

Networking Protocol for Collaborative Environment

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Overall Design

1. General

- A state machine(ConnectionStateMachine) will be created for each host and managed by the network engine.
- Each connection(Connection) will tie together the connection's state machine(ConnectionStateMachine) with host(Host) information.
- Host(Host) information will be a convenient class to access lower level details.
 - i. Host handle
 - ii. IP address
 - iii. Port
- State information(StateInformation) is the key to distributed networking algorithms.
 - i. Time stamp
 - ii. Entity handle
 - iii. Position/Velocity/Acceleration
- System works with request/response two way handshake for connect/disconnect messages. State updates are not acknowledged.

2. Network States

- Disconnected(Disconnected)
- Connected(Connected)
- Attempting to Connect(Connecting)
- Attempting to Disconnect(Disconnecting)

3. Packets

- Connect → contains current state information
- Disconnect
- State Update → contains current state
- Connect ACK → contains current state information
- Disconnect ACK

4. Tasks for the State Machine

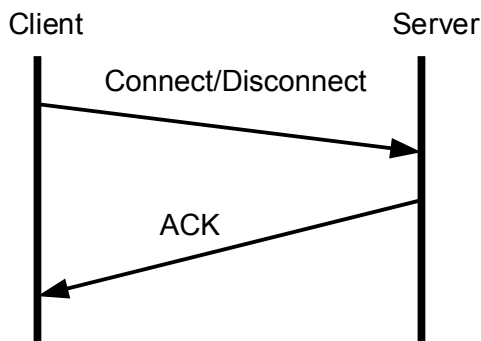
- Update the state information
- Increment the sequence number
- Update connection list → add or drop hosts
- Start/stop/reset/tear down remote heartbeat timer
- Reset local heartbeat timer
- Respond with message

5. Timers

- Connect timer per host
- Disconnect timer per host
- Remote heartbeat timer per host
- Local heartbeat timer

6. Important classes

- State
 - i. Connected
 - ii. Disconnected
 - iii. Connecting
 - iv. Disconnecting
- StateInformation
- ConnectionStateMachine
- Packet
 - i. ConnectPacket
 - ii. DisconnectPacket
 - iii. StateUpdatePacket
 - iv. ConnectAckPacket
 - v. DisconnectAckPacket
- Host



State Machine

1. Disconnected
 - Receive 'Connect'
 - i. Move to 'Connected' state
 - ii. Respond 'Connect ACK'
 - iii. Update connection list
 - iv. Update state information
 - v. Set remote sequence number
 - vi. Start remote heartbeat timer
 - Receive 'Disconnect' (Error)
 - i. Respond 'Disconnect ACK'
 - Receive 'Connect ACK' (Error)
 - i. Respond 'No connect message sent'
 - Receive 'Disconnect ACK' (Error)
 - i. Respond 'No disconnect message sent'
 - Receive 'State Update' (Error)
 - i. Respond 'Not connected'
 - Transmit 'Connect'
 - i. Move to 'Trying to Connect' state
 - ii. Update connection list

- iii. Start connect timer
- 2. Connected
 - Receive 'Connect' (Error)
 - i. Respond 'Connect ACK'
 - ii. Reset remote heartbeat timer
 - iii. Update state information
 - iv. Set remote sequence number
 - Receive 'Disconnect'
 - i. Move to 'Disconnected' state
 - ii. Respond 'Disconnect ACK'
 - iii. Update connection list
 - iv. Tear down remote heartbeat timer
 - Receive 'Connect ACK' (Error)
 - i. Respond 'No connect message sent'
 - ii. Update state information
 - iii. Set remote sequence number
 - iv. Reset remote heartbeat timer
 - Receive 'Disconnect ACK' (Error)
 - i. Respond 'No disconnect message sent'
 - Receive 'State Update'
 - i. Update state information
 - ii. Reset remote heartbeat timer
 - iii. Set remote sequence number
 - Transmit 'Disconnect'
 - i. Move to 'Trying to Disconnect' state
 - ii. Start disconnect timer
 - iii. Tear down remote heartbeat timer
 - Transmit 'State Update'
 - i. Reset local heartbeat timer
 - Remote heartbeat timer expires
 - i. Send 'Disconnect'
 - ii. Move to 'Trying to Disconnect' state
 - iii. Start disconnect timer
 - iv. Tear down remote heartbeat timer
- 3. Trying to Connect
 - Receive 'Connect'
 - i. Move to 'Connected' state
 - ii. Update state information
 - iii. Set remote sequence number
 - iv. Start remote heartbeat timer
 - v. Tear down connect timer
 - Receive 'Disconnect' (Error)
 - i. Respond 'Not connected'
 - Receive 'Connect ACK'
 - i. Move to 'Connect' state
 - ii. Update state information
 - iii. Set remote sequence number

- iv. Start remote heartbeat timer
- v. Tear down connect timer
- Receive 'Disconnect ACK' (Error)
 - i. Respond 'No disconnect message sent'
- Receive 'State Update' (Error)
 - i. Respond 'Not connected'
- Connect timer expires
 - i. Move to 'Disconnect' state
 - ii. Tear down connect timer
- 4. Trying to Disconnect
 - Receive 'Connect'
 - i. Respond 'Connect ACK'
 - ii. Update state information
 - iii. Set remote sequence number
 - iv. Reset remote heartbeat timer
 - Receive 'Disconnect'
 - i. Move to 'Disconnect' state
 - ii. Update connection list
 - iii. Tear down disconnect timer
 - Receive 'Connect ACK' (Error)
 - i. Respond 'No connect message sent'
 - ii. Update state information
 - iii. Set remote sequence number
 - Receive 'Disconnect ACK'
 - i. Move to 'Disconnect' state
 - ii. Update connection list
 - iii. Tear down disconnect timer
 - Receive 'State Update'
 - i. Update state information
 - ii. Set remote sequence number
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 - Disconnect timer expires
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 - iii. Tear down disconnect timer