Role of SysML in Integrating an Interdisciplinary Team

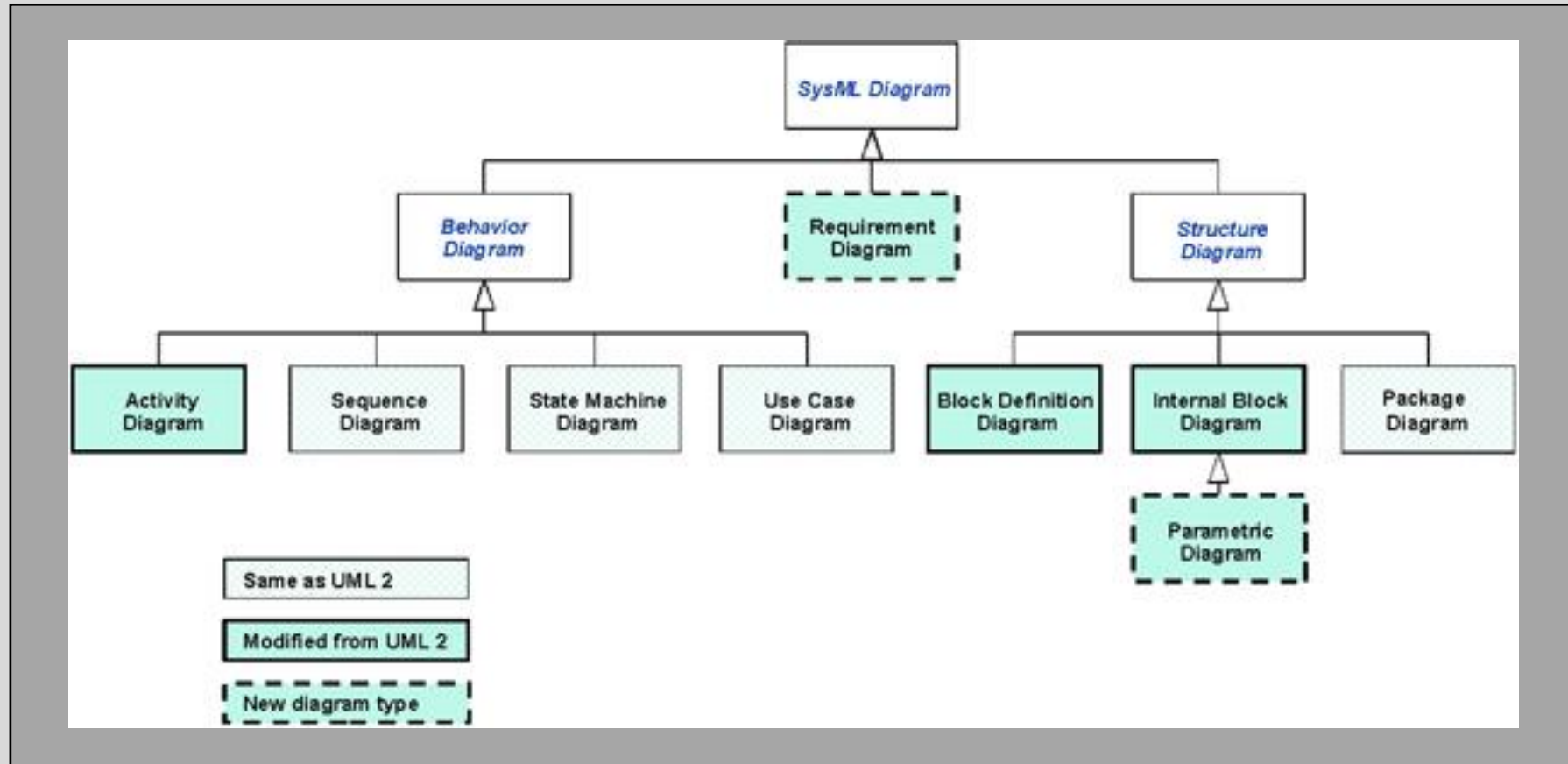Authors: Kleo Golemi (kgolemi@wpi.edu)

The main goal of this project is to conduct research to identify the factors that affect the design of optimal, robust, and resilient human-swarm teams.
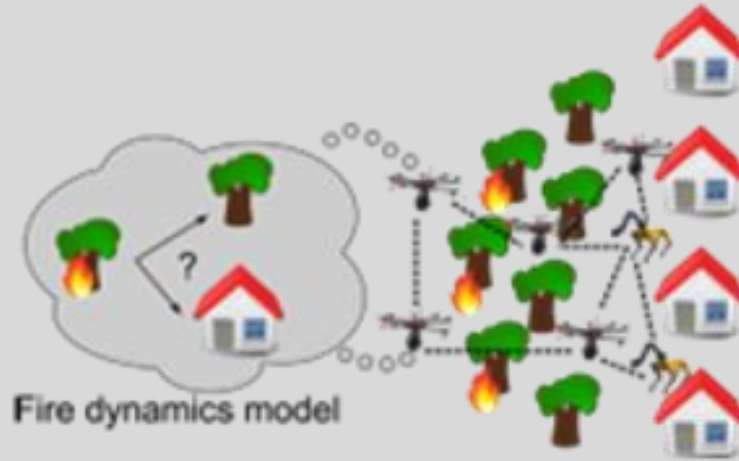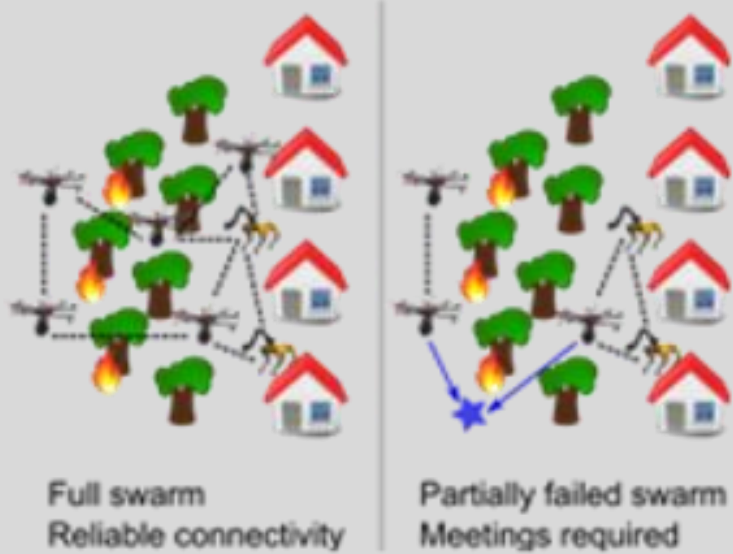
The two distinguished models of SysML are the Block Definition Diagrams (BDD) and Internal Block Diagram (IBD), which are both Structural Diagrams.

Outline

- Robot Swarm mission
- Interdisciplinary teams
- Emulator (EMANE) – SysML – Simulator (ARGoS)
- Integration through SysML
- Discussion/Future Works

Full swarm
Reliable connectivity

Partially failed swarm
Meetings required

Fire dynamics model

Calculating safe paths

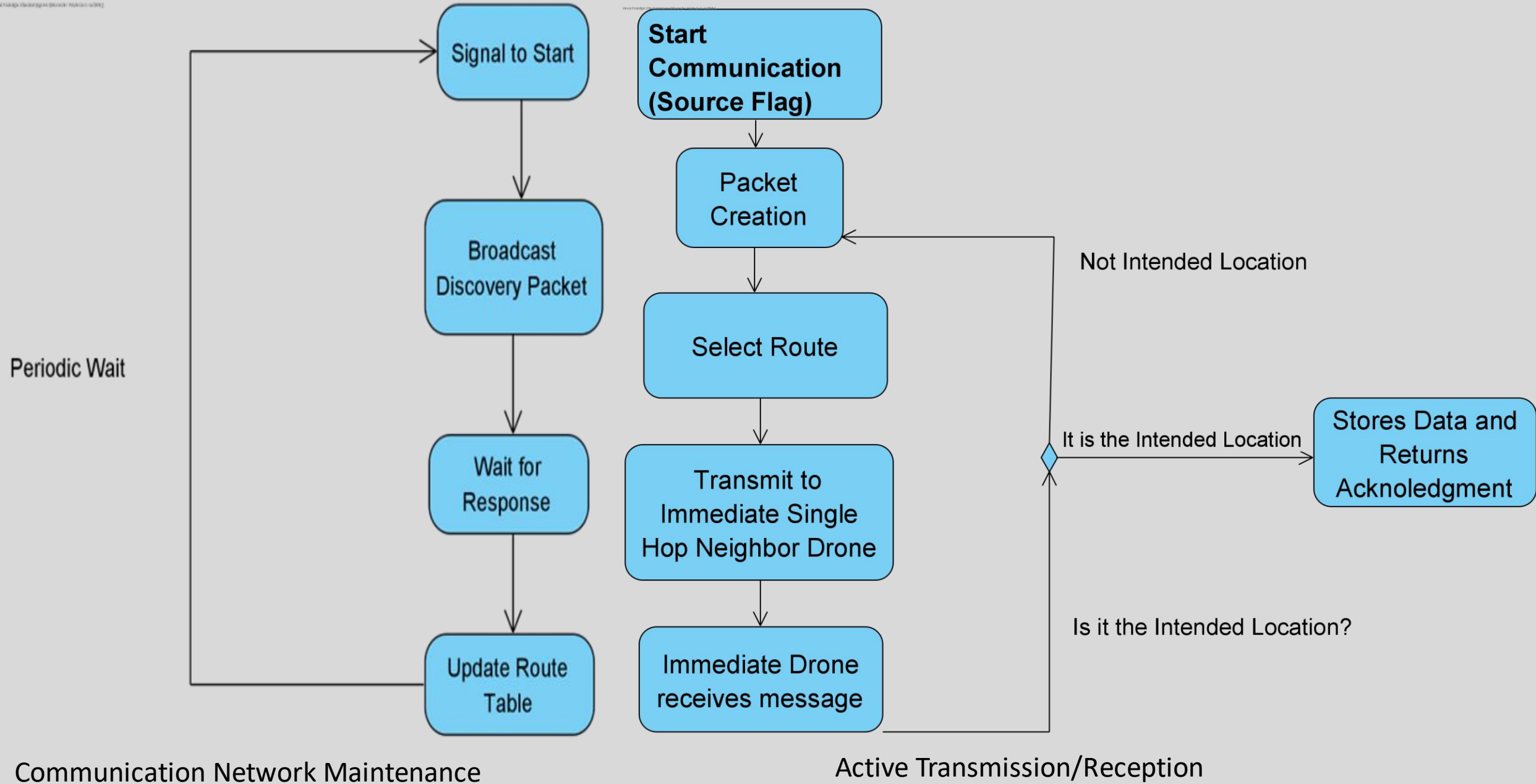## Scenario

- Team Perspective:
  - Communication Team
  - SWARM Team
  - Systems Team
- Fire Detection
  - Correctly Detect and Respond to an instance of fire without human intervention
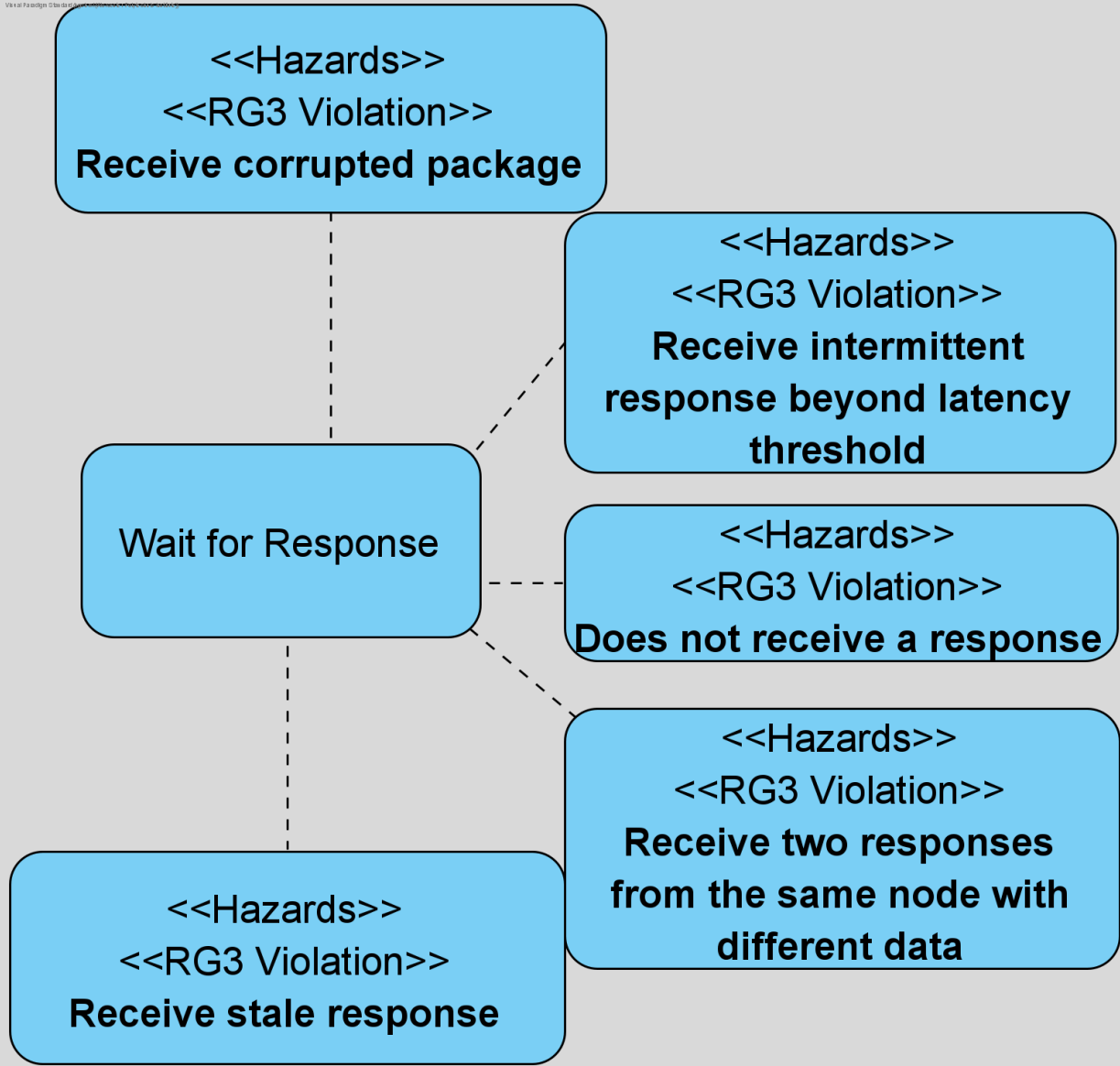 - We will focus on the communication protocol of this project

Sequence Diagram of the Integration between SysML-ARGoS-EMANE
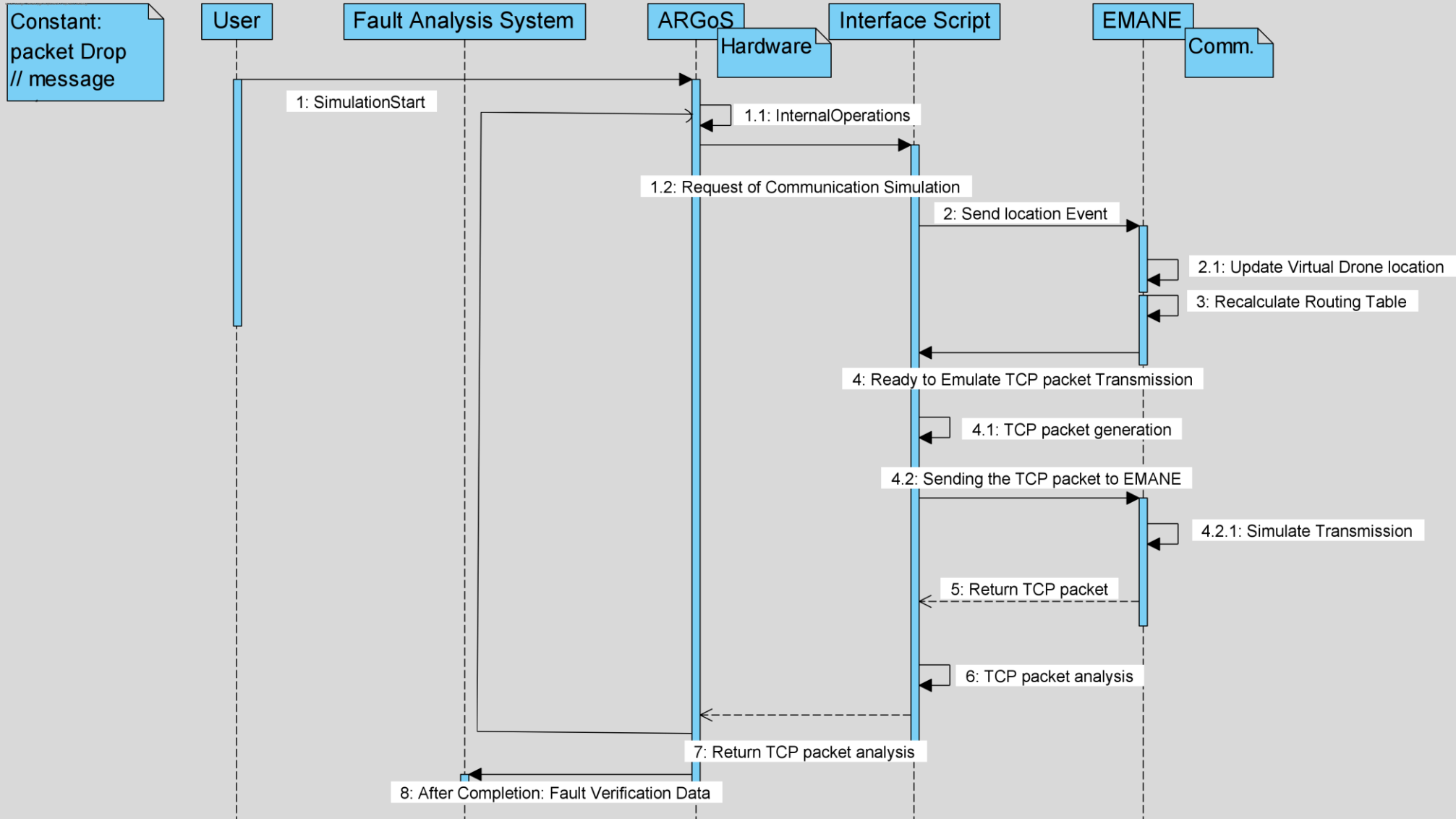
Sequence Diagrams show the relations between all teams throughout the project

Activity Diagrams of Communication Protocol

Communication Network Maintenance

Active Transmission/Reception

<<Hazards>>
<<RG3 Violation>>
Receive corrupted package

<<Hazards>>
<<RG3 Violation>>
Receive intermittent response beyond latency threshold

Wait for Response

<<Hazards>>
<<RG3 Violation>>
Does not receive a response

<<Hazards>>
<<RG3 Violation>>
Receive two responses from the same node with different data

<<Hazards>>
<<RG3 Violation>>
Receive stale response

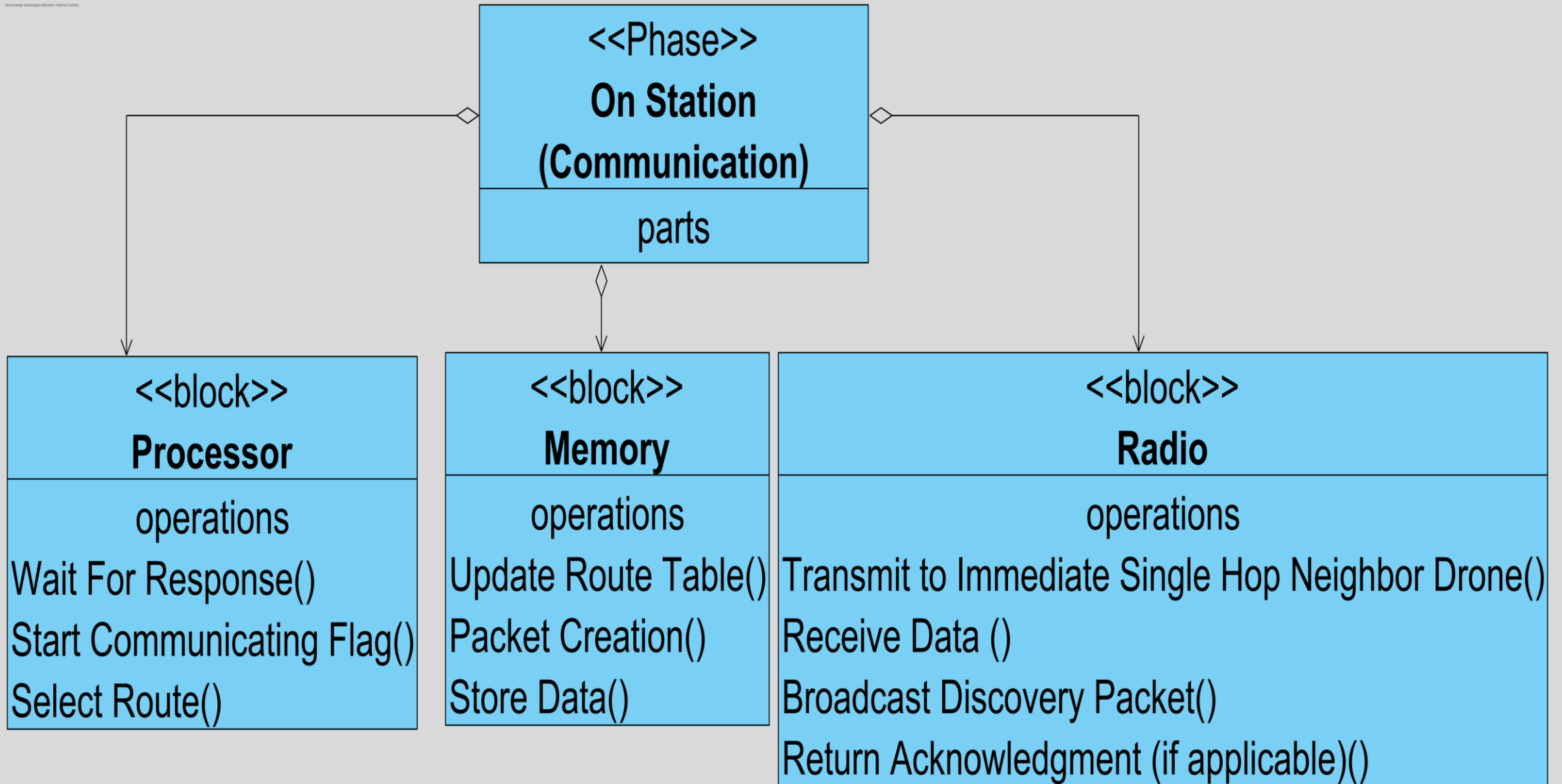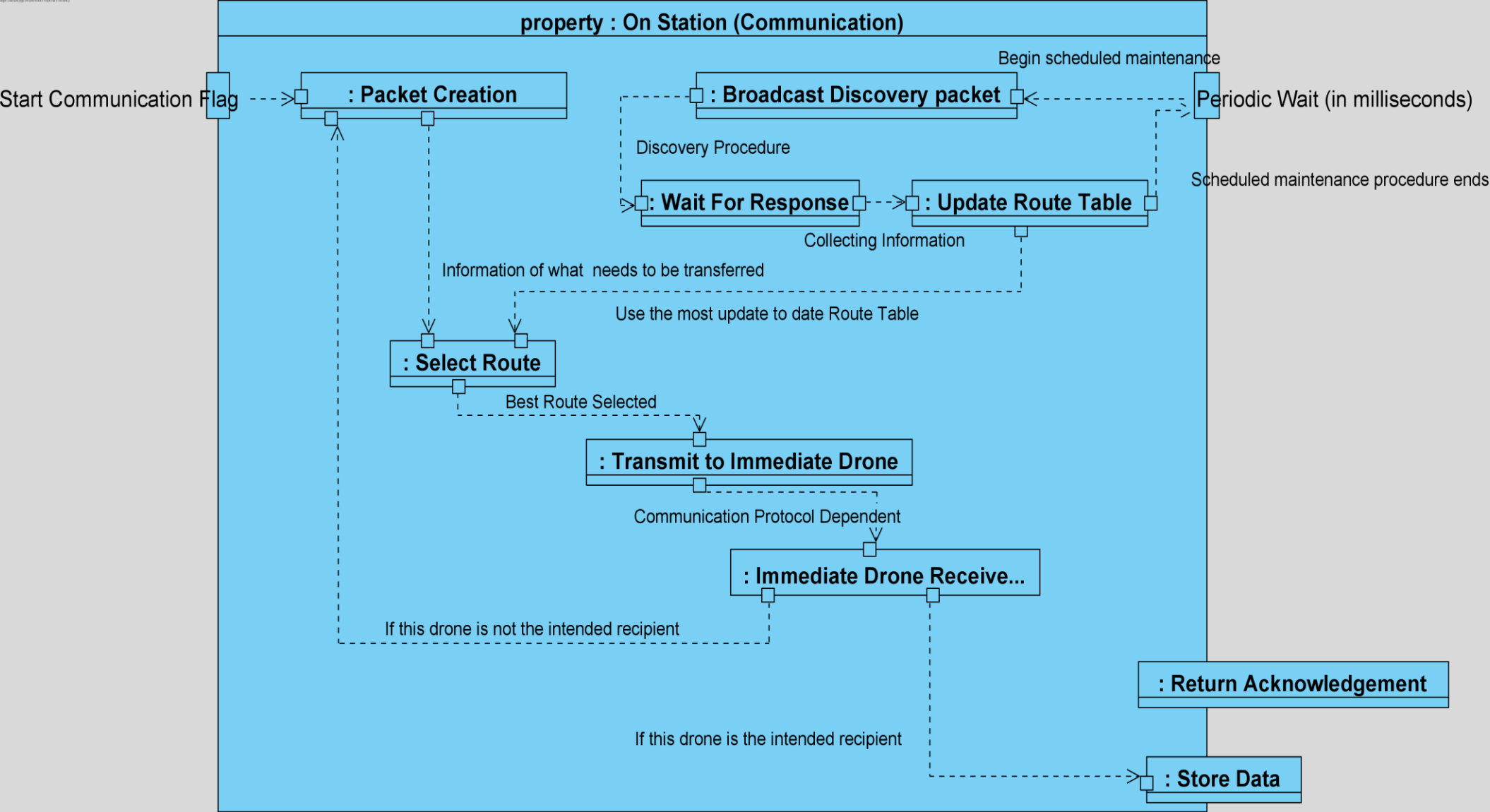Hazard Analysis of the 'Waiting for Response' Task

Hazard Analysis

Hazard analysis is used to classify and identify potentials hazards and risks associated with any action or function of the system. In addition, the assessment of potential hazards can be quantified to further aid in granular analysis of a system. This helps in finding faults and errors in complex system since any error can be traced to its respective function and potential cause.

Block Definition Diagram of Communication

<<Phase>>
On Station
(Communication)

parts

<<block>>
Processor

operations

Wait For Response()

Start Communicating Flag()

Select Route()

<<block>>
Memory

operations

Update Route Table()

Packet Creation()

Store Data()

<<block>>
Radio

operations

Transmit to Immediate Single Hop Neighbor Drone()

Receive Data ()

Broadcast Discovery Packet()

Return Acknowledgment (if applicable)()

Internal Block Diagram of Communication

Future Work & Discussion

- SysML can be used for interdisc. Teams regardless of domain.
- Integrate with EMANE and ARGoS.
- Execute Swarm Failure Analysis.
- Explainability of domain specific algorithms.
- Build feedback from verification and testing into SysML.