Distributed Real-time Systems

A distributed system is a system having spatially separated units (nodes) performing information processing with certain autonomy. Normally, each such node operates with a processor and memory of its own and receives and transmits data over a network of some kind. There is now a wide-spread conviction among researchers and in the industry that distributed solutions will be the main-stream of development of real-time systems in the future. This gives obvious advantages, but also some complicated problems in the area of process scheduling and process allocation.

A distributed real-time system allows you to distribute the processing to:

- give the best computational resource utilization
- match the hardware requirements of a specific function
- optimize overall system communication in terms of wiring harness and EMI
- give the best fault tolerance or graceful degradation
- allow for information sharing and functional integration
- increase diagnosability

The BASEMENT Solution

The BASEMENT solution has been designed to address the multiplexing of safety critical and non-safety critical vehicle functions.

Architectural philosophy

A major driving factor in BASEMENT has been the need to provide solutions where safety critical functions are "always" guaranteed the resources they need (when they need them) in order to operate properly. To accomplish this goal, adequate resources are "a priori" bound via an off-line scheduler and execution is time driven.

With a distributed network of processors available, a wide variety of non-safety critical functions (many highly sporadic such as window control, seat adjustment, and so on) can be provided execution resources on-demand according to resource availability. Thus, scheduling takes place dynamically at run-time where execution is either event driven or time driven.

In order to differentiate between these two forms of application functions, we have introduced the names RED to denote safety critical functions and BLUE to denote non-safety critical functions.

Another major aspect of the philosophy concerns the view of applications and their development. Applications, whether RED or BLUE, are looked upon as a form of "signal processors" where the function designer views an application as a set of circuits (called "Software Circuits"). This view has been taken to achieve simplicity and understandability as well as provability of the applications.

The concepts of BASEMENT are formulated within the Swedish Road Traffic Informatics (RTI) programme (1991-1994).

Read more in related papers and articles.