Tugas Individu 2

Sistem Paralel dan Terdistribusi A

Sinkronisasi dan Distributed Systems

Disusun Oleh :

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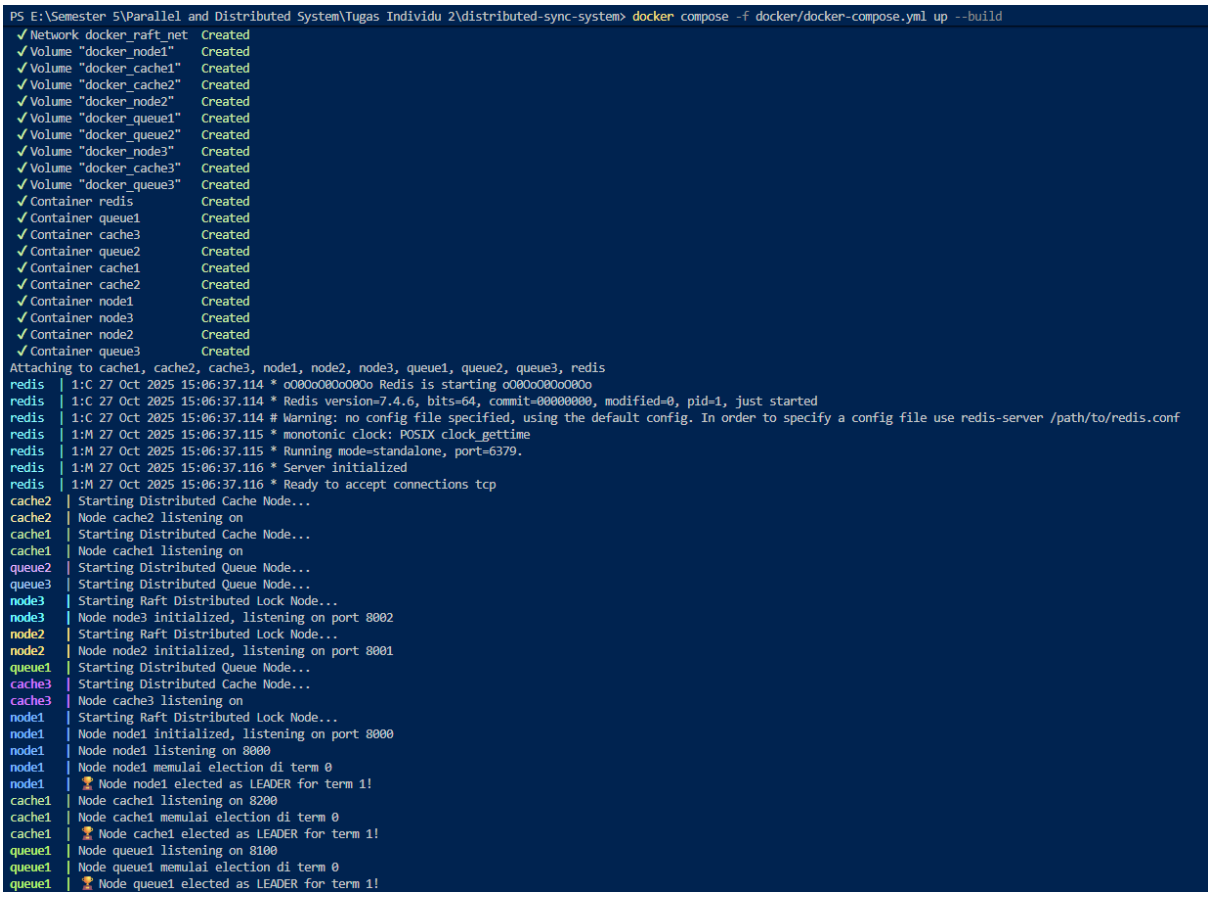
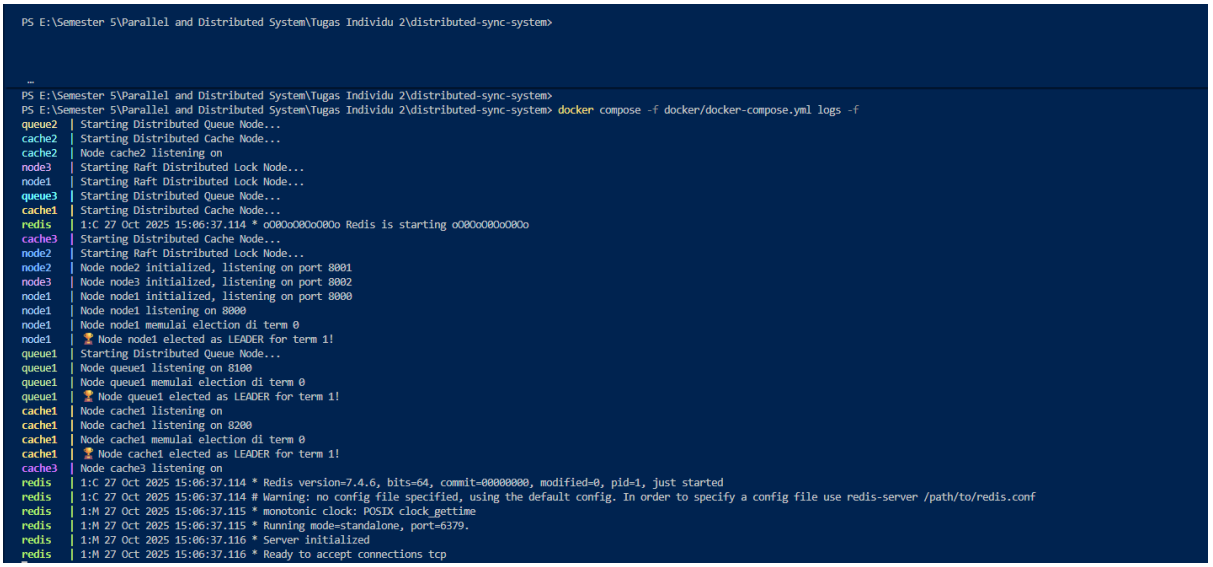
DOKUMENTASI

Build and Run Docker File



```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> docker compose -f docker/docker-compose.yml up --build
 ✓ Network docker_raft_net  Created
 ✓ Volume "docker_node1"    Created
 ✓ Volume "docker_cache1"   Created
 ✓ Volume "docker_cache2"   Created
 ✓ Volume "docker_node2"    Created
 ✓ Volume "docker_queue1"   Created
 ✓ Volume "docker_queue2"   Created
 ✓ Volume "docker_node3"    Created
 ✓ Volume "docker_cache3"   Created
 ✓ Volume "docker_queue3"   Created
 ✓ Container redis          Created
 ✓ Container queue1         Created
 ✓ Container cache3         Created
 ✓ Container queue2         Created
 ✓ Container cache1         Created
 ✓ Container cache2         Created
 ✓ Container node1          Created
 ✓ Container node3          Created
 ✓ Container node2          Created
 ✓ Container queue3         Created
Attaching to cache1, cache2, cache3, node1, node2, node3, queue1, queue2, queue3, redis
redis  | 1:C 27 Oct 2025 15:06:37.114 * oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
redis  | 1:C 27 Oct 2025 15:06:37.114 * Redis version=7.4.6, bits=64, commit=00000000, modified=0, pid=1, just started
redis  | 1:C 27 Oct 2025 15:06:37.114 # Warning: no config file specified, using the default config. In order to specify a config file use redis-server /path/to/redis.conf
redis  | 1:M 27 Oct 2025 15:06:37.115 * monotonic clock: POSIX clock_gettime
redis  | 1:M 27 Oct 2025 15:06:37.115 * Running mode=standalone, port=6379.
redis  | 1:M 27 Oct 2025 15:06:37.116 * Server initialized
redis  | 1:M 27 Oct 2025 15:06:37.116 * Ready to accept connections tcp
cache2 | Starting Distributed Cache Node...
cache2 | Node cache2 listening on
cache1 | Starting Distributed Cache Node...
cache1 | Node cache1 listening on
queue2 | Starting Distributed Queue Node...
queue3 | Starting Distributed Queue Node...
node3  | Starting Raft Distributed Lock Node...
node3  | Node node3 initialized, listening on port 8002
node2  | Starting Raft Distributed Lock Node...
node2  | Node node2 initialized, listening on port 8001
queue1 | Starting Distributed Queue Node...
cache3 | Starting Distributed Cache Node...
cache3 | Node cache3 listening on
node1  | Starting Raft Distributed Lock Node...
node1  | Node node1 initialized, listening on port 8000
node1  | Node node1 listening on 8000
node1  | Node node1 memulai election di term 0
node1  | 🏆 Node node1 elected as LEADER for term 1!
cache1 | Node cache1 listening on 8200
cache1 | Node cache1 memulai election di term 0
cache1 | 🏆 Node cache1 elected as LEADER for term 1!
queue1 | Node queue1 listening on 8100
queue1 | Node queue1 memulai election di term 0
queue1 | 🏆 Node queue1 elected as LEADER for term 1!
```

Cek Logs


PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system>
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system>
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> docker compose -f docker/docker-compose.yml logs -f
queue2 | Starting Distributed Queue Node...
cache2 | Starting Distributed Cache Node...
cache2 | Node cache2 listening on
node3 | Starting Raft Distributed Lock Node...
node1 | Starting Raft Distributed Lock Node...
queue3 | Starting Distributed Queue Node...
cache1 | Starting Distributed Cache Node...
redis | 1:C 27 Oct 2025 15:06:37.114 * oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
cache3 | Starting Distributed Cache Node...
node2 | Starting Raft Distributed Lock Node...
node2 | Node node2 initialized, listening on port 8001
node3 | Node node3 initialized, listening on port 8002
node1 | Node node1 initialized, listening on port 8000
node1 | Node node1 listening on 8000
node1 | Node node1 memulai election di term 0
node1 | 🏆 Node node1 elected as LEADER for term 1!
queue1 | Starting Distributed Queue Node...
queue1 | Node queue1 listening on 8100
queue1 | Node queue1 memulai election di term 0
queue1 | 🏆 Node queue1 elected as LEADER for term 1!
cache1 | Node cache1 listening on
cache1 | Node cache1 listening on 8200
cache1 | Node cache1 memulai election di term 0
cache1 | 🏆 Node cache1 elected as LEADER for term 1!
cache3 | Node cache3 listening on
redis | 1:C 27 Oct 2025 15:06:37.114 * Redis version=7.4.6, bits=64, commit=00000000, modified=0, pid=1, just started
redis | 1:C 27 Oct 2025 15:06:37.114 # Warning: no config file specified, using the default config. In order to specify a config file use redis-server /path/to/redis.conf
redis | 1:M 27 Oct 2025 15:06:37.115 * monotonic clock: POSIX clock_gettime
redis | 1:M 27 Oct 2025 15:06:37.115 * Running mode=standalone, port=6379.
redis | 1:M 27 Oct 2025 15:06:37.116 * Server initialized
redis | 1:M 27 Oct 2025 15:06:37.116 * Ready to accept connections tcp

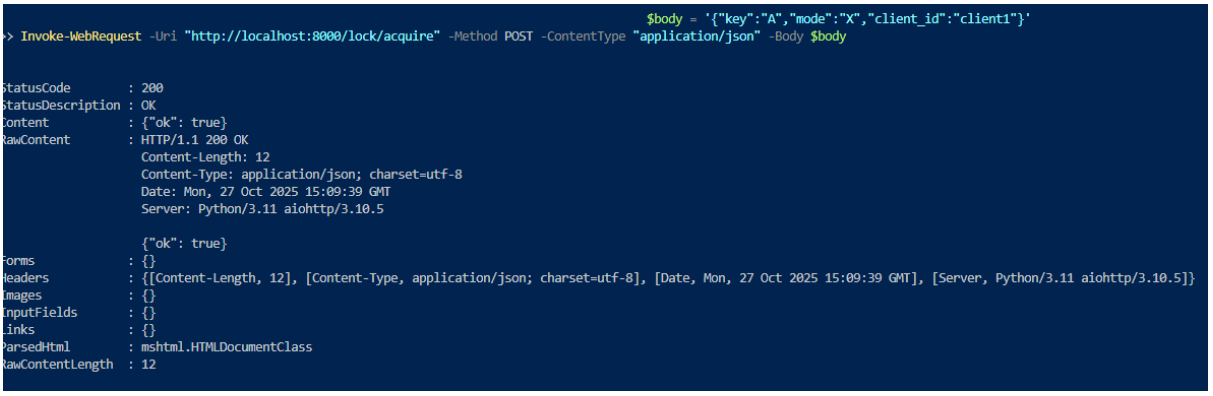
Lock Cluster - Check Health and Leader

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8000/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "node1", "role": 2, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 49
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:08:40 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "node1", "role": 2, "t...
Forms             : {}
Headers           : {[Content-Length, 49], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:08:40 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 49
```

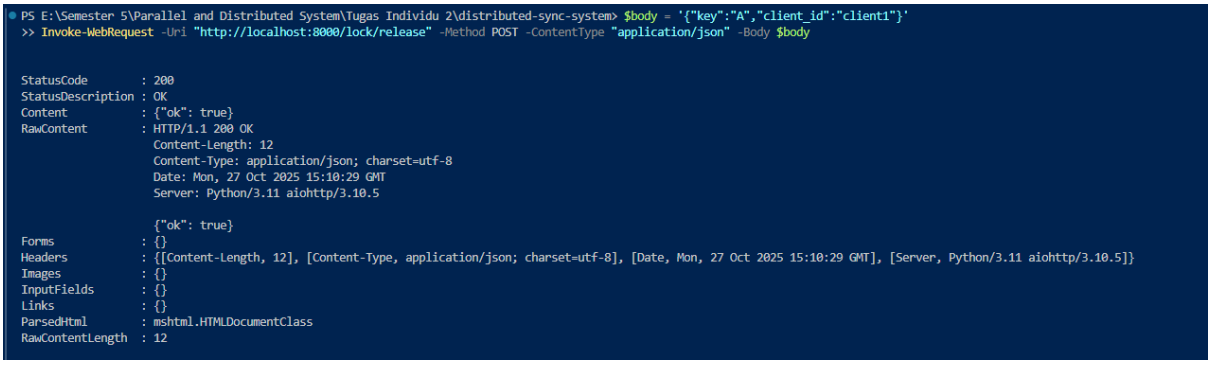
```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8001/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "node2", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 49
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:09:03 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "node2", "role": 0, "t...
Forms             : {}
Headers           : {[Content-Length, 49], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:09:03 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 49
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8002/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "node3", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 49
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:09:15 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "node3", "role": 0, "t...
Forms             : {}
Headers           : {[Content-Length, 49], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:09:15 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 49
```

Lock Cluster - Acquire Lock



Lock Cluster - Release Lock



Queue Cluster - Check Health and Leader

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8100/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "queue1", "role": 2, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:11:40 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "queue1", "role": 2, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:11:40 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8101/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "queue2", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:11:58 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "queue2", "role": 0, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:11:58 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8102/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "queue3", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:12:11 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "queue3", "role": 0, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:12:11 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

Queue Cluster - Enqueue

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> $body = '{"key":"user:42","value":"hello"}'
>> Invoke-WebRequest -Uri "http://localhost:8100/queue/enq" -Method POST -ContentType "application/json" -Body $body


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 12
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:12:57 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true}
Forms             : {}
Headers           : {[Content-Length, 12], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:12:57 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 12
```

Queue Cluster - Dequeue

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> Invoke-WebRequest -Uri "http://localhost:8100/queue/deq" -Method POST


StatusCode        : 200
StatusDescription : OK
Content           : {"msg_id": "1761578009400838721", "payload": {"key": "user:42", "value": "hello"}}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 82
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:13:29 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"msg_id": "1761578009400838721", "payloa...
Forms             : {}
Headers           : {[Content-Length, 82], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:13:29 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 82
```

Queue Cluster - Ack Message

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> $ack = '{"msg_id":"<MSG_ID_DARI_DEQ>"}'
>> Invoke-WebRequest -Uri "http://localhost:8100/queue/ack" -Method POST -ContentType "application/json" -Body $ack


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 12
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:13:51 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true}
Forms             : {}
Headers           : {[Content-Length, 12], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:13:51 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 12
```

Cache Cluster - Check Health and Leader

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8200/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "cache1", "role": 2, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:14:37 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "cache1", "role": 2, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:14:37 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8201/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "cache2", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:14:52 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "cache2", "role": 0, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:14:52 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> curl http://localhost:8202/health


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true, "id": "cache3", "role": 0, "term": 1}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 50
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:16:00 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true, "id": "cache3", "role": 0, "...
Forms             : {}
Headers           : {[Content-Length, 50], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:16:00 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 50
```

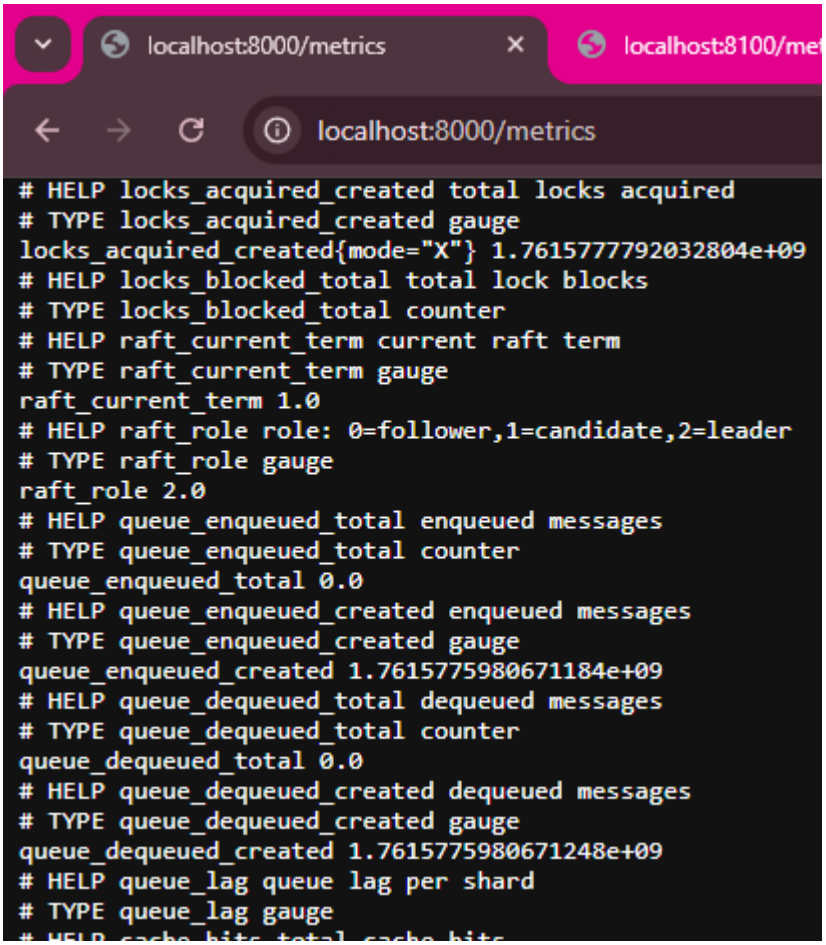
Cache Cluster - PUT Data

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> $body = @'
>> {"key":"user:42","val":{"name":"Arya","score":99}}
>> '@
>> Invoke-WebRequest -Uri "http://localhost:8200/cache/put" -Method POST -ContentType "application/json" -Body $body


StatusCode        : 200
StatusDescription : OK
Content           : {"ok": true}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 12
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:16:39 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"ok": true}
Forms             : {}
Headers           : {[Content-Length, 12], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:16:39 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 12
```

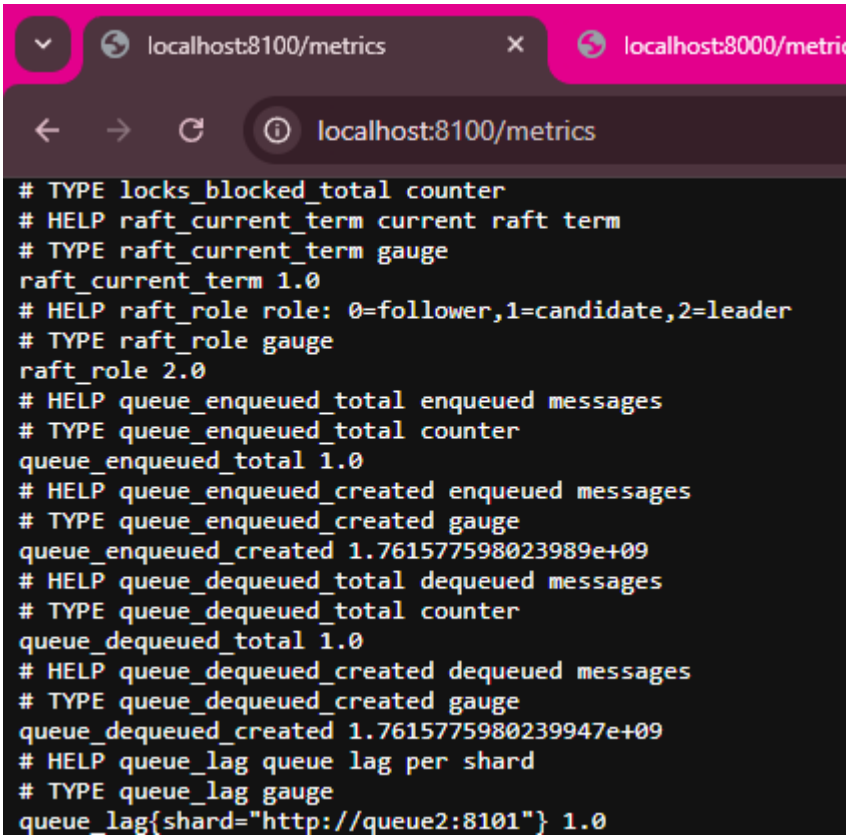
Cache Cluster - GET Data

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> $body = @'
>> {"key":"user:42"}
>> '@
>> Invoke-WebRequest -Uri "http://localhost:8200/cache/get" -Method POST -ContentType "application/json" -Body $body


StatusCode        : 200
StatusDescription : OK
Content           : {"hit": true, "val": {"name": "Arya", "score": 99}, "state": "M"}
RawContent        : HTTP/1.1 200 OK
                    Content-Length: 65
                    Content-Type: application/json; charset=utf-8
                    Date: Mon, 27 Oct 2025 15:17:08 GMT
                    Server: Python/3.11 aiohttp/3.10.5

                    {"hit": true, "val": {"name": "Arya", "sc...
Forms             : {}
Headers           : {[Content-Length, 65], [Content-Type, application/json; charset=utf-8], [Date, Mon, 27 Oct 2025 15:17:08 GMT], [Server, Python/3.11 aiohttp/3.10.5]}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 65
```

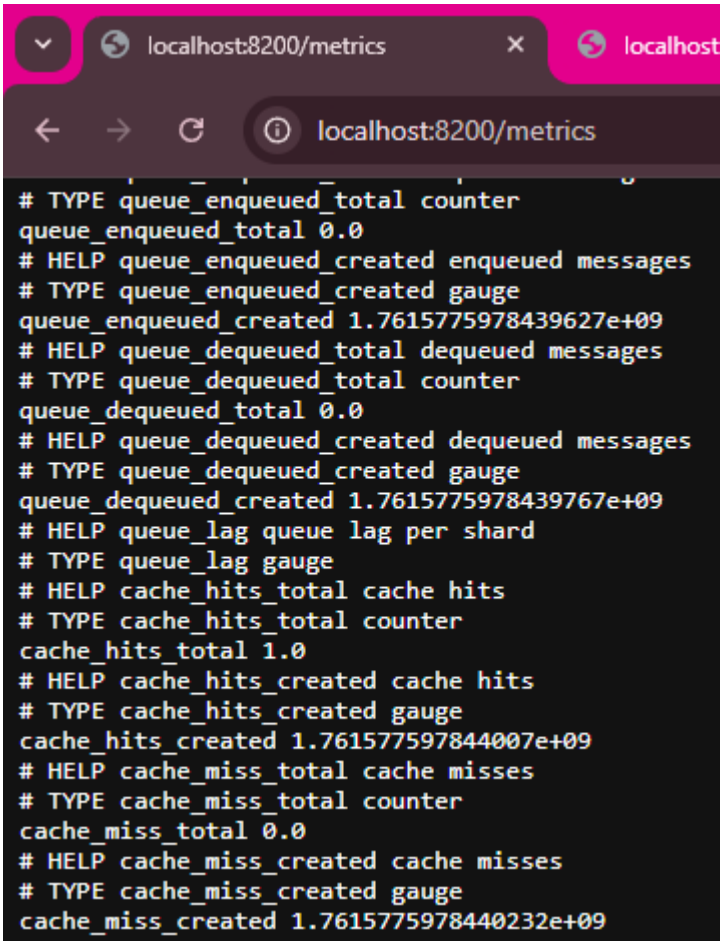
Metrics Monitoring - Lock Node



Metrics Monitoring - Queue Node



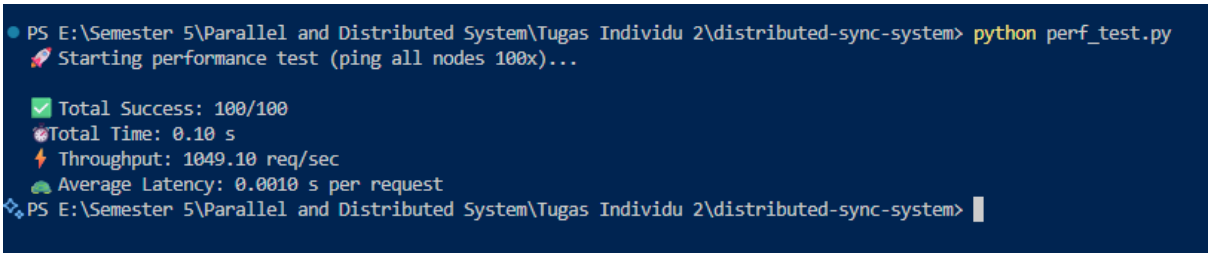
Metrics Monitoring - Cache Node



Metrics Monitoring - RPC Latency

```
rpc_latency_seconds_bucket{le="0.005",op="request_vote"} 0.0
rpc_latency_seconds_bucket{le="0.01",op="request_vote"} 0.0
rpc_latency_seconds_bucket{le="0.025",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.05",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.075",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.1",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.25",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.5",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="0.75",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="1.0",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="2.5",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="5.0",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="7.5",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="10.0",op="request_vote"} 2.0
rpc_latency_seconds_bucket{le="+Inf",op="request_vote"} 2.0
rpc_latency_seconds_count{op="request_vote"} 2.0
rpc_latency_seconds_sum{op="request_vote"} 0.022359041000072466
rpc_latency_seconds_bucket{le="0.005",op="append_entries"} 1372.0
rpc_latency_seconds_bucket{le="0.01",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.025",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.05",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.075",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.1",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.25",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.5",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="0.75",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="1.0",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="2.5",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="5.0",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="7.5",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="10.0",op="append_entries"} 1428.0
rpc_latency_seconds_bucket{le="+Inf",op="append_entries"} 1428.0
rpc_latency_seconds_count{op="append_entries"} 1428.0
rpc_latency_seconds_sum{op="append_entries"} 4.130925122989993
# HELP rpc_latency_seconds_created rpc latency
# TYPE rpc_latency_seconds_created gauge
rpc_latency_seconds_created{op="request_vote"} 1.7615776004230604e+09
rpc_latency_seconds_created{op="append_entries"} 1.7615776014266803e+09
```

Test Monitoring - Cluster Node



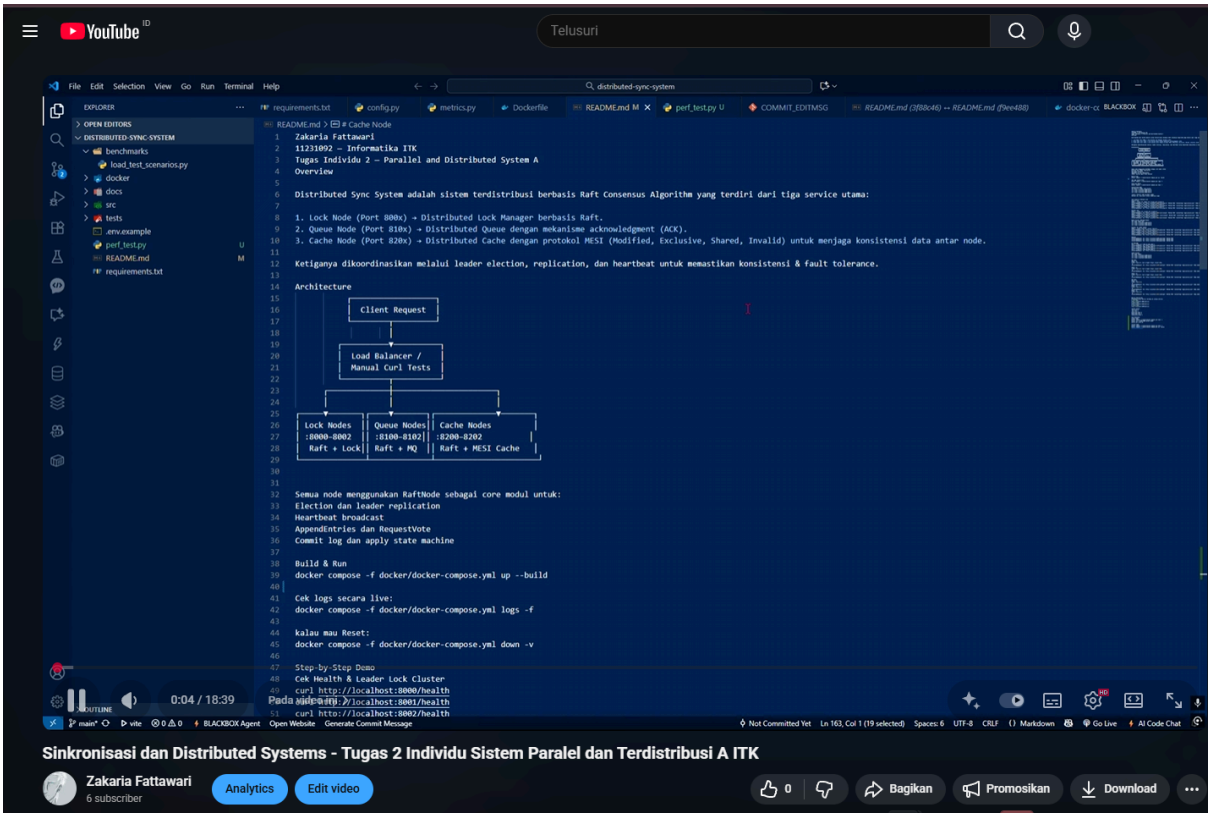
Test Monitoring - Single Node

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> docker compose -f docker/docker-compose.yml down -v
[+] Running 20/20
 ✓ Container queue3          Removed
 ✓ Container cache1          Removed
 ✓ Container cache2          Removed
 ✓ Container queue2          Removed
 ✓ Container node3           Removed
 ✓ Container node1           Removed
 ✓ Container node2           Removed
 ✓ Container queue1          Removed
 ✓ Container cache3          Removed
 ✓ Container redis           Removed
 ✓ Volume docker_cache3      Removed
 ✓ Volume docker_queue3      Removed
 ✓ Volume docker_cache2      Removed
 ✓ Volume docker_queue1      Removed
 ✓ Volume docker_queue2      Removed
 ✓ Volume docker_node3       Removed
 ✓ Network docker_raft_net   Removed
 ✓ Volume docker_node1       Removed
 ✓ Volume docker_cache1      Removed
 ✓ Volume docker_node2       Removed
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> docker run -p 8000:8000 docker-node1
Starting Raft Distributed Lock Node...
Node node-1 initialized, listening on port 8000
Node node-1 listening on 8000
Node node-1 memulai election di term 0
🏆 Node node-1 elected as LEADER for term 1!
[node-1] Became LEADER at term 1, starting heartbeat loop
```

```
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system> python perf_test.py
🚀 Starting performance test (ping all nodes 100x)...

✅ Total Success: 34/100
⏱️ Total Time: 2.34 s
⚡ Throughput: 14.55 req/sec
🐢 Average Latency: 0.0234 s per request
PS E:\Semester 5\Parallel and Distributed System\Tugas Individu 2\distributed-sync-system>
```

Video

Link Video Youtube:



https://youtu.be/smnjEYT1LxM.