



CIP Tool® – Model-based Construction of Embedded Real-Time Components

Software development for embedded systems is not a straightforward matter. A fair amount of corrections after testing is to be expected, usually in a loop with minor changes applied each time. Conventional development techniques involve going back to an off-line design and correcting the already existing implementation subsequently. For a number of reasons, this is often not feasible and alterations made in the code are not reflected in the specification. Example projects with such inconsistencies abound.

With CIP Tool® this repetition is limited to a much shorter phase in the development cycle. While testing, corrections are made in the CIP model only, code is then generated automatically. Once the interface to the environment is stable, functional alterations can be made without disrupting the project integrity. Automated interaction analysis allows to represent all potential interaction sequences at construction time already. Code and documentation are produced from a single source, the CIP model. CIP Tool® eliminates the problems of transforming a CIP model into correctly executing code, it thus increases quality and productivity, it adds robustness and reliability to your software products, and it ensures flexibility in system maintenance.

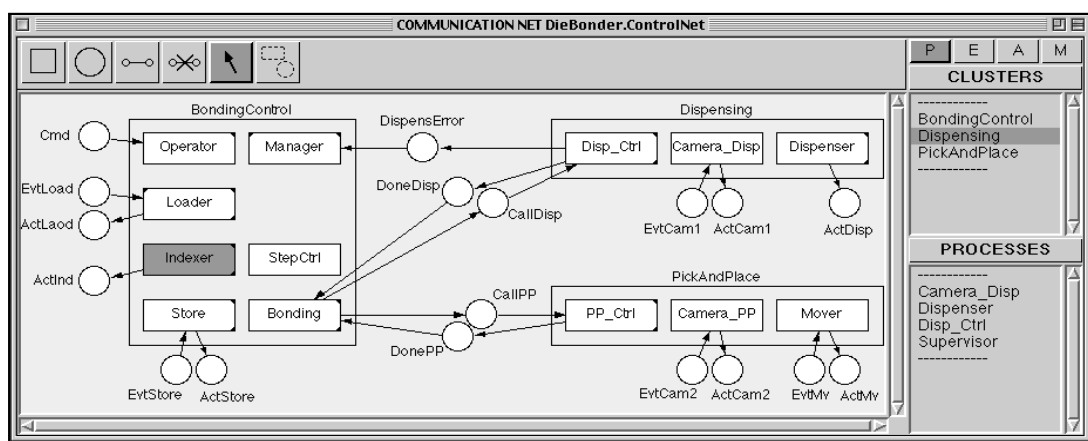
Construction of CIP Models: Compose and Connect

With the CIP method (Communicating Interacting Processes) embedded systems are specified by means of architectural and behavioural models of cooperating processes, designed as extended finite state machines. A CIP model consists of modelling elements like channels, processes, messages or operations. CIP Tool®, a framework of graphic and text editors, allows you to create, compose and connect these elements in a flexible way. Changes made in one editor are immediately updated in all dependent model parts and views. The tool permits to build consistent CIP models only and their completeness is checked automatically.

Systems

A CIP model is composed of a set of concurrent clusters, each consisting of a number of synchronously cooperating processes. The processes can communicate with each other and with the environment by means of asynchronous channels.

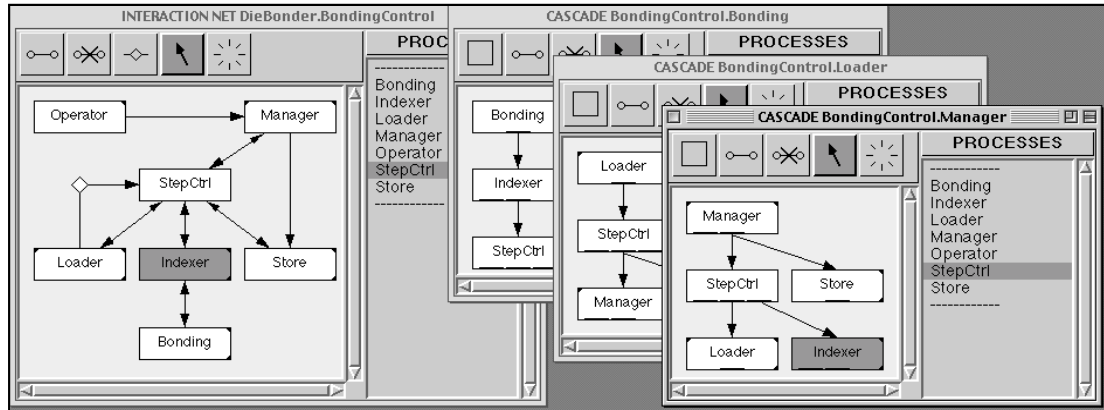
When a CIP model is partitioned into implementation units, the entering and leaving channels of such a unit define the interface model for the generated software component.



The COMMUNICATION NET Editor is used to interconnect processes of the various clusters by channels. Source and sink channels model the interface to the system environment.

Clusters

Processes interact within a cluster by means of synchronous event multicast. The interaction connections among processes are defined in the graphical interaction net editor. Cyclic interaction chains are prevented by the tool, ensuring thus bounded response times of system reactions.

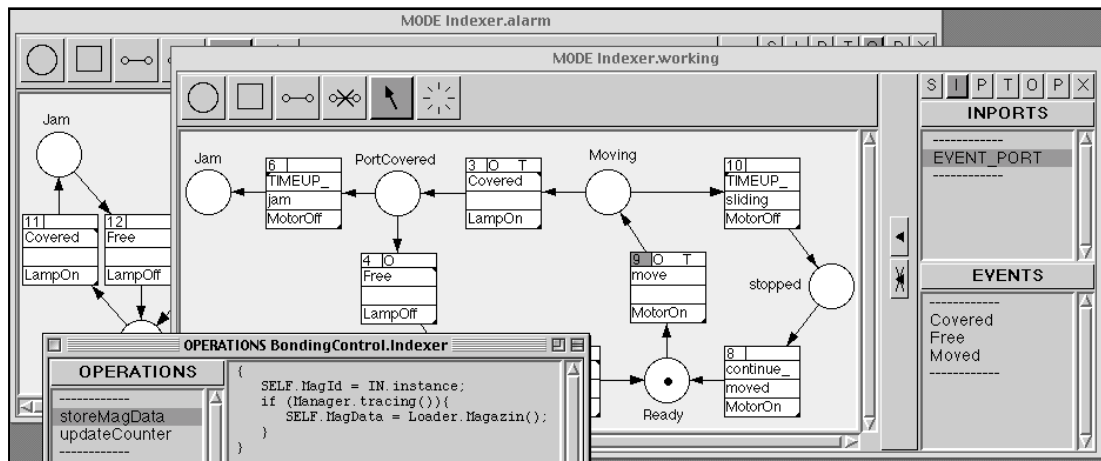


With the INTERACTION NET Editor you create multicast connections among the processes of a cluster. CASCADES are control flow structures generated by the tool, representing envelopes of the event trees caused by the individual processes.

Processes

Processes are state machines extended by static variables, input and output data types and operations executed in state transitions. The behaviour of a process is specified by one or several alternative modes, each edited graphically as a state transition diagram.

The active mode at run time is determined by the current state of one or more processes designated as masters. The full master-slave relationship of a cluster is defined in a specific hierarchy editor.



The MODE Editor allows you to specify the behaviour of a process by means of state transition diagrams. Transitions are specified by allocating inputs and outputs from interface tables of the process. Operations defined in the OPERATION Editor can be executed in state transitions.

CIP models can be saved and loaded as portable ASCII files (some 100 K for large systems). Clusters, processes and channels may each be exported and imported separately.

Free Download of CIP Tool® with Tutorial

A trial version (limited model size) for PC (MS Windows) and a tutorial consisting of a number of exercises are available as download at the CIP web site <http://www.ciptool.ch>.