209912141	2.4590796	2.8011693
Only Buy requests	3.0321812	2.79929041	3.108393351	3.4928792	3.7760567
Only Query requests	2.8954648	2.14667558	2.140399614	2.6290786	3.1923193

As the number of clients change, we have observed that the average latencies are initially slightly higher in all the cases(only buy requests , only query requests, both requests) when the number of clients is 1 and it is increasing as the number of clients are increasing.