Project 3 - Socket Programming

Transient Services

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CS 372 - Intro to Computer Networks

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Table of Contents

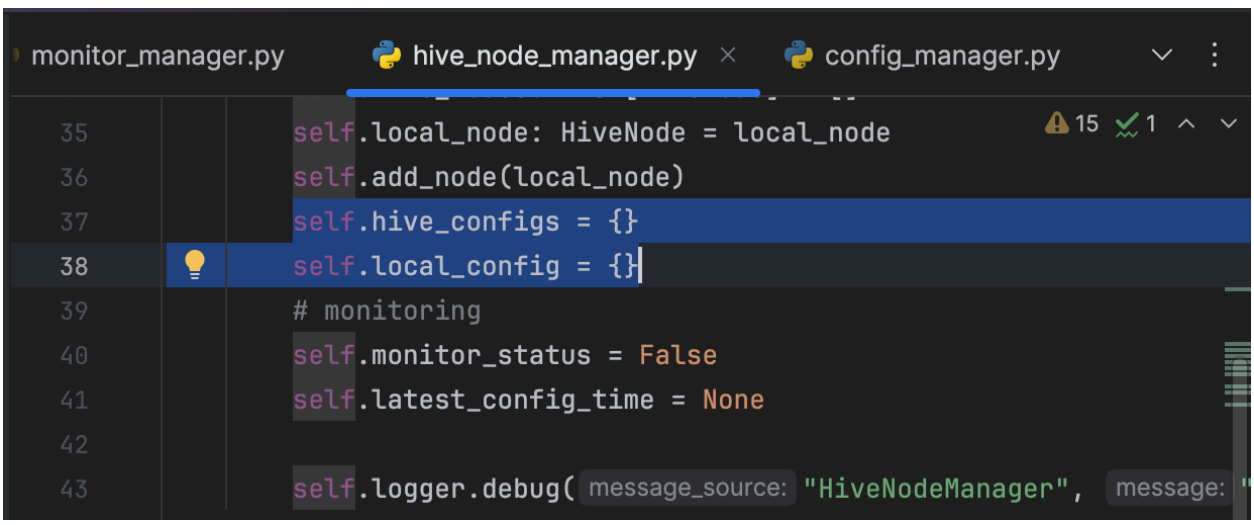
Hive Member Software Requirement Specifications

Hive SRS 1

Existing functionality was not changed. Functionality was only added. Some methods were added in the provided files to extend functionality, but most functionality is in new files and classes.

Hive SRS 2

Hive configuration and local node configuration are both stored in memory as python dictionaries in the HiveNodeManager object. When the HiveReceiverService receives a new configuration for a node, the list in the HiveNodeManager is updated.



The ConfigManager ensures that each hive node is continually updating the rest of the nodes with their current configuration. This is performed in the run function that contains a while loop. This is initiated in a dedicated thread in the app_main function, so that it runs continuously when the app is started. Configuration information is sent as a config_message type, which uses the BaseMessage class is similar to the GossipMessage class. See the figure below.

app_main.py monitor_manager.py hive_node_manager.py config_manager.py

```python

    def run(self) -> None:
        """
        Starts the config protocol by periodically sending config messages to all nodes in the network.
        """
        while True:
            if ConfigManager.enable:
                self.logger.debug( message_source: "ConfigManager",  message: "Running...")

                # get config info and send to all other nodes
                config_info: Dict[str, Dict[str, str]] = {
                    self.hive_node_manager.local_node.friendly_name: {
                        'config': self.hive_node_manager.local_config}
                }
                # send config update to all nodes
                recipient_nodes = self.hive_node_manager.get_all_live_nodes()
                for node in recipient_nodes:
                    if node:

                        config_message: ConfigMessage = ConfigMessage(
                            sender=self.hive_node_manager.local_node,
                            recipient=node,
                            config=config_info
                        )
                        new_hive_message: HiveMessage = HiveMessage(config_message)
                        # print(f"Testing {new_hive_message}")
                        self.outbound_message_queue.enqueue(new_hive_message)
                    else:
                        self.logger.debug( message_source: "ConfigManager",  message: "No live nodes found...")

            time.sleep(AppSettings.CONFIG_FREQUENCY_IN_SECONDS)
```

Hive SRS 3

The configuration uses the default names given in the assignment description for each node. London, Los Angeles, New York, etc. A snip below, shows a configuration with the node name. As nodes are added and configured, they are added to this overall configuration dictionary.

```
{
    "London": {"tasks": [
        {
            "hostname": "google.com",
            "service": "HTTP",
            "ip": "None",
            "port": 80,
            "frequency": 15
        },
        {
            "hostname": "oregonstate.edu",
            "service": "HTTPS",
            "ip": "None",
            "port": 443,
            "frequency": 15
        },
        {
            "hostname": "nist.gov",
            "service": "TCP",
            "ip": "51.164.123.247",
            "port": 80,
            "frequency": 15
        }]
            },
```

Hive SRS 4

The monitoring configuration is managed in the MonitorManager. When a node receives an updated configuration from another node, it can easily update the dictionary shown in the figure above. The method access the specific nodes configuration data in the dictionary's and updates it.

This is handled in the HiveReceiverService object. When a config_message from another node is received, it is passed to the hive_node_manager, which manages the configuration list. The hive_node_manager is responsible for updating the configuration.

```python
def handle_config(self, data_dict: Dict, sender_node: HiveNode) -> None:
    """
    Handles an incoming 'config' message, updating the node manager with any new configurations and logging the information.

    Parameters:
    ----------
    data_dict : Dict
        The dictionary containing the data from the incoming message.
    sender_node : HiveNode
        The node that sent the config message.
    """
    config = data_dict.get('config', {})
    for friendly_name, config_info in config.items():
        if friendly_name != self.hive_node_manager.local_node.friendly_name:
            self.hive_node_manager.add_config(friendly_name, config_info)

    self.logger.info( message_source: "HiveReceiverService",  message: f"Handled config from {sender_node.friendly_name}")
```

Hive SRS 5

The results from the monitoring are logged and then printed to the terminal, using the Logger class, similar to the rest of the program. Below is a screenshot of the terminal, and the second figure is a snip of the same results in the log.

```
Hive.v01 — -zsh — 178×25
[2024-06-03 03:46:57][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:46:57]: HTTPS request to oregonstate.edu. Description: 200 Server is up
[2024-06-03 03:46:57][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49170)
[2024-06-03 03:46:57][HiveReceiverService            ][INFO   ] Handled heartbeat from LosAngeles
[2024-06-03 03:47:00][HeartbeatProtocolCommandManager][INFO   ] Sending heartbeat to LosAngeles...
[2024-06-03 03:47:00][InboundQueueCommandProcessor   ][INFO   ] Received heartbeat from LosAngeles...
[2024-06-03 03:47:00][InboundQueueCommandProcessor   ][INFO   ] Found LosAngeles in the node list...
[2024-06-03 03:47:00][InboundQueueCommandProcessor   ][INFO   ] Updated last heartbeat for LosAngeles...
[2024-06-03 03:47:01][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49172)
[2024-06-03 03:47:01][HiveReceiverService            ][INFO   ] Handled config from London
[2024-06-03 03:47:07][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49179)
[2024-06-03 03:47:07][HiveReceiverService            ][INFO   ] Handled config from LosAngeles
[2024-06-03 03:47:10][HeartbeatProtocolCommandManager][INFO   ] Sending heartbeat to Brisbane...
MONITOR: Successfully stopped monitoring tasks.
MONITOR: Successfully started monitoring tasks.
[2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: TCP request to nist.gov. Description:  Port 80 on 51.164.123.247 is open.
[2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: HTTP request to google.com. Description: 200
[2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: HTTPS request to oregonstate.edu. Description: 200 Server is up
[2024-06-03 03:47:14][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49187)
[2024-06-03 03:47:14][HiveReceiverService            ][INFO   ] Handled config from Brisbane
[2024-06-03 03:47:17][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49189)
[2024-06-03 03:47:17][HiveNodeManager                ][INFO   ] Node LosAngeles already exists in the node list...
[2024-06-03 03:47:17][HiveNodeManager                ][INFO   ] Node Brisbane already exists in the node list...
[2024-06-03 03:47:17][HiveReceiverService            ][INFO   ] Handled gossip from LosAngeles
London> exit
sawyer@Sawyers-Air Hive.v01 %
```

```
app_main.py   monitor_manager.py   hive_node_manager.py   hive_receiver_service.py   app.London.log   config_manager.py
608 [2024-06-03 03:47:00][InboundQueueCommandProcessor   ][INFO   ] Updated last heartbeat for LosAngeles...
609 [2024-06-03 03:47:01][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49172)
610 [2024-06-03 03:47:01][HiveReceiverService            ][INFO   ] Handled config from London
611 [2024-06-03 03:47:07][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49179)
612 [2024-06-03 03:47:07][HiveReceiverService            ][INFO   ] Handled config from LosAngeles
613 [2024-06-03 03:47:10][HeartbeatProtocolCommandManager][INFO   ] Sending heartbeat to Brisbane...
614 [2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: TCP request to nist.gov. Description:  P
615 [2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: HTTP request to google.com. Description:
616 [2024-06-03 03:47:12][MonitorManager                 ][INFO   ] [  ON-LINE   ] [2024-06-03 03:47:12]: HTTPS request to oregonstate.edu. Descri
617 [2024-06-03 03:47:14][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49187)
618 [2024-06-03 03:47:14][HiveReceiverService            ][INFO   ] Handled config from Brisbane
619 [2024-06-03 03:47:17][HiveReceiverService            ][INFO   ] Connection from ('127.0.0.1', 49189)
620 [2024-06-03 03:47:17][HiveNodeManager                ][INFO   ] Node LosAngeles already exists in the node list...
621 [2024-06-03 03:47:17][HiveNodeManager                ][INFO   ] Node Brisbane already exists in the node list...
622 [2024-06-03 03:47:17][HiveReceiverService            ][INFO   ] Handled gossip from LosAngeles
```

Hive SRS 6

Tabular formatting of the network monitoring services can be printed on command from the CLI. I couldn't get the tabular formatting working in time, due to issues with the dictionary storing the configuration for all three nodes (LosAngeles, London, Brisbane), but the tabular formatting is shown to be working in the next section. This screen shot shows that one node contains configurations for the three other nodes.

```
LosAngeles> list_config all
The configured services for LosAngeles:
[2024-06-04 15:50:10][HiveNodeManager                ][INFO   ] ------------------------------------------------------------
-------------------------------------------------------------
[2024-06-04 15:50:10][HiveNodeManager                ][INFO   ] Hostname:<30 | Service:<7 | frequency:<7
[2024-06-04 15:50:10][HiveNodeManager                ][INFO   ] ------------------------------ | ------- | -------
{'LosAngeles': {'tasks': [{'hostname': 'google.com', 'service': 'https', 'ip': 'None', 'port': '443', 'frequency': 10}, {'hos
tname': 'oregonstate.edu', 'service': 'tcp', 'ip': 'None', 'port': '80', 'frequency': 11}, {'hostname': 'nist.gov', 'service'
: 'udp', 'ip': 'None', 'port': '80', 'frequency': 12}]}, 'London': {'config': {'tasks': [{'hostname': 'google.com', 'service'
: 'HTTP', 'ip': 'None', 'port': 80, 'frequency': 15}, {'hostname': 'oregonstate.edu', 'service': 'HTTPS', 'ip': 'None', 'port
': 443, 'frequency': 15}, {'hostname': 'nist.gov', 'service': 'TCP', 'ip': '51.164.123.247', 'port': 80, 'frequency': 15}]}}}
{'tasks': [{'hostname': 'google.com', 'service': 'https', 'ip': 'None', 'port': '443', 'frequency': 10}, {'hostname': 'oregon
state.edu', 'service': 'tcp', 'ip': 'None', 'port': '80', 'frequency': 11}, {'hostname': 'nist.gov', 'service': 'udp', 'ip':
'None', 'port': '80', 'frequency': 12}]}
```

Hive SRS 7

Tabular formatting of the local monitoring services can be printed on command from the CLI. This was done using a similar function to the tabular printing for the given "list_nodes" command.

The initial command can be seen on line 1:

>> list_config local

```
LosAngeles> list_config local
The configured services for tasks:
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] ------------------------------------------------------------
------------------
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] Hostname:<30 | Service:<7 | frequency:<7
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] ------------------------------ | ------- | -------
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] google.com                     | https   | 10
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] oregonstate.edu                | tcp     | 11
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] nist.gov                       | udp     | 12
[2024-06-04 15:34:01][HiveNodeManager                ][INFO   ] ------------------------------------------------------------
------------------
```

Hive SRS 8

Extra credit not completed.