

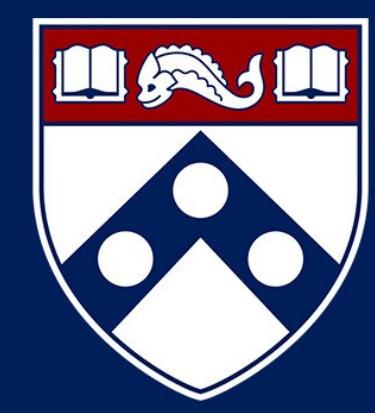
# BFTGym: An Interactive Playground for BFT Protocols

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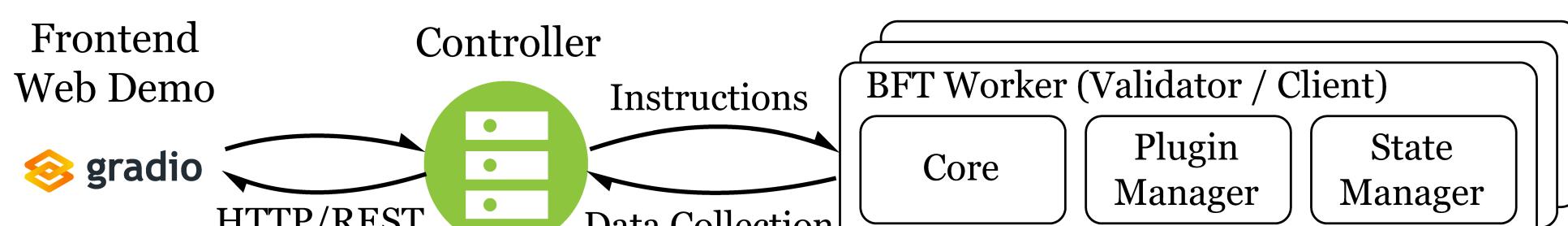
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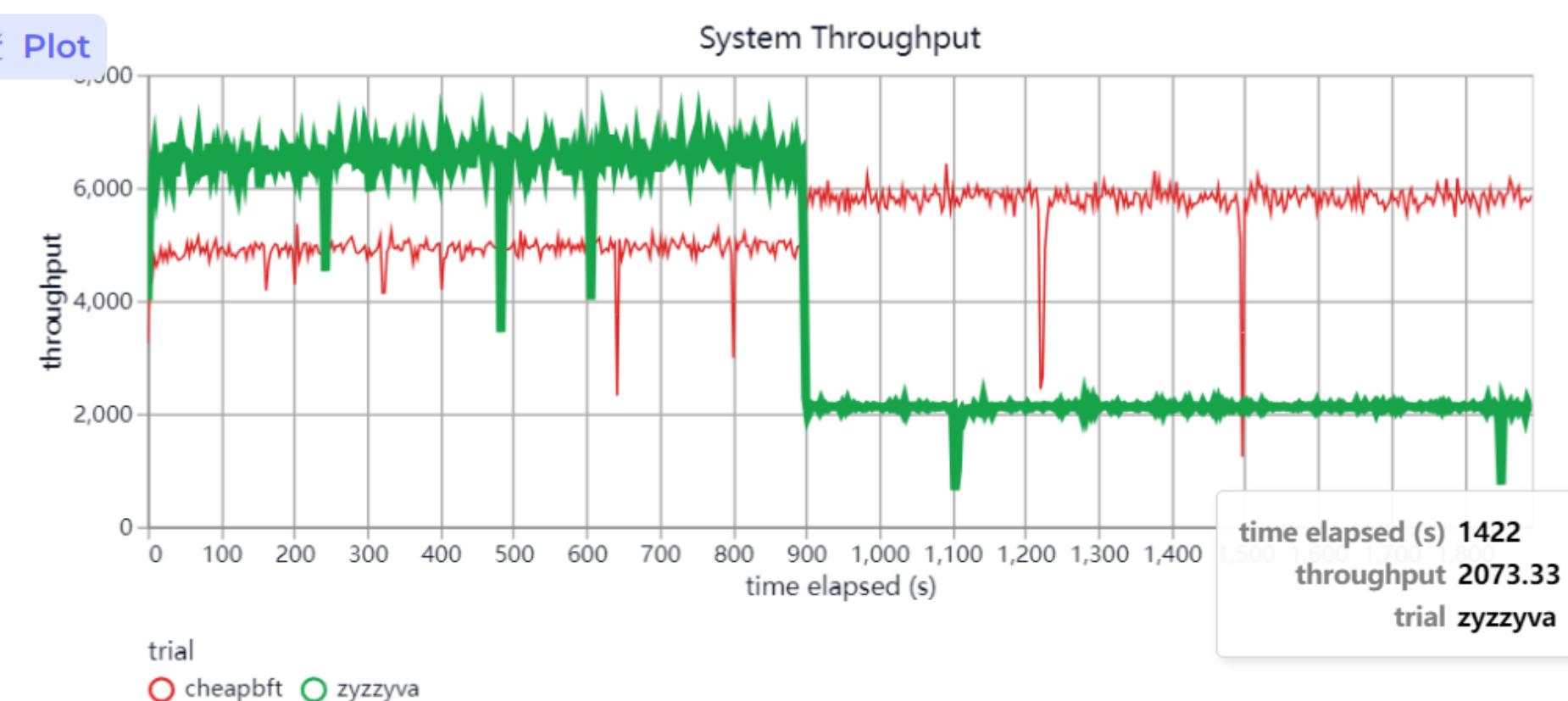
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## System Architecture

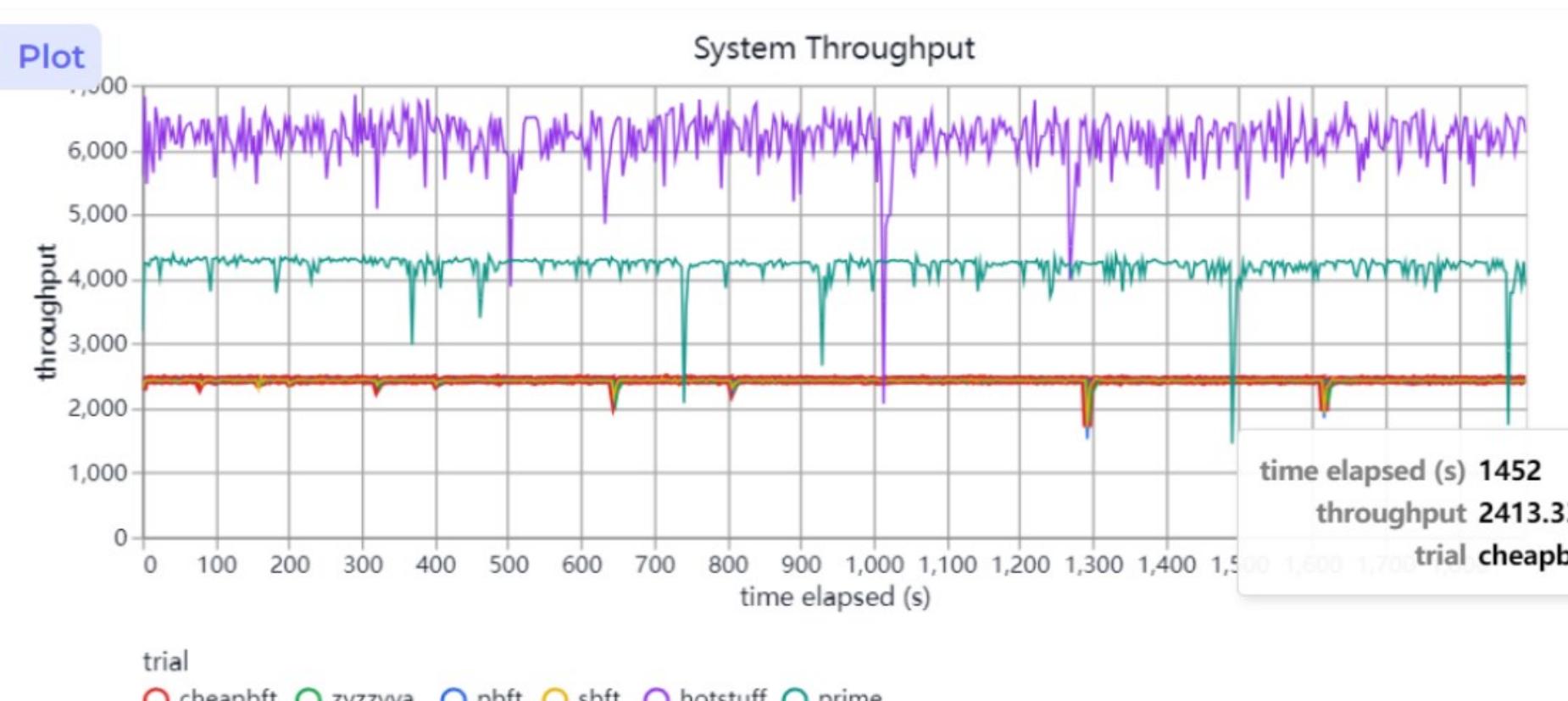


- An **interactive playground** for evaluating, comparing and gathering insights for various BFT protocols under a **unified framework** and a **wide range of conditions**;
- Support **workload adjustment** and **fault injection** with **immediate performance feedback**;
- Enable rapid **prototyping** for new BFT protocols through **Bedrock Domain Specific Language (DSL)**

## Evaluation

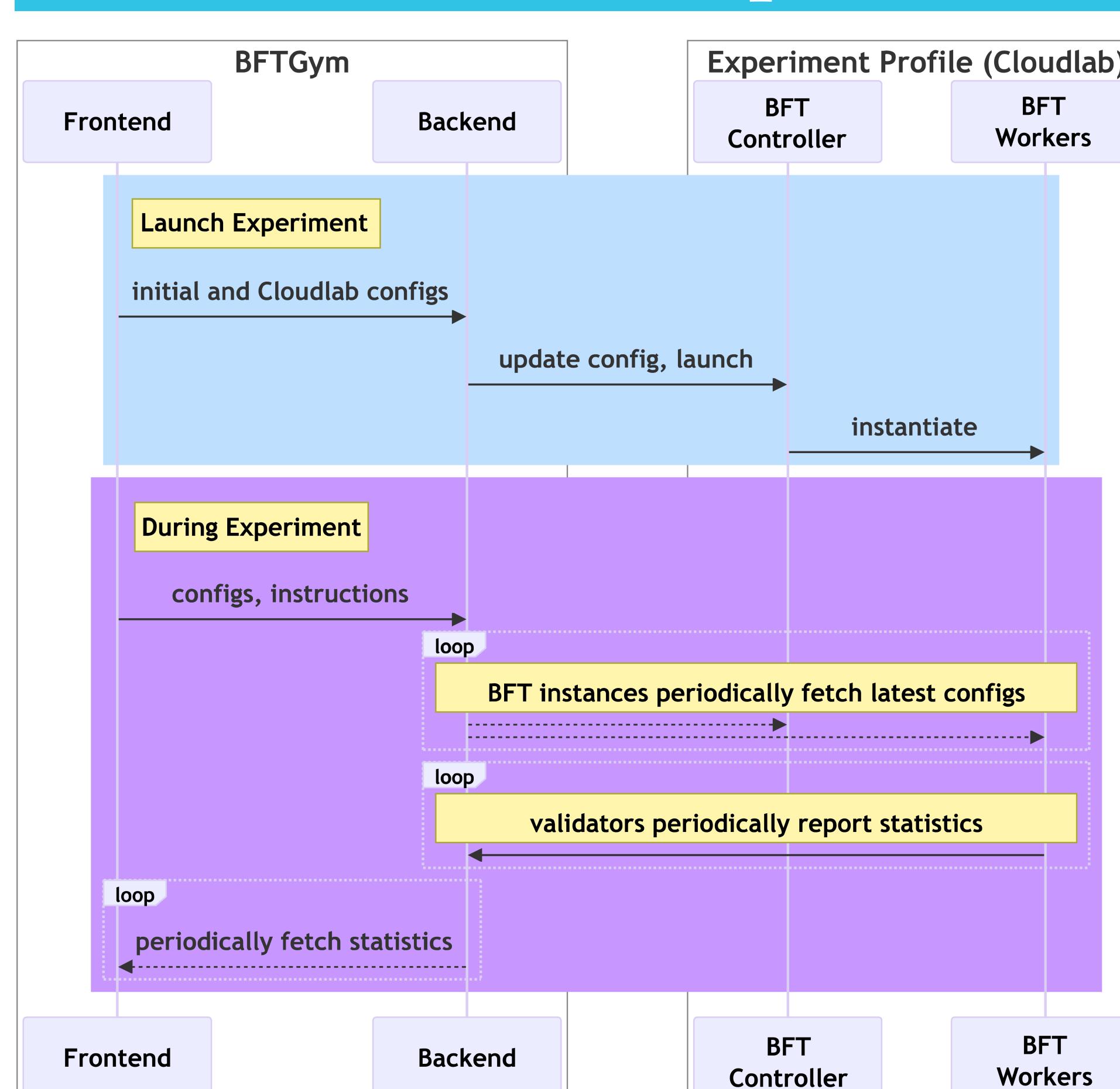


Comparing speculative and non-speculative protocol under 0/0 standard workload with non-responsive fault launched at the middle



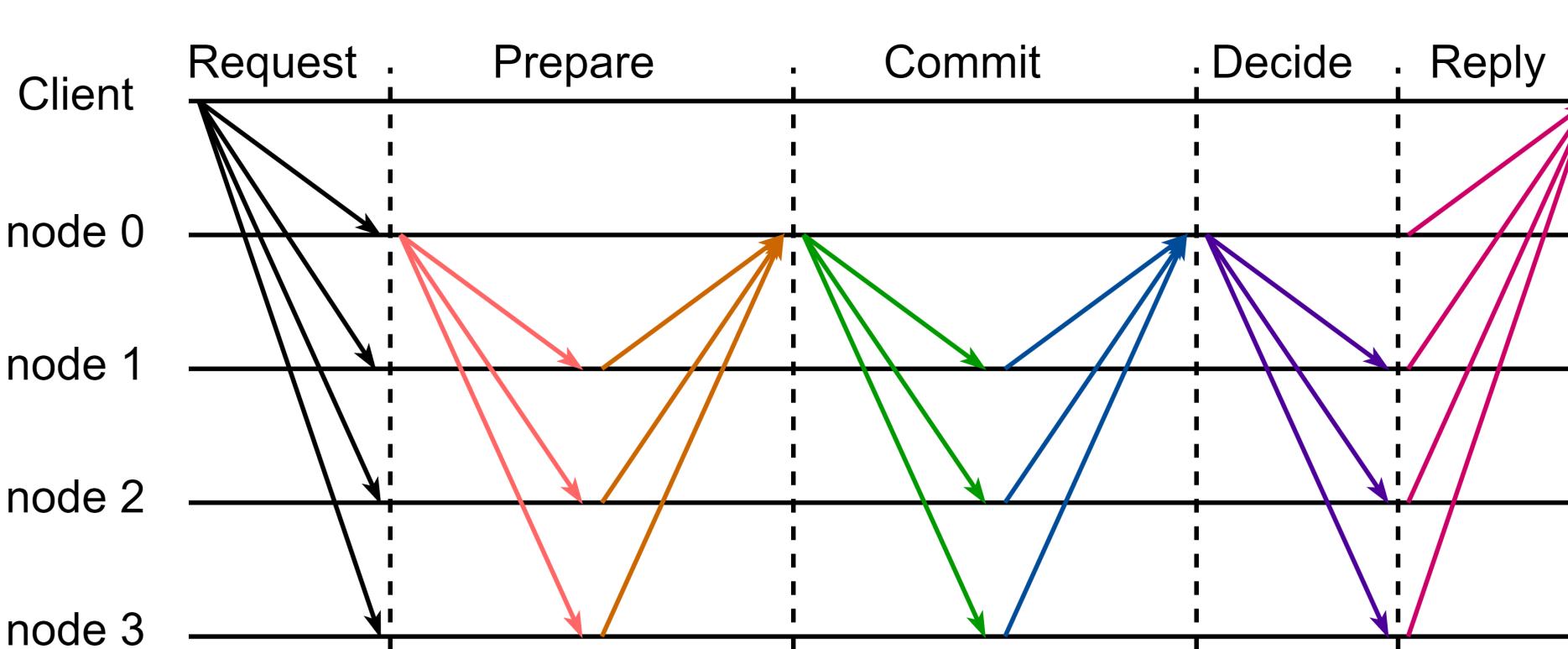
Throughput comparison of 5 protocols under 1/0 standard workload with 20 millisecond slowness fault

## Demo Setup



## Protocol Prototyping

- BFTGym can enable fast protocol prototyping.** Code snippet on the right shows the Bedrock DSL modeling Hotstuff-2, whose communication diagram is shown below.
- Protocols are first-class citizens in BFTGym.** Custom protocols can be seamlessly integrated into the experimental workflow, benefiting from the same functionalities as other built-in ones.



```
# protocol properties
general:
  leader: rotate
  request-target: primary

# roles involved
roles:
  - primary
  - nodes
  - client

# phase definitions
phases:
  - name: normal
    states:
      - idle
      - wait_prepare
      - wait_commit_primary
      - wait_commit_all
      - wait_decide
      - executed
    messages:
      - name: request
        request-block: true
      - name: reply
        request-block: true
      - name: prepare
        request-block: true
      - commit
      - decide

  - name: checkpoint
    messages:
      - checkpoint

# data flow
transitions:
  from:
    - role: client
      state: idle
      to:
        - state: executed
          update: sequence
          condition:
            type: message
            message: commit
            quorum: 2f + 1
          response:
            - target: nodes
              message: decide
            - target: client
              message: reply

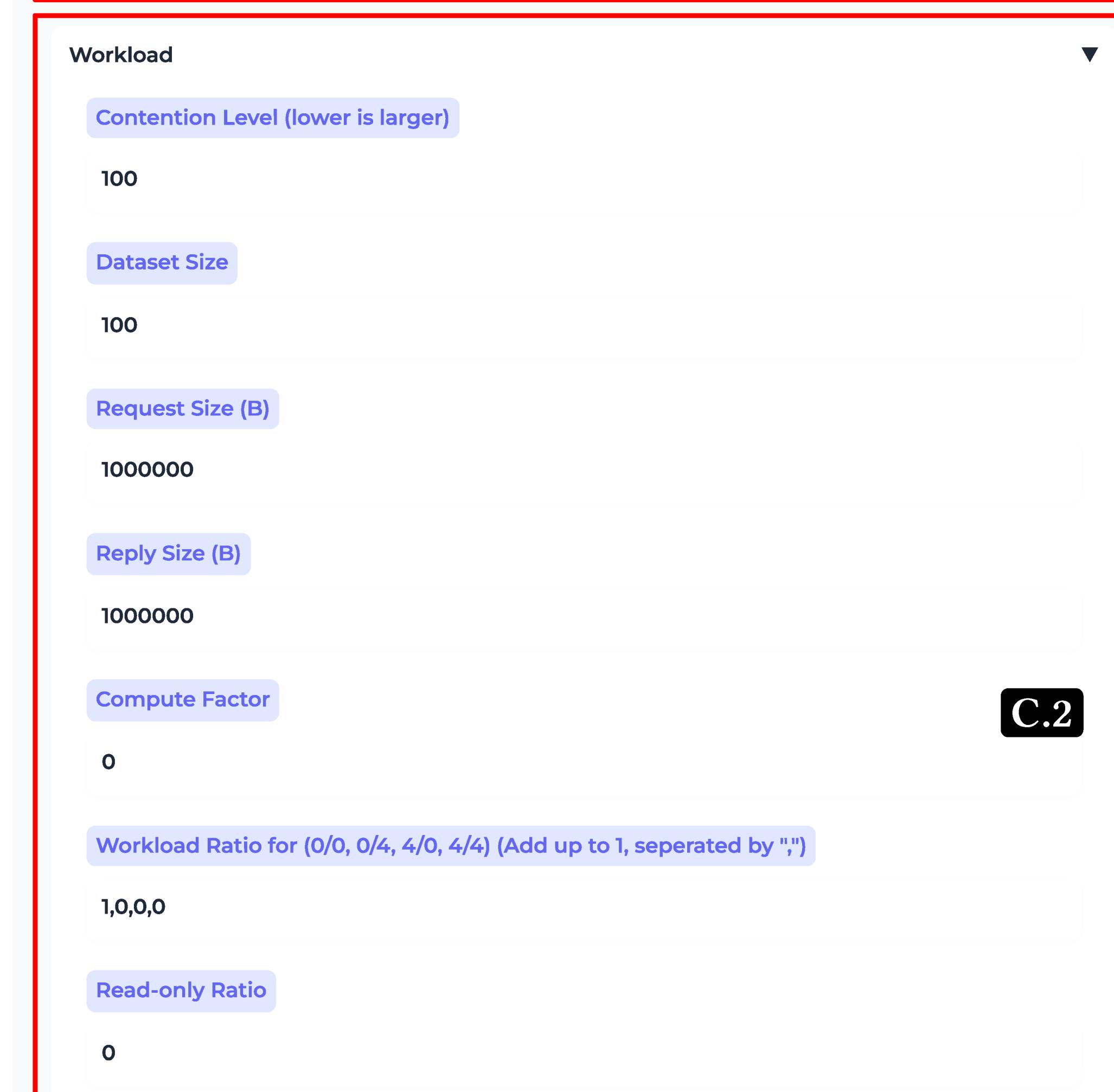
    - role: primary
      state: idle
      to:
        - state: wait_prepare
          condition:
            type: message
            message: prepare
            quorum: 1
          response:
            - target: primary
              message: prepare

    - role: nodes
      state: wait_commit_all
      to:
        - state: wait_decide
          condition:
            type: message
            message: commit
            quorum: 1
          response:
            - target: primary
              message: commit

    - role: primary
      state: wait_commit_primary
      to:
        - state: executed
          update: sequence
          condition:
            type: message
            message: commit
            quorum: 2f + 1
          response:
            - target: nodes
              message: decide
            - target: client
              message: reply

    - role: nodes
      state: wait_decide
      to:
        - state: wait_prepare
          condition:
            type: message
            message: request
            quorum: 1
          response:
            - target: nodes
              message: prepare
```

## Demo Interface



### BFTGym: An Interactive Playground for BFT Protocols

**A** Interactive Playground    **B** Results Comparison

**C** Step 1 - Configurations

Fault: Non-responsive Nodes (IDs separated by ",")

1

In-dark - enabled:  True  False

Slow proposal Nodes (IDs separated by ",")

0

Slowness of proposal in milliseconds

0

**C.2** Workload

Update

Units Status

Controller: Updated    Replica 0: Updated    Replica 1: Updated    Replica 2: Updated

Replica 3: Updated    Client: Updated

Cloudlab Configurations

**C.3**

**D** Step 2 - Control Panel

Trial Name: default

Protocol: pbft

Custom Protocol: Only applicable when protocol selected to custom

Start Stop

