

Міністерство освіти і науки України
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Проектування високонавантажених систем

Лабораторна робота No2
MassiveCounterIncrement

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Перевірив:

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1 Код реалізації

BaseCounter.py

```
from abc import ABC, abstractmethod
import hazelcast
# import time
# from tqdm import tqdm

class BaseCounter(ABC):
    def __init__(self, client: hazelcast.HazelcastClient, name: str,
key: str = "counter"):
        self.client = client
        self.name = name
        self.key = key

    @abstractmethod
    def increment(self):
        pass

    def bulk_increment(self, n: int): # , log_every: int = 1

        # for _ in tqdm(range(n), desc=f"{self.name}: "):
        for iteration in range(n):
            # t0 = time.time()
            self.increment()
            # dt = time.time() - t0
            # avg = dt if avg is None else avg * 0.95 + dt * 0.05

            # if iteration % log_every == 0:
            #     eta = avg * (n - iteration)
            #     print(f"[{iteration}/{n}] [{self.name}] ETA: {eta:.2f
}s", flush=True)
```

AtomicLongCounter.py

```
from Counters.BaseCounter import BaseCounter

class AtomicLongCounter(BaseCounter):
    def __init__(self, client, name="atomic_counter", key="counter"):
        super().__init__(client, name, key) # HazelcastInstance
        hazelcastInstance = Hazelcast.newHazelcastInstance();
        self.atomic = client.cp_subsystem.get_atomic_long(name).
blocking() # IAtomicLong counter = hazelcastInstance.getCPSubsystem
().getAtomicLong( "counter" );

    def increment(self):
```

```
self.atomic.add_and_get(1) # counter.incrementAndGet();
```

MapNoLockCounter.py

```
# import time
from Counters.BaseCounter import BaseCounter

class MapNoLockCounter(BaseCounter):
    def __init__(self, client, name="map_no_lock", key="counter"):
        super().__init__(client, name, key) # HazelcastInstance hz =
        Hazelcast.newHazelcastInstance();
        self.map = client.get_map(name).blocking() # IMap<String, Value
        > map = hz.getMap( "map" );
        if self.map.get(key) is None: # String key = "1";
            self.map.put(key, 0) # map.put( key, new Value() );

    def increment(self):
        v = self.map.get(self.key) or 0 # Value value = map.get( key )
        ;
        # time.sleep(1e-2) # Thread.sleep( 10 );
        v += 1 # value.amount++;
        self.map.put(self.key, v) # map.put( key, value );
```

MapOptimisticCounter.py

```
# import time
from Counters.BaseCounter import BaseCounter

class MapOptimisticCounter(BaseCounter):
    def __init__(self, client, name="map_optimistic", key="counter"):
        super().__init__(client, name, key) # HazelcastInstance hz =
        Hazelcast.newHazelcastInstance();
        self.map = client.get_map(name).blocking() # IMap<String,
        Value> map = hz.getMap( "map" );
        if self.map.get(key) is None: # String key = "1";
            self.map.put(key, 0) # map.put( key, new Value() );

    def increment(self):
        while True: # for ( ; ; ) {
            old = self.map.get(self.key) or 0 # Value oldValue = map.
            get( key );
            new = old + 1 # Value newValue = new Value( oldValue );
            newValue.amount++;
            # time.sleep(1e-2) # Thread.sleep( 10 );

            if self.map.replace_if_same(self.key, old, new): # if (
            map.replace( key, oldValue, newValue ) )
                break # break;
```

MapPessimisticCounter.py

```
# import time
from Counters.BaseCounter import BaseCounter

class MapPessimisticCounter(BaseCounter):
    def __init__(self, client, name="map_pessimistic", key="counter"):
        super().__init__(client, name, key) # HazelcastInstance hz =
        Hazelcast.newHazelcastInstance();
        self.map = client.get_map(name).blocking() # IMap<String,
        Value> map = hz.getMap( "map" );
        if self.map.get(key) is None: # String key = "1";
            self.map.put(key, 0) # map.put( key, new Value() );

    def increment(self):
        self.map.lock(self.key) # map.lock( key );
        try: # try {
            v = self.map.get(self.key) or 0 # Value value = map.get(
            key );
            # time.sleep(1e-2) # Thread.sleep( 10 );
            v += 1 # value.amount++;
            self.map.put(self.key, v) # map.put( key, value );
        finally: # } finally {
            self.map.unlock(self.key) # map.unlock( key );
```

HazelcastCounters.py

```
import threading
import time
# from tqdm import tqdm
# import tqdm

import hazelcast

from Counters import AtomicLongCounter, MapNoLockCounter,
    MapOptimisticCounter, MapPessimisticCounter

def run_benchmark(counter_cls, client, threads: int = 10,
    increments_per_thread: int = 10_000): # , log_every: int = 1000
    total = threads * increments_per_thread
    counter = counter_cls(client)
    if isinstance(counter, AtomicLongCounter):
        counter.atomic.set(0)
    else:
        m = client.get_map(counter.name).blocking()
        m.put(counter.key, 0)

    threads_list = []
    start = time.perf_counter()
```

```

    for t in range(threads):
        th = threading.Thread(target=counter.bulk_increment, args=(
increments_per_thread, ))
        th.start()
        threads_list.append(th)

    for th in threads_list:
        th.join()

    elapsed = time.perf_counter() - start
    throughput = total / elapsed

    if isinstance(counter, AtomicLongCounter):
        final = counter.atomic.get()
    else:
        final = client.get_map(counter.name).blocking().get(counter.key
)

    return final, total, elapsed, throughput

if __name__ == "__main__":
    print("[PRE] Connecting to Hazelcast...")
    client = hazelcast.HazelcastClient(
        cluster_name="dev",
        cluster_members=["hazelcast1:5701", "hazelcast2:5702", "
hazelcast3:5703"]
    )

    print("[MAIN] Starting different Counters...")
    variants = {
        "Map no-lock": MapNoLockCounter,
        "Map pessimistic": MapPessimisticCounter,
        "Map optimistic": MapOptimisticCounter,
        "AtomicLong (CP)": AtomicLongCounter,
    }
    threads = 10
    increments_per_thread = 10_000
    # log_every = 100
    try:
        # for _ in range(5):
        for name, cls in variants.items():
            print("[MAIN] Running:", name)
            val, expected, elapsed, throughput = run_benchmark(cls,
client, threads=threads, increments_per_thread=increments_per_thread
) # , log_every=log_every
            print(f"[Results] Received: {val}\n[Results] Expected: {
expected}\n[Results] Time: {elapsed:.2f} sec\n[Results] Throughput:

```

```
{throughput:.2f} requests/sec\n", "-"*60)
    finally:
        client.shutdown()
```

Dockerfile

```
FROM python:3.11-slim

WORKDIR /app

COPY req.txt .
RUN pip install --no-cache-dir -r req.txt

COPY ./Counters ./Counters
COPY HazelcastCounters.py .

CMD ["python", "HazelcastCounters.py"]
```

docker-compose.yml

```
services:
  hazelcast1:
    image: hazelcast/hazelcast:5.4
    container_name: hz1
    ports:
      - "5701:5701"
    volumes:
      - ./hazelcast.yaml:/opt/hazelcast/hazelcast.yaml
    environment:
      HAZELCAST_CONFIG: /opt/hazelcast/hazelcast.yaml

  hazelcast2:
    image: hazelcast/hazelcast:5.4
    container_name: hz2
    ports:
      - "5702:5701"
    volumes:
      - ./hazelcast.yaml:/opt/hazelcast/hazelcast.yaml
    environment:
      HAZELCAST_CONFIG: /opt/hazelcast/hazelcast.yaml

  hazelcast3:
    image: hazelcast/hazelcast:5.4
    container_name: hz3
    ports:
      - "5703:5701"
    volumes:
      - ./hazelcast.yaml:/opt/hazelcast/hazelcast.yaml
    environment:
      HAZELCAST_CONFIG: /opt/hazelcast/hazelcast.yaml
```

```
python-client:
  build: .
  container_name: hz-client
  depends_on:
    - hazelcast1
    - hazelcast2
    - hazelcast3
  environment:
    - PYTHONUNBUFFERED=1
```

hazelcast.yaml

```
hazelcast:
  cluster-name: dev

  network:
    join:
      multicast:
        enabled: false
      tcp-ip:
        enabled: true
        member-list:
          - hazelcast1
          - hazelcast2
          - hazelcast3

  cp-subsystem:
    cp-member-count: 3
    group-size: 3
```


2 Результати

Результат:

[PRE] Connecting to Hazelcast...
[MAIN] Starting different Counters...
[MAIN] Running: Map no-lock
[Results] Received: 15414
[Results] Expected: 100000
[Results] Time: 22.10 sec

[MAIN] Running: Map pessimistic
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 123.39 sec

[MAIN] Running: Map optimistic
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 117.23 sec

[MAIN] Running: AtomicLong (CP)
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 11.59 sec

Не розумію у чому проблема, але на наступний день і далі воно більше не показувало такі хороші результати, навіть коли відкатувався до версії того дня.

[PRE] Connecting to Hazelcast...
[MAIN] Starting different Counters...
[MAIN] Running: Map no-lock
[Results] Received: 14923
[Results] Expected: 100000
[Results] Time: 60.42 sec
[Results] Throughput: 1654.96 requests/sec

[MAIN] Running: Map pessimistic
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 3232.21 sec
[Results] Throughput: 30.94 requests/sec

[MAIN] Running: Map optimistic
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 162.34 sec
[Results] Throughput: 616.00 requests/sec

[MAIN] Running: AtomicLong (CP)
[Results] Received: 100000
[Results] Expected: 100000
[Results] Time: 17.34 sec
[Results] Throughput: 5766.02 requests/sec

3 Лог, який видають ноди Hazelcast

33 Строка

```
1 #####
2 # JAVA=/usr/bin/java
3 # JAVA_OPTS=--add-modules java.se --add-exports java.base/jdk.internal.ref=ALL-UNNAMED --add-opens java.base/java.
   lang=ALL-UNNAMED --add-opens java.base/sun.nio.ch=ALL-UNNAMED --add-opens java.management/sun.management=ALL-
   UNNAMED --add-opens jdk.management/com.sun.management.internal=ALL-UNNAMED -Dlog4j.shutdownHookEnabled=false -
   Dhazelcast.logging.shutdown=true -Dhazelcast.logging.type=log4j2 -Dlog4j.configurationFile=file:/opt/hazelcast/
   config/log4j2.properties -Dhazelcast.config=/opt/hazelcast/hazelcast.yaml -Djet.custom.lib.dir=/opt/hazelcast/
   custom-lib -Djava.net.preferIPv4Stack=true -XX:MaxRAMPercentage=80.0
4 # CLASSPATH=/opt/hazelcast/*:/opt/hazelcast/lib:/opt/hazelcast/lib/*:/opt/hazelcast/bin/user-lib:/opt/hazelcast/bin/
   user-lib/*
5 #####
6 2025-11-22 15:15:58,553 [ INFO] [main] [c.h.i.c.AbstractConfigLocator]: Loading configuration '/opt/hazelcast/
   hazelcast.yaml' from System property 'hazelcast.config'
7 2025-11-22 15:15:58,556 [ INFO] [main] [c.h.i.c.AbstractConfigLocator]: Using configuration file at /opt/hazelcast/
   hazelcast.yaml
8 2025-11-22 15:15:59,496 [ WARN] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] You configured your member
   address as host name. Please be aware of that your dns can be spoofed. Make sure that your dns configurations
   are correct.
9 2025-11-22 15:15:59,497 [ INFO] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] Resolving domain name '
   hazelcast3' to address(es): [172.18.0.4]
10 2025-11-22 15:15:59,498 [ WARN] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] You configured your member
   address as host name. Please be aware of that your dns can be spoofed. Make sure that your dns configurations
   are correct.
11 2025-11-22 15:15:59,499 [ INFO] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] Resolving domain name '
   hazelcast2' to address(es): [172.18.0.3]
12 2025-11-22 15:15:59,500 [ WARN] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] You configured your member
   address as host name. Please be aware of that your dns can be spoofed. Make sure that your dns configurations
   are correct.
13 2025-11-22 15:15:59,500 [ INFO] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] Resolving domain name '
   hazelcast1' to address(es): [172.18.0.2]
14 2025-11-22 15:15:59,501 [ INFO] [main] [c.h.i.AddressPicker]: [LOCAL] [dev] [5.4.0] Interfaces is disabled, trying
   to pick one address from TCP-IP config addresses: [hazelcast3/172.18.0.4, hazelcast2/172.18.0.3, hazelcast1
   /172.18.0.2]
15 2025-11-22 15:15:59,563 [ INFO] [main] [c.h.s.logo]: [hazelcast1]:5701 [dev] [5.4.0]
16   o   o   o   o---o   o--o   o   o---o   o   o---o   o---o
17   |   |   / \   /   |   /   / \   |   |
18   o---o   o   o   o---o   |   o   o---o   o   o---o   |
19   |   |   *   \   /   |   \   *   \   |   |
20   o   o *   o---o   o--o   o---o   o---o *   o---o   o
21 2025-11-22 15:15:59,563 [ INFO] [main] [c.h.system]: [hazelcast1]:5701 [dev] [5.4.0] Copyright (c) 2008-2024,
   Hazelcast, Inc. All Rights Reserved.
22 2025-11-22 15:15:59,568 [ INFO] [main] [c.h.system]: [hazelcast1]:5701 [dev] [5.4.0] Hazelcast Platform 5.4.0
   (20240415) starting at [hazelcast1]:5701
23 2025-11-22 15:15:59,568 [ INFO] [main] [c.h.system]: [hazelcast1]:5701 [dev] [5.4.0] Cluster name: dev
24 2025-11-22 15:15:59,569 [ INFO] [main] [c.h.system]: [hazelcast1]:5701 [dev] [5.4.0] Integrity Checker is disabled.
   Fail-fast on corrupted executables will not be performed. For more information, see the documentation for
   Integrity Checker.
25 2025-11-22 15:15:59,571 [ INFO] [main] [c.h.system]: [hazelcast1]:5701 [dev] [5.4.0] The Jet engine is disabled.
   To enable the Jet engine on the members, do one of the following:
26   - Change member config using Java API: config.getJetConfig().setEnabled(true)
27   - Change XML/YAML configuration property: Set hazelcast.jet.enabled to true
28   - Add system property: -Dhz.jet.enabled=true (for Hazelcast embedded, works only when loading config via Config.
   load)
29   - Add environment variable: HZ_JET_ENABLED=true (recommended when running container image. For Hazelcast embedded,
   works only when loading config via Config.load)
30 2025-11-22 15:16:00,577 [ INFO] [main] [c.h.s.security]: [hazelcast1]:5701 [dev] [5.4.0] Enable DEBUG/FINE log level
   for log category com.hazelcast.system.security or use -Dhazelcast.security.recommendations system property to
   see f0E security recommendations and the status of current config.
31 2025-11-22 15:16:00,695 [ INFO] [main] [c.h.i.i.Node]: [hazelcast1]:5701 [dev] [5.4.0] Using TCP/IP discovery
32 2025-11-22 15:16:00,698 [ INFO] [main] [c.h.c.CPSubsystem]: [hazelcast1]:5701 [dev] [5.4.0] CP Subsystem is enabled
   with 3 members.
33 2025-11-22 15:16:00,996 [ INFO] [main] [c.h.i.d.Diagnostics]: [hazelcast1]:5701 [dev] [5.4.0] Diagnostics disabled.
   To enable add -Dhazelcast.diagnostics.enabled=true to the JVM arguments.
34 2025-11-22 15:16:01,006 [ INFO] [main] [c.h.c.LifecycleService]: [hazelcast1]:5701 [dev] [5.4.0] [hazelcast1]:5701
   is STARTING
35 2025-11-22 15:16:01,051 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
   [5.4.0] [hazelcast3]:5702 is added to the blacklist.
36 2025-11-22 15:16:01,053 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
   [5.4.0] [hazelcast2]:5702 is added to the blacklist.
37 2025-11-22 15:16:01,053 [ INFO] [hz.fervent_brown.cached.thread-4] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
   [5.4.0] [hazelcast3]:5703 is added to the blacklist.
38 2025-11-22 15:16:01,054 [ INFO] [hz.fervent_brown.cached.thread-5] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
   [5.4.0] [hazelcast2]:5703 is added to the blacklist.
39 2025-11-22 15:16:01,055 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
   [5.4.0] [hazelcast1]:5702 is added to the blacklist.
```

```

41 2025-11-22 15:16:01,055 [ INFO] [hz.fervent_brown.cached.thread-6] [c.h.i.c.i.TcpIpJoiner]: [hazelcast1]:5701 [dev]
    [5.4.0] [hazelcast1]:5703 is added to the blacklist.
42 2025-11-22 15:16:01,075 [ INFO] [hz.fervent_brown.IO.thread-in-0] [c.h.i.s.t.TcpServerConnection]: [hazelcast1]:5701
    [dev] [5.4.0] Initialized new cluster connection between /172.18.0.2:53723 and hazelcast2/172.18.0.3:5701
43 2025-11-22 15:16:01,088 [ INFO] [hz.fervent_brown.IO.thread-in-1] [c.h.i.s.t.TcpServerConnection]: [hazelcast1]:5701
    [dev] [5.4.0] Initialized new cluster connection between /172.18.0.2:5701 and /172.18.0.4:49055
44 2025-11-22 15:16:01,090 [ INFO] [hz.fervent_brown.IO.thread-in-1] [c.h.i.s.t.TcpServerConnection]: [hazelcast1]:5701
    [dev] [5.4.0] Initialized new cluster connection between /172.18.0.2:59433 and hazelcast3/172.18.0.4:5701
45 2025-11-22 15:16:01,109 [ INFO] [hz.fervent_brown.IO.thread-in-0] [c.h.i.s.t.TcpServerConnection]: [hazelcast1]:5701
    [dev] [5.4.0] Initialized new cluster connection between /172.18.0.2:5701 and /172.18.0.3:44381
46 2025-11-22 15:16:06,067 [ INFO] [main] [c.h.i.c.ClusterService]: [hazelcast1]:5701 [dev] [5.4.0]
47
48 Members {size:1, ver:1} [
49   Member [hazelcast1]:5701 - 32344188-d3ed-4efd-a15a-5237ace5c754 this
50 ]
51
52 2025-11-22 15:16:06,085 [ INFO] [main] [c.h.c.LifecycleService]: [hazelcast1]:5701 [dev] [5.4.0] [hazelcast1]:5701
    is STARTED
53 2025-11-22 15:16:06,097 [ INFO] [hz.fervent_brown.priority-generic-operation.thread-0] [c.h.i.c.ClusterService]: [
    hazelcast1]:5701 [dev] [5.4.0]
54
55 Members {size:2, ver:2} [
56   Member [hazelcast1]:5701 - 32344188-d3ed-4efd-a15a-5237ace5c754 this
57   Member [hazelcast3]:5701 - c69b03ec-86d5-4f1b-bcf8-cbcefa29946e
58 ]
59
60 2025-11-22 15:16:06,112 [ INFO] [hz.fervent_brown.priority-generic-operation.thread-0] [c.h.i.c.ClusterService]: [
    hazelcast1]:5701 [dev] [5.4.0]
61
62 Members {size:3, ver:3} [
63   Member [hazelcast1]:5701 - 32344188-d3ed-4efd-a15a-5237ace5c754 this
64   Member [hazelcast3]:5701 - c69b03ec-86d5-4f1b-bcf8-cbcefa29946e
65   Member [hazelcast2]:5701 - c287e3ce-0ba4-41c1-be6d-4657cb36f62e
66 ]
67
68 2025-11-22 15:16:06,127 [ INFO] [hz.fervent_brown.priority-generic-operation.thread-0] [c.h.c.i.p.t.
    AuthenticationMessageTask]: [hazelcast1]:5701 [dev] [5.4.0] Received auth from Connection[id=1,
    /172.18.0.2:5701->/172.18.0.5:56210, qualifier=null, endpoint=[172.18.0.5]:56210, remoteUuid=ee4861ba-4dc1-4e64
    -89bb-affff916135d, alive=true, connectionType=PYH, planeIndex=-1], successfully authenticated, clientUuid:
    ee4861ba-4dc1-4e64-89bb-affff916135d, client name: hz.client_0, client version: 5.5.0
69 2025-11-22 15:16:06,235 [ INFO] [hz.fervent_brown.generic-operation.thread-3] [c.h.i.p.i.PartitionStateManager]: [
    hazelcast1]:5701 [dev] [5.4.0] Initializing cluster partition table arrangement...
70 2025-11-22 15:16:06,991 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftInvocationManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Replaced CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=-1}, members
    =[]} with CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=0}, members=[CPMember{uuid=c287e3ce
    -0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e,
    address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701}]}
71 2025-11-22 15:16:07,010 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftService]: [hazelcast1]:5701 [dev]
    [5.4.0] RaftNode[CPGroupId{name='METADATA', seed=0, groupId=0}] is created with [RaftEndpoint{uuid='c287e3ce-0
    ba4-41c1-be6d-4657cb36f62e'}, RaftEndpoint{uuid='c69b03ec-86d5-4f1b-bcf8-cbcefa29946e'}, RaftEndpoint{uuid='
    32344188-d3ed-4efd-a15a-5237ace5c754'}]
72 2025-11-22 15:16:07,011 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.RaftNode(METADATA)]: [
    hazelcast1]:5701 [dev] [5.4.0] Status is set to: ACTIVE
73 2025-11-22 15:16:09,522 [ WARN] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.
    RaftNodeImpl$LeaderFailureDetectionTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] We are FOLLOWER and there is
    no current leader. Will start new election round...
74 2025-11-22 15:16:09,527 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.t.PreVoteTask(METADATA)
    ]: [hazelcast1]:5701 [dev] [5.4.0] Pre-vote started for next term: 1, last log index: 0, last log term: 0
75 2025-11-22 15:16:09,527 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.RaftNode(METADATA)]: [
    hazelcast1]:5701 [dev] [5.4.0]
76
77 CP Group Members {groupId: METADATA(0), size:3, term:0, logIndex:0} [
78   CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}
79   CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}
80   CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} - FOLLOWER this
81 ]
82
83 2025-11-22 15:16:09,539 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    PreVoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] Pre-vote granted from RaftEndpoint{uuid='
    c287e3ce-0ba4-41c1-be6d-4657cb36f62e'} for term: 1, number of votes: 2, majority: 2
84 2025-11-22 15:16:09,539 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    PreVoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] We have the majority during pre-vote
    phase. Let's start real election!
85 2025-11-22 15:16:09,540 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.t.LeaderElectionTask(
    METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] Leader election started for term: 1, last log index: 0, last log
    term: 0
86 2025-11-22 15:16:09,541 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.RaftNode(METADATA)]: [
    hazelcast1]:5701 [dev] [5.4.0]
87
88 CP Group Members {groupId: METADATA(0), size:3, term:1, logIndex:0} [
89   CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}

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90 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}
91 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} - CANDIDATE this
92 ]
93
94 2025-11-22 15:16:09,545 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    PreVoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] Ignored PreVoteResponse{voter=
    RaftEndpoint{uuid='c69b03ec-86d5-4f1b-bcf8-cbcefa29946e'}, term=1, granted=true}. We are not FOLLOWER anymore.
95 2025-11-22 15:16:09,548 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    VoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] Vote granted from RaftEndpoint{uuid='
    c69b03ec-86d5-4f1b-bcf8-cbcefa29946e'} for term: 1, number of votes: 2, majority: 2
96 2025-11-22 15:16:09,548 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    VoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] We are the LEADER!
97 2025-11-22 15:16:09,550 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.RaftNode(METADATA)]: [
    hazelcast1]:5701 [dev] [5.4.0]
98
99 CP Group Members {groupId: METADATA(0), size:3, term:1, logIndex:0} [
100 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}
101 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}
102 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} - LEADER this
103 ]
104
105 2025-11-22 15:16:09,552 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.r.i.h.
    VoteResponseHandlerTask(METADATA)]: [hazelcast1]:5701 [dev] [5.4.0] Ignored VoteResponse{voter=RaftEndpoint{uuid
    ='c287e3ce-0ba4-41c1-be6d-4657cb36f62e'}, term=1, granted=true}. We are not CANDIDATE anymore.
106 2025-11-22 15:16:09,708 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.RaftInvocationManager]: [
    hazelcast1]:5701 [dev] [5.4.0] Replaced CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=0},
    members=[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec
    -86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754,
    address=[hazelcast1]:5701}]} with CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=2}, members
    =[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec-86d5-4
    f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[
    hazelcast1]:5701}]}
107 2025-11-22 15:16:09,712 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.RaftInvocationManager]: [
    hazelcast1]:5701 [dev] [5.4.0] Replaced CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=2},
    members=[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec
    -86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754,
    address=[hazelcast1]:5701}]} with CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=3}, members
    =[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec-86d5-4
    f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[
    hazelcast1]:5701}]}
108 2025-11-22 15:16:09,721 [ INFO] [hz.fervent_brown.partition-operation.thread-0] [c.h.c.i.RaftInvocationManager]: [
    hazelcast1]:5701 [dev] [5.4.0] Replaced CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=3},
    members=[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec
    -86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754,
    address=[hazelcast1]:5701}]} with CPMembersContainer{version=CPMembersVersion{groupIdSeed=0, version=4}, members
    =[CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec-86d5-4
    f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701}, CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[
    hazelcast1]:5701}]}
109 2025-11-22 15:16:09,722 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.MetadataRaftGroupManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] CP Subsystem is initialized with: [CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e,
    address=[hazelcast2]:5701}, CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701},
    CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701}]
110 2025-11-22 15:17:09,732 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Current leadership claims:
111 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
112 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
113 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
114 2025-11-22 15:17:09,738 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Current leadership claims:
115 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
116 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
117 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
118 2025-11-22 15:17:09,739 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Searching a candidate transfer leadership from CPMember{uuid=32344188-d3ed-4efd-a15a-5237
    ace5c754, address=[hazelcast1]:5701} with 1 leaderships.
119 2025-11-22 15:17:09,739 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] No candidate could be found to get leadership from CPMember{uuid=32344188-d3ed-4efd-a15a
    -5237ace5c754, address=[hazelcast1]:5701}. Skipping to next...
120 2025-11-22 15:17:09,741 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Current leadership claims:
121 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
122 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
123 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
124 2025-11-22 15:17:09,741 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] CPGroup leadership balance is fine, cannot rebalance further...
125 2025-11-22 15:18:09,728 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
    ]:5701 [dev] [5.4.0] Current leadership claims:
126 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
127 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
128 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
129 2025-11-22 15:18:09,730 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1

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181 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
182 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
183 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
184 2025-11-22 15:21:09,725 [ INFO] [hz.fervent_brown.cached.thread-2] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] CPGGroup leadership balance is fine, cannot rebalance further...
185 2025-11-22 15:22:09,718 [ INFO] [hz.fervent_brown.cached.thread-1] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
186 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
187 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
188 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
189 2025-11-22 15:22:09,720 [ INFO] [hz.fervent_brown.cached.thread-1] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
190 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
191 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
192 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 0, leaderships.
193 .....
194 2025-11-22 17:07:09,461 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Searching a candidate transfer leadership from CPMember{uuid=32344188-d3ed-4efd-a15a-5237
ace5c754, address=[hazelcast1]:5701} with 1 leaderships.
195 2025-11-22 17:07:09,461 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] No candidate could be found to get leadership from CPMember{uuid=32344188-d3ed-4efd-a15a
-5237ace5c754, address=[hazelcast1]:5701}. Skipping to next...
196 2025-11-22 17:07:09,462 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
197 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
198 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
199 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 1, leaderships.
200 2025-11-22 17:07:09,462 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] CPGGroup leadership balance is fine, cannot rebalance further...
201 2025-11-22 17:08:09,456 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
202 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
203 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
204 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 1, leaderships.
205 2025-11-22 17:08:09,458 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
206 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
207 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
208 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 1, leaderships.
209 2025-11-22 17:08:09,458 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Searching a candidate transfer leadership from CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657
cb36f62e, address=[hazelcast2]:5701} with 1 leaderships.
210 2025-11-22 17:08:09,458 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] No candidate could be found to get leadership from CPMember{uuid=c287e3ce-0ba4-41c1-be6d
-4657cb36f62e, address=[hazelcast2]:5701}. Skipping to next...
211 2025-11-22 17:08:09,459 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
212 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
213 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
214 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 1, leaderships.
215 2025-11-22 17:08:09,459 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Searching a candidate transfer leadership from CPMember{uuid=32344188-d3ed-4efd-a15a-5237
ace5c754, address=[hazelcast1]:5701} with 1 leaderships.
216 2025-11-22 17:08:09,459 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] No candidate could be found to get leadership from CPMember{uuid=32344188-d3ed-4efd-a15a
-5237ace5c754, address=[hazelcast1]:5701}. Skipping to next...
217 2025-11-22 17:08:09,459 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] Current leadership claims:
218 CPMember{uuid=c69b03ec-86d5-4f1b-bcf8-cbcefa29946e, address=[hazelcast3]:5701} priority 0 has 0,
219 CPMember{uuid=32344188-d3ed-4efd-a15a-5237ace5c754, address=[hazelcast1]:5701} priority 0 has 1,
220 CPMember{uuid=c287e3ce-0ba4-41c1-be6d-4657cb36f62e, address=[hazelcast2]:5701} priority 0 has 1, leaderships.
221 2025-11-22 17:08:09,459 [ INFO] [hz.fervent_brown.cached.thread-3] [c.h.c.i.RaftGroupMembershipManager]: [hazelcast1
]:5701 [dev] [5.4.0] CPGGroup leadership balance is fine, cannot rebalance further...

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