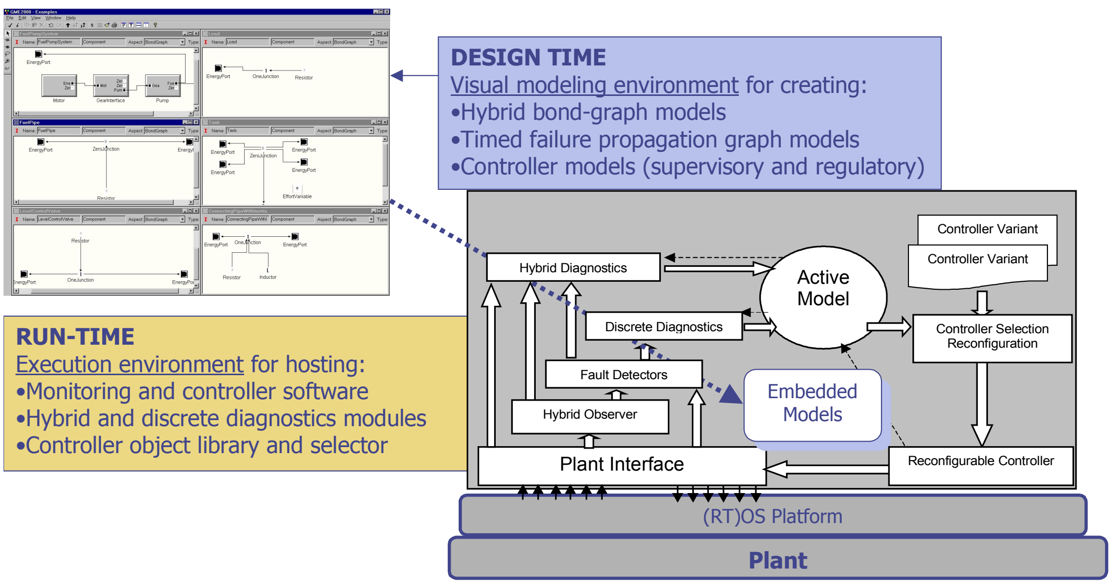
FACT: Fault-Adaptive Control Technology
Tools for Developing Fault-Adaptive Control Applications[1]
Summary of Features

The FACT tool suite assists engineers of complex aerospace and robotic systems to design and implement control systems that can maintain control even when the controlled system: the “plant” fails. The tool suite is using a model-based approach, where the designer creates design models of the plant and its associated control system, and the tools automatically generate code that implements fault-detection, isolation, and control reconfiguration (FDICR) functions.

The FACT tool suite has three components:

- A modeling tool that allows creating, editing, and maintaining models described above. This tool is based on GME; an independently maintained and supported tool from ISIS.
- Software code generators that translate models into executable code that could be deployed on an embedded system. The generated code instantiates the “embedded models”.
- Run-time support code that implements the algorithms that perform FDICR in conjunction with the code generated from the models.

The figure below illustrates the various pieces of the FACT tool suite:



In the **design-time** environment the modeler creates plant models in the form of hybrid bond-graphs (HBG) and timed failure propagation graphs (TFPG). The models also contain information about how the plant is equipped with sensors and actuators. Additionally, the designer can model reconfigurable controllers that react to faults in the plant and change their architecture as necessary.

In the **run-time environment** *embedded models* are used to configure the various generic software components: the plant interface (that connects to sensor, actuators, and monitors on the plant), the hybrid observer (that tracks the plant in continuous time and across discrete mode changes), the fault detectors (that signal if significant deviations are detected between the expected and observed behavior of the plant), the discrete diagnosis (that uses the causal TFPG models to isolate fault causes), the hybrid diagnosis (that uses the fine grain HBG models to isolate fault causes), the active model (that stores the best current estimate of the plant’s state), the controller reconfigurator (that manages changes in the controllers), and the reconfigurable controllers.

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