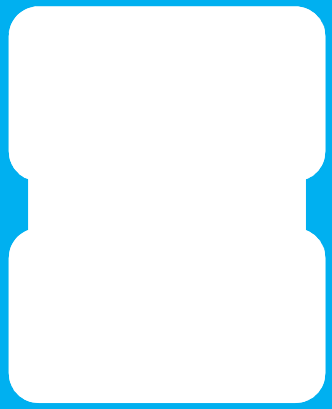

Using FORTE in infomechatronics lab

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The University of Auckland, NZ
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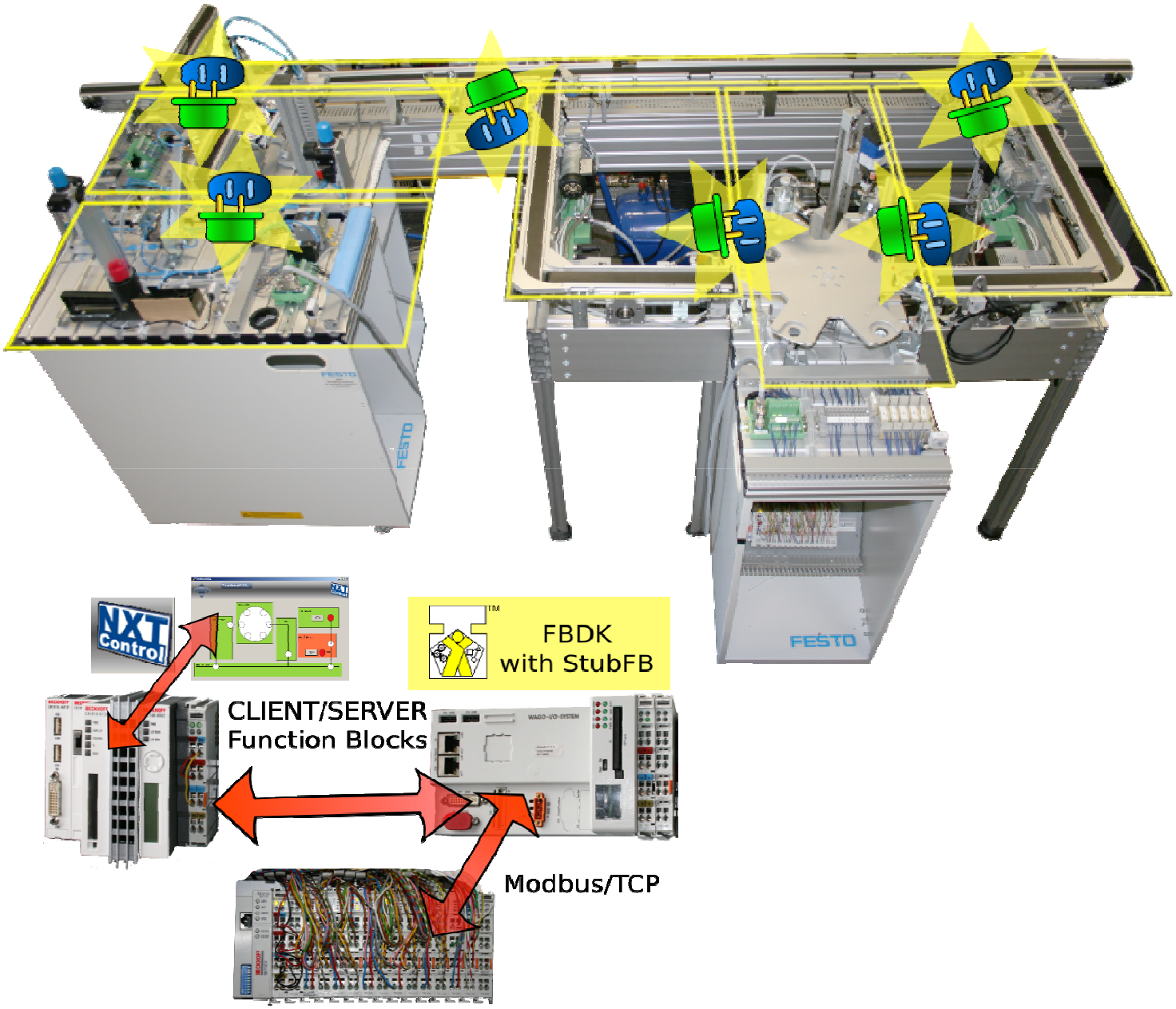
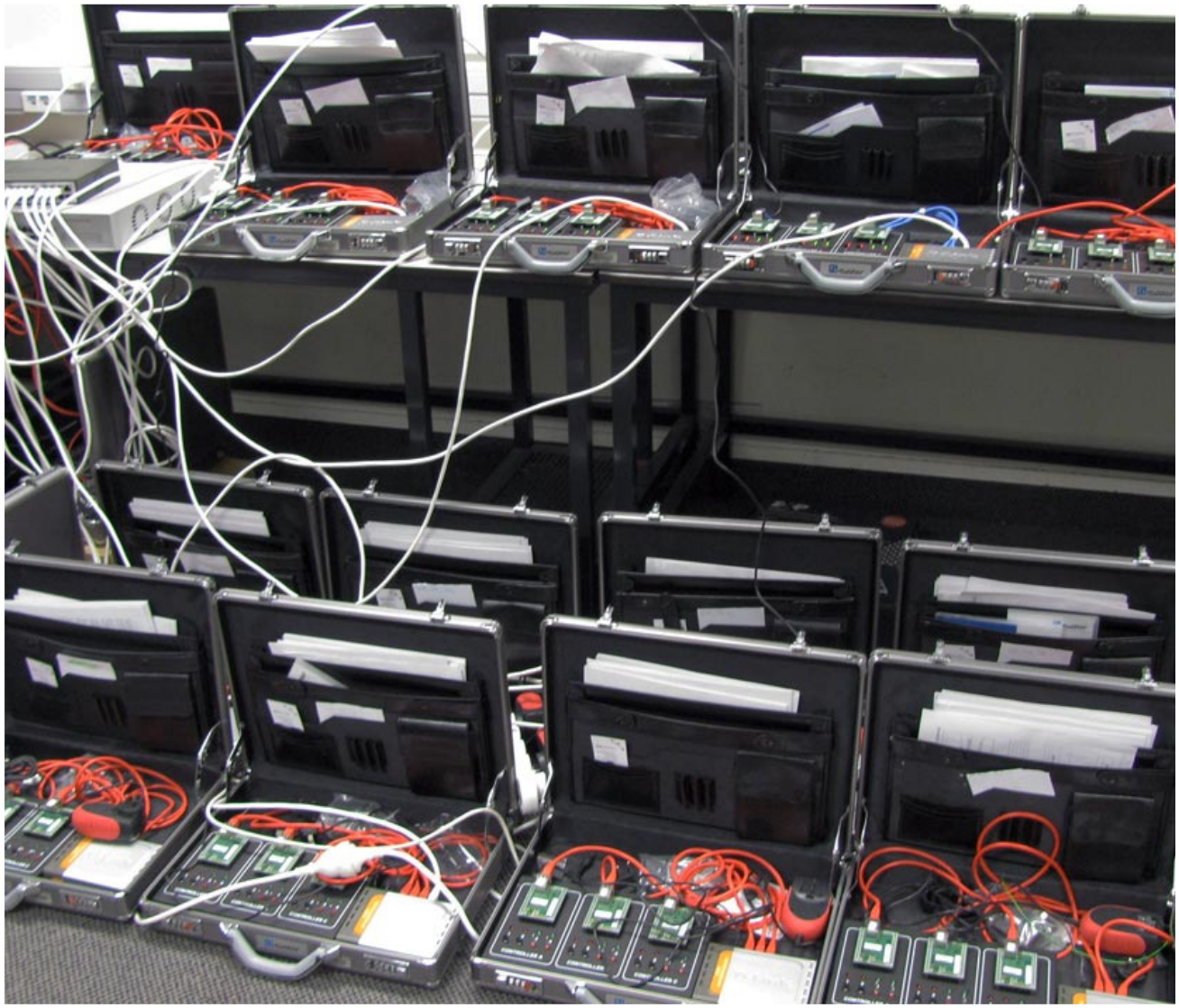
Reconfigurable Testbed with NxtControl



Distributed FB Testbed with 50+ Nodes



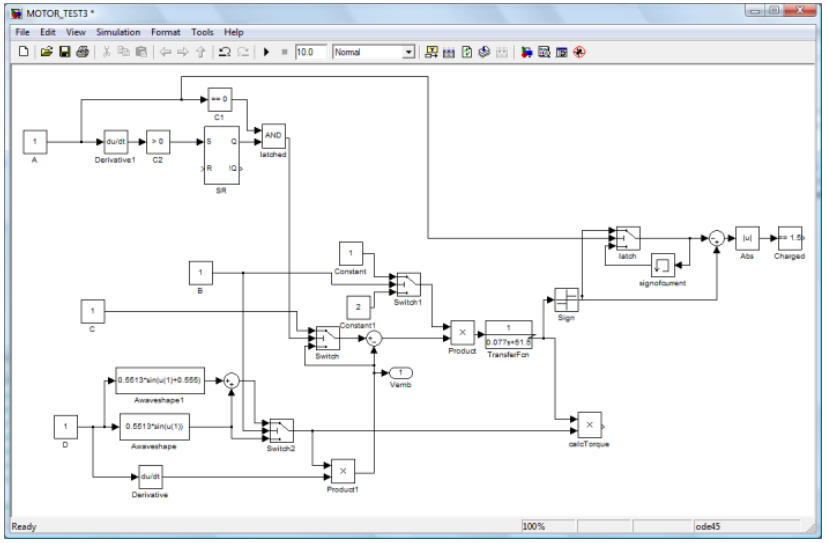
Use of 4DIAC

1. NxtFORTE
2. Simulation environment Simulink -> FB
3. Intelligent Mechatronic Components design framework: portability test

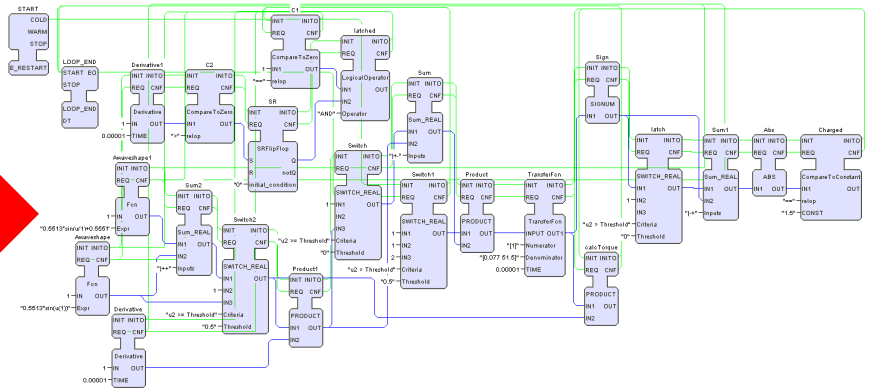
Model Transformation

- Transform from Simulink models to Function Block models
- Originally FBDK (FBRT) was the target

Simulink model of a motor industry



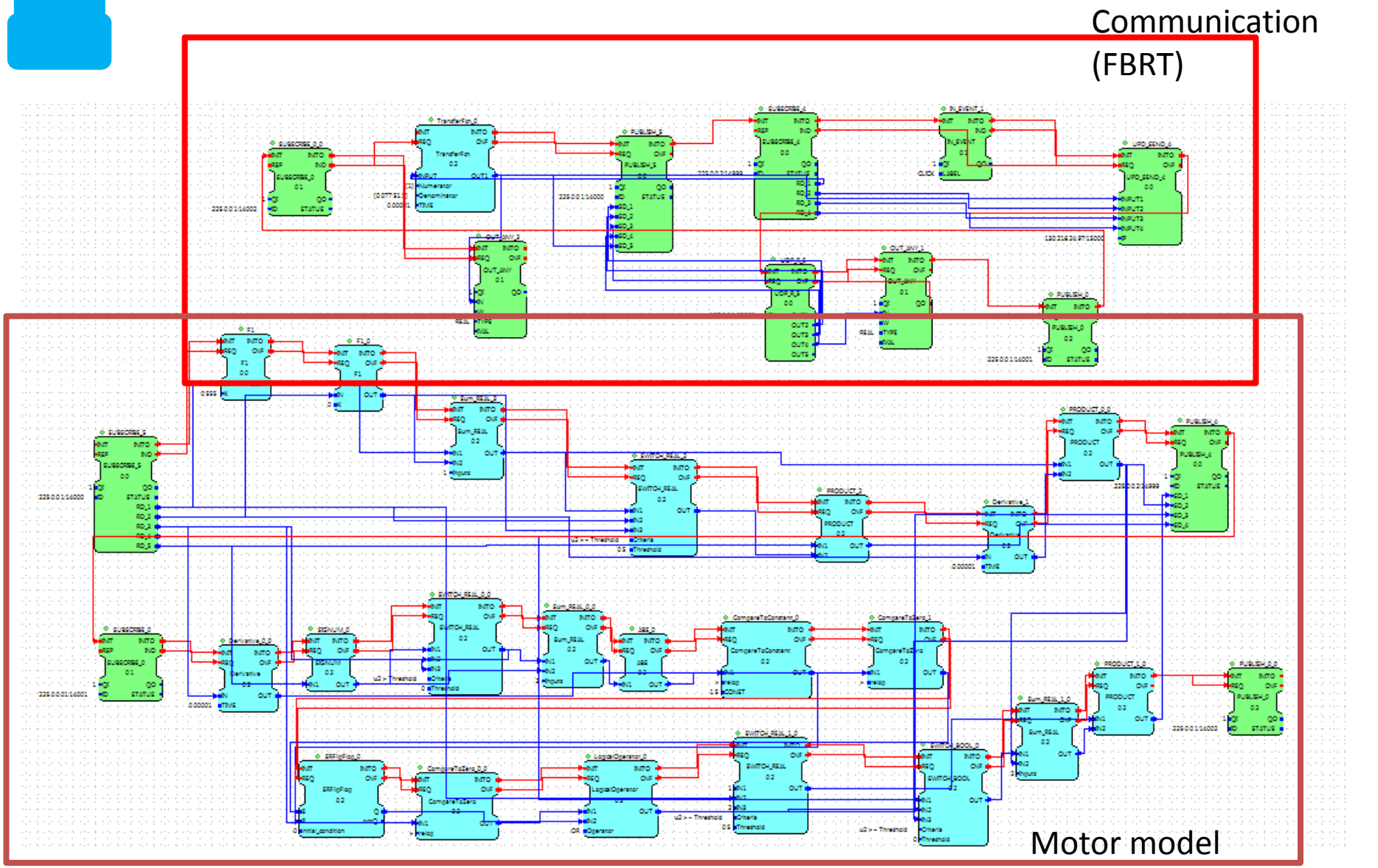
Transformed FB application in FBDK



4DIAC Implementation

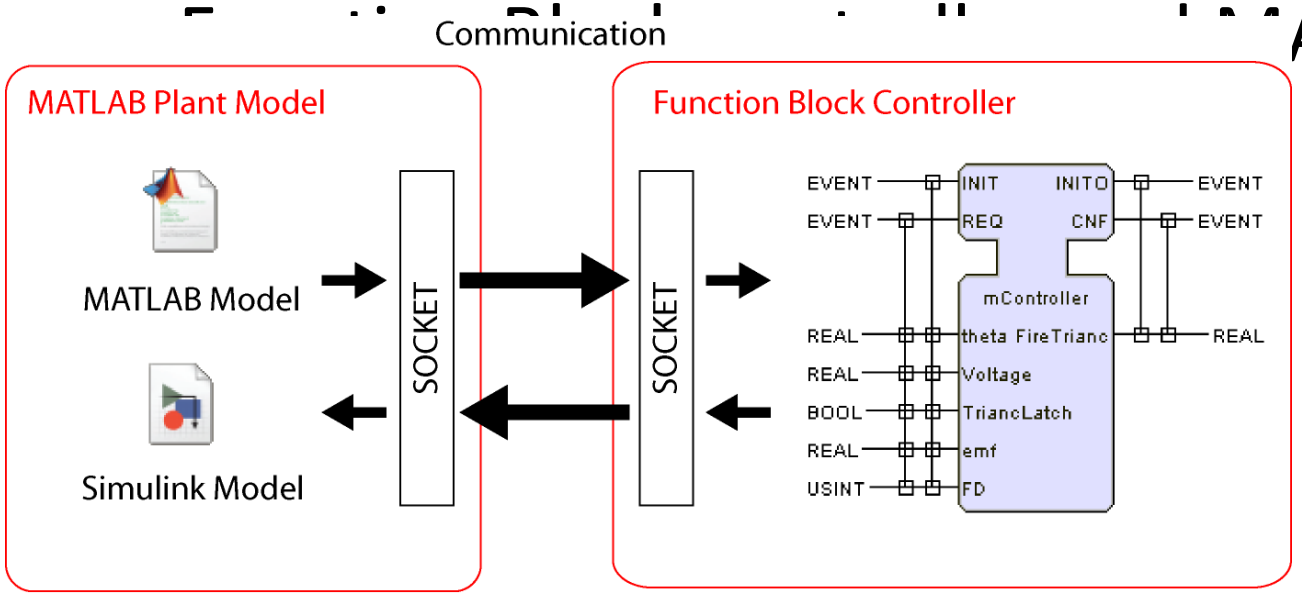
- Exactly the same model can also be created under 4Diac
  - Currently the example model is manually created because the XML format is different to the FBDK's one
- The transformed model can be opened by using 4Diac if the FBDK import functionality exists (which is disabled in new version?)

Motor Model in 4DIAC



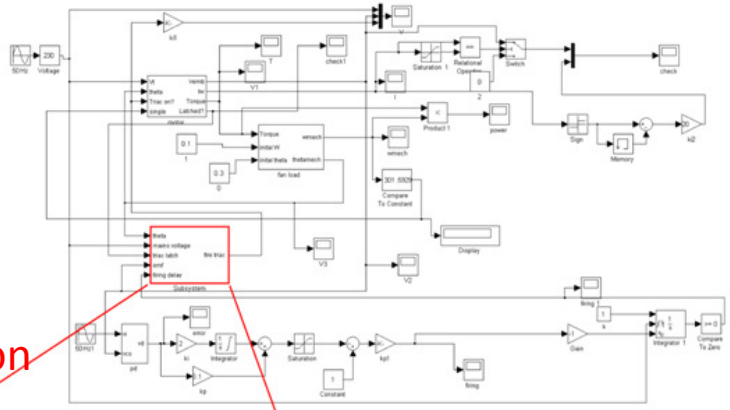
Data Communication with Simulink

- FB Models can exchange data with Simulink by using Sockets (i.e. UDP or TCP protocols)
- Closed-loop simulation between

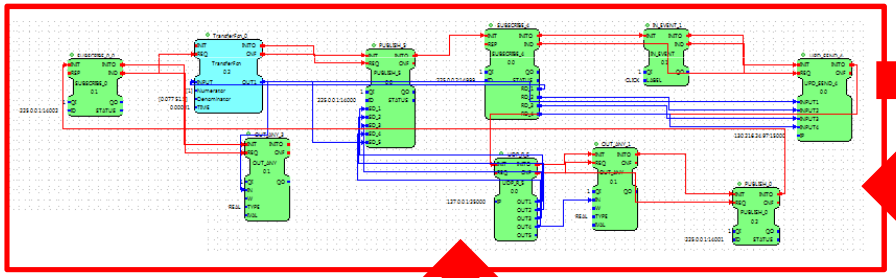


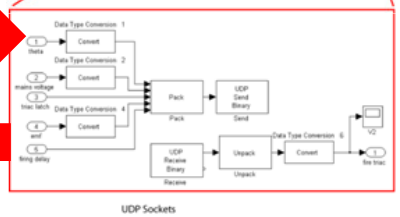
Closed-loop Simulation with Simulink

The motor part of the complete Simulink model is transformed into a FB model.

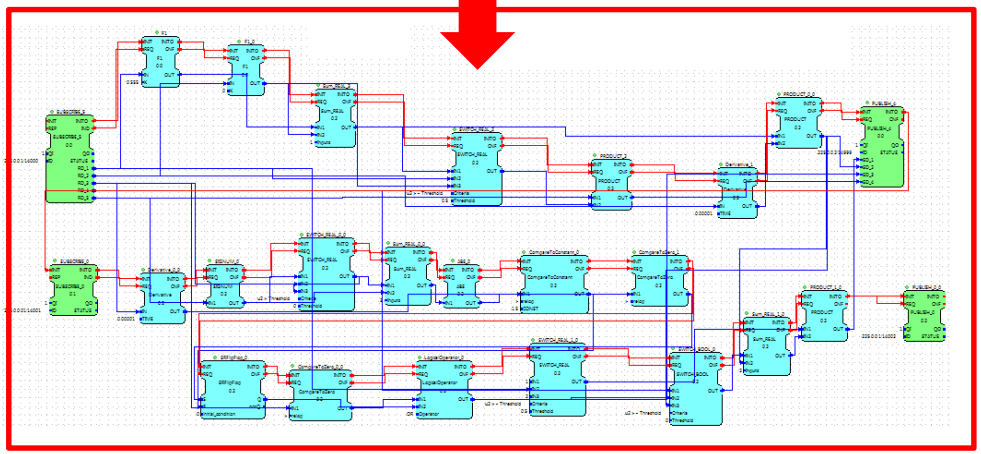


Data Communication



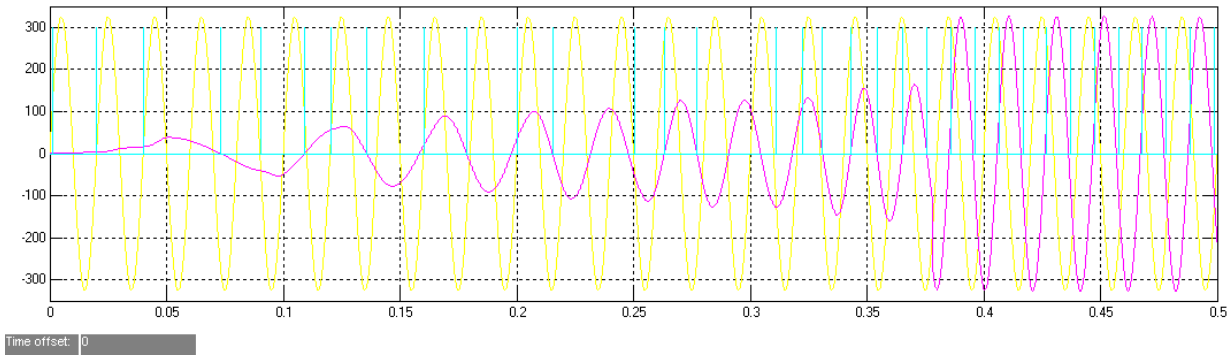


The transformed part of model is replaced by the communication block.

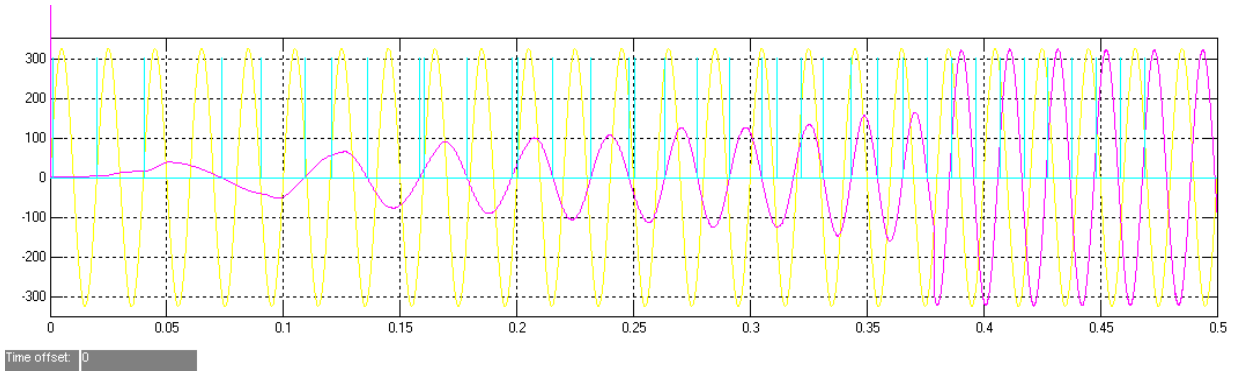


Closed-loop Simulation between the two models can be performed. Data communication is achieved through the specified protocol.

Simulation Results



Output from original Simulink model

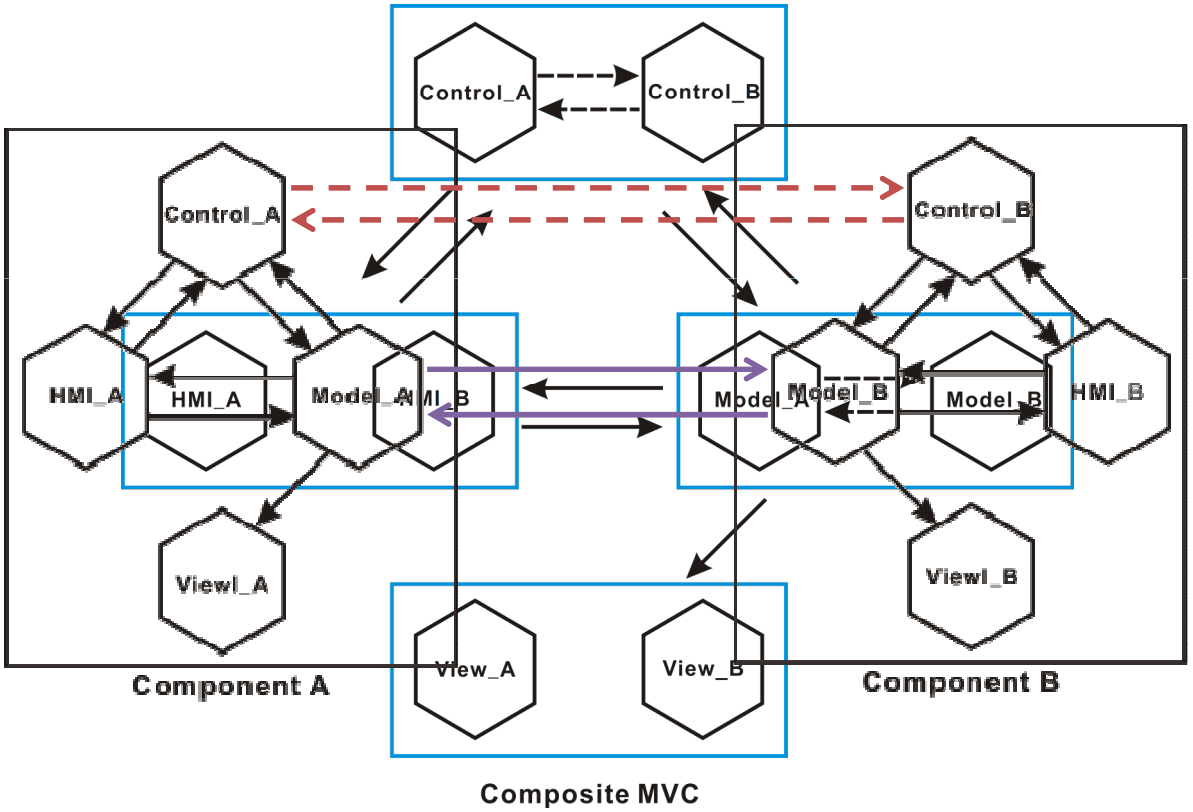


Output from the closed-loop communication setup between 4Diac and Simulink

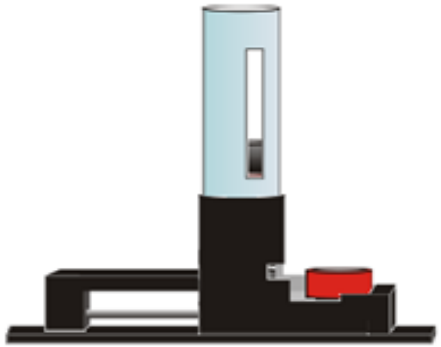
Problems discovered

- Geometric layout: FB network looks messy
- Import of Function Block applications from FBDK

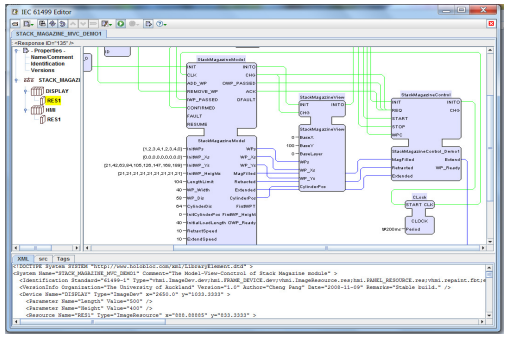
Composite MVC Design Pattern



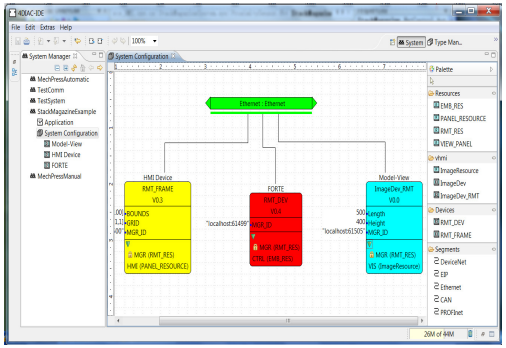
Design Portability



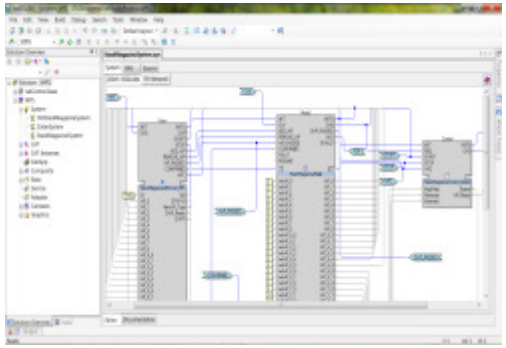
MVC Model



FBDK



4DIAC



nxtStudio

Aims

- To demonstrate the IEC 61499 standard's interoperability feature
- Find out the impacts of different execution semantics on the same control logic
- Figure out a generic storage means which supports seamless porting of the same design to different tools

Porting to 4DIAC

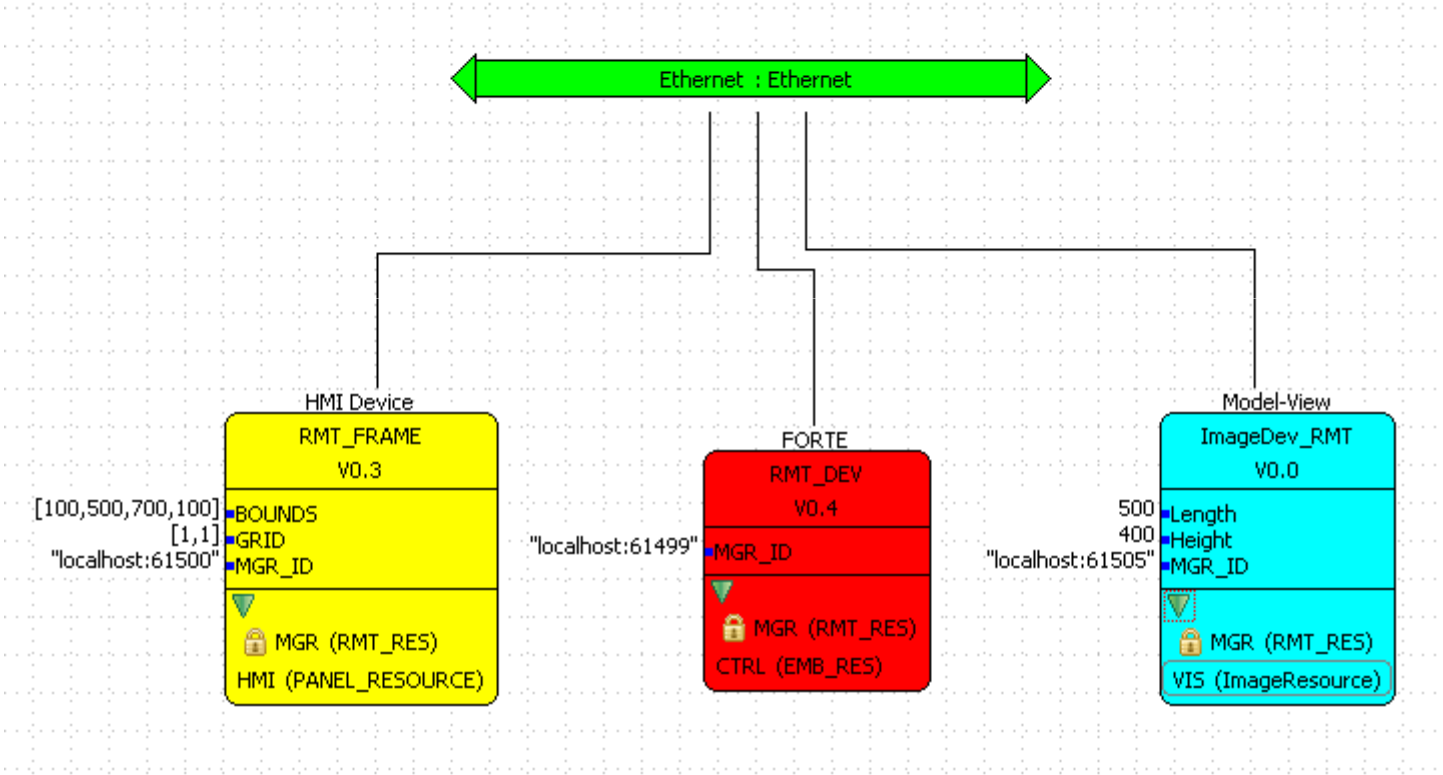
- The original model of the Stack Magazine (SM) is developed using FBDK
- The SM's Control FB can be directly deployed to the built-in RMT_DEV in FORTE due to:
  - Basic FB
  - Algorithms are coded in ST
- The SM's HMI parts are also directly ported to FORTE using the built-in library

Porting to 4DIAC

- The SM's Model and View cannot be run in FORTE due to:
  - Use a more advanced visualization library developed in Java

  As a result, a new remote device (ImageDev_RMT） and related resource (ImageResource) supporting the visualization library are developed in FORTE.

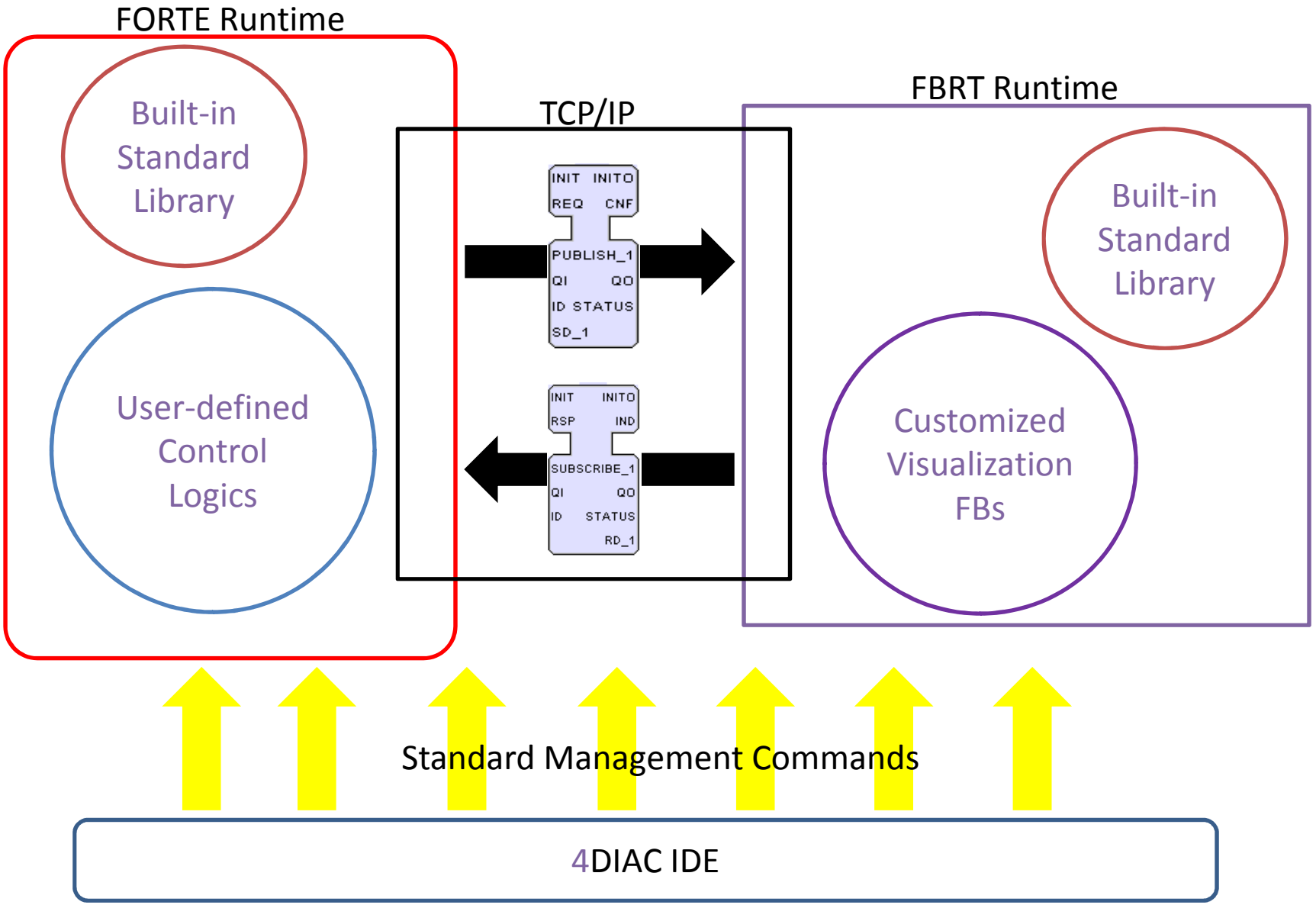
System Configuration of the SM MVC Model



Porting to 4DIAC

- As a result, the HMI and Control FBs will be running on FORTE while the Model and View FBs will be running on FBRT, where they are communicating via Publisher and Subscriber SIFBs using TCP/IP protocol.
- The MVC FBs are deployed to FORTE and FBRT respectively using the standard management commands through 4DIAC.
- It has been demonstrated that the SM's control logic performs the exact behaviors under both FORTE and FBRT.

Interoperation with other tools

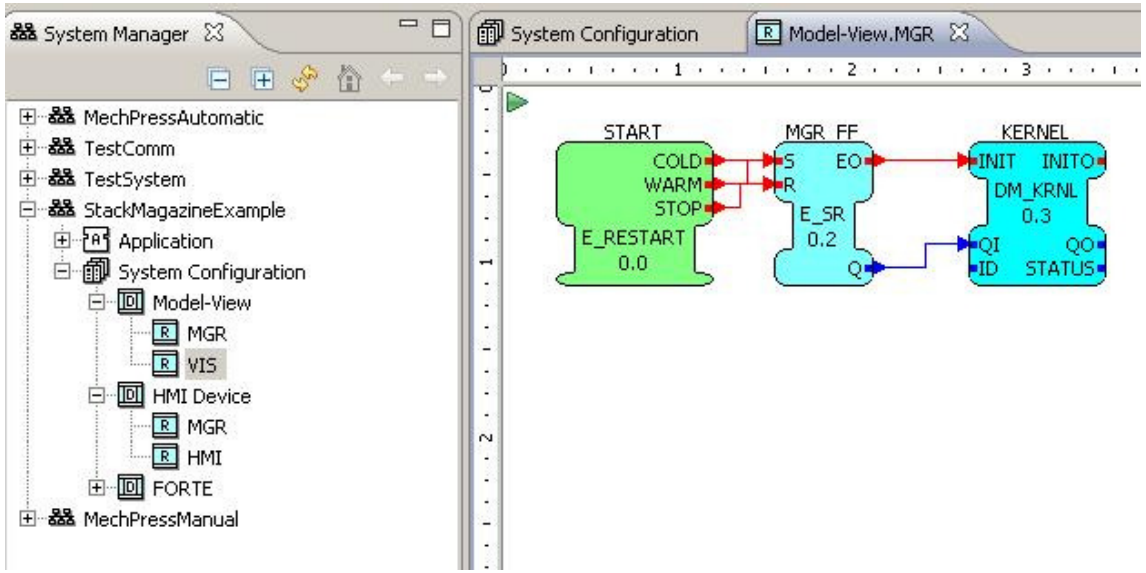


Comments on 4DIAC

- The 4DIAC IDE is not user-friendly compared to FBDK and nxtStudio
  - The FB Type manager is hard to use, e.g. a small mistake during the type import process results in a re-import of the whole library previously imported
  - The export feature is buggy
  - The FB editor of 4DIAC requires further development to be more usable
- Lack of documentation
  - User guide for 4DIAC
  - Developer guide for FORTE

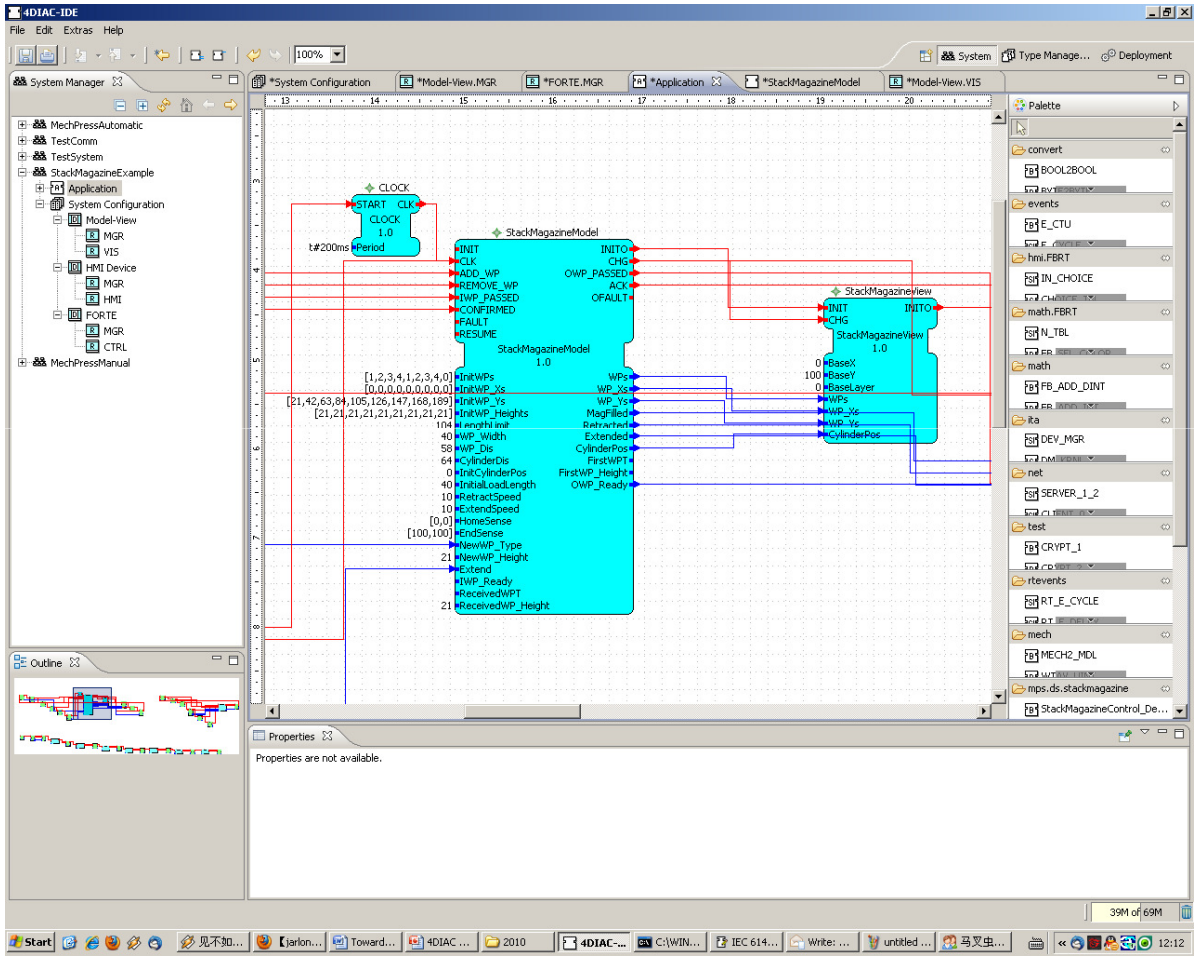
ImageDev_RMT

The ImageDev_RMT device contains three FBs:



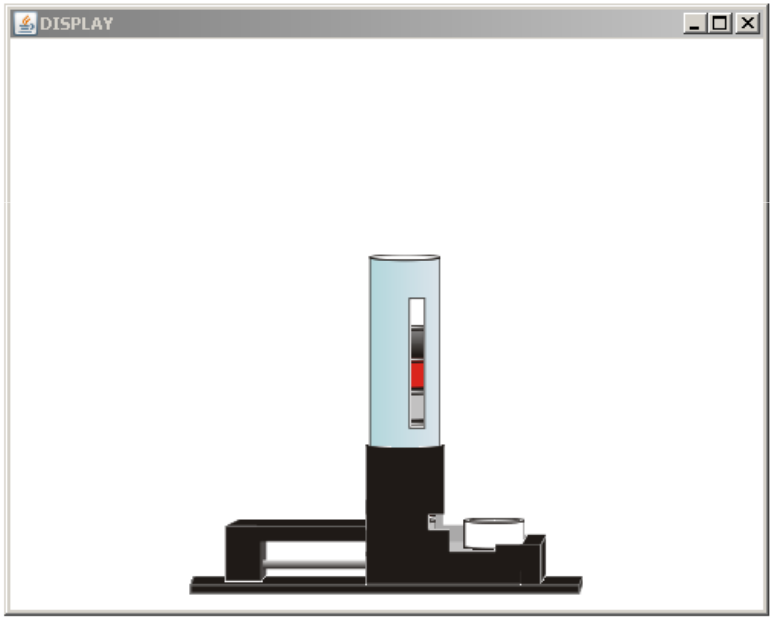
which is as defined in the standard to provide the mechanism for conveying management commands.

MV in ImageDev_RMT



ImageDev_RMT

As the View is still rendered by FBRT, the SM model will have the same visualization as:



Comments on 4DIAC

- The 4DIAC IDE is not user-friendly compared to FBDK and nxtStudio
  - The FB Type manager is hard to use, e.g. a small mistake during the type import process results in a re-import of the whole library previously imported.
  - Composite FB are not imported properly, the FB network can’t be displayed.
  - Want a more polished FB editor
- Lack of documentation
  - User guide for 4DIAC
  - Developer guide for FORTE, the source code of FORTE is hard to comrehend