Міністерство освіти і науки України
Національний технічний університет України
«Київський політехнічний інститут імені Ігоря Сікорського»
Фізико-технічний інститут

Проектування високонавантажених систем

Лабораторна робота 4
«Налаштування реплікації та перевірка відмовостійкості MongoDB»

Виконав:
Студент групи ФБ-42мп
Осіпчук Антон

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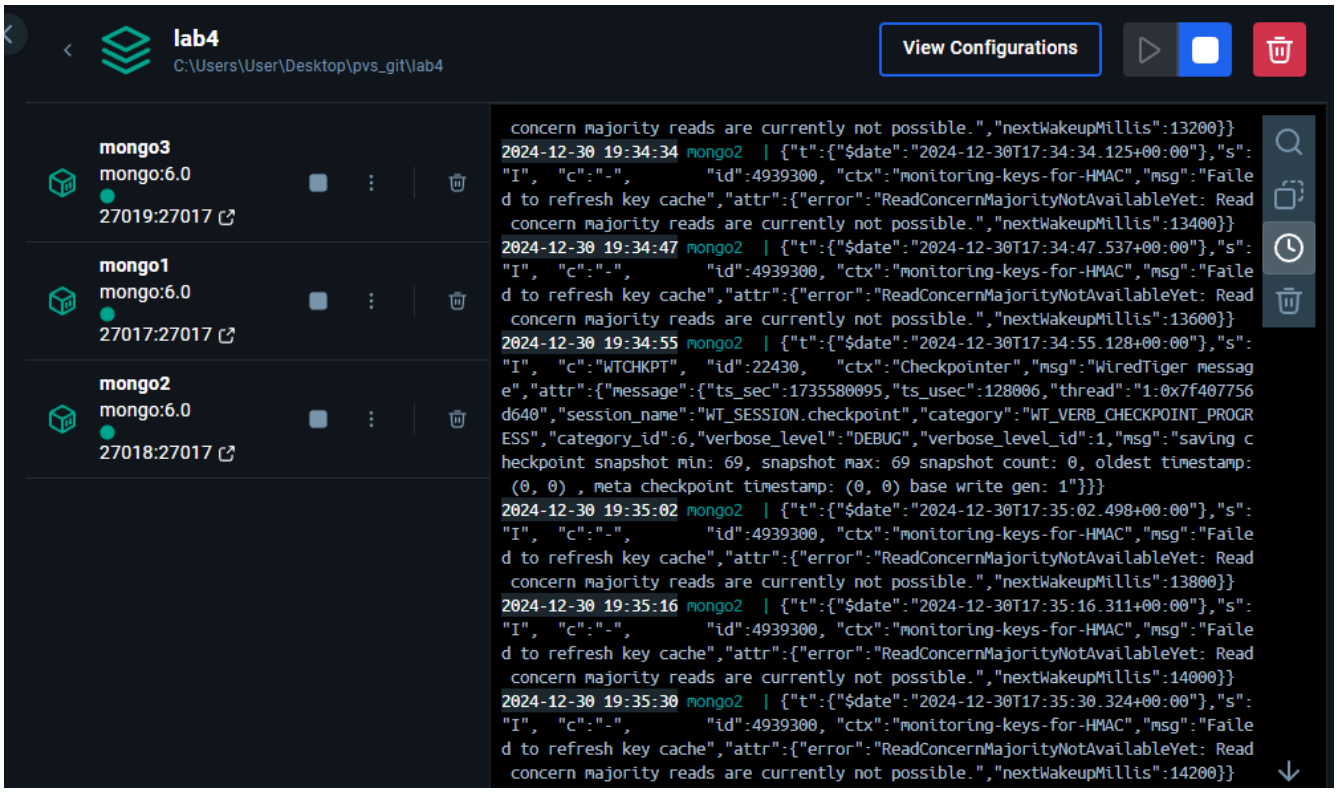
1) Налаштувати реплікацію в конфігурації: Primary with Two Secondary Members

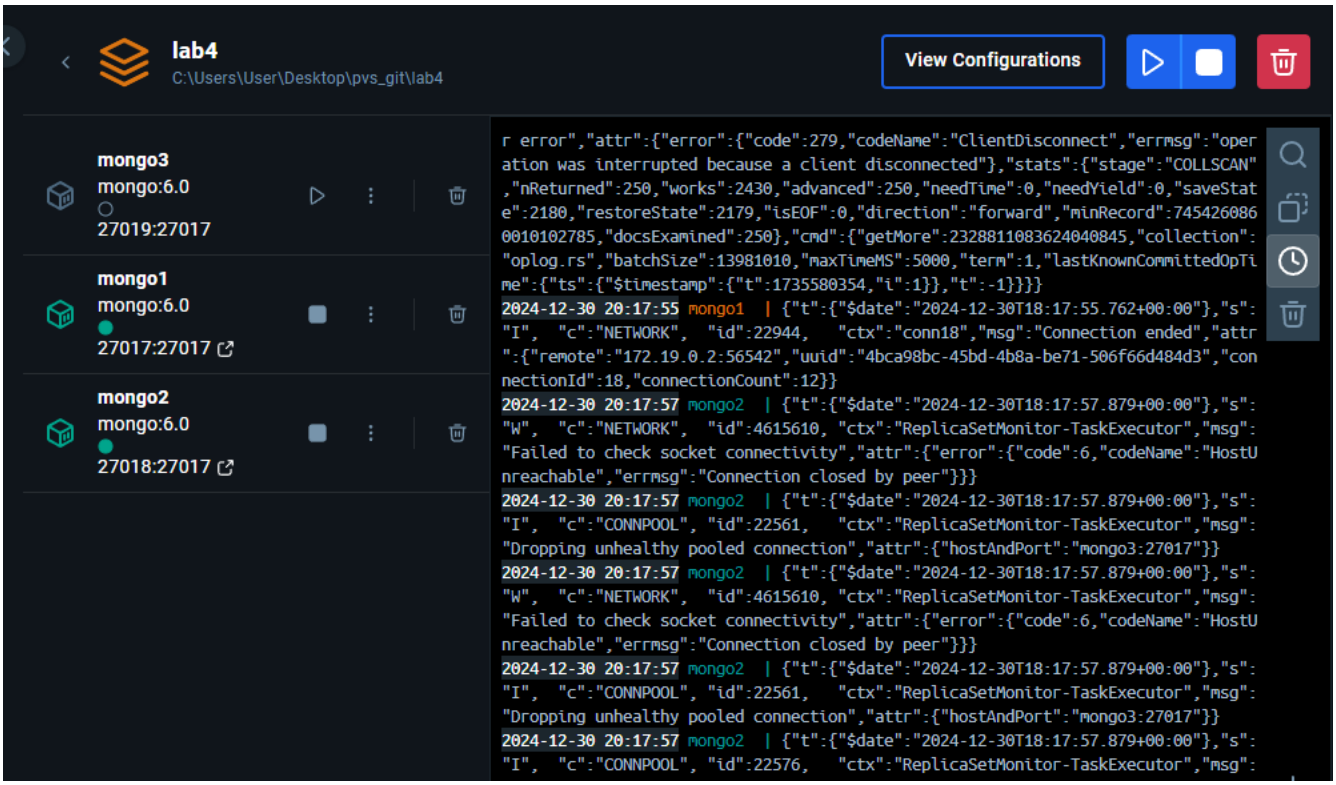



```
test> rs.initiate({_id: "rs0", members: [{_id: 0, host: "mongo1:27017"}, {_id: 1, host: "mongo2:27017"}, {_id: 2, host: "mongo3:27017"}]});
{ ok: 1 }
rs0 [direct: other] test> rs.status()
```

Primary нода mongo1

```
rs0 [direct: other] test> rs.status()
{
  set: 'rs0',
  date: ISODate('2024-12-30T17:40:43.016Z'),
  myState: 1,
  term: Long('1'),
  syncSourceHost: '',
  syncSourceId: -1,
  heartbeatIntervalMillis: Long('2000'),
  majorityVoteCount: 2,
  writeMajorityCount: 2,
  votingMembersCount: 3,
  writableVotingMembersCount: 3,
  optimes: {
    lastCommittedOpTime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
    lastCommittedWallTime: ISODate('2024-12-30T17:40:34.923Z'),
    readConcernMajorityOpTime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
    appliedOpTime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
    durableOpTime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
    lastAppliedWallTime: ISODate('2024-12-30T17:40:34.923Z'),
    lastDurableWallTime: ISODate('2024-12-30T17:40:34.923Z')
  },
  lastStableRecoveryTimestamp: Timestamp({ t: 1735580404, i: 1 }),
  electionCandidateMetrics: {
    lastElectionReason: 'electionTimeout',
    lastElectionDate: ISODate('2024-12-30T17:39:24.603Z'),
    electionTerm: Long('1'),
    lastCommittedOpTimeAtElection: { ts: Timestamp({ t: 1735580354, i: 1 }), t: Long('-1') },
    lastSeenOpTimeAtElection: { ts: Timestamp({ t: 1735580354, i: 1 }), t: Long('-1') },
    numVotesNeeded: 2,
    priorityAtElection: 1,
    electionTimeoutMillis: Long('10000'),
    numCatchUpOps: Long('0'),
    newTermStartDate: ISODate('2024-12-30T17:39:24.663Z'),
    wMajorityWriteAvailabilityDate: ISODate('2024-12-30T17:39:25.951Z')
  },
  members: [
    {
      _id: 0,
      name: 'mongo1:27017',
      health: 1,
      state: 1,
      stateStr: 'PRIMARY',
      uptime: 829,
      optime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
      optimeDate: ISODate('2024-12-30T17:40:34.000Z'),
      lastAppliedWallTime: ISODate('2024-12-30T17:40:34.923Z'),
      lastDurableWallTime: ISODate('2024-12-30T17:40:34.923Z'),
      syncSourceHost: '',
      syncSourceId: -1,
      infoMessage: 'Could not find member to sync from',
      electionTime: Timestamp({ t: 1735580364, i: 1 }),
      electionDate: ISODate('2024-12-30T17:39:24.000Z'),
      configVersion: 1,
      configTerm: 1,
      self: true,
      lastHeartbeatMessage: ''
    },
    {
      _id: 1,
      name: 'mongo2:27017',
      health: 1,
      state: 2,
      stateStr: 'SECONDARY',
      uptime: 88,
      optime: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
      optimeDurable: { ts: Timestamp({ t: 1735580434, i: 1 }), t: Long('1') },
      optimeDate: ISODate('2024-12-30T17:40:34.000Z'),
      optimeDurableDate: ISODate('2024-12-30T17:40:34.000Z'),
      lastAppliedWallTime: ISODate('2024-12-30T17:40:34.923Z'),
      lastDurableWallTime: ISODate('2024-12-30T17:40:34.923Z'),
      lastHeartbeat: ISODate('2024-12-30T17:40:41.193Z'),
      lastHeartbeatRecv: ISODate('2024-12-30T17:40:41.222Z'),
      pingMs: Long('0'),
      lastHeartbeatMessage: '',
      syncSourceHost: 'mongo1:27017',
      syncSourceId: 0,
      infoMessage: '',
      configVersion: 1,
      configTerm: 1
    },
    {
      _id: 2,
      name: 'mongo3:27017',
      health: 1,
      state: 2,
```

2) Спробувати зробити запис з однією відключеною нодою та write concern рівнім 3 та нескінченім таймаутом. Спробувати під час таймаута включити відключену ноду




```
rs0 [direct: primary] test> db.test.insertOne({test: "all nodes work"}, {writeConcern: {w: 3, wtimeout:0}});
{
  acknowledged: true,
  insertedId: ObjectId('6772e3b61fae32f5fbfe6911')
}
rs0 [direct: primary] test> db.test.insertOne({test: "mongo3 stopped"}, {writeConcern: {w: 3, wtimeout:0}});
```

```
rs0 [direct: primary] test> db.test.insertOne({test: "mongo3 stopped"}, {writeConcern: {w: 3, wtimeout:10000}});
Uncaught:
MongoWriteConcernError[WriteConcernFailed]: waiting for replication timed out
Additional information: {
  wtimeout: true,
  writeConcern: { w: 3, wtimeout: 10000, provenance: 'clientSupplied' }
}
Result: {
  n: 1,
  electionId: ObjectId('7fffffff0000000000000001'),
  opTime: { ts: Timestamp({ t: 1735582848, i: 1 }), t: Long('1') },
  writeConcernError: {
    code: 64,
    codeName: 'WriteConcernFailed',
    errmsg: 'waiting for replication timed out',
    errInfo: {
      wtimeout: true,
      writeConcern: { w: 3, wtimeout: 10000, provenance: 'clientSupplied' }
    }
  },
  ok: 1,
  '$clusterTime': {
    clusterTime: Timestamp({ t: 1735582848, i: 1 }),
    signature: {
      hash: Binary.createFromBase64('AAAAAAAAAAAAAAAAAAAAAAAAAAA=', 0),
      keyId: Long('0')
    }
  },
  operationTime: Timestamp({ t: 1735582848, i: 1 })
}
```

3) Аналогічно попередньому пункту, але задати скінченний таймаут та дочекатись його закінчення. Перевірити чи данні записались і чи доступні на читання з рівнем readConcern: “majority”

```
rs0 [direct: primary] test> db.test.insertOne({test: "mongo3 stopped, but started in timeout"}, {writeConcern: {w: 3, wt
wtimeout:100000}});
{
  acknowledged: true,
  insertedId: ObjectId('67730ee03831521f9ffe6911')
}
rs0 [direct: primary] test> db.test.find()
[
  { _id: ObjectId('6772e3b61fae32f5fbfe6911'), test: 'all nodes work' },
  { _id: ObjectId('6772e3df1fae32f5fbfe6912'), test: 'mongo3 stopped' },
  { _id: ObjectId('6772e4801fae32f5fbfe6913'), test: 'mongo3 stopped' },
  {
    _id: ObjectId('6772eb5c3b96cd969efe6911'),
    test: 'another primary'
  },
  {
    _id: ObjectId('67730ee03831521f9ffe6911'),
    test: 'mongo3 stopped, but started in timeout'
  }
]
```

4) Продемонстрував перевибори primary node відключивши поточний primary, і що після відновлення роботи старої primary на неї реплікуються нові дані, які з'явилися під час її простою

```
members: [
  {
    _id: 0,
    name: 'mongo1:27017',
    health: 0,
    state: 8,
    stateStr: '(not reachable/healthy)',
    uptime: 0,
    optime: { ts: Timestamp({ t: 0, i: 0 }), t: Long('-1') },
    optimeDurable: { ts: Timestamp({ t: 0, i: 0 }), t: Long('-1') },
    optimeDate: ISODate('1970-01-01T00:00:00.000Z'),
    optimeDurableDate: ISODate('1970-01-01T00:00:00.000Z'),
    lastAppliedWallTime: ISODate('2024-12-30T18:39:54.397Z'),
    lastDurableWallTime: ISODate('2024-12-30T18:39:44.396Z'),
    lastHeartbeat: ISODate('2024-12-30T18:42:00.591Z'),
    lastHeartbeatRecv: ISODate('2024-12-30T18:39:53.398Z'),
    pingMs: Long('0'),
    lastHeartbeatMessage: 'Error connecting to mongo1:27017 :: caused by :: Could not find address for mongo1:27017:
cketException: Host not found (authoritative)',
    syncSourceHost: '',
    syncSourceId: -1,
    infoMessage: '',
    configVersion: 1,
    configTerm: 2
  },
  {
    _id: 1,
    name: 'mongo2:27017',
    health: 1,
    state: 1,
    stateStr: 'PRIMARY',
    uptime: 4515,
    optime: { ts: Timestamp({ t: 1735584125, i: 1 }), t: Long('2') },
    optimeDate: ISODate('2024-12-30T18:42:05.000Z'),
    lastAppliedWallTime: ISODate('2024-12-30T18:42:05.836Z'),
    lastDurableWallTime: ISODate('2024-12-30T18:42:05.836Z'),
    syncSourceHost: '',
    syncSourceId: -1,
    infoMessage: '',
    electionTime: Timestamp({ t: 1735583984, i: 1 }),
    electionDate: ISODate('2024-12-30T18:39:44.000Z'),
    configVersion: 1,
    configTerm: 2,
    self: true,
    lastHeartbeatMessage: ''
  },
  {
    _id: 2,
    name: 'mongo3:27017',
    health: 1,
    state: 2,
    stateStr: 'SECONDARY',
    uptime: 435,
    optime: { ts: Timestamp({ t: 1735584125, i: 1 }), t: Long('2') },
    optimeDurable: { ts: Timestamp({ t: 1735584125, i: 1 }), t: Long('2') },
    optimeDate: ISODate('2024-12-30T18:42:05.000Z'),
    optimeDurableDate: ISODate('2024-12-30T18:42:05.000Z'),
    lastAppliedWallTime: ISODate('2024-12-30T18:42:05.836Z'),
    lastDurableWallTime: ISODate('2024-12-30T18:42:05.836Z'),
    lastHeartbeat: ISODate('2024-12-30T18:42:08.703Z'),
    lastHeartbeatRecv: ISODate('2024-12-30T18:42:08.798Z'),
    pingMs: Long('0'),
    lastHeartbeatMessage: '',
    syncSourceHost: 'mongo2:27017',
    syncSourceId: 1,
    infoMessage: '',
    configVersion: 1,
    configTerm: 2
  }
],
```

```
rs0 [direct: primary] test> db.test.insertOne({test: "another primary"})
{
  acknowledged: true,
  insertedId: ObjectId('6772eb5c3b96cd969efe6911')
}
```

```
rs0 [direct: primary] test> db.test.find()
[
  { _id: ObjectId('6772e3b61fae32f5fbfe6911'), test: 'all nodes work' },
  { _id: ObjectId('6772e3df1fae32f5fbfe6912'), test: 'mongo3 stopped' },
  { _id: ObjectId('6772e4801fae32f5fbfe6913'), test: 'mongo3 stopped' },
  {
    _id: ObjectId('6772eb5c3b96cd969efe6911'),
    test: 'another primary'
  }
]
```

```
rs0 [direct: primary] test> db.test.find()
[
  { _id: ObjectId('6772e3b61fae32f5fbfe6911'), test: 'all nodes work' },
  { _id: ObjectId('6772e3df1fae32f5fbfe6912'), test: 'mongo3 stopped' },
  { _id: ObjectId('6772e4801fae32f5fbfe6913'), test: 'mongo3 stopped' },
  {
    _id: ObjectId('6772eb5c3b96cd969efe6911'),
    test: 'another primary'
  }
]
rs0 [direct: primary] test>

C:\Users\User>docker exec -it mongo1 mongosh
Current Mongosh Log ID: 6772ebdb6f080cf68afe6910
Connecting to:          mongodb://127.0.0.1:27017/?directConnection=true&serverSelec
.3.2
Using MongoDB:          6.0.19
Using Mongosh:          2.3.2

For mongosh info see: https://www.mongodb.com/docs/mongodb-shell/

------
   The server generated these startup warnings when booting
   2024-12-30T18:51:47.290+00:00: Using the XFS filesystem is strongly recommended w
ee http://dochub.mongodb.org/core/prodnotes-filesystem
   2024-12-30T18:51:47.540+00:00: Access control is not enabled for the database. Re
iguration is unrestricted
   2024-12-30T18:51:47.540+00:00: /sys/kernel/mm/transparent_hugepage/enabled is 'al
er' in this binary version
   2024-12-30T18:51:47.540+00:00: vm.max_map_count is too low
------

rs0 [direct: secondary] test> db.test.find()
[
  { _id: ObjectId('6772e3b61fae32f5fbfe6911'), test: 'all nodes work' },
  { _id: ObjectId('6772e3df1fae32f5fbfe6912'), test: 'mongo3 stopped' },
  { _id: ObjectId('6772e4801fae32f5fbfe6913'), test: 'mongo3 stopped' },
  {
    _id: ObjectId('6772eb5c3b96cd969efe6911'),
    test: 'another primary'
  }
]
```

Аналіз продуктивності та перевірка цілісності