Performance results of your measurements/experiments should be included in the docs directory. Provide the results/data as simple graphs or tables with brief explanation.

1

Deploy your system on three machines, with each of the three component on a different edlab machine. BE SURE NOT TO USE PORT 80 for your code since it may conflict with processes run by other (also port 80 is reserved and typically not allowed for user processes). Run a client on a separate 4th machine and show that your code works properly by making different types of requests and printing appropriate log messages at the client and the components.

CLIENT

```
chenhaos-MacBook-Pro:artifacts chenhaohuang$ java -jar Client_jar/Client.jar
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
1
What is the topic?
graduate school
{"Xen and the Art of Surviving Graduate School":3,"Cooking for the Impatient Graduate Student":4}
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
1
What is the topic?
nooo
{"message":"no book under the topic is found"}
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
2
What is the item number?
2
{"price":"14.9","name":"RPCs for Dummies","topic":"distributed systems","id":2,"stock":8}
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
3
What is the item number?
2
You bought the book: RPCs for Dummies, the stock is now 7
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
3
What is the item number?
2
You bought the book: RPCs for Dummies, the stock is now 6
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
2
What is the item number?
2
{"price":"14.9","name":"RPCs for Dummies","topic":"distributed systems","id":2,"stock":6}
Welcome, what would you like to do? search, lookup, buy？type in or indicate by number 1,2,3 or quit
```

CATALOG

```
elnux2 src) > cat CATALOG.log
Apr 07, 2020 3:52:23 AM Main main
INFO: Catalog running
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: ======================================
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: book id id has stock in stock
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: book id 1 has 9 in stock
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: book id 2 has 8 in stock
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: book id 3 has 10 in stock
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: book id 4 has 10 in stock
Apr 07, 2020 3:52:23 AM Main setuplog
INFO: ======================================
Apr 07, 2020 3:52:45 AM Main search
INFO: Searching for graduate-school
Apr 07, 2020 3:52:50 AM Main search
INFO: Searching for nooo
Apr 07, 2020 3:52:54 AM Main lookup
INFO: look up for id2
Apr 07, 2020 3:52:57 AM Main lookup
INFO: look up for id2
Apr 07, 2020 3:52:57 AM Main querybuy
INFO: stock for 2 is 8
Apr 07, 2020 3:52:57 AM Main buy
INFO: Buying 2
Apr 07, 2020 3:52:57 AM Main buy
INFO: Writting 2 after buy
Apr 07, 2020 3:53:04 AM Main lookup
INFO: look up for id2
Apr 07, 2020 3:53:04 AM Main querybuy
INFO: stock for 2 is 7
Apr 07, 2020 3:53:04 AM Main buy
INFO: Buying 2
Apr 07, 2020 3:53:04 AM Main buy
INFO: Writting 2 after buy
Apr 07, 2020 3:53:06 AM Main lookup
INFO: look up for id2
```

FRONT end log

```
elnux2 src) > cat FRONT.log
Apr 07, 2020 3:52:33 AM Main lambda$main$0
INFO: search for topic
Apr 07, 2020 3:52:34 AM Main lambda$main$0
```

INFO: topicgraduate-school
Apr 07, 2020 3:52:34 AM Main search
INFO: search graduate-school
Apr 07, 2020 3:52:34 AM Main search
INFO: Sever returns: {"Xen and the Art of Surviving Graduate School":3,"Cooking for the Impatient Graduate Student":4}
Apr 07, 2020 3:52:39 AM Main lambda$main$0
INFO: search for topic
Apr 07, 2020 3:52:39 AM Main lambda$main$0
INFO: topicnooo
Apr 07, 2020 3:52:39 AM Main search
INFO: search nooo
Apr 07, 2020 3:52:39 AM Main search
INFO: Sever returns: {"message":"no book under the topic is found"}
Apr 07, 2020 3:52:42 AM Main lambda$main$1
INFO: look up for id
Apr 07, 2020 3:52:42 AM Main lambda$main$1
INFO: id2
Apr 07, 2020 3:52:42 AM Main lookup
INFO: look up 2
Apr 07, 2020 3:52:42 AM Main lookup
INFO: Sever returns: {"price":"14.9","name":"RPCs for Dummies","topic":"distributed systems","id":2,"stock":8}
Apr 07, 2020 3:52:45 AM Main lambda$main$2
INFO: buy
Apr 07, 2020 3:52:45 AM Main lambda$main$2
INFO: id2
Apr 07, 2020 3:52:45 AM Main buy
INFO: Tring to buy 2
Apr 07, 2020 3:52:45 AM Main buy
INFO: Sever returns: RPCs for Dummies---7
Apr 07, 2020 3:52:52 AM Main lambda$main$2
INFO: buy
Apr 07, 2020 3:52:52 AM Main lambda$main$2
INFO: id2
Apr 07, 2020 3:52:52 AM Main buy
INFO: Tring to buy 2
Apr 07, 2020 3:52:52 AM Main buy
INFO: Sever returns: RPCs for Dummies---6
Apr 07, 2020 3:52:54 AM Main lambda$main$1
INFO: look up for id
Apr 07, 2020 3:52:54 AM Main lambda$main$1
INFO: id2
Apr 07, 2020 3:52:54 AM Main lookup
INFO: look up 2
Apr 07, 2020 3:52:54 AM Main lookup
INFO: Sever returns: {"price":"14.9","name":"RPCs for Dummies","topic":"distributed systems","id":2,"stock":6}

ORDER log

elnux2 src) > cat ORDER.log
Apr 07, 2020 3:52:17 AM Main main
INFO: Order running
Apr 07, 2020 3:52:45 AM Main lambda$main$0
INFO: look 2

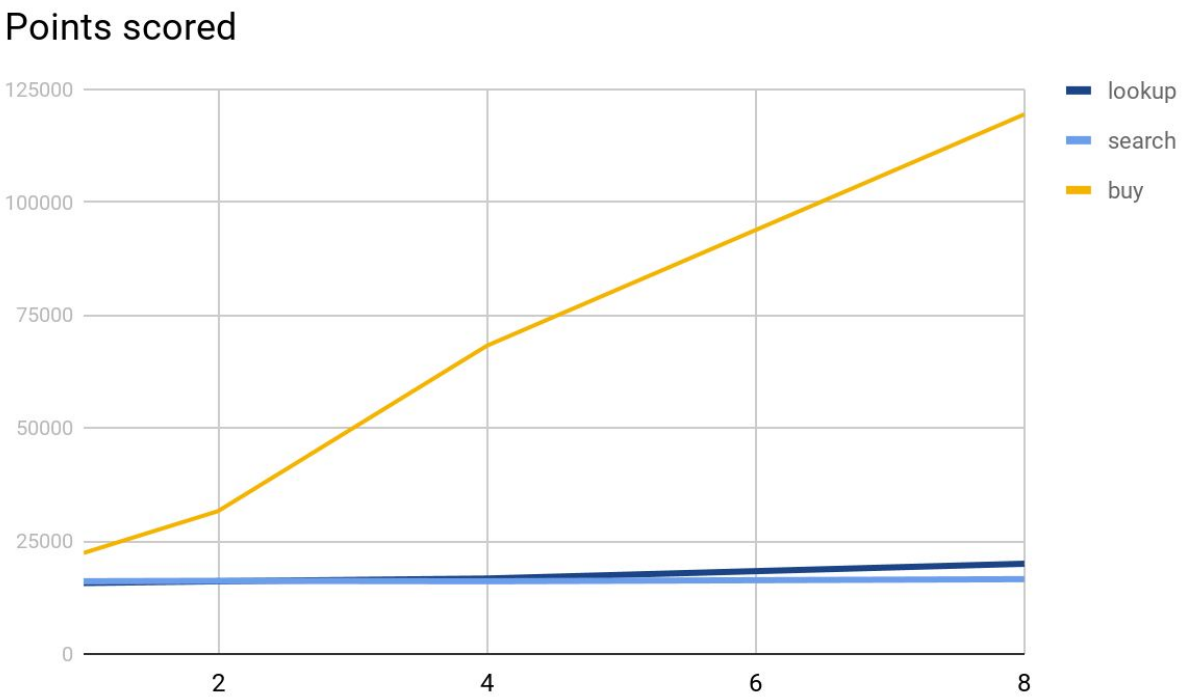
```
Apr 07, 2020 3:52:45 AM Main query
INFO: making query request
Apr 07, 2020 3:52:45 AM Main query
INFO: making buying request
Apr 07, 2020 3:52:45 AM Main query
INFO: Successfully boughtRPCs for Dummies---7
Apr 07, 2020 3:52:52 AM Main lambda$main$0
INFO: look 2
Apr 07, 2020 3:52:52 AM Main query
INFO: making query request
Apr 07, 2020 3:52:52 AM Main query
INFO: making buying request
Apr 07, 2020 3:52:52 AM Main query
INFO: Successfully boughtRPCs for Dummies---6
elnux2 src) >
```

2

Compute the average response time per client search request by measuring the end-to-end response time seen by a client for , say, 1000 sequential requests.

1000 calls of each method	milliseconds	reason
Look up	15710	Easiest call because it finds the the item with ID then it breaks the search
search	16099	More complex than look up since it has to go through the whole database to find all occurance
successful buy	22366	Takes the most time because it need to call order server and query then buy which are three calls
unsuccessful buy	18728	Takes less than successful because the query knows it sold out so it will skip the buying call from order to catalog

Also, measure the response times when multiple clients are concurrently making requests to the system, for instance, you can vary the number of clients and observe how the average response time changes.



3

Following the idea shown above, break down the end-to-end response time into component-specific response times by computing the per-tier response time for query and buy requests

1000 calls of each method	buy	Look up	Search
Front	1824	1998	1780
Order server	2660		
Catalog	7818	572	422

Catalog uses more time to update the database