

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

**S. Esquembri**, M. Ruiz, A. De Gracia, M. Astrain, A. Carpeño

*Instrumentation and Applied Acoustic Research Group, Universidad Politécnica de Madrid,  
Madrid, Spain*

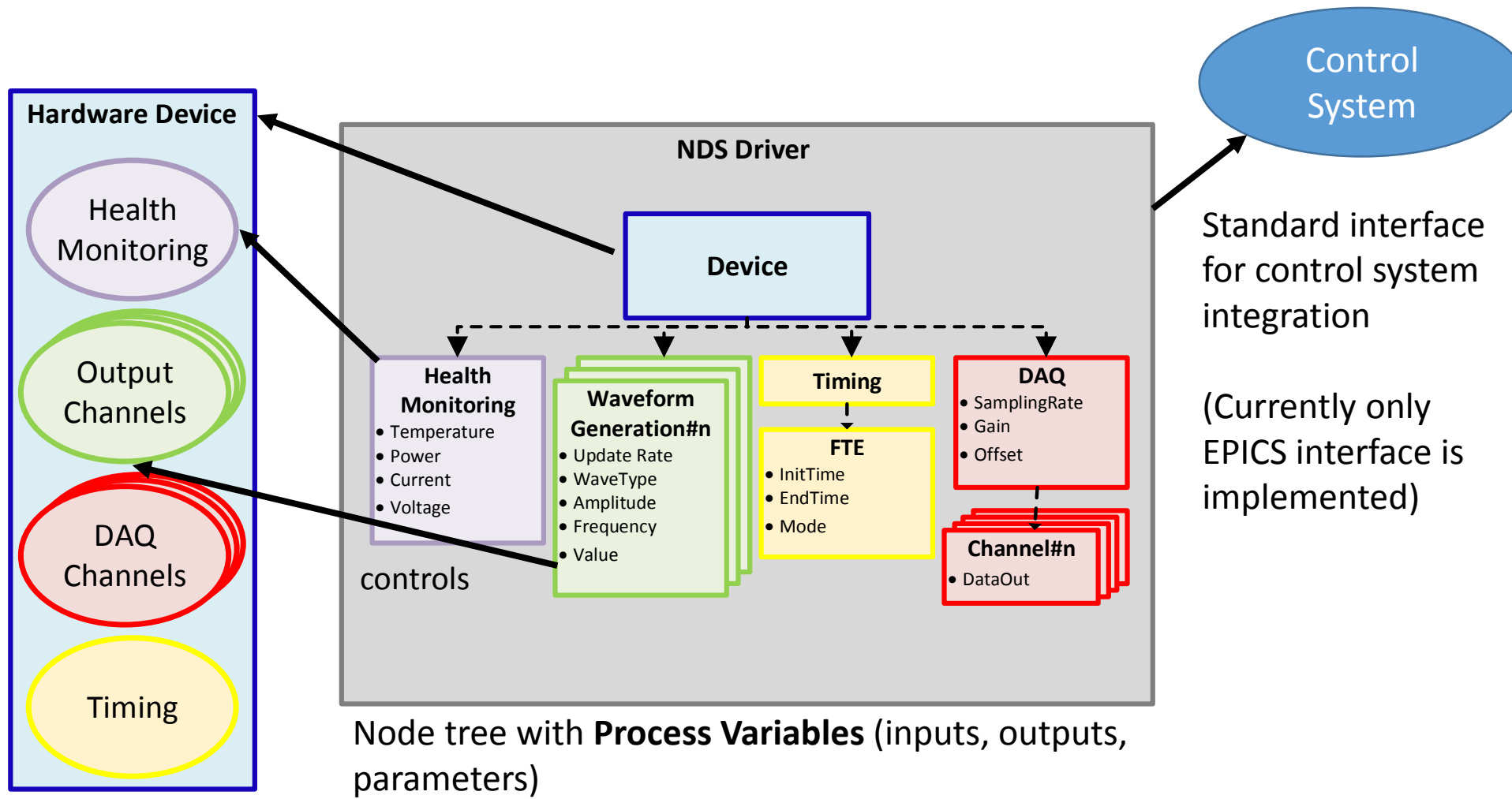
**Email:** [s.esquembri@upm.es](mailto:s.esquembri@upm.es)

# NDS (Nominal Device Support)

Framework for standardize Device Driver integration in control systems

PCIe, PXIe, MTCA, ...

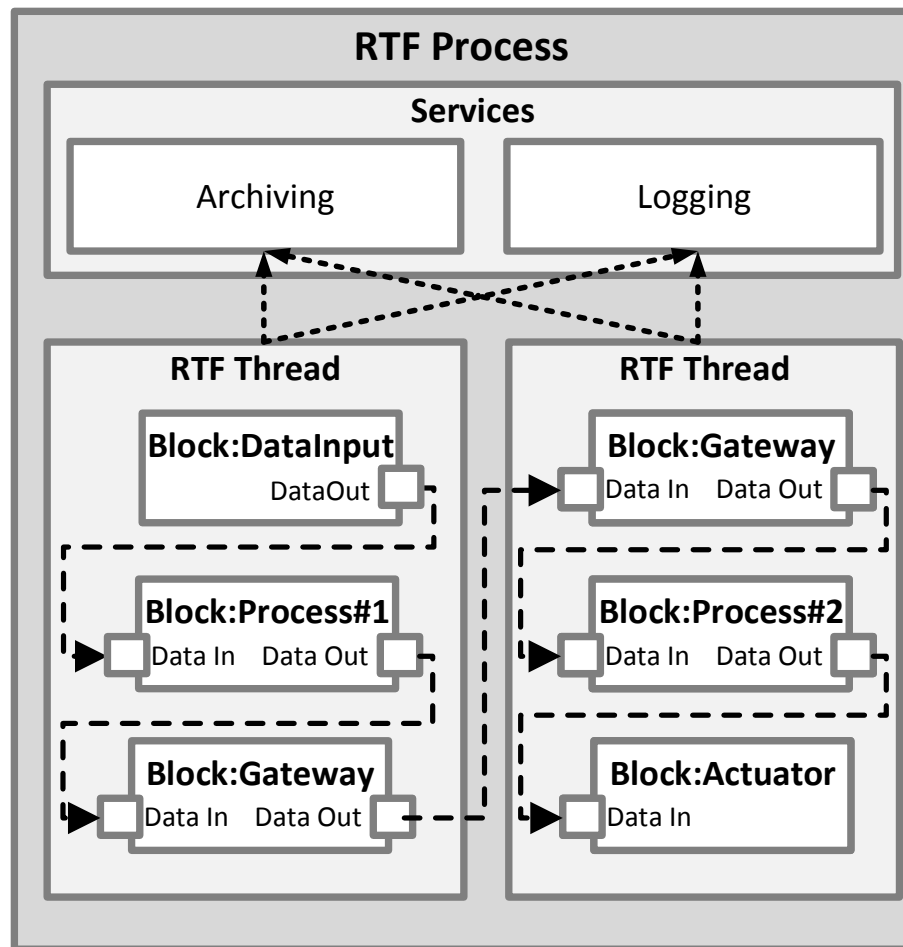
Timing board,  
Analog I/O,  
Digital I/O  
Image acquisition,  
...



Framework for complex real-time algorithm implementation and real-time control of actuators

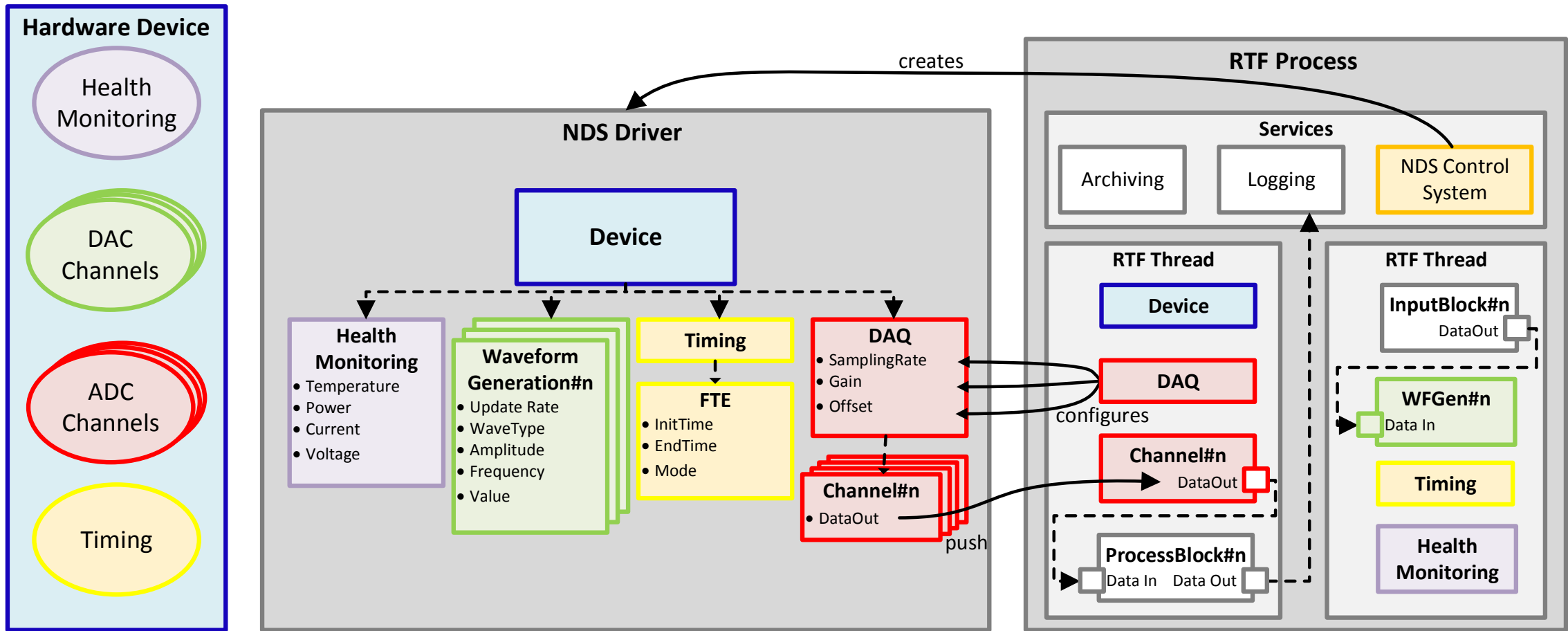
RTF applications are a set of interconnected blocks

Blocks can be distributed among threads



Implemented blocks can be distributed as plugins and shared for reuse

Implement RTF service acting as NDS Control System and RTF Blocks to manage NDS Nodes



- Integration of NDS in RTF will allow component reuse
  - Increased maintainability
  - Reduced development effort
  
- Data acquisition devices serve as data sources for real-time control algorithms

- RTF-NDS blocks and service distributed as plugin
- Device drivers will be integrated with block configuration, not with a new driver implementation



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Email: [s.esquembri@upm.es](mailto:s.esquembri@upm.es)

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S. Esquembri, M. Ruiz, A. De Gracia, M. Astrain, A. Carpeño  
Instrumentation and Applied Acoustic Research Group, Universidad Politécnica de Madrid (UPM), Madrid, Spain  
s.esquembri@upm.es

**ABSTRACT**

- NDS is the framework chosen by ITER to develop software device drivers of the hardware used for Diagnostics and I&C systems and simplify the integration in EPICS or other software applications.
- ITER RTF will be used to implement control algorithms that will require data from ITER plants.
- Device drivers must be integrated in ITER RTF to provide inputs for control algorithms and allow real-time control of actuators.

**BACKGROUND**

**ITER Nominal Device Support (NDS)**

- NDS framework serves to integrate Data Acquisition and timing devices in control systems in a "standardized" manner to provide homogeneous control of heterogeneous systems.
- In NDS, Device drivers are abstracted from the control system by standardized interface, allowing a single Device Driver to be used from different control systems.
- NDS drivers are a set of nodes where each node maps to a hardware functional block.
- Hardware functions parameters, inputs, and outputs are mapped into process variables known as NDS PVs.
- Several PVs and MTCAs devices already count with NDS integration.

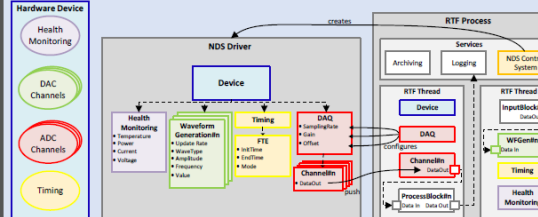
**ITER Real Time Framework (RTF)**

- ITER RTF is a flexible high-performance software for complex real-time algorithm execution and real-time control of actuator systems.
- Data acquisition devices must provide input for the real-time algorithm.
- RTF applications are a set of interconnected functional blocks.
- Blocks can be distributed among threads.
- Blocks can be configured asynchronously, but inputs and outputs are synchronized by the RTF thread scheduler.
- RTF provides logging, archiving, and Life Cycle Management services.
- These services are accessible by all the blocks.

**Hardware Device**

- Health Monitoring
- DAC Channels
- ADC Channels
- Timing

**RTF Process**



**IMPLEMENTATION**


- An RTF service will act as NDS-Control System, acting as a factory to create the NDS Drivers
- RTF blocks will be used for NDS nodes
- A first implementation maps manually RTF blocks with NDS nodes
- Future work will propose tools for automatic code generation.
- NDS service and blocks are provided as RTF plug-in

**CONCLUSION**

- Integration of NDS in RTF will allow component reuse
- Increased maintainability
- Reduced development effort
- Data acquisition devices serve as data sources for real-time control algorithms
- Device drivers will be integrated with configuration, not with development.

**ACKNOWLEDGEMENTS**

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