CMUSWARM: Full Stack Swarm Architecture
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Motivation
There are many robotics frameworks...
There are many simulation platforms...
There are many swarm algorithms...
However, swarm robotics researchers must often implement and migrate the numerous swarm algorithms outlined in the literature between these frameworks as they evolve or become deprecated.

Objective
Create a cohesive system that permits swarm robotics researchers to efficiently design, deploy, operate and evaluate robotic swarms.
design: create abstract swarm behaviors.
deploy: implement specializations for specific robotic platforms.
operate: enable human-in-the-loop experiments.
evaluate: benchmark algorithm performance with respect to user-defined metrics.

Approach
We design CMUSWARM: A full stack swarm architecture that outlines a design pattern for creating robust swarm applications.

Then we demonstrate and validate a Framework implementation of CMUSWARM on the ROS platform.

Implementation
Software Agnostic
Real World Ready
7 ROS Packages
16+ ROS Nodes
6+ Algorithms
3 Performance Metrics
Holonomic and
NonHolonomic
Robot Dynamics

Validation
The architecture was implemented on ROS and was successfully able to simulate 32 iCreate robots. Benchmarks for 3 different multirobot algorithms were produced across over 600 automated trials.

Future
Our validation results demonstrate the Frameworks ability to operate as a robust swarm system designed wholly from our full stack architecture. We wish to do future comparative work on swarm algorithms, along with human-swarm interaction experiments using the Framework.

Acknowledgments
The authors wish to thank Dr. Katia Sycara, Dr. Changjoo Nam, and Sasanka Nagavalli, for providing insight and support. Further thanks to Rachel Burcin and the RISS coordinating team for the opportunity to conduct research at CMU.

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