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Integration of data acquisition devices in the ITER Real-Time Framework using Nominal Device Support

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The implementation of control algorithms for nuclear fusion requires a real-time environment to ensure the correct operation of the device. Although several alternatives have been used in the fusion community during the past decades, ITER has committed to develop a new generation real-time framework for control, the ITER Real-Time Framework (RTF). The ITER-RTF has been developed taking into account the experience gained with the use of the previously existing frameworks and addressing the new requirements derived of ITER needs (e.g. long-pulse operation, integration of heterogeneous systems developed by several domestic agencies).

The control algorithms in RTF are implemented using function blocks. Each function block can have input and output signals, which are the most basic form of data communication among function blocks. Therefore, control applications are built by simply connecting function blocks. There is a set of already implemented function blocks providing basic functionality, as file reading, simple data processes, and logging. Advanced users can also implement custom function blocks to address functionality not covered with the provided function blocks. In a control algorithm, some of these function blocks must manage the data acquisition devices to provide the necessary inputs to the control algorithms. However, the lack of non-standardized software interfaces with data acquisition devices requires developing custom function blocks for each device. This leads to a high cost in terms of development time and maintainability.

One proposal to standardize such data acquisition devices integration in control systems is Nominal Device Support (NDS). In NDS v3 applications, there are two main components, device drivers and control systems. The interface between both is accomplished using an abstraction layer, so every device driver implemented using NDS can be managed with any control system with an interface to NDS. ITER is using NDS for the implementation of instrumentation and control systems for diagnostics. Currently, there are several PXIe and MTCA data acquisition and timing devices in NDS, but the only control system integrated so far is EPICS.

In this paper, the first integration of NDS device drivers in RTF is presented. The objective of this work is to propose a methodology for the inclusion of NDS in RTF that allows reusing all the devices integrated with NDS to develop control applications using RTF.

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