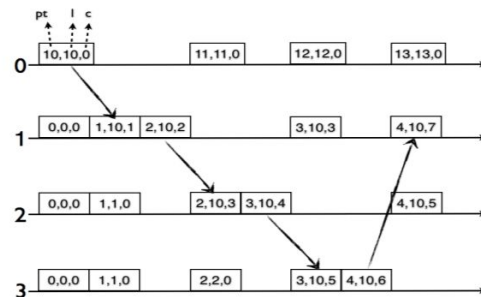# pyHLC

By Patrick Cudahy
Based on *Logical Physical Clocks*

Background

- Combination of Vector and Physical Clocks
    - Called Hybrid Logical Clocks (HLC)
- Maintains serializability between Physical time updates
- Avoids the hardware requirements of Spanner
- Used in CockroachDB

My Goals

- Create a Python implementation of HLC
- Open source code for future use
- Runs on low-spec hardware
- Easily scalable for adding subtracting nodes
- Drops in to other Python programs

Implementation

- Coded in Python 3.6
- Uses ZeroMQ for low-latency, efficient messaging
- All nodes communicate actions and timestamps
- Modified NTP timestamps by replacing last three digits with c values
- One NTP node that sends out update for physical time at assigned interval
- For testing, every node randomly announces an empty action every .01 to 1 seconds
- Nodes maintain their TCP address and all other nodes TCP addresses in a .txt file

Results

c Values Over Differing NTP Update Intervals
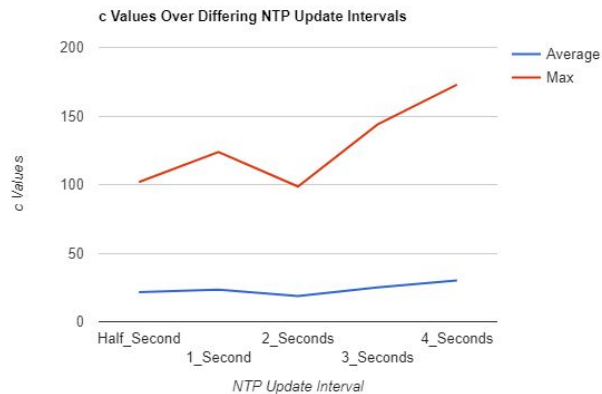
['Local': [49, 50, 50, 50, 48], 'Half': [101, 102, 102, 102, 102], 'One': [124, 124, 124, 123, 124], 'Two': [99, 99, 98, 99, 98], 'Three': [144, 144, 144, 144, 143], 'Four': [173, 173, 173, 173, 172]}
Local
49.4
Half
101.8
One
123.8
Two
98.6
Three
143.8
Four
172.8
['Local': [13.92868719611021, 13.764561115668581, 13.638141809290953, 13.424635332252837, 13.801360544217687], 'Half': [21.118218161050827, 21.549382716049383, 21.567045454545454, 22.064590542099193, 21.46113989637306], 'One': [23.457184750733138, 23.508957415565344, 23.09973521624007, 23.446062407132242, 23.23215898825655], 'Two': [18.727069351230426, 18.811830985915492, 18.63108983384962, 18.914383561643834, 18.77898034747935], 'Three': [24.913364307187756, 24.8365673681333337, 25.027671232876713, 24.99614218793056, 25.047763666482606], 'Four': [30.149740034662045, 30.614986187845304, 30.78308697146786, 29.138898632058925, 29.58148404993065]}
Local
13.711477199508053
Half
21.552075354023582
One
23.34881975558547
Two
18.772670816023744
Three
24.9643017525222
Four
30.053639175192956

Future Work

- Removal of all print() statements
- Node TCP addresses sent out by NTP node
- Packaged for pip installation
- Message modification for final installable

Questions?