

Lab Experiment 4: The Raft Consensus Algorithm

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A. The following screenshots are to be submitted in a PDF file:

- a. 1a: Pyenv installed and local Python version changed to 3.6.8

```
CC_E4_PES1UG20CS243 — python -m conda create -n mypyenv python=3.8.11 anaconda —...
[(base) mahika@the-book CC_E4_PES1UG20CS243 % conda create -n mypyenv python=3.8.11 anaconda]
Collecting package metadata (current_repodata.json): done
Solving environment: failed with repodata from current_repodata.json, will retry with next repo
data source.
Collecting package metadata (repodata.json): done
Solving environment: done

==> WARNING: A newer version of conda exists. <==
  current version: 22.9.0
  latest version: 23.1.0

Please update conda by running

$ conda update -n base -c defaults conda

## Package Plan ##

environment location: /Users/mahika/miniforge3/envs/mypyenv

added / updated specs:
- anaconda
```



```
[(base) mahika@the-book CC_E4_PES1UG20CS243 % conda activate mypyenv
```



```
[(mypyenv) mahika@the-book CC_E4_PES1UG20CS243 % python3 --version
Python 3.8.11
(mypyenv) mahika@the-book CC_E4_PES1UG20CS243 % ]
```

- b. 2a: Initial leader election has occurred, and first value has replicated.

```
(base) mahika@the-book raftos % conda activate mypyenv  
(mypyenv) mahika@the-book raftos % python node.py --node 1
```

```
[/Users/mahika/zprofile: export 25; not valid in this context: PATH=/opt/homebrew/bin  
/opt/homebrew/bin:/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/usr/local/mysql-8.0-38-macos12-arm64/bin:/usr/local/mysql-8.0-38-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/bin:/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin  
(base) mahika@the-book:~$ raftos % code activate mypyenv  
(mypyenv) mahika@the-book:~$ raftos % tail -f node1_CUSTOMLOG.log  
Leader is now: 127.0.0.1:8000  
Done writing VARIABLE  
Check the .log and .state_machine files!
```

```
File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/events.py", line 81, in _run
    self._context.run(self._callback, *self._args)
File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/selector_events.py", line 1021, in _read_ready
    self._protocol.datagram_received(data, addr)
File "/Users/mahika/CC_E4_PESUG02CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/CC_E4_PESUG02CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/CC_E4_PESUG02CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, 'on_receive')(format(data['type']))(data)
File "/Users/mahika/CC_E4_PESUG02CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.Futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'
```

```
/Users/mahika/.zprofile: export: 28: not valid in this context: PATH=/opt/homebrew/bin  
/usr/opt/homebrew/bin:/opt/local/bin:/usr/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/lib:/opt/homebrew/sbin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/bin/usr/local/mysql-8.0.38-macos12-arm64/bin:/usr/local/mysql-8.0.38-macos12-arm64-support-files:/Applications/Vimwave/Fusion.app/Contents/Resources:/Library/Apple/usr/bin:/Users/mahika/.nv/versions/node/v16.14.2/bin:/Users/mahika/mingfor3d/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/lib:/opt/local/bin:/usr/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin  
(base) mahika $ ./book rafts % conda activate mypyenv  
(mypyenv) mahika$the-book rafts % tail -f node2_CUSTOMLOG.log  
Leader is now: 127.0.0.1:8000
```

```
File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/selector_events.py", line 1021, in _read_ready
    self._protocol.datagram_received(data, addr)
File "/Users/mahika/E4_PESU1020CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/E4_PESU1020CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/E4_PESU1020CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, 'on_receive_{}'.format(format(data['type'])))(data)
File "/Users/mahika/E4_PESU1020CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.Futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'
```

```
/Users/mahika/.zprofile:export:25: not valid in this context: PATH:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin/:/bin:/usr/sbin:/sbin:/usr/local/mysql-8.0.30-macos12-arm64/bin:/usr/local/mysql-8.0.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin
(base) mahika@the-book raftos % conda activate mypyenv
(mypyenv) mahika@the-book raftos % tail -f node1_CUSTOMLOG.log
Leader is now: 127.0.0.1:8000
Done writing VARIABLE
Check the .log and .state_machine files!
```

```
/Users/mahika/.zprofile:export:25: not valid in this context: PATH:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin/:/bin:/usr/sbin:/sbin:/usr/local/mysql-8.0.30-macos12-arm64/bin:/usr/local/mysql-8.0.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin
(base) mahika@the-book raftos % conda activate mypyenv
(mypyenv) mahika@the-book raftos % tail -f node2_CUSTOMLOG.log
Leader is now: 127.0.0.1:8000
```

```
:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin/:/bin:/usr/sbin:/sbin:/usr/local/mysql-8.0.30-macos12-arm64/bin:/usr/local/mysql-8.0.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin/3
(base) mahika@the-book raftos % conda activate mypyenv
(mypyenv) mahika@the-book raftos % tail -f node3_CUSTOMLOG.log
Leader is now: 127.0.0.1:8000
```

We can see that the elected leader is node 1.

c. 2b: Leader crashed, new leader elected, and second value replicated.

<pre>(base) mahika@the-book raftos % conda activate mypyenv (mypyenv) mahika@the-book raftos % python node.py --node 1 <decorator->(most recent call last): File "node.py", line 88, in <module> loop.run_forever() File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/base_events.py", line 570, in run_forever self._run_once() File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/base_events.py", line 1823, in _run_once event_list = self._selector.select(timeout) File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/selectors.py", line 558, in select key_list = self._selector.control(None, max_ev, timeout) KeyboardInterrupt (base) mahika@the-book raftos %</pre>	<pre>/Users/mahika/.zprofile:export:25: not valid in this context: PATH=/opt/homebrew/bin:/bin:/usr/local/bin:/usr/local/sbin:/usr/local/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/sbin:/usr/local/mysql-8.0_30-macos12-arm64/bin:/usr/local/mysql-8.0_30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin (base) mahika@the-book raftos % conda activate mypyenv (mypyenv) mahika@the-book raftos % tail -f node1_CUSTOMLOG.log Leader is now: 127.0.0.1:8000 Done writing VARIABLE Check the .log and .state_machine files!</pre>
<pre>File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/events.py", line 81, in _run self._context.run(self._callback, *self._args) File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/selector_events.py", line 1021, in _read_ready self._protocol.datagram_received(data, addr) File "/Users/mahika/E4_PES1UG20CS243/raftos/raftos/network.py", line 33, in datagram_received self.request_handler(data) File "/Users/mahika/E4_PES1UG20CS243/raftos/raftos/server.py", line 73, in request_handler getattr(self.state, 'on_receive_1')().format(data['type']))(data) File "/Users/mahika/CC_E4_PES1UG20CS243/raftos/raftos/state.py", line 534, in request_handler getattr(self.state, 'on_receive_1')().format(data['type']))(data) except (asyncio.futures.InvalidStateError, AttributeError): AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError' File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/selector_events.py", line 1021, in _read_ready self._protocol.datagram_received(data, addr) File "/Users/mahika/CC_E4_PES1UG20CS243/raftos/raftos/network.py", line 33, in datagram_received self.request_handler(data) File "/Users/mahika/E4_PES1UG20CS243/raftos/raftos/server.py", line 73, in request_handler getattr(self.state, 'on_receive_1')().format(data['type']))(data) File "/Users/mahika/CC_E4_PES1UG20CS243/raftos/raftos/state.py", line 534, in request_handler getattr(self.state, 'on_receive_1')().format(data['type']))(data) File "/Users/mahika/CC_E4_PES1UG20CS243/raftos/raftos/state.py", line 53, in wrapped except (asyncio.futures.InvalidStateError, AttributeError): AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'</pre>	<pre>n:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin:/30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin (base) mahika@the-book raftos % conda activate mypyenv (mypyenv) mahika@the-book raftos % tail -f node2_CUSTOMLOG.log Leader is now: 127.0.0.1:8000 Leader is now: None Leader is now: 127.0.0.1:8002 Done writing VARIABLE Check the .log and .state_machine files!</pre>

The Newly elected leader is now node 2.

```
/Users/mahika/.zprofile:export:25: not valid in this context: PATH:/opt/homebrew/bin  
n:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin,:/bin:/usr/sbin:/sbin:usr/local/mysql-8.0.30-macos12-arm64/bin:/usr/local/mysql-8.0.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin  
(base) mahika@the-book raftos % conda activate mypyenv  
(mypyenv) mahika@the-book raftos % tail -f node1_CUSTOMLOG.log  
Leader is now: 127.0.0.1:8000  
Done writing VARIABLE  
Check the .log and .state_machine files!
```

```
n:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/usr/bin,:/bin:/usr/sbin:/sbin:usr/local/mysql-8.0.30-macos12-arm64/bin:/usr/local/mysql-8.0.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/bin/3  
(base) mahika@the-book raftos % conda activate mypyenv  
(mypyenv) mahika@the-book raftos % tail -f node2_CUSTOMLOG.log  
Leader is now: 127.0.0.1:8000  
Leader is now: None  
Leader is now: 127.0.0.1:8002
```

```
.30-macos12-arm64/support-files:/Applications/VMware Fusion.app/Contents/Public:/Library/Apple/usr/bin:/Users/mahika/.nvm/versions/node/v16.14.2/bin:/Users/mahika/miniforge3/envs/mypyenv/bin:/Users/mahika/miniforge3/condabin:/opt/homebrew/bin:/opt/homebrew/sbin:/opt/local/bin:/opt/local/sbin:/Library/Frameworks/Python.framework/Versions/3.9/bin:/Users/mahika/.local/bin:/Users/mahika/Development/mongodb/binry  
(base) mahika@the-book raftos % conda activate mypyenv  
(mypyenv) mahika@the-book raftos % tail -f node3_CUSTOMLOG.log  
Leader is now: 127.0.0.1:8000  
Leader is now: None  
Leader is now: 127.0.0.1:8002  
Done writing VARIABLE  
Check the .log and .state_machine files!
```

- d. 2c: Old leader comes back online, but becomes a follower instead and updates its old state to its new state.

```

self._protocol.datagram_received(data, addr)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, '_on_receive', {})(format(data['type']))(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'
Exception in callback _SelectorTransport._read_ready()
handle: <Handle _SelectorTransport._read_ready()
Traceback (most recent call last):
  File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 52, in wrapped
    self.apply_future.set_result(not_applied)
AttributeError: 'Follower' object has no attribute 'apply_future'

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/events.py", line 81, in _run
    self._loop.default_exception_handler(self, exc)
  File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio(selector_events.py", line 1021, in _read_ready
    self._protocol.datagram_received(data, addr)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, '_on_receive', {})(format(data['type']))(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'

File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio/events.py", line 81, in _run
    self._loop.default_exception_handler(self, exc)
  File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio(selector_events.py", line 1021, in _read_ready
    self._protocol.datagram_received(data, addr)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, '_on_receive', {})(format(data['type']))(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'

File "/Users/mahika/miniforge3/envs/mypyenv/lib/python3.8/asyncio(selector_events.py", line 1021, in _read_ready
    self._protocol.datagram_received(data, addr)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/network.py", line 33, in datagram_received
    self.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/server.py", line 73, in request_handler
    self.state.request_handler(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 534, in request_handler
    getattr(self.state, '_on_receive', {})(format(data['type']))(data)
File "/Users/mahika/CC_E4_PESLU02G0CS243/raftos/raftos/state.py", line 53, in wrapped
    except (asyncio.futures.InvalidStateError, AttributeError):
AttributeError: module 'asyncio.futures' has no attribute 'InvalidStateError'

[0] 8 python3.8

```

-the-book.domain.name 09:59 28-Mar-22

B. In addition, all the .log (including CUSTOMLOG), .state_machine and .storage files need to be zipped, with the zip file named the same as above, and submitted.