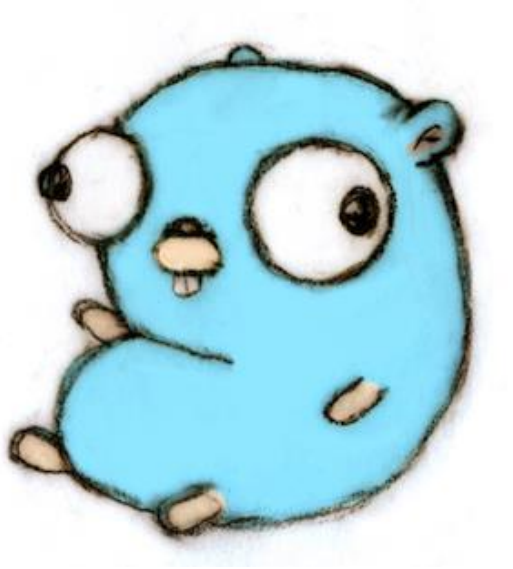
P1 : Distributed Bitcoin Miner

15-440/15-640
10/03/2018



Overview

- P1 Post-checkpoint Unit Tests
- P1 Part B
- Q&A

P1 Post-checkpoint Unit Tests

- TestSendReceive*
- TestRobust*
- TestWindow*
- TestExpBackOff*
- TestServerSlowStart*
- TestServerClose*
- TestServerCloseConns*
- TestClientClose*
- TestServerFastClose*
- TestServerToClient*
- TestClientToServer*
- TestRoundTrip*
- TestVariableLengthMsgServer
- TestVariableLengthMsgClient
- TestCorruptedMsgServer
- TestCorruptedMsgClient

TestSendReceive*

- TestSendReceive* test that all messages sent from one side are received by the other (without relying on epochs to resend any messages)
- Window size = 1
- Otherwise similar to TestBasic*

TestRobust*

- TestRobust* test robustness by inserting random delays in between client/server reads or writes, and by increasing the packet loss to up to 20%
- Window size up to 10
- Client count up to 5

TestWindow*

- TestWindow1~3 test the case that …
  - The sliding window has reached its maximum capacity.
  - Only 'w' unacknowledged messages can be sent out at once.
- TestWindow4~6 test the case that …
  - Messages are returned by Read in the order they were sent (i.e. in order of their sequence numbers).
  - If messages 1-5 are dropped and messages 6-10 are received, then the latter 5 should not be returned by Read until the first 5 are received.

TestExpBackOff*

- TestExpBackOff* test that the number of messages sent due to exponential back-off falls within a reasonable range
- We sniff messages sent through lspnet
- Up to 10 clients
- Up to 15 messages

TestServerSlowStart*

- TestServerSlowStart* test that a client is able to connect to a slow-starting server
  - if the server starts a few epochs later than a client, the presence of epoch events should ensure that the connection is eventually established
- Up to 3 clients
- Timeout after 5 epochs

TestServerClose*
TestServerCloseConns*
TestClientClose*

- Check that the client/server Close methods work correctly
- Pending messages should be returned by Read and pending messages should be written and acknowledged by the other side before Close returns
- CloseConn should return immediately without blocking
- Check that no extra messages are received on the client/server

TestServerFastClose*

- Streaming messages in large batches and the network is toggled on/off (i.e. drop percent is set to either 0% or 100%) throughout.

TestServerFastClose* (Cont.)

- Test procedure at high level
  1. Wait for all servers and clients to be ready
  2. Shut down network
  3. Client application starts writing…
  4. Turn on network and delay (server-client communication resumed)
  5. Shut down network
  6. Server application starts reading…
  7. Server application starts writing…
  8. Start closing server (pending messages need to be ready for send)
  9. Turn on network and delay (server-client communication resumed)
  10. Shut down network
  11. Client application starts reading…
  12. Start closing client

TestServerToClient*
TestClientToServer*
TestRoundTrip*

- Variants of

  TestServerFastClose*

- For more details, read

  lsp4_test.master()

TestVariableLengthMsgServer TestVariableLengthMsgClient

- Check that server/client…
  - Can read normal length message
  - Truncates long messages
  - Doesn't read short messages

TestCorruptedMsgServer TestCorruptedMsgClient

- Check that server/client…
  - Drop **Data** messages whose calculated and recorded checksums don’t match

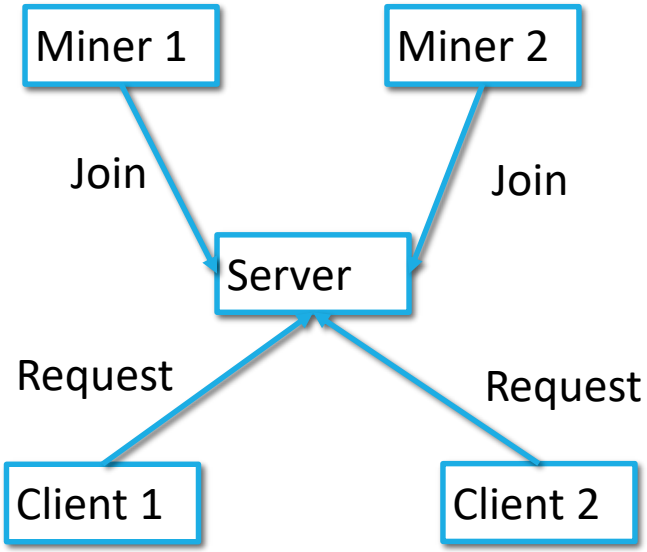
P1 Part B

- Implement a distributed mining infrastructure on top of the LSP you develop for part A

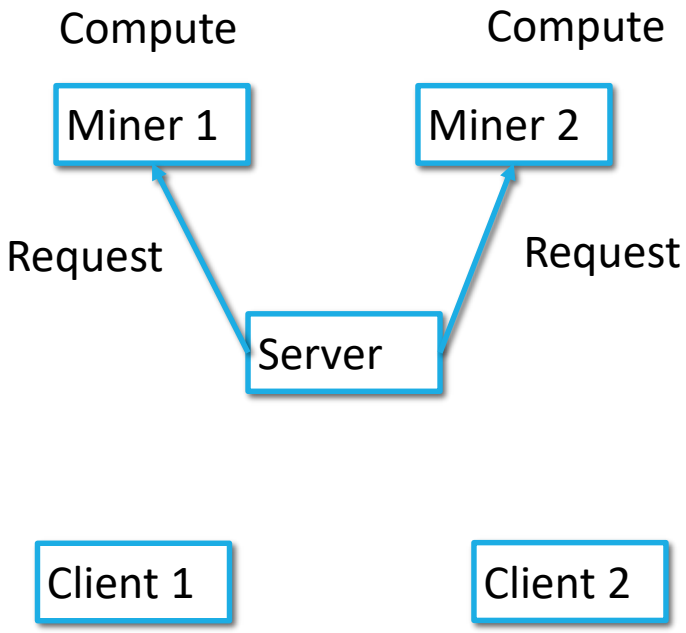
Mining

- Given
  - Message M
  - Unsigned integer N
- Find n such that
  - $0 \leq n \leq N$
  - $\mathrm{h}ash(M, n) \leq \mathrm{h}ash(M, n') \; \forall \; 0 \leq n' \leq N$
- Run brute-force search to enumerate all possible scenarios across multiple machines

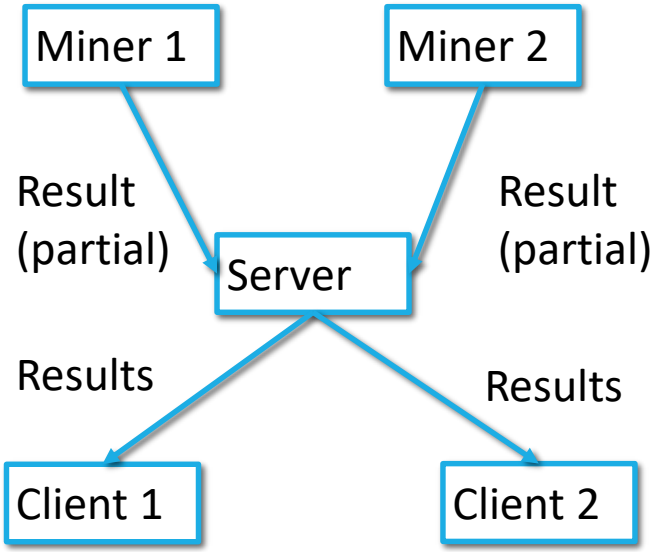
Architecture



Architecture



Architecture



Handling Failures

- When a miner loses contact with the server it should shut itself down.
- When the server loses contact with a miner, **it should reassign any job that the worker was handling to a different worker**. If there are no available miners left, the server should wait for a new miner to join before reassigning the old miner's job.
- When the server loses contact with a request client, it should cease working on any requests being done on behalf of the client (you need not forcibly terminate a job on a miner—just wait for it to complete and ignore its results).
- When a request client loses contact with the server, it should print Disconnected to standard output and exit.
- You should design **a scheduler that balances loads** across all requests, so that the number of workers assigned to each outstanding request is roughly equal. Your code should contain **documentation on how your scheduler achieves this requirement**.

Questions I know you will ask

- Are there hidden tests in part B?
  - Yes
- Does passing the public test mean we can pass the hidden tests?
  - No, not even close
- If we fail the hidden tests on Autolab, can we get useful hints on what is wrong?
  - Barely. You probably don't want to waste 15 submission attempts on debugging. So write good tests!!
- How can we split the work?
  - It depends.
  - Total LOC of bitcoin implementation in our reference solution: ~360
  - Total LOC in hidden tests: >700
  - Write good tests from day 1!!