

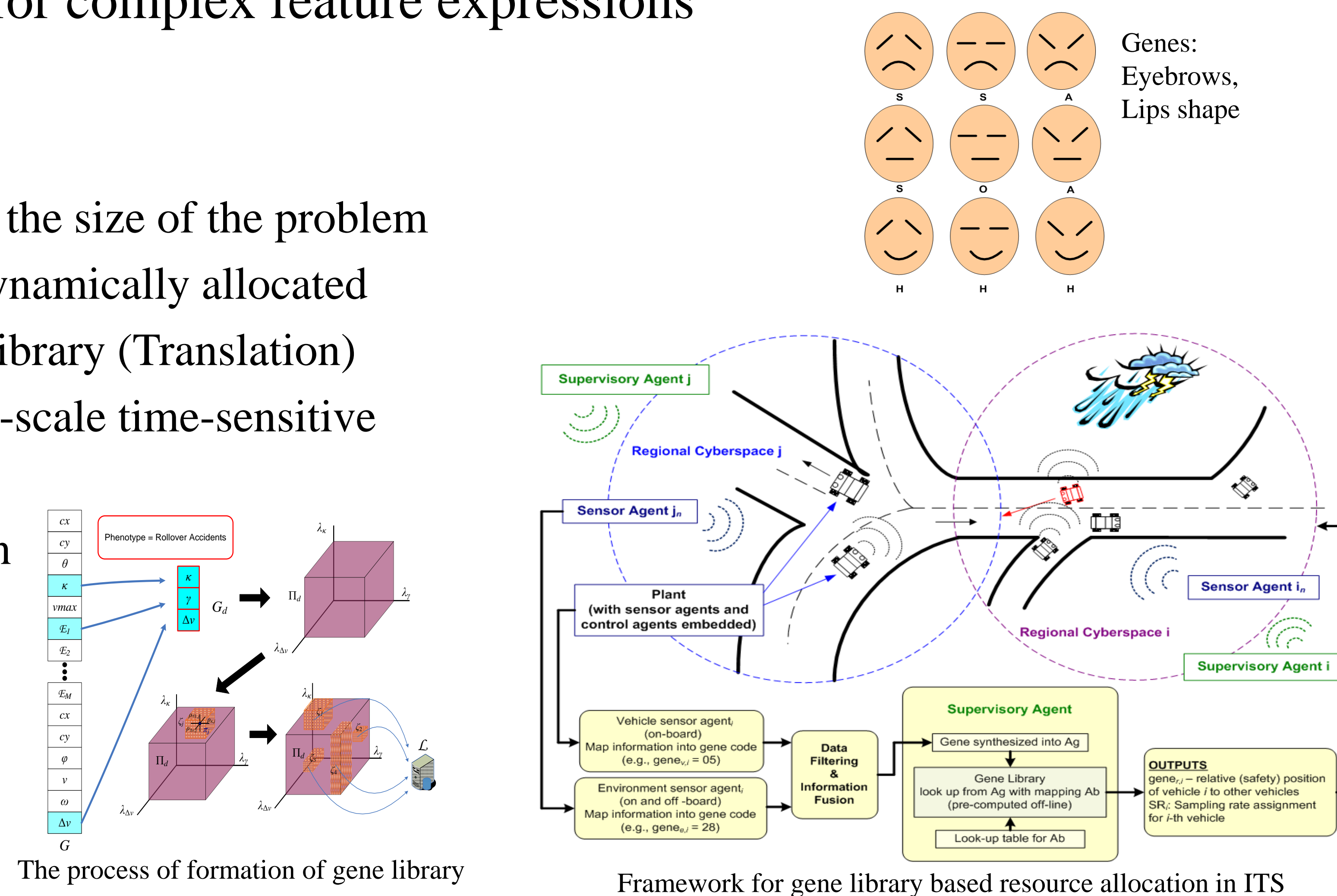
Real-time Optimal Bandwidth Allocation

Gene Library based Approach

- Gene libraries are biologically inspired database that contain DNA-type building blocks for complex feature expressions

Features

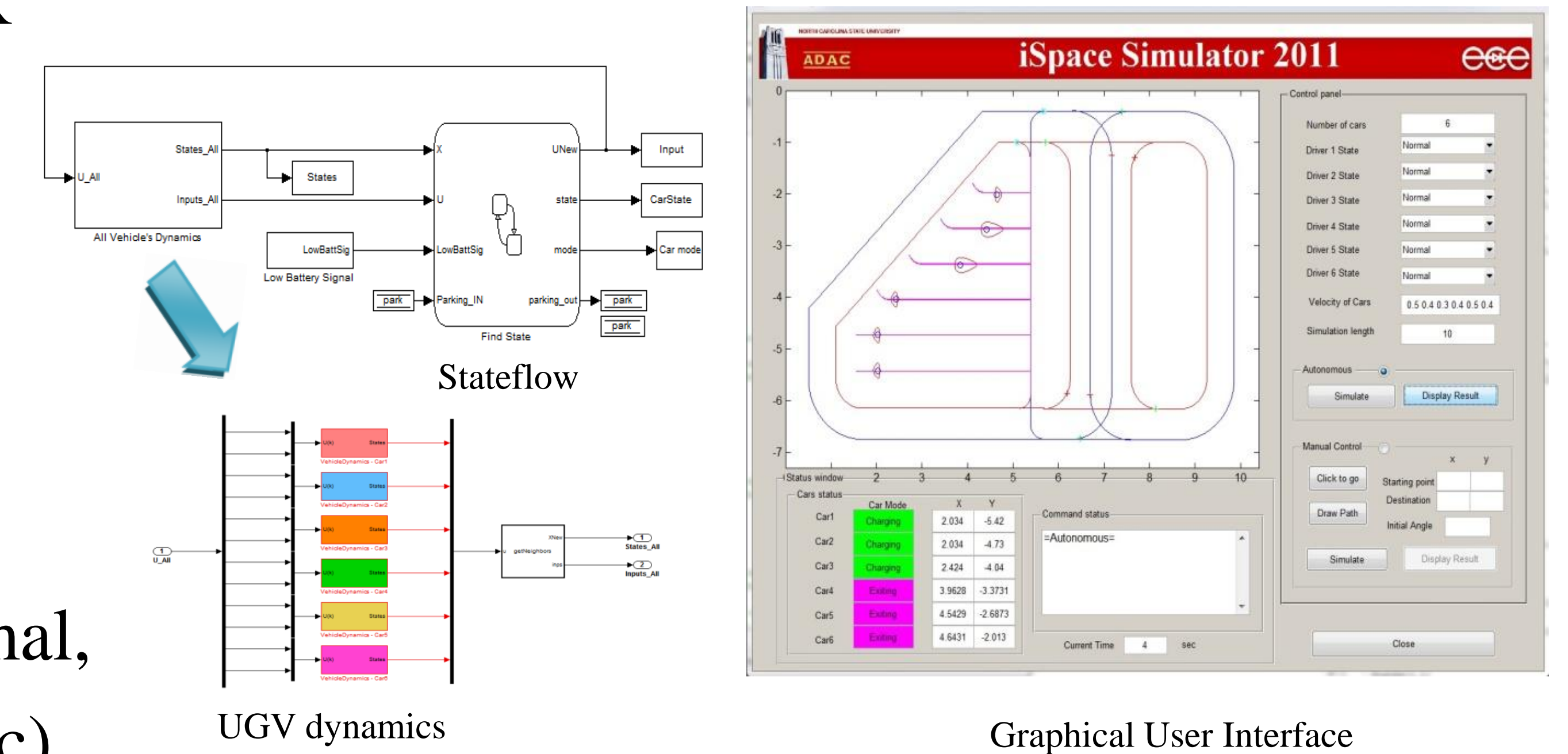
- Adaptive
- Scales linearly with the size of the problem
- Resources can be dynamically allocated based on the gene library (Translation)
- Application in large-scale time-sensitive systems integrated over communication network e.g. Intelligent Transportation System (ITS)



Test Platform: iSpace

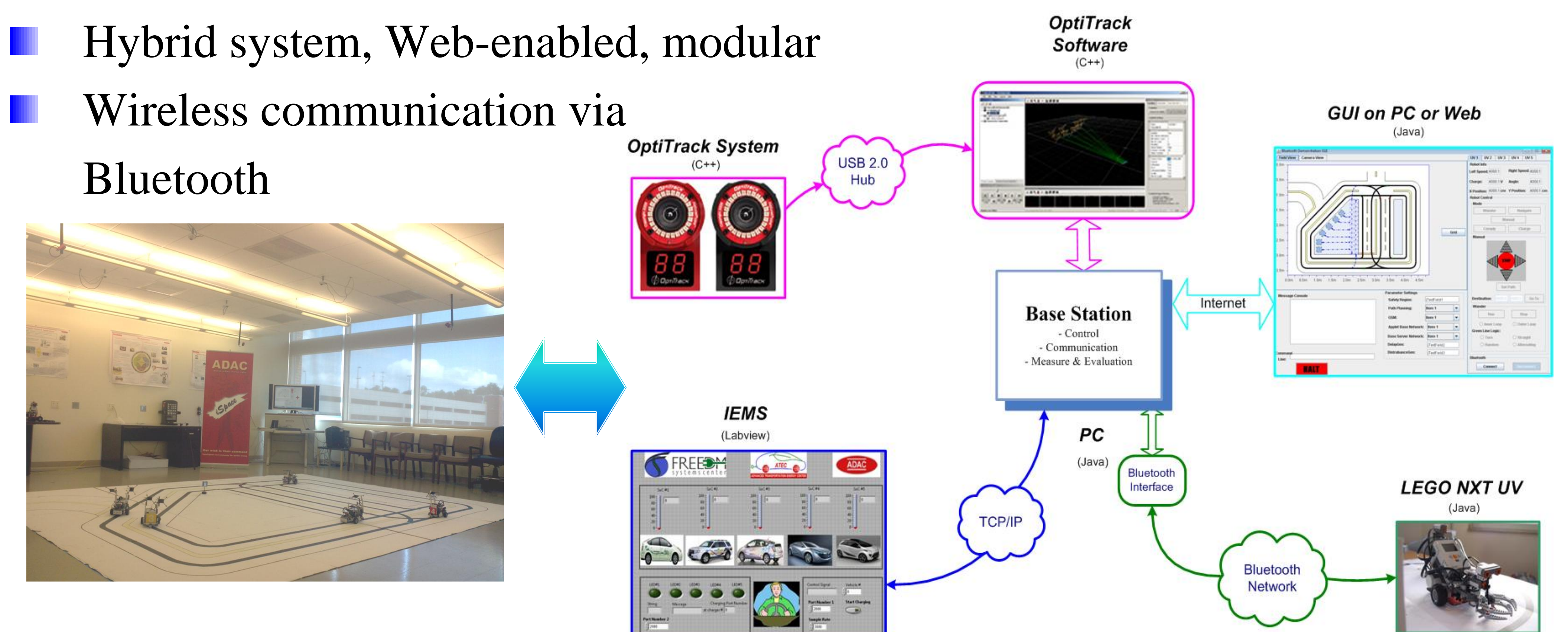
iSpace Simulator

- Matlab/Simulink-based software
- Simulates behavior of unmanned ground vehicles in various traffic scenarios
- Implements quadratic curve path tracking algorithm, fast marching based path generation, feedback preprocessor, predictive control gain scheduler, dynamic bandwidth allocation etc
- Simulates different kinds of driving behavior (normal, conservative, impaired etc).



iSpace at ADAC

- Physical realization of iSpace simulator using JAVA and LeJOS
- Lego-mindstorms based unmanned ground vehicles (UGVs)
- Indoor GPS system using the OptiTrack for localization of UGVs
- Hybrid system, Web-enabled, modular
- Wireless communication via Bluetooth

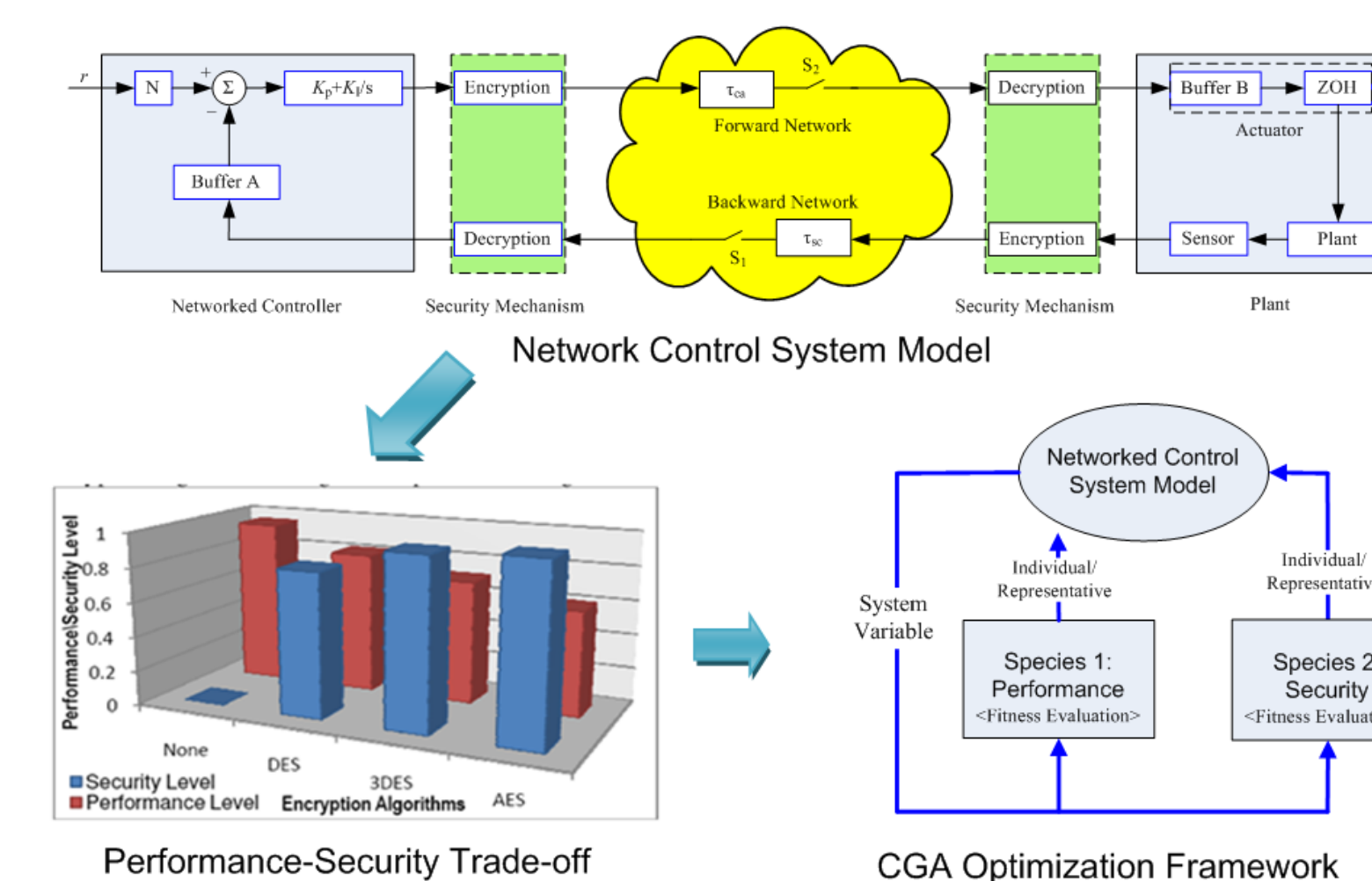


Performance-Security Optimization

Coevolutionary Paradigm

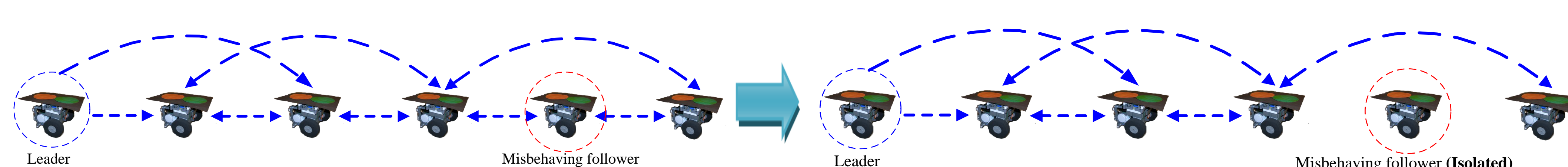
- Cooperative and competitive Coevolutionary Genetic Algorithms (CGA)

- Fast convergence & good diversity
- Robust to the local minima and non-linearity
- Multi-objective optimization and machine learning
- Application in performance-security trade-off optimization on NCS



Secured Distributed Control Algorithms

- Distributed control algorithms (consensus, gossip etc) are vulnerable to malicious cyber attacks
- Analyze the vulnerabilities of distributed algorithms and their impacts
- Design novel secured distributed control algorithms that can detect the misbehaving nodes and recover from the malicious attacks



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