A Logical Framework for Self-Optimizing Networked Cyber-Physical Systems (NCPS)

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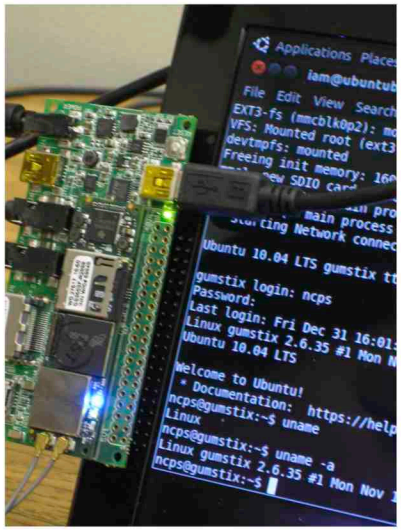
Vision of the Declarative Control for NCPS



- explicitly represents the problem (as opposed to a particular solution)
- avoids over-constraining the problem by low-level programming
- allows system to adapt while maintaining or trying to accomplish the goal
- opportunistic communication paradigm does not constrain information flow
- view system as a single asset (avoid individual programming of components)
- no dependency on individual components or on the number of components
- resiliency/performance scales with number of components/resources

New Contributions and Ongoing Work

- Cyber-application framework (foundation for the following)
  - partially-ordered knowledge sharing model for loosely-coupled distributed computing
  - supports simulation, probabilistic analysis, and real deployment
- Distributed logical framework for declarative control
  - explicit proof objects and meta-theoretic results (soundness, completeness, termination)
- Parallel and distributed optimization framework
  - supports a wide range of multi-objective evolutionary optimization algorithms
- NCPS testbed consisting of 12 toy quadricopters
  - Many sensors and actuators (e.g. video, navigation) available through the cyber-framework API

All developments are available under the Apache 2.0 Open Source License at http://ncps.csl.sri.com