

Fault Tolerance Experiment

- Scenario 1: All servers are up:
Below are the screenshots of various components

Client.py:

```
Anaconda Prompt - python client.py

(base) C:\Users\swaru>cd C:\Users\swaru\OneDrive\Documents\UMass\677\lab-3-sp\src
(base) C:\Users\swaru\OneDrive\Documents\UMass\677\lab-3-sp\src>python client.py
Welcome to Pygmy.com, the world's smallest book store!

Please select one of the following indices:
1. Search for a topic
2. Lookup a title with its item number
3. Buy a title
2
Please enter an item number you wish to lookup:
If you wish to go to the main menu press b
5
Cost : 25
ItemNumber : 5
Stock : 37
Time : Wed, 24 Apr 2019 22:43:09 GMT
Title : How to finish Project 3 on time
Topic : DistributedSystems

Please enter an item number you wish to lookup:
If you wish to go to the main menu press b
b
Please select one of the following indices:
1. Search for a topic
2. Lookup a title with its item number
3. Buy a title
```

catalogServer1.py: All server flags are '1' which means all are up.

```
Select Anaconda Prompt - python catalogServer1.py

{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:43:40] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:43:50] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:43:50] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:43:53] "POST /restock/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:00] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:00] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:10] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:10] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:20] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:21] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:23] "POST /restock/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:27] "GET /lookup/4 HTTP/1.1" 301 -
192.168.0.9 - - [24/Apr/2019 22:44:27] "GET /lookup/4/ HTTP/1.1" 200 -
new stock = 24
192.168.0.9 - - [24/Apr/2019 22:44:28] "POST /buy/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:29] "PUT /update/1:buy HTTP/1.1" 301 -
Updating stock for How to get a good grade in 677 in 20 minutes a day to 43
192.168.0.9 - - [24/Apr/2019 22:44:30] "PUT /update/1:buy/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:31] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:31] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:31] "PUT /update/6:buy HTTP/1.1" 301 -
Updating stock for Why theory classes are so hard to 45
192.168.0.9 - - [24/Apr/2019 22:44:31] "PUT /update/6:buy/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:41] "GET / HTTP/1.1" 200 -
```

orderServer1.py: The highlighted boxes show that both catalogServers are being requested in a round robin fashion and the other orderServer is also being sent an update request

```
Anaconda Prompt - python orderServer1.py
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:43:50] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:00] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:00] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:10] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:10] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:21] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:21] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:27] "GET /buy/4 HTTP/1.1" 301 -
chose catalog server 1 for buy
Update request sent to orderServer2 to update orders file
192.168.0.9 - - [24/Apr/2019 22:44:28] "GET /buy/4/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:30] "POST /update_order/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:31] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:31] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:31] "GET /buy/6 HTTP/1.1" 301 -
chose catalog server 2 for buy
Update request sent to orderServer2 to update orders file
192.168.0.9 - - [24/Apr/2019 22:44:31] "GET /buy/6/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:41] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:41] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:44:51] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:44:51] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:45:01] "GET / HTTP/1.1" 200 -
```

- Scenario 2: OrderServer2 is down
Below are a few screenshots to demonstrate

frontEndServer.py: The heartbeat has detected that orderServer2 is down and also sends this information to the other servers. All buy requests are now routed to orderServer1

```
Anaconda Prompt - python frontEndServer.py
invalidated
192.168.0.9 - - [24/Apr/2019 22:49:40] "DELETE /invalidate/4/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:40] "GET /buy/4/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:41] "GET /buy/6 HTTP/1.1" 301 -
chose order server 1 for buy
192.168.0.9 - - [24/Apr/2019 22:49:41] "DELETE /invalidate/6 HTTP/1.1" 301 -
entered invalidate
invalidated
192.168.0.9 - - [24/Apr/2019 22:49:41] "DELETE /invalidate/6/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:41] "GET /buy/6/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:42] "GET /buy/1 HTTP/1.1" 301 -
chose order server 1 for buy
192.168.0.9 - - [24/Apr/2019 22:49:42] "DELETE /invalidate/1 HTTP/1.1" 301 -
entered invalidate
invalidated
192.168.0.9 - - [24/Apr/2019 22:49:42] "DELETE /invalidate/1/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:42] "GET /buy/1/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:43] "GET /buy/7 HTTP/1.1" 301 -
chose order server 1 for buy
192.168.0.9 - - [24/Apr/2019 22:49:43] "DELETE /invalidate/7 HTTP/1.1" 301 -
entered invalidate
invalidated
192.168.0.9 - - [24/Apr/2019 22:49:43] "DELETE /invalidate/7/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:43] "GET /buy/7/ HTTP/1.1" 200 -
order2 down
order2 down
order2 down
order2 down
order2 down
```

orderServer1.py

```
Anaconda Prompt - python orderServer1.py
* Debug mode: off
* Running on http://0.0.0.0:8911/ (Press CTRL+C to quit)
192.168.0.9 - - [24/Apr/2019 22:49:23] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:49:24] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:34] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:49:35] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:40] "GET /buy/4 HTTP/1.1" 301 -
chose catalog server 1 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:49:40] "GET /buy/4/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:41] "GET /buy/6 HTTP/1.1" 301 -
chose catalog server 2 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:49:41] "GET /buy/6/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:42] "GET /buy/1 HTTP/1.1" 301 -
chose catalog server 1 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:49:42] "GET /buy/1/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:43] "GET /buy/7 HTTP/1.1" 301 -
chose catalog server 2 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:49:43] "GET /buy/7/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:45] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:49:46] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:49:56] "GET / HTTP/1.1" 200 -
```

- Scenario 3: Catalog Server 1 and order server 2 are down

frontEndServer.py:

[illegible]

catalogServer1.py: All requests are now routed to catalogServer1

```
Anaconda Prompt - python catalogServer2.py
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:04] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:14] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:15] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:26] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:27] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:30] "POST /restock/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:30] "GET /lookup/6 HTTP/1.1" 301 -
192.168.0.9 - - [24/Apr/2019 22:51:30] "GET /lookup/6/ HTTP/1.1" 200 -
catalogServer1 not updated on buy because it is down
new stock = 43
192.168.0.9 - - [24/Apr/2019 22:51:30] "POST /buy/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:31] "GET /lookup/5 HTTP/1.1" 301 -
192.168.0.9 - - [24/Apr/2019 22:51:31] "GET /lookup/5/ HTTP/1.1" 200 -
catalogServer1 not updated on buy because it is down
new stock = 36
192.168.0.9 - - [24/Apr/2019 22:51:32] "POST /buy/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:33] "GET /lookup/5 HTTP/1.1" 301 -
192.168.0.9 - - [24/Apr/2019 22:51:33] "GET /lookup/5/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:34] "GET /lookup/4 HTTP/1.1" 301 -
192.168.0.9 - - [24/Apr/2019 22:51:34] "GET /lookup/4/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:38] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:39] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:50] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:51] "PUT /heartbeat/ HTTP/1.1" 200 -
```

orderServer2:

```
Anaconda Prompt - python orderServer1.py
192.168.0.9 - - [24/Apr/2019 22:50:52] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:50:53] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:03] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:04] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:14] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:15] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:26] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:27] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:30] "GET /buy/6 HTTP/1.1" 301 -
chose catalog server 2 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:51:30] "GET /buy/6/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:31] "GET /buy/5 HTTP/1.1" 301 -
chose catalog server 2 for buy
Cannot update orders for orderServer2 since it is down
192.168.0.9 - - [24/Apr/2019 22:51:32] "GET /buy/5/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:38] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:39] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:51:50] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:51:51] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:52:02] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 0}
192.168.0.9 - - [24/Apr/2019 22:52:03] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:52:14] "GET / HTTP/1.1" 200 -
```

- Scenario 4: catalogServer2 and orderServer1 are restarted

orderServer2.py: Both catalogServers are now being requested

```
(base) C:\Users\swaru\OneDrive\Documents\UMass\677\lab-3-sp\src>python orderServer2.py
syncing
* Serving Flask app "orderServer2" (lazy loading)
* Environment: production
  WARNING: Do not use the development server in a production environment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://0.0.0.0:8915/ (Press CTRL+C to quit)
192.168.0.9 - - [24/Apr/2019 22:55:27] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:55:27] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:55:38] "GET / HTTP/1.1" 200 -
{'catalog1': 0, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:55:39] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:55:49] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:55:49] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:55:59] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:55:59] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:56:09] "GET / HTTP/1.1" 200 -
{'catalog1': 1, 'catalog2': 1, 'order1': 1, 'order2': 1}
192.168.0.9 - - [24/Apr/2019 22:56:09] "PUT /heartbeat/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:56:15] "GET /buy/5 HTTP/1.1" 301 -
chose catalog server 2 for buy
Update request sent to orderServer1 to update orders file
192.168.0.9 - - [24/Apr/2019 22:56:15] "GET /buy/5/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:56:16] "POST /update_order/ HTTP/1.1" 200 -
192.168.0.9 - - [24/Apr/2019 22:56:17] "GET /buy/7 HTTP/1.1" 301 -
chose catalog server 1 for buy
```

Here we can see that flags of both catalog1 and order2 are set to '1'

And all buy requests are now being serviced by both catalogServers