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- Catalog Server

Catalog file

```
JS app.js M catalog.csv M ●
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,4,30
3 1,RPCs for Noobs,distributed systems,9,20
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,15,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,23,20
6
```

First operation: Query

- 1) query-by-subject

<http://localhost:4000/query/subject/distributed%20systems>

```
< > localhost
[{"item_number": "0", "title": "How to get a good grade in DOS in 40 minutes a day", "topic": "distributed systems", "items_in_stock": "4", "cost": "30"}, {"item_number": "1", "title": "RPCs for Noobs", "topic": "distributed systems", "items_in_stock": "9", "cost": "20"}]
```

Note: If the subject doesn't exist

<http://localhost:4000/query/subject/unknown>

```
< > localhost:4000/query/subject/unknown
"Item not found in the catalog"
```

- 2) query-by-item

<http://localhost:4000/query/itemNumber/1>

```
< > localhost
[{"item_number": "1", "title": "RPCs for Noobs", "topic": "distributed systems", "items_in_stock": "9", "cost": "20"}]
```

Note: If the item doesn't exist

<http://localhost:4000/query/itemNumber/10>

```
< > localhost:4000/query/itemNumber/10
"Item not found in the catalog"
```

Second operation: Update

1) update-cost

<http://localhost:4000/update/cost/1/15>

localhost:4000/update/cost/1/15

```
{ "message": "Cost updated successfully", "book_name": "RPCs for Noobs" }
```

```
JS app.js M catalog.csv M X
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,4,30
3 1,RPCs for Noobs,distributed systems,9,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,15,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,23,20
```

Note: if the item doesn't exist

<http://localhost:4000/update/cost/7/15>

localhost:4000/update/cost/7/15

Item not found in the catalog

2) Decrement the stock

<http://localhost:4000/update/decrement/0>

localhost:4000/update/decrement/0

```
{ "message": "Stock updated successfully", "book_name": "How to get a good grade in DOS in 40 minutes a day" }
```

```
JS app.js M catalog.csv M X
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,3,30
3 1,RPCs for Noobs,distributed systems,9,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,15,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,22,20
```

Note: if the item doesn't exist

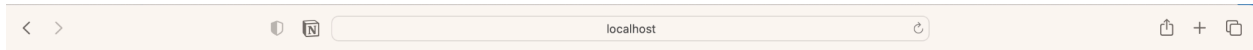
<http://localhost:4000/update/decrement/7>

localhost:4000/update/decrement/7

```
{ "message": "Item not found in the catalog" }
```

### 3) Increment the stock

<http://localhost:4000/update/increment/3/1>

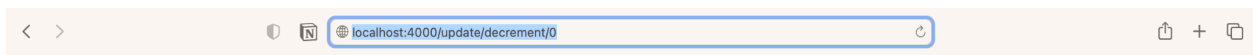


```
JS app.js M • catalog.csv M X
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,3,30
3 1,RPCs for Noobs,distributed systems,9,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,15,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,23,20
```

Note:

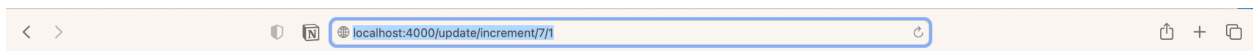
- 1) If the stock was 0 it won't allow the decrement operation.

```
JS app.js M • catalog.csv M X
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,0,30
3 1,RPCs for Noobs,distributed systems,9,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,15,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,23,20
```



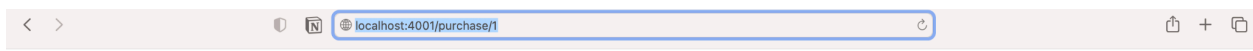
### 2) If the item doesn't exist

<http://localhost:4000/update/increment/7/1>



- Order Server

<http://localhost:4001/purchase/1>



JS app.js M

order.csv M X

order > order.csv

	order_number	item_number
1	0	3
2	1	2
3	2	1
4	3	0
5	4	1
6	5	0
7	6	0
8	7	0
9	8	3
10	9	0
11	10	2
12	11	2
13	12	2
14	13	2
15	14	2
16	15	2
17	16	1
18	17	0
19	18	0
20	19	1

JS app.js M

order.csv M X

order > order.csv

	order_number	item_number
1	0	3
2	1	2
3	2	1
4	3	0
5	4	1
6	5	0
7	6	0
8	7	0
9	8	3
10	9	0
11	10	2
12	11	2
13	12	2
14	13	2
15	14	2
16	15	2
17	16	1
18	17	0
19	18	0
20	19	1
21	20	1

Note:

- 1) If the item doesn't exist

<http://localhost:4001/purchase/6>

< >

localhost:4001/purchase/6

{ "error": "Item not found in the catalog" }

- 2) If the stock is empty

<http://localhost:4001/purchase/0>

< >

localhost:4001/purchase/0

"Item is out of stock"

- Front

First operation: Query

- 1) Search by a topic

<http://localhost:4002/search/distributed%20systems>

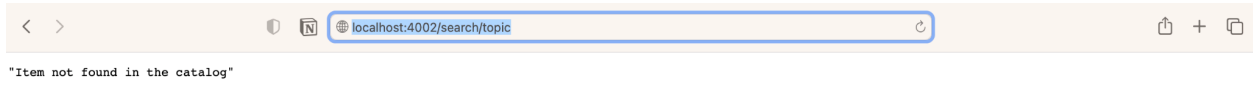


localhost:4002/search/distributed%20systems

```
[{"item_number": "0", "title": "How to get a good grade in DOS in 40 minutes a day", "topic": "distributed systems", "items_in_stock": "0", "cost": "30"}, {"item_number": "1", "title": "RPCs for Noobs", "topic": "distributed systems", "items_in_stock": "6", "cost": "15"}]
```

Note: If the topic doesn't exist

<http://localhost:4002/search/topic>



localhost:4002/search/topic

"Item not found in the catalog"

2) Search by an item number

<http://localhost:4002/info/1>

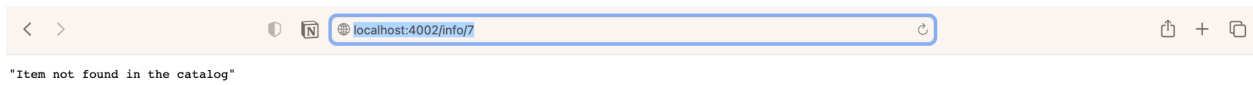


localhost:4002/info/1

```
[{"item_number": "1", "title": "RPCs for Noobs", "topic": "distributed systems", "items_in_stock": "6", "cost": "15"}]
```

Note: If the item doesn't exist

<http://localhost:4002/info/7>

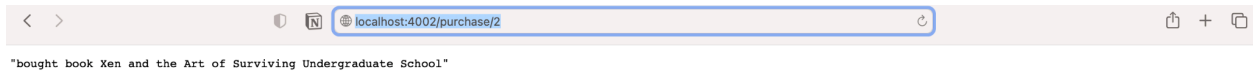


localhost:4002/info/7

"Item not found in the catalog"

Second operation: Purchase

<http://localhost:4002/purchase/2>



localhost:4002/purchase/2

"bought book Xen and the Art of Surviving Undergraduate School"

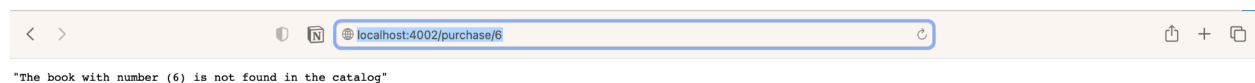
```
order.csv M × JS app.js M
order > order.csv
1 order_number,item_number
2 0,3
3 1,2
4 2,1
5 3,0
6 4,1
7 5,0
8 6,0
9 7,0
10 8,3
11 9,0
12 10,2
13 11,2
14 12,2
15 13,2
16 14,2
17 15,2
18 16,1
19 17,0
20 18,0
21 19,1
22 20,1
23 21,1
24 22,1
25 23,2
```

```
catalog.csv M × JS app.js M
catalog > catalog.csv
1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,0,30
3 1,RPCs for Noobs,distributed systems,6,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,14,10
5 3,Cooking for the Impatient Undergrad,undergraduate school,23,20
```

Note:

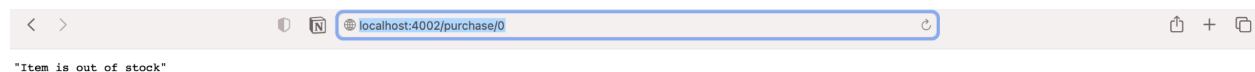
- 1) If the item doesn't exist

<http://localhost:4002/purchase/6>



- 2) If the stock is empty

<http://localhost:4002/purchase/0>



## Part 2:

### Response Time:

Time for info of itemNumber without caching:

2024-01-10 00:11:35	bazar-front-1	time for info: 59 ms
2024-01-10 00:11:45	bazar-front-1	time for info: 10 ms
2024-01-10 00:11:47	bazar-front-1	time for info: 9 ms
2024-01-10 00:11:49	bazar-front-1	time for info: 8 ms
2024-01-10 00:11:51	bazar-front-1	time for info: 8 ms
2024-01-10 00:11:53	bazar-front-1	time for info: 23 ms
2024-01-10 00:11:55	bazar-front-1	time for info: 7 ms

Time for search by topic without caching:

2024-01-09 23:33:27	bazar-front-1	time for search by topic: 41 ms
2024-01-09 23:33:28	bazar-front-1	time for search by topic: 27 ms
2024-01-09 23:33:31	bazar-front-1	time for search by topic: 7 ms
2024-01-09 23:33:35	bazar-front-1	time for search by topic: 6 ms
2024-01-09 23:33:43	bazar-front-1	time for search by topic: 6 ms

Time for purchase without caching:

2024-01-09 23:38:51	bazar-front-1	time for purchase: 17 ms
2024-01-09 23:38:54	bazar-front-1	time for purchase: 17 ms
2024-01-09 23:38:55	bazar-front-1	time for purchase: 31 ms
2024-01-09 23:38:57	bazar-front-1	time for purchase: 22 ms
2024-01-09 23:39:00	bazar-front-1	time for purchase: 29 ms
2024-01-09 23:39:02	bazar-front-1	time for purchase: 28 ms
2024-01-09 23:39:04	bazar-front-1	time for purchase: 18 ms

Time for search by topic , with and without caching"

```
2024-01-09 23:47:28 bazar-front-1 | time for search by topic: 60 ms
2024-01-09 23:47:33 bazar-front-1 | time for search by topic -- cached: 0 ms
2024-01-09 23:47:38 bazar-front-1 | time for search by topic: 8 ms
2024-01-09 23:47:41 bazar-front-1 | time for search by topic -- cached: 0 ms
2024-01-09 23:47:47 bazar-front-1 | time for search by topic: 7 ms
2024-01-09 23:47:50 bazar-front-1 | time for search by topic -- cached: 0 ms
2024-01-09 23:47:51 bazar-front-1 | time for search by topic: 7 ms
2024-01-09 23:47:53 bazar-front-1 | time for search by topic -- cached: 0 ms
2024-01-09 23:47:58 bazar-front-1 | time for search by topic -- cached: 1 ms
2024-01-09 23:47:59 bazar-front-1 | time for search by topic: 6 ms
2024-01-09 23:48:00 bazar-front-1 | time for search by topic -- cached: 0 ms
```

Time for info of itemNumber , with and without caching :

```
2024-01-09 23:49:23 bazar-front-1 | time for info: 16 ms
2024-01-09 23:49:25 bazar-front-1 | time for info -- cached: 0 ms
2024-01-09 23:49:30 bazar-front-1 | time for info: 8 ms
2024-01-09 23:49:32 bazar-front-1 | time for info: 8 ms
2024-01-09 23:49:38 bazar-front-1 | time for info -- cached: 1 ms
2024-01-09 23:49:40 bazar-front-1 | time for info -- cached: 0 ms
2024-01-09 23:49:44 bazar-front-1 | time for info: 7 ms
2024-01-09 23:49:46 bazar-front-1 | time for info -- cached: 0 ms
2024-01-09 23:49:48 bazar-front-1 | time for info: 10 ms
2024-01-09 23:49:49 bazar-front-1 | time for info -- cached: 0 ms
2024-01-09 23:49:51 bazar-front-1 | time for info: 7 ms
2024-01-09 23:49:52 bazar-front-1 | time for info -- cached: 0 ms
2024-01-09 23:49:54 bazar-front-1 | time for info: 10 ms
2024-01-09 23:49:56 bazar-front-1 | time for info -- cached: 0 ms
```

First searched for the item with number 2 , it was uncached, then searched for it again so it was cached, then i purchased it and searched for it after but the item wasn't in the cache since the item has removed from the cache "cache invalidation"

```
2024-01-10 00:04:10 bazar-front-1 | cache when request received: [ null, null, null, null, null ]
2024-01-10 00:04:10 bazar-front-1 | time for info: 43 ms
2024-01-10 00:04:16 bazar-front-1 | cache when request received: [ 'info-2', null, null, null, null ]
2024-01-10 00:04:16 bazar-front-1 | time for info -- cached: 1 ms
2024-01-10 00:04:27 bazar-front-1 | time for purchase: 90 ms
2024-01-10 00:04:42 bazar-front-1 | cache when request received: [ null, null, null, null, null ]
2024-01-10 00:04:42 bazar-front-1 | time for info: 8 ms
```



Request	Without caching	With caching
Search by topic:	7ms	1ms
Search by item number	8ms	0ms

### Shared files between replicas:

if two replicas of a service are writing to the same file in a shared volume, then changes made by one will be visible to the other.

Here you can notice that the file for replica 1 item 2 has 4 in stock:

**bazar-catalog-1**  
bazar  
0f18d62fbc78

STATUS: Running (1 minute ago)

Logs Inspect Bind mounts Exec **Files** Stats

Hide file editor

Name	Note	Size	Last modified	Mode
.dockerenv		0 Bytes	1 minute ago	-rwxr-xr-x
bin -> usr/bin		7 Bytes	3 months ago	Lrwxrwxrwx
boot			2 years ago	drwxr-xr-x

/home/catalog.csv

```

1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,0,25
3 1,RPCs for Noobs,distributed systems,0,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,4,30
5 3,Cooking for the Impatient Undergrad,undergraduate school,21,20
6 4,HowtofinishProject3ontime,new,13,20
7 5,Whytheoryclassesaresohard,new1,18,15
8 6,SpringinthePioneerValley,new2,23,20

```

Same for replica 2:

**bazar-catalog-2**  
bazar  
b505a3166bbe

STATUS: Running (42 seconds ago)

Logs Inspect Bind mounts Exec **Files** Stats

Hide file editor

Name	Note	Size	Last modified	Mode
.dockerenv		0 Bytes	46 seconds ago	-rwxr-xr-x
bin -> usr/bin		7 Bytes	3 months ago	Lrwxrwxrwx
boot			2 years ago	drwxr-xr-x

/home/catalog.csv

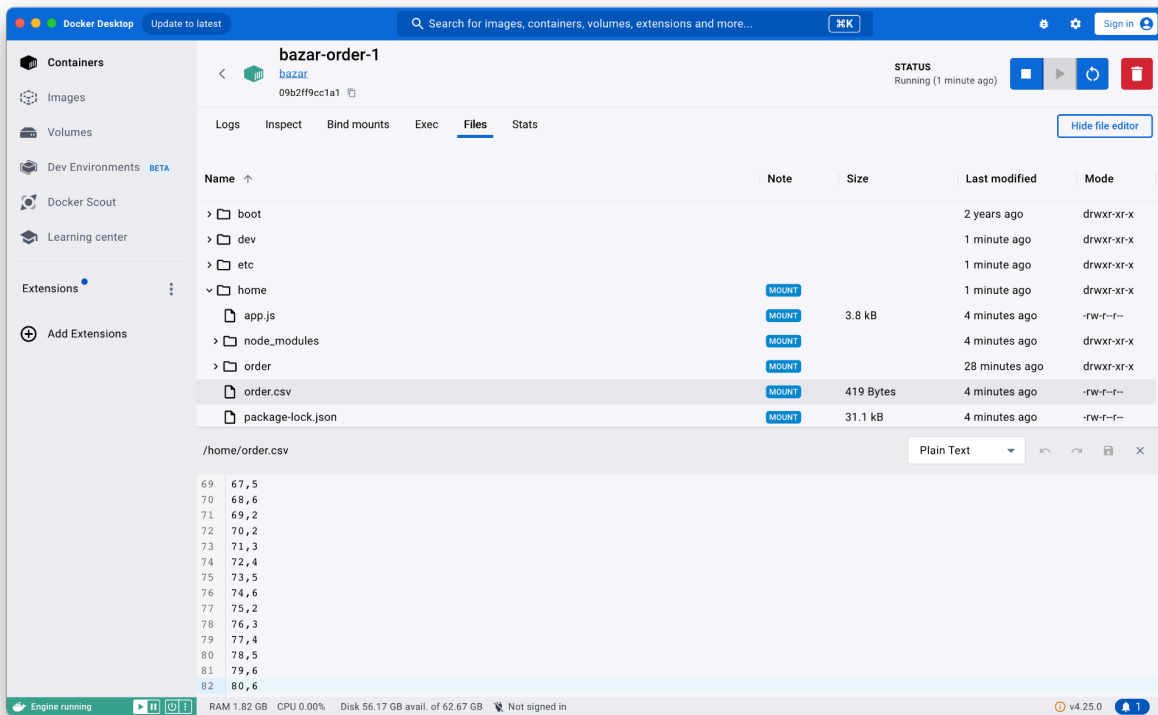
```

1 item_number,title,topic,items_in_stock,cost
2 0,How to get a good grade in DOS in 40 minutes a day,distributed systems,0,25
3 1,RPCs for Noobs,distributed systems,0,15
4 2,Xen and the Art of Surviving Undergraduate School,undergraduate school,4,30
5 3,Cooking for the Impatient Undergrad,undergraduate school,21,20
6 4,HowtofinishProject3ontime,new,13,20
7 5,Whytheoryclassesaresohard,new1,18,15
8 6,SpringinthePioneerValley,new2,23,20

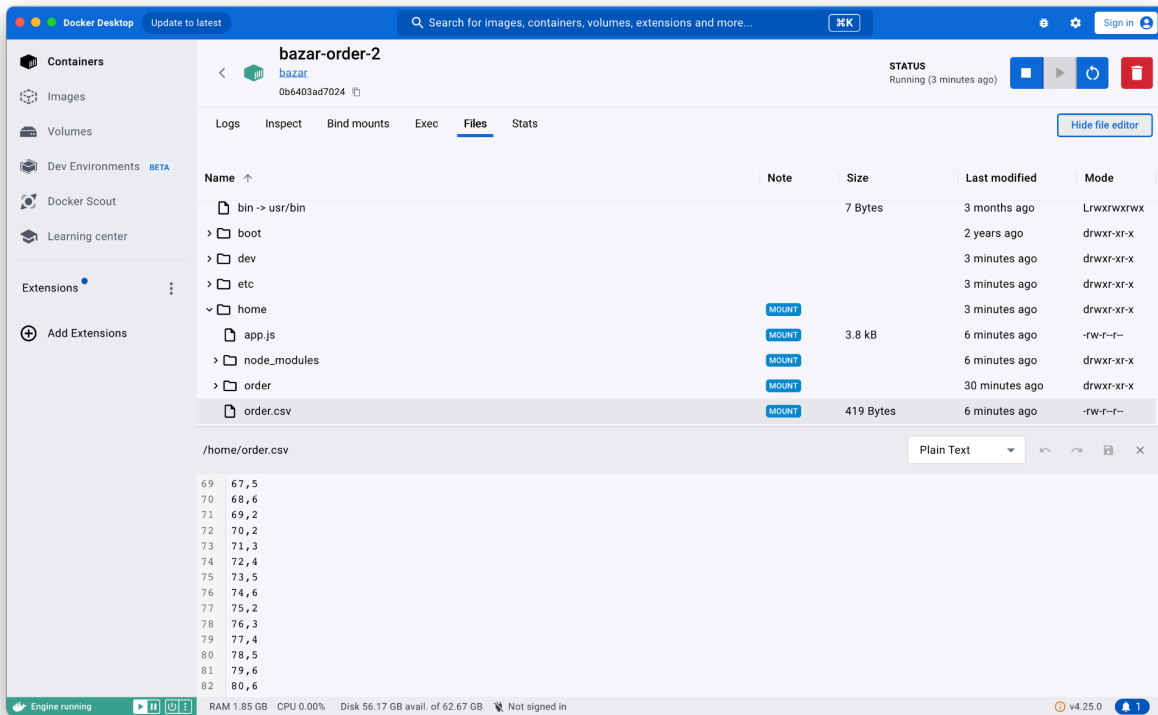
```

After purchasing item 3, the stock is 3 for replica 1:

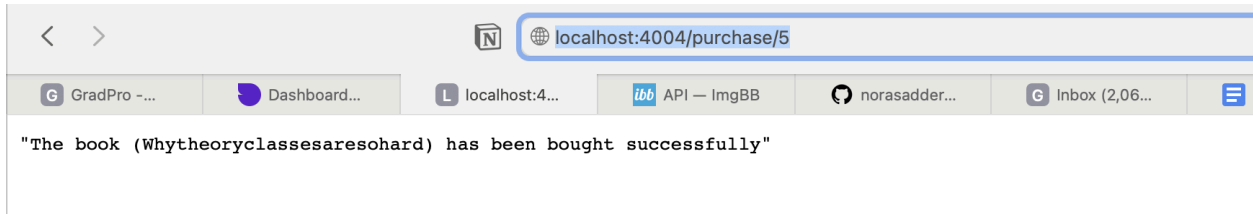




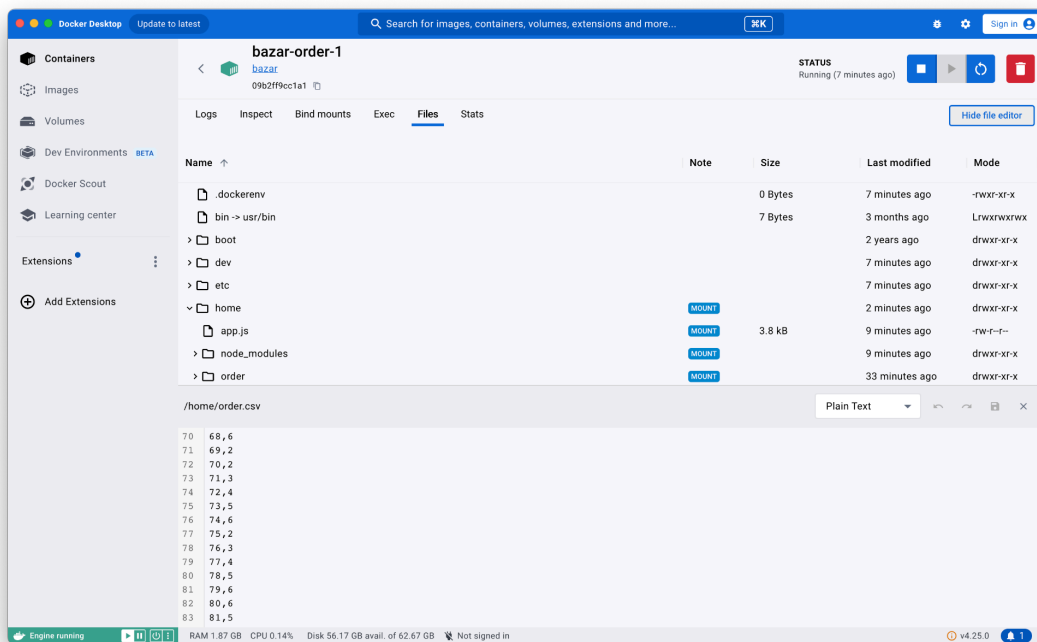
Order file for replica 2:



Purchasing item 5:

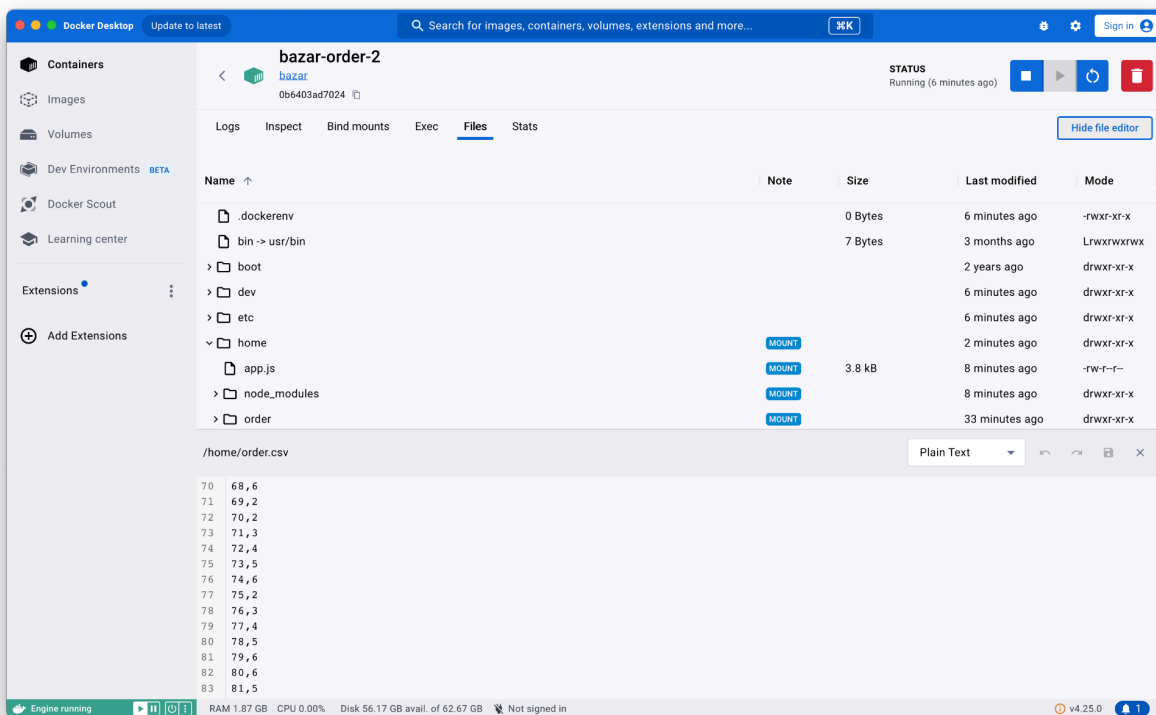


Order file for replica one: we can see that a new row is inserted.

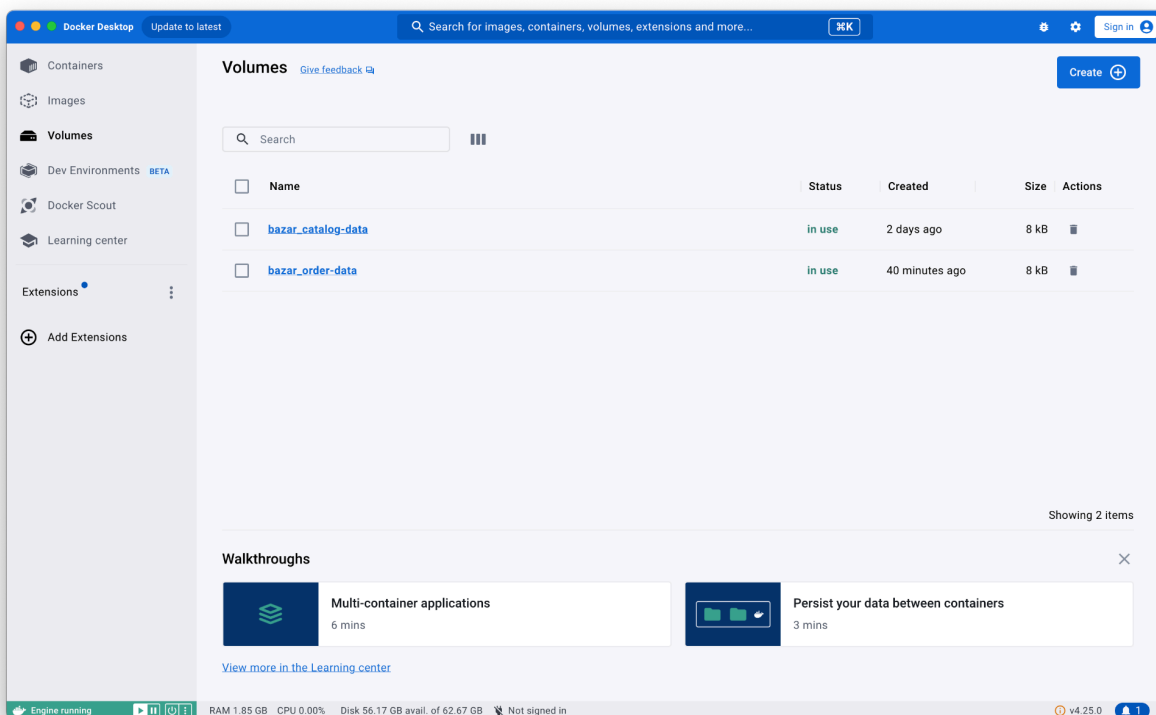


we can see that a new row is inserted.

Now, Let's see replica two order file:



Same as replica one, because the file is shared.



Two replicas for catalog handling the requests.

```
2024-01-10 19:55:28 bazar-catalog-1 | query by item number in catalog server
2024-01-10 19:55:36 bazar-catalog-1 | query by item number in catalog server
2024-01-10 19:55:39 bazar-catalog-2 | search by topic in catalog server
2024-01-10 19:55:40 bazar-catalog-1 | search by topic in catalog server
2024-01-10 19:55:40 bazar-catalog-2 | search by topic in catalog server
2024-01-10 19:55:51 bazar-catalog-1 | query by item number in catalog server
2024-01-10 19:55:59 bazar-catalog-2 | query by item number in catalog server
2024-01-10 19:56:01 bazar-catalog-1 | query by item number in catalog server
2024-01-10 19:56:06 bazar-catalog-2 | search by topic in catalog server
```

Two replicas for order handling the requests.

```
2024-01-10 19:59:13 bazar-order-1 | purchase item in order server
2024-01-10 19:59:15 bazar-order-1 | purchase item in order server
2024-01-10 19:59:16 bazar-order-2 | purchase item in order server
2024-01-10 19:59:18 bazar-order-2 | purchase item in order server
2024-01-10 19:59:32 bazar-order-1 | purchase item in order server
2024-01-10 19:59:34 bazar-order-1 | purchase item in order server
2024-01-10 19:59:35 bazar-order-2 | purchase item in order server
2024-01-10 19:59:36 bazar-order-2 | purchase item in order server
2024-01-10 19:59:36 bazar-order-1 | purchase item in order server
2024-01-10 19:59:37 bazar-order-2 | purchase item in order server
2024-01-10 19:59:37 bazar-order-1 | purchase item in order server
2024-01-10 19:59:38 bazar-order-1 | purchase item in order server
2024-01-10 19:59:47 bazar-order-2 | purchase item in order server
2024-01-10 19:59:53 bazar-order-2 | purchase item in order server
```

The cache size in our code is 5, after caching 5 requests, Using LRU (least recently used) when caching requests for item 5 it replaced the item 0 because it is the least recently used and so on.

```
2024-01-10 20:07:54 bazar-front-1 | query by item number , item number : 0
2024-01-10 20:07:54 bazar-front-1 | cache when request received: [ null, null, null, null, null ]
2024-01-10 20:08:00 bazar-front-1 | query by item number , item number : 1
2024-01-10 20:08:00 bazar-front-1 | cache when request received: [ 'info-0', null, null, null, null ]
2024-01-10 20:08:02 bazar-front-1 | query by item number , item number : 2
2024-01-10 20:08:02 bazar-front-1 | cache when request received: [ 'info-0', 'info-1', null, null, null ]
2024-01-10 20:08:04 bazar-front-1 | query by item number , item number : 3
2024-01-10 20:08:04 bazar-front-1 | cache when request received: [ 'info-0', 'info-1', 'info-2', null, null ]
2024-01-10 20:08:06 bazar-front-1 | query by item number , item number : 4
2024-01-10 20:08:06 bazar-front-1 | cache when request received: [ 'info-0', 'info-1', 'info-2', 'info-3', null ]
2024-01-10 20:08:08 bazar-front-1 | query by item number , item number : 5
2024-01-10 20:08:08 bazar-front-1 | cache when request received: [ 'info-0', 'info-1', 'info-2', 'info-3', 'info-4' ]
2024-01-10 20:08:13 bazar-front-1 | query by item number , item number : 0
2024-01-10 20:08:13 bazar-front-1 | cache when request received: [ 'info-5', 'info-1', 'info-2', 'info-3', 'info-4' ]
2024-01-10 20:08:18 bazar-front-1 | query by item number , item number : 1
2024-01-10 20:08:18 bazar-front-1 | cache when request received: [ 'info-5', 'info-0', 'info-2', 'info-3', 'info-4' ]
```