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Validators experiment

- Setup

Our environment consists of the regular machines, including two executors, a gcmanager, garbler, and a sequencer. Instead of the regular validator, we have introduced new components: internal validators and external validators.

An internal validator is a validator that is configured with the sequencer's public key as an argument in the Docker Compose file. This allows it to identify the sequencer as a peer. Internal validators are always connected to the sequencer and may also establish connections with other validators.

An external validator, on the other hand, is designed to connect exclusively to other validators (internal or external) and is explicitly prohibited from connecting to the sequencer.

- Machine spec

Machine Name	Instance Type
Sequencer	t3a.small
Executor-1	t3a.medium
Executor-2	t3a.medium
GCManager	m5.large
Garbler	m5.large
Validators	t2.small

- Zone

All machines are located in the same availability zone within the Amazon **us-east-1** region (Northern Virginia).

- Validators Connections

As previously mentioned, each internal validator is connected to the sequencer. Connections with other validators are established randomly, as described below:

★ Internal Validator
- Connect to the sequencer
- Choose a random number num_connections between 1 to min(3, **num_internal_validators**)
- For each connection i (from 1 to num_connections):
  - Choose a random internal validator id between 1 to num_internal_validators
  - If the selected id matches this internal validator id or has already been selected, choose another id number.
  - Connects to the internal validator corresponding to the selected id.

★ External Validator
- Choose a random number num_connections between 1 to min(3, **num_internal_validators**)
- For each connection i (from 1 to num_connections):
  - Choose a random internal validator id between 1 to num_internal_validators
  - If the selected id has already been selected, choose another id number.
  - Connects to the internal validator corresponding to the selected id.

    - Choose a random number num_connections between 1 to **num_external_validators**/10
    - For each connection i (from 1 to num_connections):
        - Choose a random external validator id between 1 to num_external_validators
        - If the selected id matches this external validator id or has already been selected, choose another id number.
        - Connects to the external validator corresponding to the selected id.

- Experiment details

Once all the components have been integrated and connected, the next step involves executing the MPC precompile test. This test is run against each validator—both internal and external validators—to verify that the chain functions as expected.

- Experiment goals
    - Ensure all tests pass successfully.
    - Compare the number of tests conducted within an hour.
    - Compare the number of transactions in the most recent blocks.

- Experiment results

    - 1 Internal validator, 1 MPC test, 1 flood test
        - A total of 23 MPC tests were conducted in an hour
        - Number of transactions in 20 blocks: ~400 (between 300-500)

    - 1 Internal validator, 10 MPC tests, 1 flood test
        - A total of 80 MPC tests were conducted in an hour (8 tests passed for each Docker)
        - Number of transactions in 20 blocks: ~700 (between 600-850)

    - 2 Internal validators, 1 External validator
        - A total of 53 MPC tests were conducted in an hour (14, 19, 20)

        - Number of transactions in 20 blocks: ~600 (between 500-800)

    - 5 Internal validators, 10 External validators
        - A total of 83 MPC tests were conducted in an hour (7 validators ran 5 tests, 8 ran 6 tests)
        - Number of transactions in 20 blocks: ~750 (between 650-900)

    - 10 Internal validators, 50 External validators
        - Experiment 1 - running MPC tests against all internal validators and against 3 external validators
            - A total of 81 MPC tests were conducted in an hour (10 validators ran 6 tests, 3 ran 7 tests)
            - Number of transactions in 20 blocks: ~720 (between 650-850)
        - Experiment 2 - running MPC tests against all internal validators and all external validators
            - 43 MPC tests succeeded within an hour, though there were additional tests that timed out after waiting a long time for receipts.
            - Number of transactions in 20 blocks: ~300 (between 150-450)