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CECS 327-02

Project 2 - A Try of P2P System

| Youtube Link | |
|------------------------|---|
| Docker Steps | |
| System Design Analysis | |
| Architecture Overview | 2 |
| Container Behavior | 3 |
| Challenges Faced | 3 |
| Contributions | 3 |
| Screenshots | |

Youtube Link - https://youtu.be/PrzpqShtasg

Docker Steps

- 1. Create a Project Directory
 - a. mkdir p2p-system && cd p2p-system
- 2. Write a Basic P2P Node Application
 - a. Making sure that we create a unique uuid for each node
 - b. Make a flask server as well to get these request for the peer to peer communication
- 3. Run these files together

System Design Analysis

Architecture Overview

Type: Peer-to-Peer (P2P) system
Total Nodes: 50 + 1 bootstrap node

Technology Stack:

- Python 3.9
- Flask (API framework)
- Flask-CORS (for cross-origin communication)
- Docker (container orchestration)
- Docker Compose (multi-container deployment)

Components

Bootstrap Node

Acts as the initial registry for all nodes

- Exposes endpoints to:
 - Register new nodes (/register)
 - List all known peers (/peers)
- Doesn't initiate communication just a directory.

P2P Nodes (node1 to node50)

- Each has a unique port (8001-8050)
- On startup, registers itself with the bootstrap node
- Receives peer list from bootstrap
- Randomly selects a peer to send a message t

Workflow

Startup:

- nodeX → Registers to bootstrap via POST /register
- nodeX → Retrieves peer list from bootstrap via GET /peers
- nodeX → Sends a POST /message to a random peer
- 2. Messaging:
 - Messages contain sender ID and custom greeting
 - Peers respond with confirmation + their hostname
- 3. Health Check:

- Each node has /status endpoint
- Bootstrap has /status and /health

Container Behavior

- Each container is self-contained with its own Flask app and peer registry.
- Docker Compose spins up 51 services (bootstrap + 50 nodes).
- Nodes use internal Docker DNS (e.g., node5:8050) for service discovery.

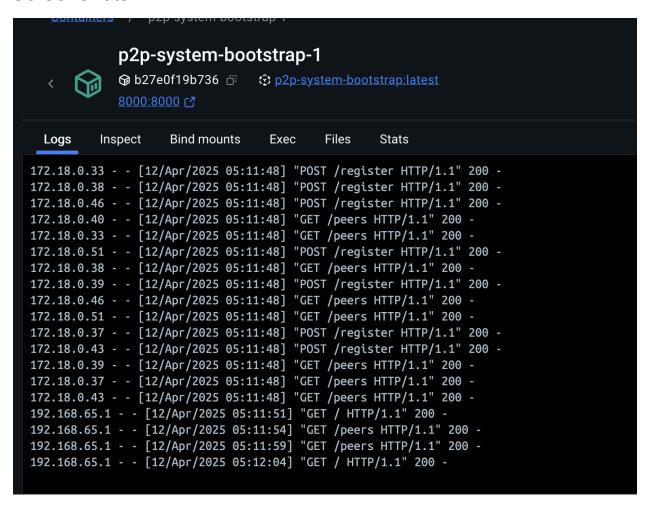
Challenges Faced

- Connecting to the nodes at first
- Making sure Flask is fully on for the nodes when sending messages
- No other challenges faced

Contributions

Joseph - Dockerfiles and part of p2pnode.py, docs for system architecture **Jayden** - Completed p2pnode.py, bootstrap.py, debugging **Dominique** - Video demo, screenshots and README

Screenshots

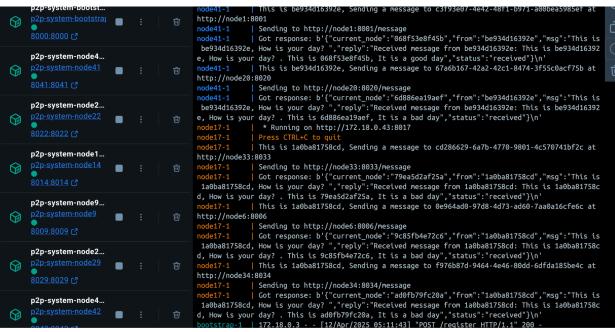


```
2025-04-10 10:56:39 node49-1
                                                                               Serving Flask app 'p2pnode
                                                                           * Debug mode: on
 2025-04-10 10:56:39 node49-1
 2025-04-10 10:56:39 node49-1
                                                                                             This is a development server. Do not use it in a production deployment. Use a produ
                                                                                                                                                                                                                                                                                                 (1)
                                                                           * Running on all addresses (0.0.0.0)
* Running on http://127.0.0.1:8049
 2025-04-10 10:56:39 node49-1
 2025-04-10 10:56:39 node49-1
                                                                                                                                                                                                                                                                                                 (1)
                                                                           * Running on http://172.19.0.39:8049
 2025-04-10 10:56:39 node49-1
 2025-04-10 10:56:39 node49-1
                                                                       * Restarting with stat

* Debugger is active!

* Debugger PIN: 106-407-069

172.19.0.37 - - [10/Apr/2025 17:56:40] "GET /status HTTP/1.1" 200 -
172.19.0.37 - - [10/Apr/2025 17:56:40] "POST /message HTTP/1.1" 200 -
 2025-04-10 10:56:39 node49-1
 2025-04-10 10:56:40 node49-1
 2025-04-10 10:56:40 node49-1
 2025-04-10 10:56:40 node49-1
 2025-04-10 10:56:40 node49-1
                                                                        Starting as regular node, connecting to bootstrap: http://bootstrap:8000
Starting P2P node with ID: f7858e6a-6dd6-4815-8850-ddc85c6b2d47
Node is running on http://localhost:8016
 2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
                                                                        Successfully registered with bootstrap node at http://bootstrap:8000
Got 41 peers from bootstrap node
2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
2025-04-10 10:56:40 node16-1
                                                                         This is 760ecc060a17, Sending a message to 1c90702b-4ce3-4eeb-a396-9329c7ec2ee7 at http://no
Dezs:0929 Dezs:0929 Dezs:0929 Dezs:0929 Dez:0929 Dez:0929
                                                                          * Debug mode: on
 2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
                                                                                             This is a development server. Do not use it in a production deployment. Use a produ
 2025-04-10 10:56:40 node16-1
                                                                          * Running on all addresses (0.0.0.0)
                                                                          * Running on http://127.0.0.1:8016
* Running on http://172.19.0.28:8016
 2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
 2025-04-10 10:56:40 node16-1
2025-04-10 10:56:40 node16-1
                                                                          * Restarting with stat
* Debugger is active!
 2025-04-10 10:56:40 node16-1
                                                                           * Debugger PIN: 910-934-866
 2025-04-10 10:56:40 node16-1
                                                                         Starting as regular node, connecting to bootstrap: http://bootstrap:8000
 2025-04-10 10:56:37 node2-1
2025-04-10 10:56:37 node2-1
2025-04-10 10:56:37 node2-1
                                                                        Starting P2P node with ID: a9f6649c-50e7-4603-856b-ea22e807f11c Node is running on http://localhost:8002
                                                                        Successfully registered with bootstrap node at http://bootstrap:8000
Got 20 peers from bootstrap node
 2025-04-10 10:56:37 no
 2025-04-10 10:56:37 node2-1
```



```
| Status : received | Sjatranglaydens-Air-2 p2p-system % curl —X POST http://localhost:8050/message —H "Content—Type: application/json" —d '{"sender": "Node5", "msg": "Hello Node50!, This is a test"}  
| "current_node": "37c2be685920", ""from": "Node5", "msg": "Nello Node50!, This is a test", "reply": "Received message from Node5: Hello Node50!, This is a test. This is d7c2be685020, It is a bad day", "status": "received" | SjatrangJaydens-Air-2 p2p-system % curl —X POST http://localhost:8021/message —H "Content—Type: application/json" —d '{"sender": "Node5", "msg": "Hello Node21!, This is a test"}'  
| "current_node": "709b04fab5b2", "from": "Node21!, This is a test", "reply": "Received message from Node5: Hello Node21!, This is a test. This is 709b04fab5b2, It is a good day", "status": "received" | SjatrangJaydens—Air-2 p2p-system % curl —X POST http://localhost:8005/message —H "Content—Type: application/json" —d '{"sender": "Node21", "msg": "Hello Node5!, This is a test"}'  
| "current_node": "2c34cea90035", "from": "Node21", "msg": "Hello Node5!, This is a test")  
| "current_node": "2c34cea90035", "from": "Node21", "msg": "Hello Node5!, This is a test")  
| "reply": "Received message from Node21! Hello Node5!, This is a test", "reply": "Received message from Node21!, "msg": "Hello Node5!, This is a test")  
| "reply": "Received message from Node21!, "msg": "Hello Node5!, This is a test")  
| "reply": "Received message from Node21!, "msg": "Hello Node5!, This is a test")  
| "reply": "Received message from Node21!, "msg": "Hello Node5!, This is a test")  
| "reply": "Received message from Node21!, "msg": "Hello Node5!, This is a test", "reply": "Received message from Node5! Hello Node5!, This is a test")  
| "reply": "Received message from Node5!, This is a test")  
| "reply": "Received message from Node5!, This is a test")  
| "reply": "Received message from Node5!, This is a test")  
| "reply": "Received message from Node5!, This is a test")  
| "reply": "Received message from Node5!, This is a test")  
|
```

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[10/Apr/2025 17:56:35] "POST /register HTTP/1.1" 200 - [10/Apr/2025 17:56:35] "POST /register HTTP/1.1" 200 -
                                                                                                                                                                                                                                                                       172, 19, 0.7

172, 19, 0.3

172, 19, 0.3

172, 19, 0.4

172, 19, 0.8

172, 19, 0.6

172, 19, 0.6

172, 19, 0.5

172, 19, 0.3

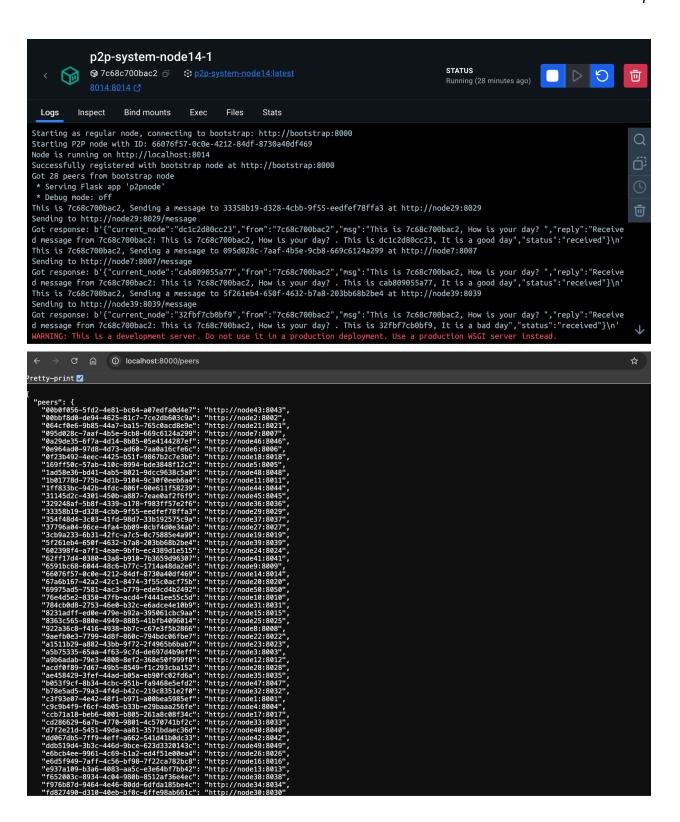
172, 19, 0.8

172, 19, 0.9

172, 19, 0.9

172, 19, 0.9

172, 19, 0.9
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2025-04-10 10:56:35 bootstrap-1
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[10/Apr/2025 17:56:35] "POST /register HTTP/1.1" 200
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| 172.19.0.12 -
| 172.19.0.11 -
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[10/Apr/2025 17:56:35] "POST /register HTTP/1.1" 200 -
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2025-04-10 10:56:35 bootstrap-1
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2025-04-10 10:56:37 bootstrap-1
```



```
← → ♂ ⑥ ⑥ localhost:8014

Pretty-print ☑ {
"message": "Node 66076f57-0c0e-4212-84df-8730a40df469 is running!"
}
```