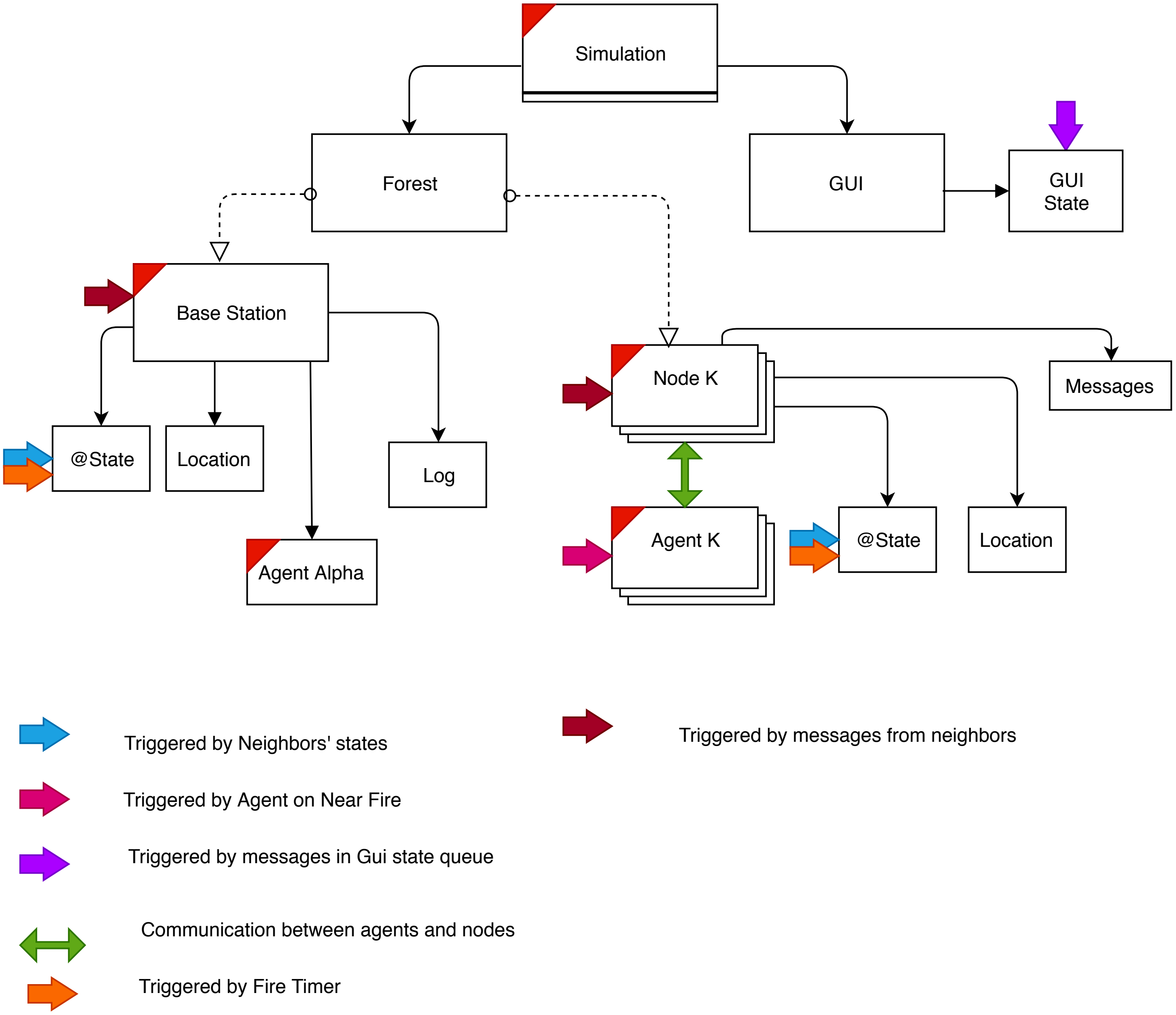
Mobile Agent Design Diagram


Simulation
Forest
GUI
GUI State
Base Station
@State
Location
Log
Agent Alpha
Node K
Messages
Agent K
@State
Location
Triggered by Neighbors' states
Triggered by messages from neighbors
Triggered by Agent on Near Fire
Triggered by messages in Gui state queue
Communication between agents and nodes
Triggered by Fire Timer

Mobile Agents Design

Simulation:

- Procedure that starts the simulation
- Starts both the forest and the GUI display

Forest:

- Reads and parses configuration file
- Keeps track of nodes, edges, base station and initial fire from config file
- Connects the nodes to edges in graph in a form of an adjacency list
- Creates nodes, base station and initial fire threads.

Base Station:

- Has a log
- Triggered by messages received from other nodes to put messages into log
- Creates the first agent that walks to find a near fire node
- **Agent Alpha:**
  - The only agent that can move among nodes
  - Stops at a near fire node
- Has a location and state
- Sends messages to the GUI's message queue to update state of base station
- **Log:**
  - Contains messages from nodes about creation of agents
- **Location:**
  - Location of station
- **State:**
  - There are 3 states: "not on fire", "near fire" and "on fire"
  - Synchronized methods to get and set state
  - Triggered to change to near fire when a neighbor node is on fire
  - Triggered to change to on fire by a timer

GUI:

- Displays the graph of sensor nodes
- Displays the base log

GUI State:

- Keeps track of the changes that are needed to update the GUI
- Triggered by messages from a queue (See "Other Design Decisions: GUI")

Node K:

- Also includes Base Station
- Nodes have a location, state, a message queue and a reference to its agent and to its neighbors.
- Communicates with only its agent and its neighbors
- Has a message queue to receive messages from neighbor nodes
- Can send messages to neighbors
- Sends messages to GUI to update its state

Agent K:

- Can copy itself to neighbors not on fire
- Has a unique id which is the location of the node that was created, e.g. if agent k was created on node (20,3) then agent k's unique id is 203.
- Communicates only with the node it's on
- Gets created by a node that has a near fire neighbor with an agent
- Sends a log message to the node it's on that it was created
- Sends messages to the GUI to update its state

Messages:

- Has different messages including log messages, state messages and GUI messages

Other Design Decisions

Calculating Distance from Base:

Before the actual simulation starts, the distance from the base is calculated for each node. These distances are used to send messages back to the base station. When a node is determining which neighbor to send the message to, a neighbor with a shorter or equal distance to the base is chosen. These distances were calculated through a simple breadth first search algorithm.

Sending Messages:

Log messages are sent back by using the distances as described above. If there are multiple neighbor nodes that can messages can be sent to, a random node is picked among these nodes. If the base station is a neighbor, the message is immediately sent to the base station. Messages cannot be sent to nodes that are on fire.

Agent Walk/Search Algorithm:

The Agent Alpha, created from the Base Station, searches for a near fire node by using a depth first search algorithm. This particular algorithm checks to see if nodes can be walked to (not on fire) and stops if it finds a near fire node.

GUI:

The changes in the states of the nodes, the creation of agents, the location of Agent Alpha, and the death of the agents are updated in the GUI using a Queue that acts as a playback. When changes happen in the simulation, messages are sent to this Queue. The GUI then takes these messages and plays back at a human perceivable speed. The queue uses each messages' timestamp as a priority to determine the correct order the updates.

Fire Spreading:

Fire spreads to each node with a timer. When a node changes from "not on fire" to "near fire", a timer is started to change the node's state to "on fire".