

# 연구 보고서

작성자	김한호	작성일자	2021.04.11.
1. 연구 계획			
<ul style="list-style-type: none"> <li>- Hyperledger caliper 설치</li> <li>- Hyperledger caliper benchmark 실행</li> </ul>			
2. 논문 연구 진행			
하이퍼레저 패브릭 basic 예제의 성능을 caliper를 사용하여 측정함.			
<pre>h2kim@h2kim-VBox:~/fabric-samples/test-network\$ ./network.sh up createChannel Creating channel 'mychannel'. If network is not up, starting nodes with CLI timeout of '5' tries and CLI delay of '3' seconds and using database 'leveldb' Generating channel create transaction 'mychannel.tx' + configtxgen -profile TwoOrgsChannel -outputCreateChannelTx ./channel-artifacts/mychannel.tx -channelID mychannel 2021-04-06 17:05:05.551 KST [common.tools.configtxgen] main -&gt; INFO 001 Loading configuration 2021-04-06 17:05:05.595 KST [common.tools.configtxgen.localconfig] Load -&gt; INFO 002 Loaded configuration: /home/h2kim/fabric-samples/test-network/configtx/configtx.yaml 2021-04-06 17:05:05.595 KST [common.tools.configtxgen] doOutputChannelCreateTx -&gt; INFO 003 Generating new channel configtx 2021-04-06 17:05:05.597 KST [common.tools.configtxgen] doOutputChannelCreateTx -&gt; INFO 004 Writing new channel tx + res=0 Generating anchor peer update transactions Generating anchor peer update transaction for Org1MSP + configtxgen -profile TwoOrgsChannel -outputAnchorPeersUpdate ./channel-artifacts/Org1MSPanchors.tx -channelID mychannel -asOrg Org1MSP 2021-04-06 17:05:05.628 KST [common.tools.configtxgen] main -&gt; INFO 001 Loading configuration 2021-04-06 17:05:05.662 KST [common.tools.configtxgen.localconfig] Load -&gt; INFO 002 Loaded configuration: /home/h2kim/fabric-samples/test-network/configtx/configtx.yaml 2021-04-06 17:05:05.663 KST [common.tools.configtxgen] doOutputAnchorPeersUpdate -&gt; INFO 003 Generating anchor peer update 2021-04-06 17:05:05.668 KST [common.tools.configtxgen] doOutputAnchorPeersUpdate -&gt; INFO 004 Writing anchor peer update + res=0 Generating anchor peer update transaction for Org2MSP + configtxgen -profile TwoOrgsChannel -outputAnchorPeersUpdate ./channel-artifacts/Org2MSPanchors.tx -channelID mychannel -asOrg Org2MSP 2021-04-06 17:05:05.693 KST [common.tools.configtxgen] main -&gt; INFO 001 Loading configuration 2021-04-06 17:05:05.727 KST [common.tools.configtxgen.localconfig] Load -&gt; INFO 002 Loaded configuration: /home/h2kim/fabric-samples/test-network/configtx/configtx.yaml 2021-04-06 17:05:05.727 KST [common.tools.configtxgen] doOutputAnchorPeersUpdate -&gt; INFO 003 Generating anchor peer update 2021-04-06 17:05:05.728 KST [common.tools.configtxgen] doOutputAnchorPeersUpdate -&gt; INFO 004 Writing anchor peer update + res=0 Creating channel mychannel Using organization 1</pre>			
\$ ./network.sh up createChannel 명령어를 사용하여 채널을 생성.			

```

h2kim@h2kim-VBox:~/fabric-samples/test-network$ ./network.sh deployCC -ccn basic -ccl go
deploying chaincode on channel 'mychannel'
executing with the following
- CHANNEL_NAME: mychannel
- CC_NAME: basic
- CC_SRC_PATH: NA
- CC_SRC_LANGUAGE: go
- CC_VERSION: 1.0
- CC_SEQUENCE: 1
- CC_END_POLICY: NA
- CC_COLL_CONFIG: NA
- CC_INIT_FCN: NA
- DELAY: 3
- MAX_RETRY: 5
- VERBOSE: false
Determining the path to the chaincode
asset-transfer-basic
Vendoring Go dependencies at ../asset-transfer-basic/chaincode-go/
~/fabric-samples/asset-transfer-basic/chaincode-go ~/fabric-samples/test-network
~/fabric-samples/test-network
Finished vendoring Go dependencies
Using organization 1
+ peer lifecycle chaincode package basic.tar.gz --path ../asset-transfer-basic/chaincode-go/ --la
ng golang --label basic_1.0

```

\$ ./network.sh deployCC -ccn basic -ccl go 명령어를 사용하여 체인코드 이름은 basic으로 하고 언어는 go언어 기반의 체인코드를 Peer에 올림.

```

h2kim@h2kim-VBox:~/caliper-benchmarks$ docker ps
CONTAINER ID        IMAGE                                     COMMAND                  CREATED             STATUS              PORTS
ND MES
d39254aa7fe7        dev-peer0.org1.example.com-basic_1.0-4ec191e793b27e953ff2ede5a8bcc63152cecb1e4c3f301a26e22692c61967ad-42f57faac8360472e47cbbbf3940e81bba83439702d085878d148089a1b213ca "chaincode -peer.add..." 9 minutes ago       Up 8 minutes
v-peer0.org1.example.com-basic_1.0-4ec191e793b27e953ff2ede5a8bcc63152cecb1e4c3f301a26e22692c61967ad
d93bd6afe390        dev-peer0.org2.example.com-basic_1.0-4ec191e793b27e953ff2ede5a8bcc63152cecb1e4c3f301a26e22692c61967ad-6c0d5b0755cb92ed5555bd2e8a8765a6f425d1ed5ed9a90e625e01939e2113be "chaincode -peer.add..." 9 minutes ago       Up 8 minutes
v-peer0.org2.example.com-basic_1.0-4ec191e793b27e953ff2ede5a8bcc63152cecb1e4c3f301a26e22692c61967ad
d832739c573d        hyperledger/fabric-peer:latest
node start"        11 minutes ago     Up 11 minutes         0.0.0.0:7051->7051/tcp    "peer
er0.org1.example.comc159a0c8fb1b
hyperledger/fabric-peer:latest
node start"        11 minutes ago     Up 11 minutes         7051/tcp, 0.0.0.0:9051->9051/tcp    "peer
er0.org2.example.com58997680c87d
hyperledger/fabric-orderer:latest
rer"                11 minutes ago     Up 11 minutes         0.0.0.0:7050->7050/tcp    "orde
derer.example.com

```

\$ docker ps를 통해 Peer에 체인코드가 올라가 있는 것을 확인할 수 있음.

```

2021.04.06-17:18:19.763 info [caliper] [worker-message-handler] Preparing Worker#0 for Round#0
2021.04.06-17:18:19.763 info [caliper] [connectors/v2/FabricGateway] Connecting user with identity User1 to a Network Gateway
2021.04.06-17:18:19.763 info [caliper] [connectors/v2/FabricGateway] Successfully connected user with identity User1 to a Network Gateway
2021.04.06-17:18:19.771 info [caliper] [connectors/v2/FabricGateway] Generating contract map for user User1
2021.04.06-17:18:19.827 info [caliper] [caliper-worker] Info: worker 0 prepare test phase for round 0 is starting...
Worker 1: Creating asset 1_1
Worker 0: Creating asset 0_1
Worker 0: Creating asset 0_2
Worker 1: Creating asset 1_2
Worker 1: Creating asset 1_3
Worker 0: Creating asset 0_3
Worker 0: Creating asset 0_4
Worker 1: Creating asset 1_4
Worker 0: Creating asset 0_5
Worker 1: Creating asset 1_5
Worker 1: Creating asset 1_6
Worker 0: Creating asset 0_6
Worker 0: Creating asset 0_7
Worker 1: Creating asset 1_7
Worker 1: Creating asset 1_8
Worker 0: Creating asset 0_8
Worker 0: Creating asset 0_9
Worker 1: Creating asset 1_9
2021.04.06-17:18:40.650 info [caliper] [caliper-worker] Info: worker 1 prepare test phase for round 0 is completed
2021.04.06-17:18:40.650 info [caliper] [worker-message-handler] Worker#1 prepared for Round#0
2021.04.06-17:18:40.652 info [caliper] [caliper-worker] Info: worker 0 prepare test phase for round 0 is completed
2021.04.06-17:18:40.652 info [caliper] [worker-message-handler] Worker#0 prepared for Round#0
2021.04.06-17:18:40.653 info [caliper] [worker-orchestrator] 2 workers prepared, progressing to test phase.
2021.04.06-17:18:40.653 info [caliper] [round-orchestrator] Monitors successfully started
2021.04.06-17:18:40.654 info [caliper] [worker-message-handler] Worker#0 is starting Round#0
2021.04.06-17:18:40.655 info [caliper] [worker-message-handler] Worker#1 is starting Round#0
2021.04.06-17:18:40.660 info [caliper] [caliper-worker] Worker #0 starting workload loop
2021.04.06-17:18:40.661 info [caliper] [caliper-worker] Worker #1 starting workload loop

```

\$ npx caliper launch manager --caliper-workspace ./ --caliper-networkconfig networks/networkConfig.yaml --caliper-benchconfig benchmarks/scenario/basic/myAssetBenchmark.yaml --caliper-flow-only-test --caliper-fabric-gateway-enabled 명령어를 입력하여 caliper를 구동시켜 성능을 측정.

```

user User1
2021.04.06-17:19:32.264 info [caliper] [worker-message-handler] Worker#0 finished Round#0
2021.04.06-17:19:37.270 info [caliper] [default-observer] [readAsset Round 0 Transaction In
fo] - Submitted: 0 Succ: 0 Fail:0 Unfinished:0
2021.04.06-17:19:37.271 info [caliper] [report-builder] ### Test result ###
2021.04.06-17:19:37.281 info [caliper] [report-builder]
+-----+-----+-----+-----+-----+-----+-----+
+-----+
| Name      | Succ | Fail | Send Rate (TPS) | Max Latency (s) | Min Latency (s) | Avg Latency (s) |
| Throughput (TPS) |
+-----+-----+-----+-----+-----+-----+-----+
| readAsset | 4431 | 0    | 149.7           | 0.19            | 0.00            | 0.01            |
| 149.7     |      |      |                 |                 |                 |                 |
+-----+-----+-----+-----+-----+-----+-----+
+-----+

2021.04.06-17:19:37.282 info [caliper] [round-orchestrator] Finished round 1 (readAsset) in 3
0.107 seconds
2021.04.06-17:19:37.288 info [caliper] [monitor.js] Stopping all monitors
2021.04.06-17:19:37.288 info [caliper] [report-builder] ### All test results ###
2021.04.06-17:19:37.291 info [caliper] [report-builder]
+-----+-----+-----+-----+-----+-----+-----+
+-----+
| Name      | Succ | Fail | Send Rate (TPS) | Max Latency (s) | Min Latency (s) | Avg Latency (s) |
| Throughput (TPS) |
+-----+-----+-----+-----+-----+-----+-----+
| readAsset | 4431 | 0    | 149.7           | 0.19            | 0.00            | 0.01            |
| 149.7     |      |      |                 |                 |                 |                 |
+-----+-----+-----+-----+-----+-----+-----+
+-----+

2021.04.06-17:19:37.335 info [caliper] [report-builder] Generated report with path /home/
h2kim/caliper-benchmarks/report.html
2021.04.06-17:19:37.335 info [caliper] [monitor.js] Stopping all monitors
2021.04.06-17:19:37.335 info [caliper] [worker-orchestrator] Sending exit message to connected
workers
2021.04.06-17:19:37.336 info [caliper] [worker-message-handler] Worker#0 is exiting
2021.04.06-17:19:37.337 info [caliper] [worker-message-handler] Worker#1 is exiting
2021.04.06-17:19:37.337 info [caliper] [round-orchestrator] Benchmark finished in 78.775 seco
nds. Total rounds: 1. Successful rounds: 1. Failed rounds: 0.
2021.04.06-17:19:37.338 info [caliper] [caliper-engine] Skipping end command due to bench
mark flow conditioning
2021.04.06-17:19:37.338 info [caliper] [cli-launch-manager] Benchmark successfully finished

```

위 명령어를 실행한 측정된 결과를 확인할 수 있음.



## Basic information

DLT: fabric  
Name: basic-contract-benchmark  
Description: test benchmark  
Benchmark Rounds: 1  
[Details](#)

## Benchmark results

[Summary](#)  
[readAsset](#)

## System under test

[Details](#)

# Caliper report

## Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
readAsset	4431	0	149.7	0.19	0.00	0.01	149.7

## Benchmark round: readAsset

### Read asset benchmark

```
txDuration: 30
rateControl:
  type: fixed-load
  opts:
    transactionLoad: 2
```

## Performance metrics for readAsset

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
readAsset	4431	0	149.7	0.19	0.00	0.01	149.7

## Resource utilization for readAsset

\$firefox report.html 명령어를 입력하여 웹브라우저에서 결과를 확인할 수 있음.

하이퍼레저 패브릭 fabcar 예제의 성능을 caliper를 사용하여 측정함.

```
h2kim@h2kim-VBox:~/caliper-benchmarks$ npx caliper launch manager --caliper-workspace ./ --caliper-networkconfig networks/networkConfig.yaml --caliper-benchconfig benchmarks/samples/fabric/fabcar/config.yaml --caliper-flow-only-test --caliper-fabric-gateway-enabled
```

```
$ npx caliper launch manager --caliper-workspace ./ --caliper-networkconfig network/networkConfig.yaml --caliper-benchconfig benchmarks/samples/fabric/fabcar/config.yaml --caliper-flow-only-test --caliper-fabric-gateway-enabled
```

명령어를 사용하여 Peer에 올라간 fabcar 체인코드 성능 측정을 함. fabcar 체인코드 내 소유자 전환(Change car owner), 모든 차 정보 확인(Query all car), 차량 정보 확인(Query a car), 차량생성(Create a car)의 성능측정을 함.

```

2021.04.09-15:17:49.409 info [caliper] [worker-orchestrator] Waiting for 5 workers to be connected...
2021.04.09-15:17:52.380 info [caliper] [cli-launch-worker] Set workspace path: /home/h2kim/caliper-benchmarks
2021.04.09-15:17:52.388 info [caliper] [cli-launch-worker] Set benchmark configuration path: /home/h2kim/caliper-benchmarks/benchmarks/samples/fabric/fabcar/config.yaml
2021.04.09-15:17:52.390 info [caliper] [cli-launch-worker] Set network configuration path: /home/h2kim/caliper-benchmarks/networks/networkConfig.yaml
2021.04.09-15:17:52.394 info [caliper] [cli-launch-worker] Set SUT type: fabric
2021.04.09-15:17:52.436 info [caliper] [cli-launch-worker] Set workspace path: /home/h2kim/caliper-benchmarks
2021.04.09-15:17:52.446 info [caliper] [cli-launch-worker] Set benchmark configuration path: /home/h2kim/caliper-benchmarks/benchmarks/samples/fabric/fabcar/config.yaml
2021.04.09-15:17:52.450 info [caliper] [cli-launch-worker] Set network configuration path: /home/h2kim/caliper-benchmarks/networks/networkConfig.yaml
2021.04.09-15:17:52.451 info [caliper] [cli-launch-worker] Set SUT type: fabric
2021.04.09-15:17:52.453 info [caliper] [cli-launch-worker] Set workspace path: /home/h2kim/caliper-benchmarks
2021.04.09-15:17:52.464 info [caliper] [cli-launch-worker] Set benchmark configuration path: /home/h2kim/caliper-benchmarks/benchmarks/samples/fabric/fabcar/config.yaml
2021.04.09-15:17:52.468 info [caliper] [cli-launch-worker] Set network configuration path: /home/h2kim/caliper-benchmarks/networks/networkConfig.yaml
2021.04.09-15:17:52.469 info [caliper] [cli-launch-worker] Set SUT type: fabric
2021.04.09-15:17:52.490 info [caliper] [cli-launch-worker] Set workspace path: /home/h2kim/caliper-benchmarks
2021.04.09-15:17:52.485 info [caliper] [cli-launch-worker] Set workspace path: /home/h2kim/caliper-benchmarks
2021.04.09-15:17:52.504 info [caliper] [cli-launch-worker] Set benchmark configuration path: /home/h2kim/caliper-benchmarks/benchmarks/samples/fabric/fabcar/config.yaml
2021.04.09-15:17:52.505 info [caliper] [cli-launch-worker] Set network configuration path: /home/h2kim/caliper-benchmarks/networks/networkConfig.yaml
2021.04.09-15:17:52.505 info [caliper] [cli-launch-worker] Set SUT type: fabric
2021.04.09-15:17:52.504 info [caliper] [cli-launch-worker] Set benchmark configuration path: /home/h2kim/caliper-benchmarks/benchmarks/samples/fabric/fabcar/config.yaml
2021.04.09-15:17:52.509 info [caliper] [cli-launch-worker] Set network configuration path: /home/h2kim/caliper-benchmarks/networks/networkConfig.yaml
2021.04.09-15:17:52.509 info [caliper] [cli-launch-worker] Set SUT type: fabric
2021.04.09-15:17:52.956 info [caliper] [worker-orchestrator] 5 workers connected, progressing to worker assignment phase.
2021.04.09-15:17:52.956 info [caliper] [worker-orchestrator] Workers currently unassigned, awaiting index assignment...
2021.04.09-15:17:52.961 info [caliper] [worker-orchestrator] Waiting for 5 workers to be assigned...
2021.04.09-15:17:53.706 info [caliper] [worker-orchestrator] 5 workers assigned, progressing to worker initialization phase.
2021.04.09-15:17:53.706 info [caliper] [worker-orchestrator] Waiting for 5 workers to be ready.

```

설정파일을 입력 받아 성능측정을 위한 준비를 하고 그 이후에 성능 측정을 위한 워커(Worker)를 생성해서 실행을 하는 것을 확인할 수 있음.



```

2021.04.09-15:20:27.708 info [caliper] [connectors/v2/FabricGateway] Generating contract map for user User1
2021.04.09-15:20:27.710 info [caliper] [caliper-worker] Info: worker 1 prepare test phase for round 0 is starting...
2021.04.09-15:55:24.844 info [caliper] [caliper-worker] Info: worker 4 prepare test phase for round 0 is completed
2021.04.09-15:55:24.844 info [caliper] [worker-message-handler] Worker#4 prepared for Round#0
2021.04.09-15:55:24.845 info [caliper] [caliper-worker] Info: worker 2 prepare test phase for round 0 is completed
2021.04.09-15:55:24.846 info [caliper] [caliper-worker] Info: worker 0 prepare test phase for round 0 is completed
2021.04.09-15:55:24.846 info [caliper] [worker-message-handler] Worker#0 prepared for Round#0
2021.04.09-15:55:24.848 info [caliper] [worker-message-handler] Worker#2 prepared for Round#0
2021.04.09-15:55:24.849 info [caliper] [caliper-worker] Info: worker 1 prepare test phase for round 0 is completed
2021.04.09-15:55:24.849 info [caliper] [worker-message-handler] Worker#1 prepared for Round#0
2021.04.09-15:55:24.850 info [caliper] [caliper-worker] Info: worker 3 prepare test phase for round 0 is completed
2021.04.09-15:55:24.850 info [caliper] [worker-message-handler] Worker#3 prepared for Round#0
2021.04.09-15:55:24.851 info [caliper] [worker-orchestrator] 5 workers prepared, progressing to test phase.
2021.04.09-15:55:24.851 info [caliper] [round-orchestrator] Monitors successfully started
2021.04.09-15:55:24.852 info [caliper] [worker-message-handler] Worker#0 is starting Round#0
2021.04.09-15:55:24.863 info [caliper] [worker-message-handler] Worker#1 is starting Round#0
2021.04.09-15:55:24.866 info [caliper] [caliper-worker] Worker #0 starting workload loop
2021.04.09-15:55:24.869 info [caliper] [worker-message-handler] Worker#2 is starting Round#0
2021.04.09-15:55:24.872 info [caliper] [worker-message-handler] Worker#3 is starting Round#0
2021.04.09-15:55:24.876 info [caliper] [caliper-worker] Worker #2 starting workload loop
2021.04.09-15:55:24.879 info [caliper] [caliper-worker] Worker #1 starting workload loop
2021.04.09-15:55:24.880 info [caliper] [worker-message-handler] Worker#4 is starting Round#0
2021.04.09-15:55:24.892 info [caliper] [caliper-worker] Worker #4 starting workload loop
2021.04.09-15:55:24.897 info [caliper] [caliper-worker] Worker #3 starting workload loop
2021.04.09-15:55:29.873 info [caliper] [default-observer] [Change car owner. Round 0 Transaction Info] - Submitted: 32 Succ: 30 Fail:0 Unfinished:2
2021.04.09-15:55:34.855 info [caliper] [default-observer] [Change car owner. Round 0 Transaction Info] - Submitted: 260 Succ: 250 Fail:0 Unfinished:10

```

워커가 모두 생성되면 설정되어 있는 체인코드를 실행.

트랜잭션을 실행하여 성능 측정하는 것을 확인할 수 있음.

```

2021.04.09-15:58:14.136 info [caliper] [round-orchestrator] Finished round 4 (Create a car.) in 32.214 seconds
2021.04.09-15:58:14.141 info [caliper] [monitor.js] Stopping all monitors
2021.04.09-15:58:14.141 info [caliper] [report-builder] ### All test results ###
2021.04.09-15:58:14.156 info [caliper] [report-builder]
+-----+-----+-----+-----+-----+-----+-----+
| Name | Succ | Fail | Send Rate (TPS) | Max Latency (s) | Min Latency (s) | Avg Latency (s) | Throughput (TPS) |
+-----+-----+-----+-----+-----+-----+-----+
| Change car owner. | 888 | 0 | 30.4 | 2.08 | 0.04 | 0.22 | 28.7 |
+-----+-----+-----+-----+-----+-----+-----+
| Query all cars. | 244 | 0 | 8.0 | 1.29 | 0.11 | 0.75 | 8.0 |
+-----+-----+-----+-----+-----+-----+-----+
| Query a car. | 4844 | 0 | 166.8 | 0.20 | 0.00 | 0.03 | 166.8 |
+-----+-----+-----+-----+-----+-----+-----+
| Create a car. | 944 | 0 | 32.3 | 2.10 | 0.04 | 0.20 | 30.3 |
+-----+-----+-----+-----+-----+-----+-----+
2021.04.09-15:58:14.205 info [caliper] [report-builder] Generated report with path /home/h2kim/caliper-benchmarks/report.html
2021.04.09-15:58:14.205 info [caliper] [monitor.js] Stopping all monitors
2021.04.09-15:58:14.205 info [caliper] [worker-orchestrator] Sending exit message to connected workers
2021.04.09-15:58:14.206 info [caliper] [worker-message-handler] Worker#0 is exiting
2021.04.09-15:58:14.207 info [caliper] [worker-message-handler] Worker#1 is exiting
2021.04.09-15:58:14.208 info [caliper] [worker-message-handler] Worker#2 is exiting
2021.04.09-15:58:14.209 info [caliper] [worker-message-handler] Worker#3 is exiting
2021.04.09-15:58:14.210 info [caliper] [worker-message-handler] Worker#4 is exiting
2021.04.09-15:58:14.210 info [caliper] [round-orchestrator] Benchmark finished in 2270.051 seconds. Total rounds: 4. Successful rounds: 4. Failed rounds: 0.
2021.04.09-15:58:14.210 info [caliper] [caliper-engine] Skipping end command due to benchmark flow conditioning

```

명령어 실행이 끝나면 각 함수가 실행된 결과 값을 보여주고 워커들이 정지하게 됨.





## Basic information

DLT: fabric

Name:

Description:

Benchmark Rounds: 4

[Details](#)

## Benchmark results

[Summary](#)

[Change car owner.](#)

[Query all cars.](#)

[Query a car.](#)

[Create a car.](#)

## System under test

[Details](#)

# Caliper report

## Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
Change car owner.	888	0	30.4	2.08	0.04	0.22	28.7
Query all cars.	244	0	8.0	1.29	0.11	0.75	8.0
Query a car.	4844	0	166.8	0.20	0.00	0.03	166.8
Create a car.	944	0	32.3	2.10	0.04	0.20	30.3

## Benchmark round: Change car owner.

```
txDuration: 30
rateControl:
  type: fixed-load
  opts:
    transactionLoad: 5
```

\$ firefox report.html 명령어를 입력하면 성능측정한 값과 설정한 정보를 확인할 수 있음.

## 3. 차주 계획

- Hyperledger caliper를 이용해 각 Peer에 속한 유저의 성능을 측정.
- 다른 Peer에 다른 함수를 실행하여 성능을 측정.

## 4. 참고 웹페이지

- [1] <https://hyperledger.github.io/caliper/v0.4.2/fabric-config/new/>
- [2] <https://hyperledger.github.io/caliper/v0.4.2/fabric-tutorial/tutorials-fabric-existing/>
- [3] <https://www.notion.so/67120062244e4c4781b4f38af54341a2>
- [4] <https://hyperledger.github.io/caliper/v0.3.2/fabric-config/>
- [5] [https://hyperledger-fabric.readthedocs.io/en/release-2.2/write\\_first\\_app.html](https://hyperledger-fabric.readthedocs.io/en/release-2.2/write_first_app.html)
- [6] <https://thinkit.co.jp/article/18190>

