

Distributed Driving Simulation Using A Modular Modeling Methodology



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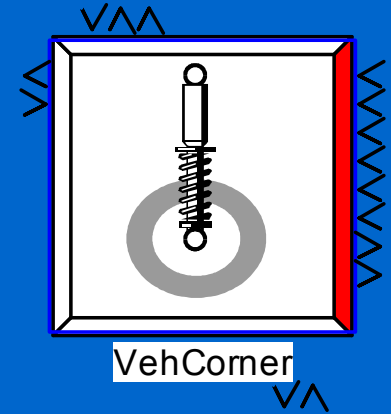
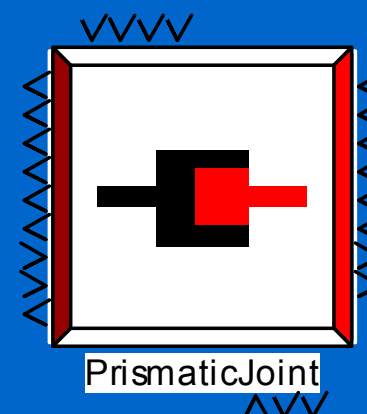
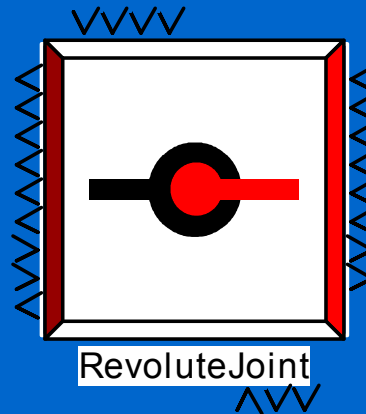
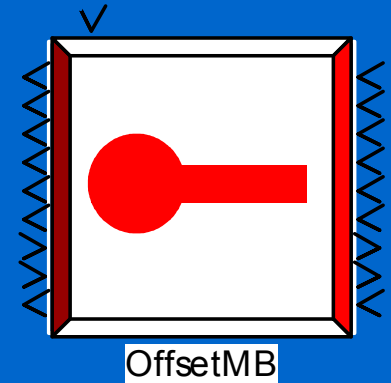
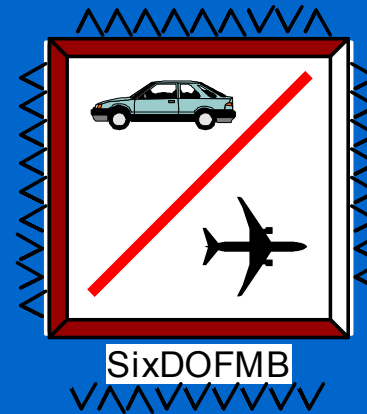
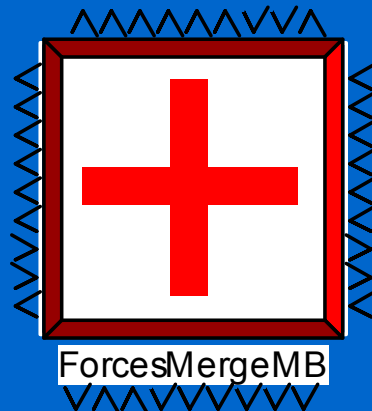


Goal of Work

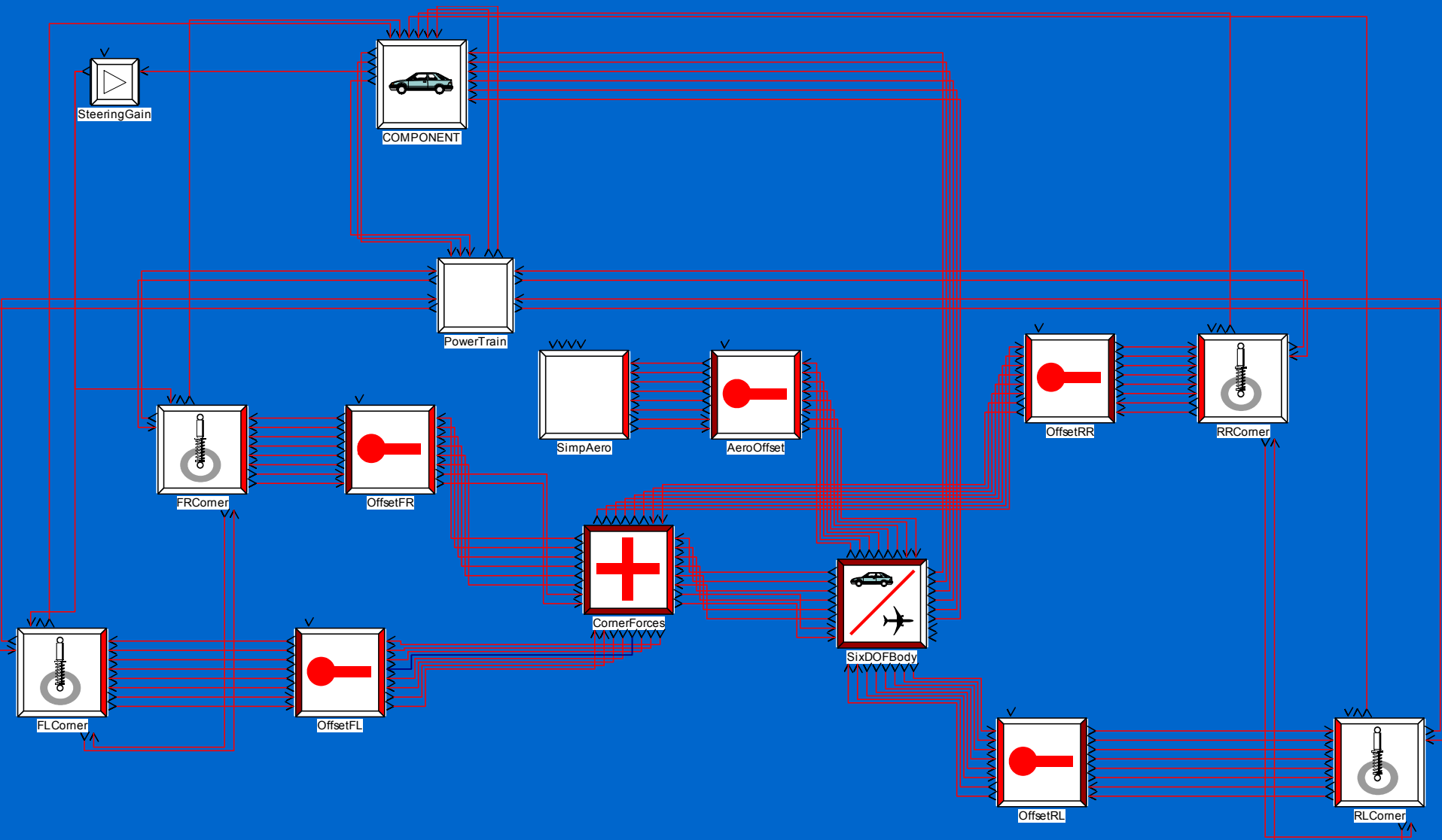
- Develop Modular Modeling Methodology That Allows For Easily Reconfigurable Simulator Subsystems
- Applied to Complete Distributed Driving Simulator to Maximize Reconfiguration Speed and Model Flexibility

Vehicle Dynamics

- Vehicle Dynamics Models Broken Down Into Several Reusable Modules

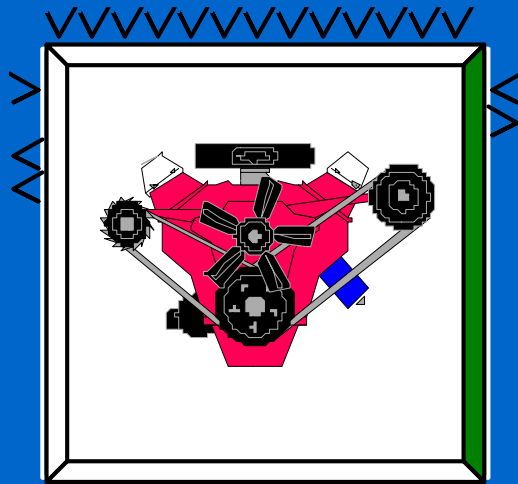


Complete Vehicle Dynamics

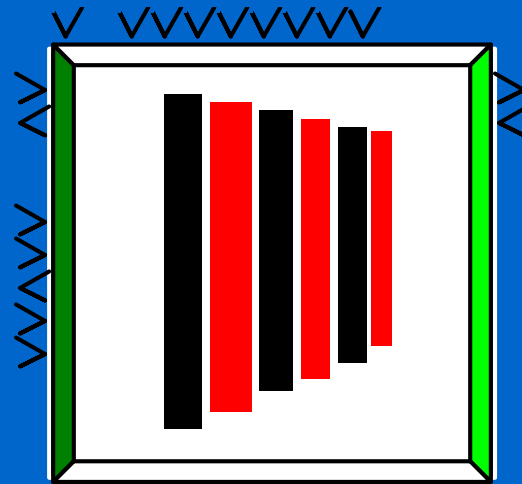


Powertrain

- Vehicle Subsystems Can Also Be Broken Down Into Reusable Modules

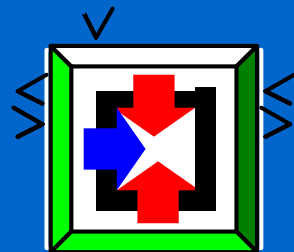


Engine

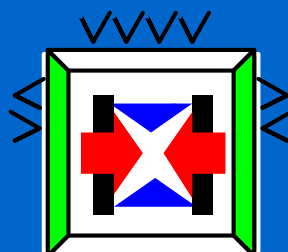


GearBox

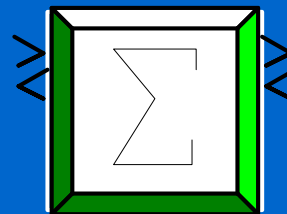
- Lowest Level Components Are C Code



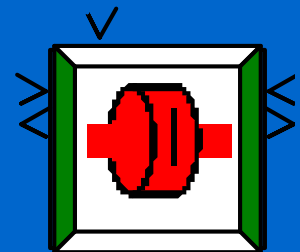
Differential



TorqueConverter

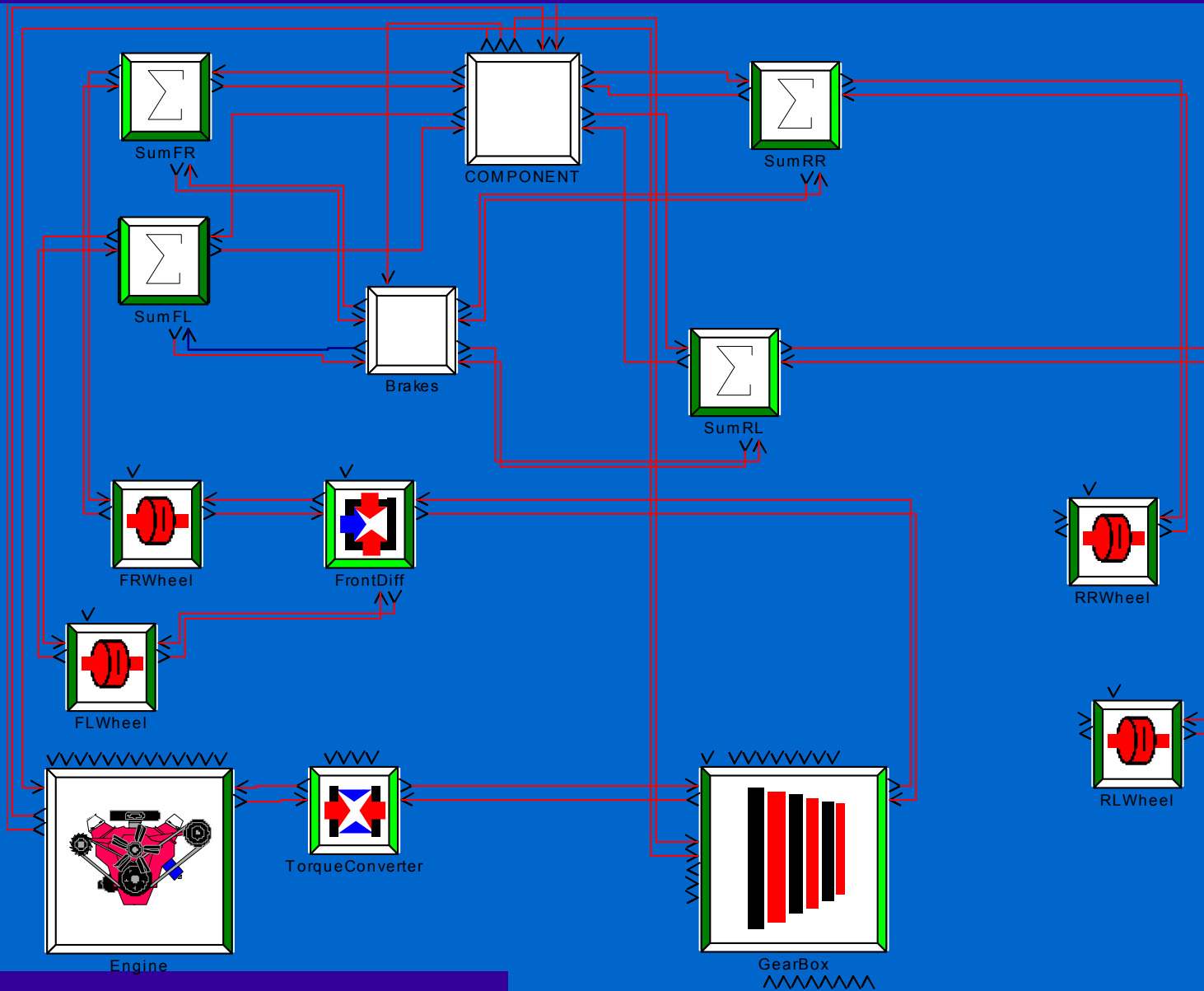


TorqueSum



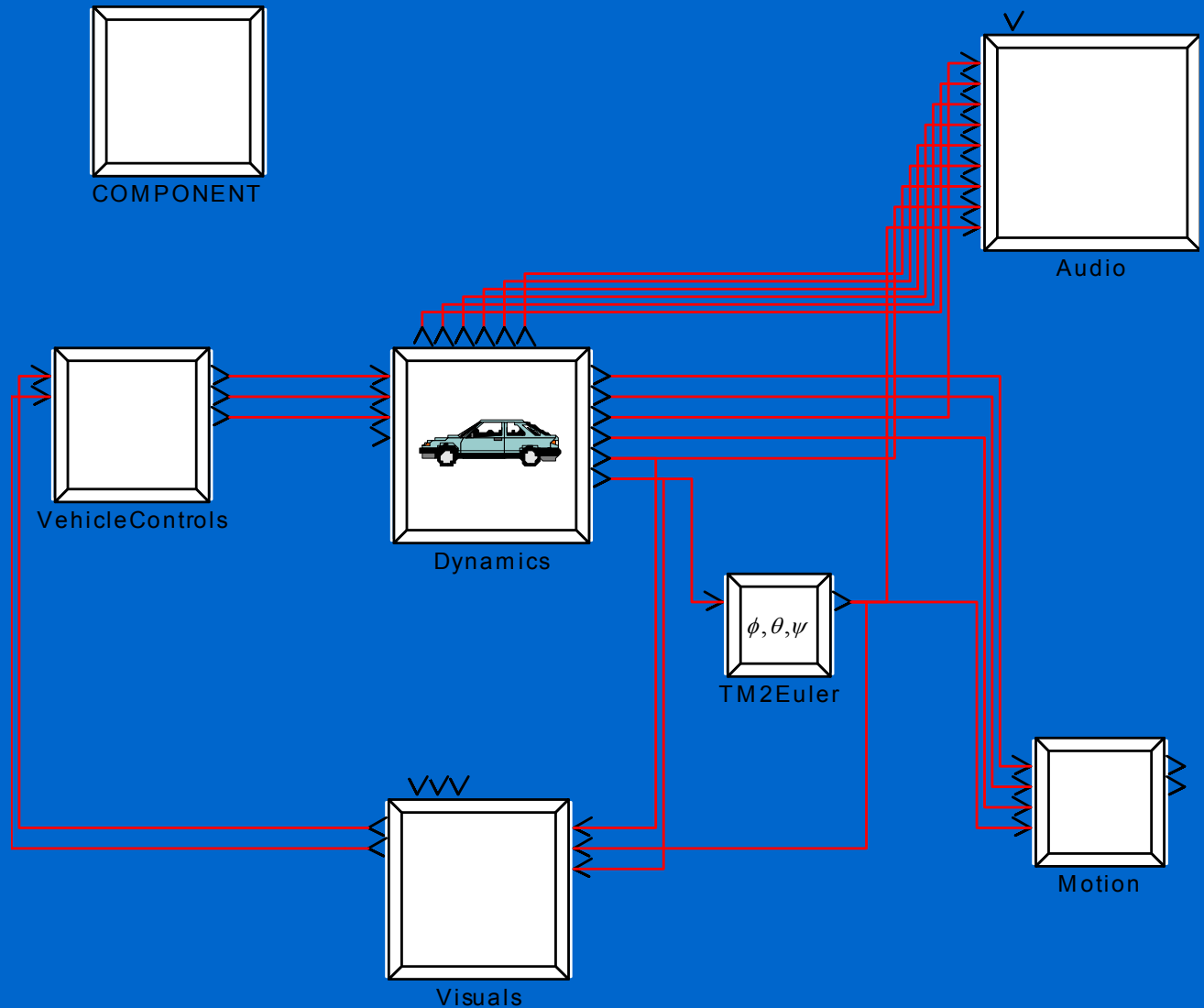
Inertia

Powertrain



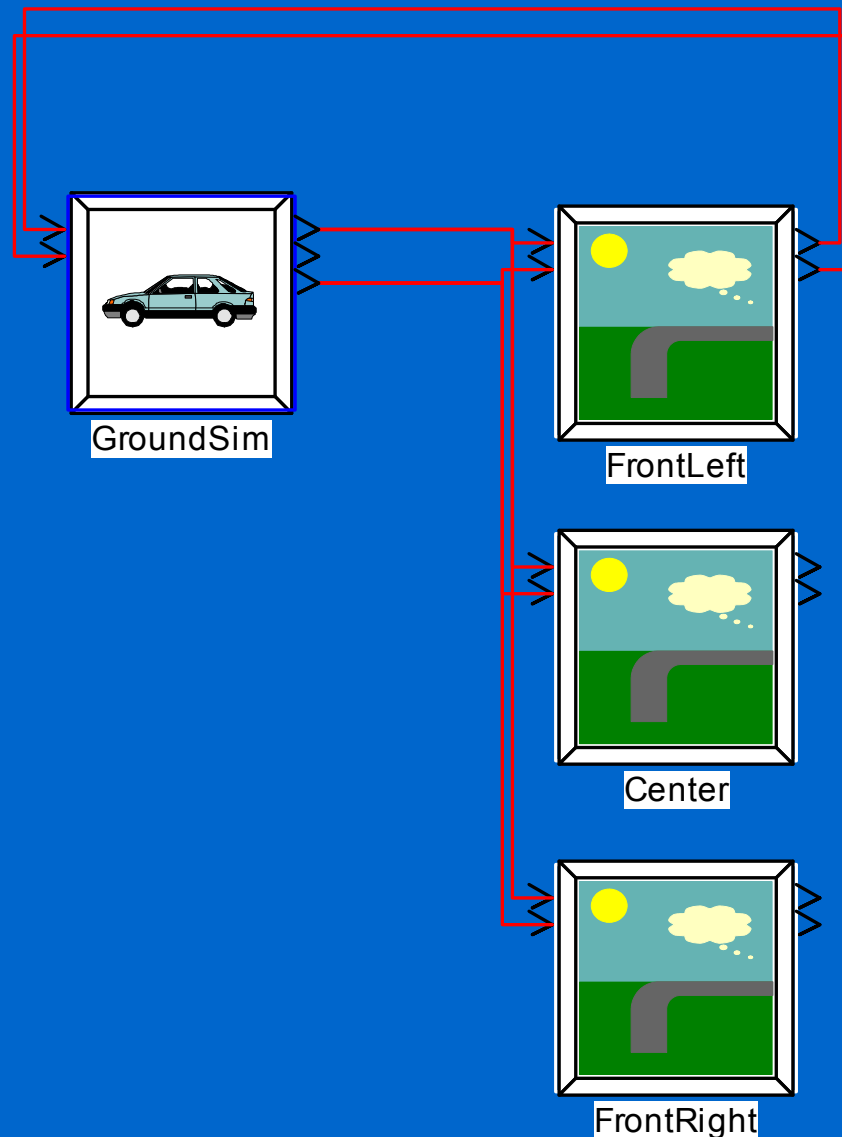
Driving Simulator

- The Driving Simulator Is Made Up Of Modules



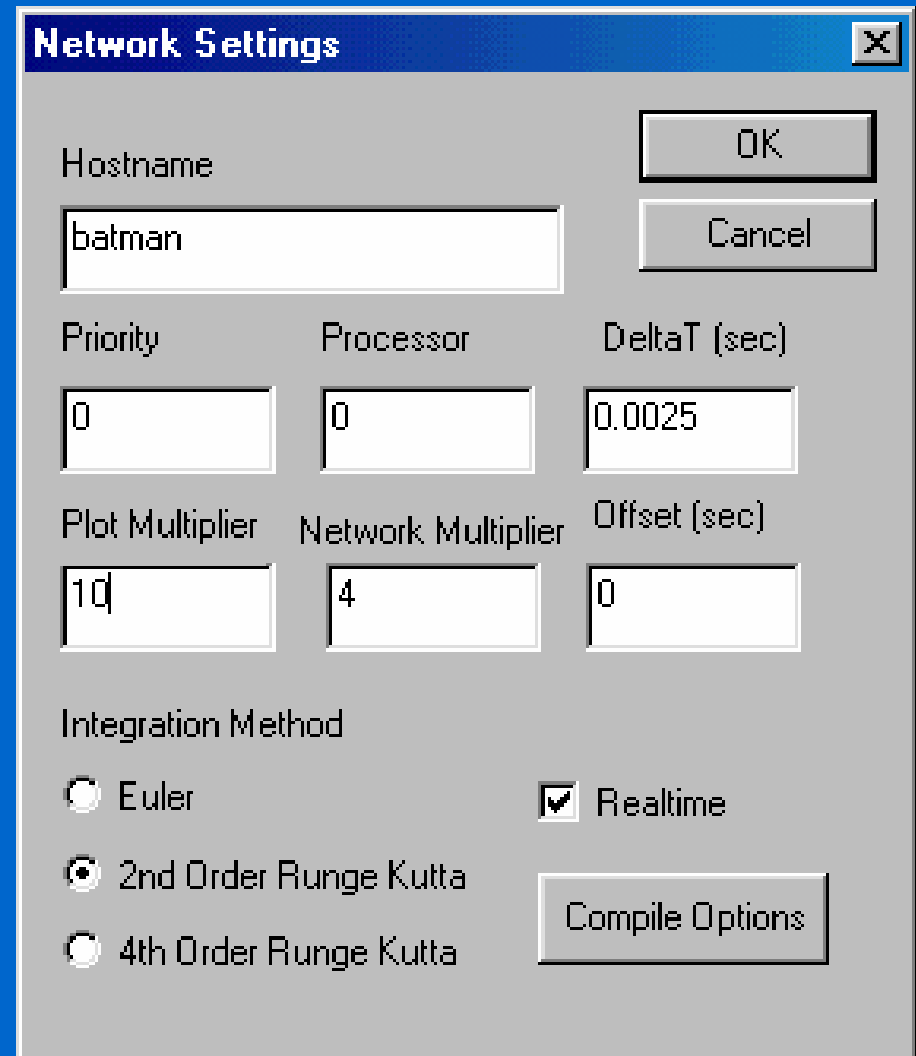
Distributed 3 Channel Simulator

- Modules At The Top Level Of Any Model Can Be Distributed



Network Properties

- Automatically Builds The Network Topology At Runtime
- Shared Memory, Reflective Memory, UDP/IP
- Distributed Compilation



The screenshot shows a 'Network Settings' dialog box with the following fields and options:

- Hostname:** A text input field containing 'batman'.
- Priority:** A numeric input field containing '0'.
- Processor:** A numeric input field containing '0'.
- DeltaT (sec):** A numeric input field containing '0.0025'.
- Plot Multiplier:** A numeric input field containing '10'.
- Network Multiplier:** A numeric input field containing '4'.
- Offset (sec):** A numeric input field containing '0'.
- Integration Method:** A group of radio buttons with 'Euler' selected, and a checked checkbox for 'Realtime'.
- Buttons:** 'OK', 'Cancel', and 'Compile Options'.

Performance

- Driving Simulator Contains 52 states
- Using Runge Kutta Second Order Method
- MultibodyVehicle Dynamics at 400 Hz
- Audio and Visual Systems at 60 Hz
- Entire Simulation Ran Faster Than Realtime
On a Pentium III 450 MHz Computer

Advantage Of GUI

- Structured Framework to Build C Code Components
- Causality
- Unified Integration Algorithm
- Built in Data Management and Plotting
- Greater Insight Into the Model
- Hierarchical Viewing
- Model and Component Reuse