

Algorithm Configuration Functions of The FPGA-Based Safety I&C Platform NicSys8000N Designed for Developing Engineering Applications

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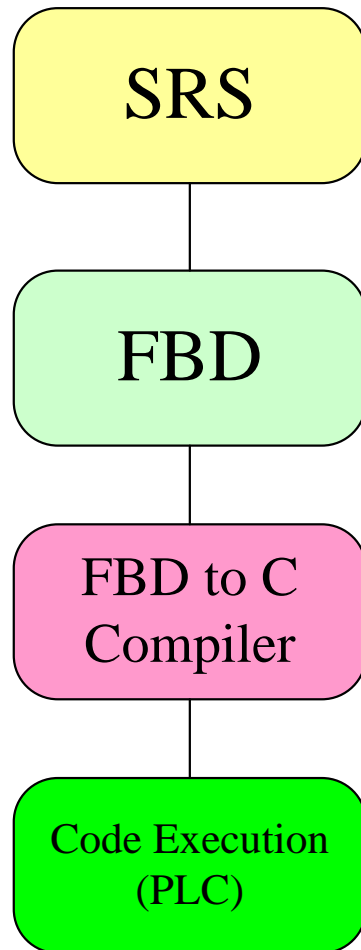


Agenda

- Background
- FPGA-based safety I&C platform NicSys8000N
- Function Block library
- Executor
- Example of an engineering application



Background



PLC Execution process

- Software Requirements Specification
- FBD Design
- Convert FBD into PLC executable code
- Download executable code to PLC

Disadvantages

- Cost of certification is very expensive
- Supply cycle of MCU and many other IC is relatively short



Background



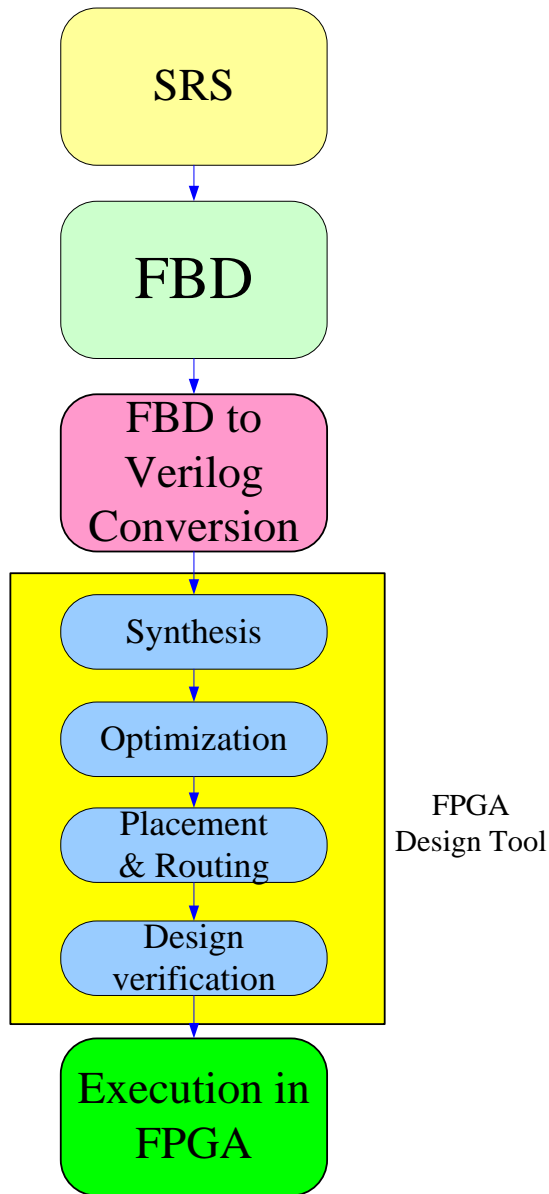
- Floating point arithmetic
- Video acceleration
- Server acceleration
- Signal processing

The performance of FPGA is excellent in the power consumption.

Background

- Advantages of FPGA
 - Lower complexity
 - Independence between the various modules
 - Short response time
 - High reliability
- How to use FPGA to realize the algorithm configuration ?





Generate a customized controller for each project

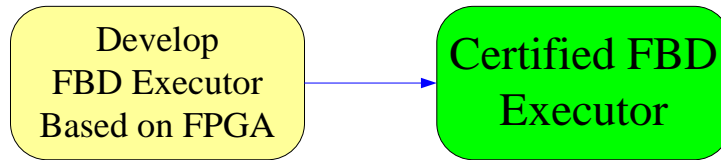
- Software Requirements Specification
- FBD Design
- Convert FBD into HDL file
- Synthesis, Optimization ,Placement& Routing, Design Verification
- Download

Disadvantages

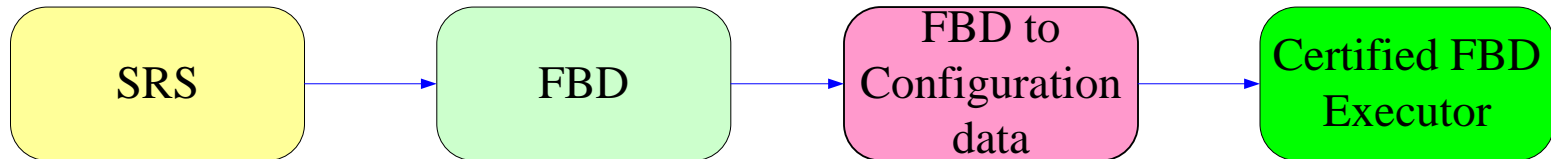
- The certification of the whole tool chains is very difficult.



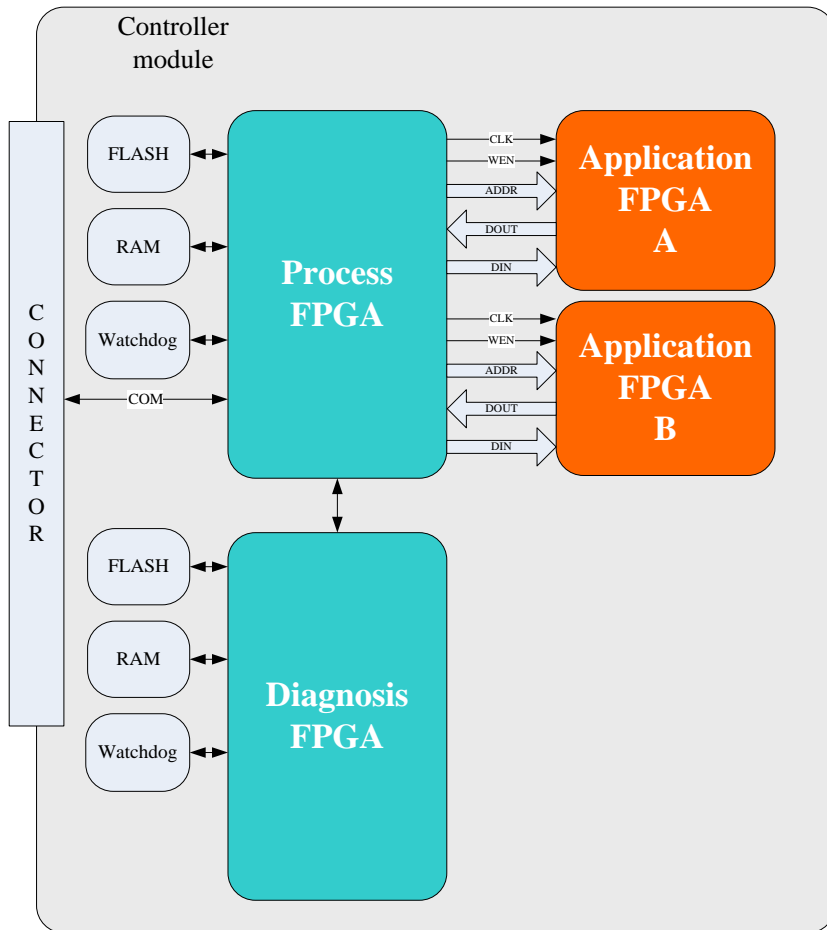
I)Development



II)Execution



FPGA-based safety I&C platform NicSys8000N



- Four Flash-based FPGAs
- Process FPGA:
 - Communication
 - Memory interface
 - Data exchange
- Application FPGA:
 - Algorithm configuration
 - Function Block library
 - Executor
- Diagnosis FPGA
 - Power diagnosis
 - Communication diagnosis
 - State of process FPGA diagnosis

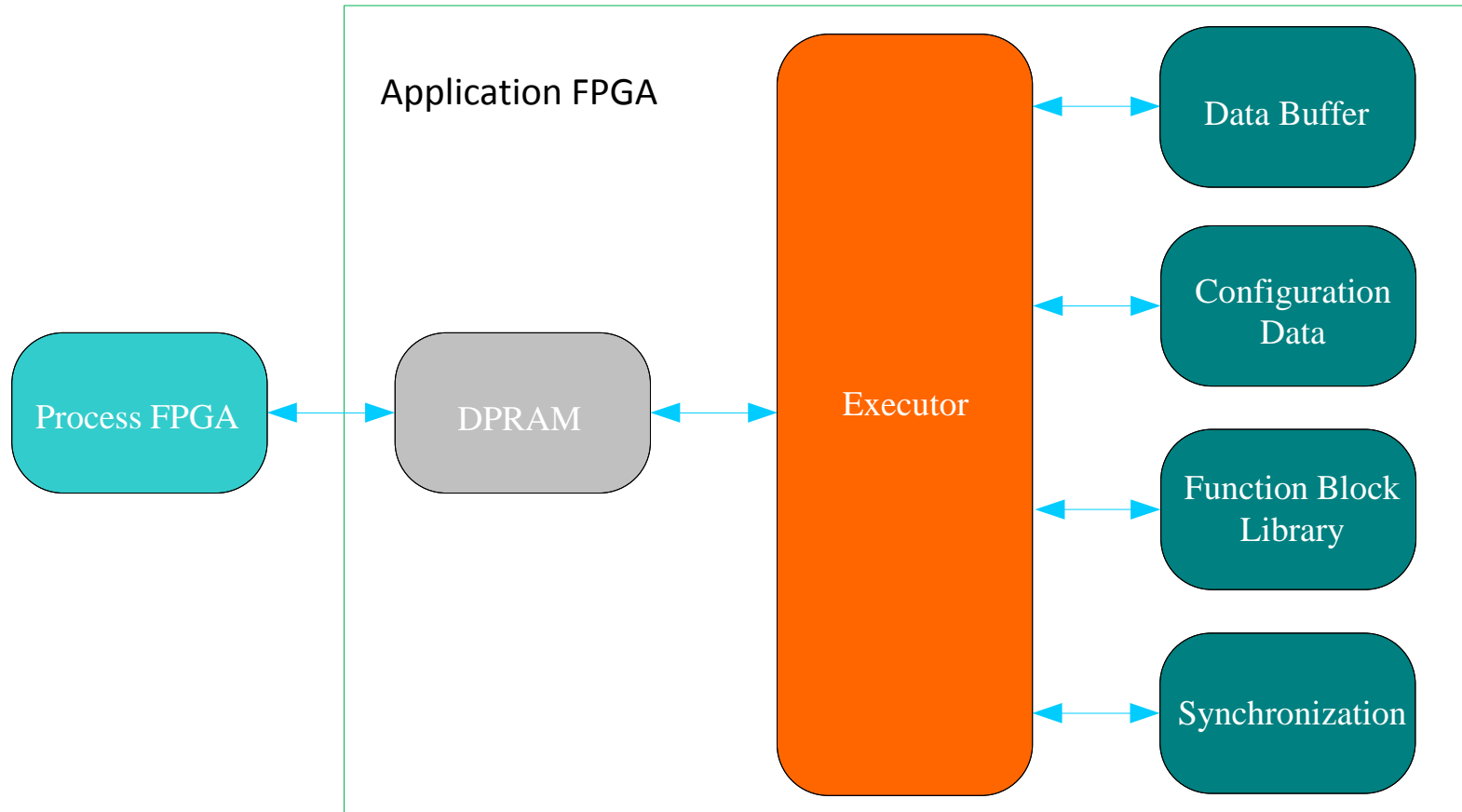
FPGA-based safety I&C platform NicSys8000N

- Performance of Application FPGA

- Run 2500 function blocks, Including 2000 simple function blocks and 500 complex function blocks
- The execution time of each block is less than 0.1ms
- The overall operation of application FPGA is less than 7ms



FPGA-based safety I&C platform NicSys8000N

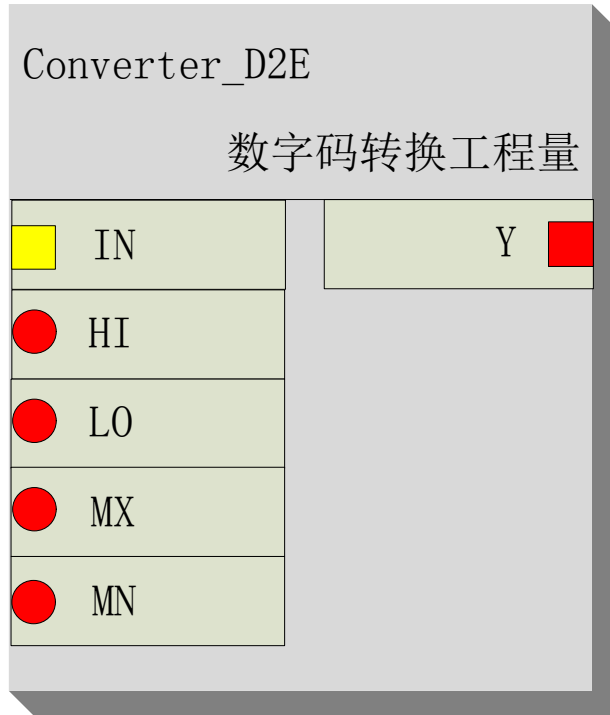


Function block library

- Advantages of using the function block library
 - Reduce development and verification
 - Improve reliability
 - Reuse function block
 - Save FPGA resources



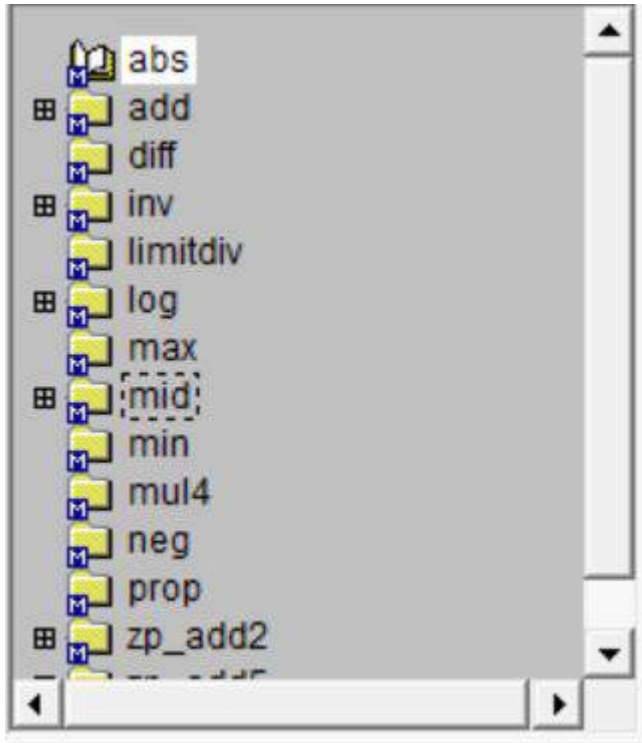
Function block library



- Types of function block
 - Arithmetic block
 - Timers block
 - Logic block
 - Converter block
 - Compare block
 - Engineering block



Function block library

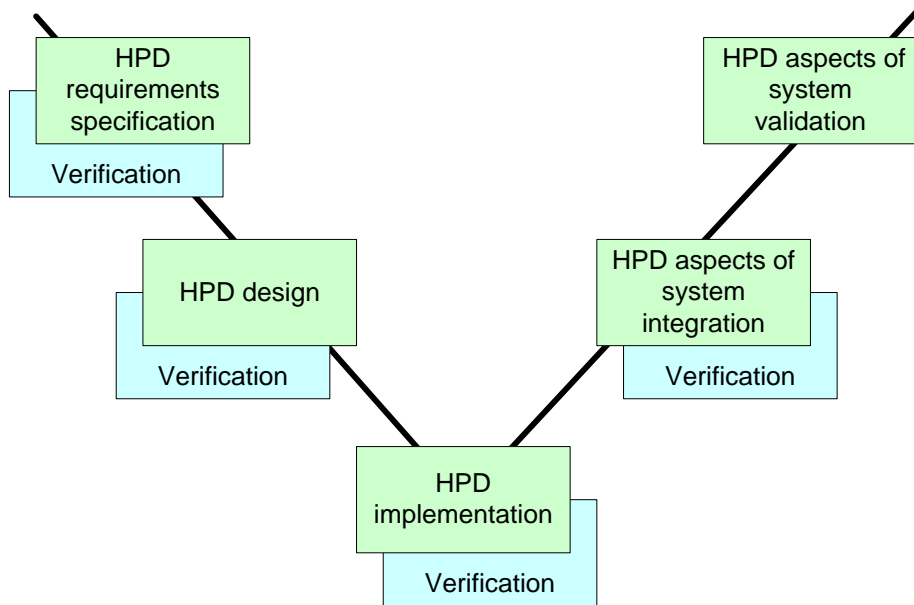


- Each function block is an independent HDL file
- Ease of management
- Function block can be independently verified
- Verified function block can be reused



Function block library

If in some engineering application, the function block library of NicSys8000N does not have a specific function block, how should we do?



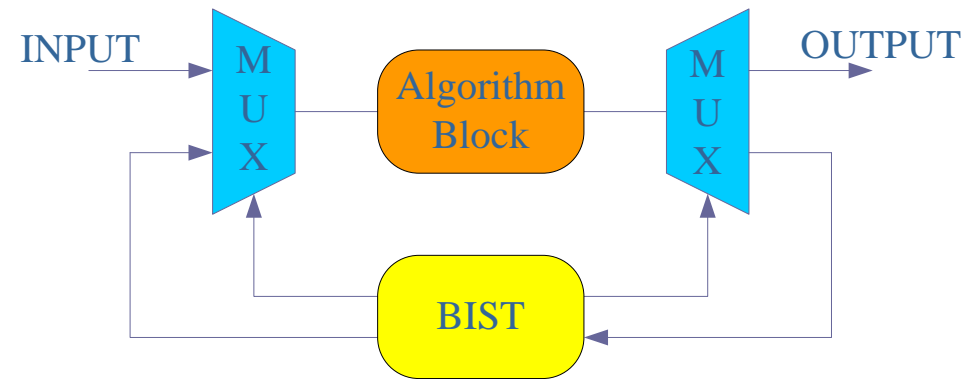
IEC 62566 Development life-cycle of HPD

- Reuse modules that have been verified
- Follow the IEC62566 standard to develop the new function block
- Complete the function block design, and fully verify the new function block
- Reduce time-to-market for new and improved products



Function block library

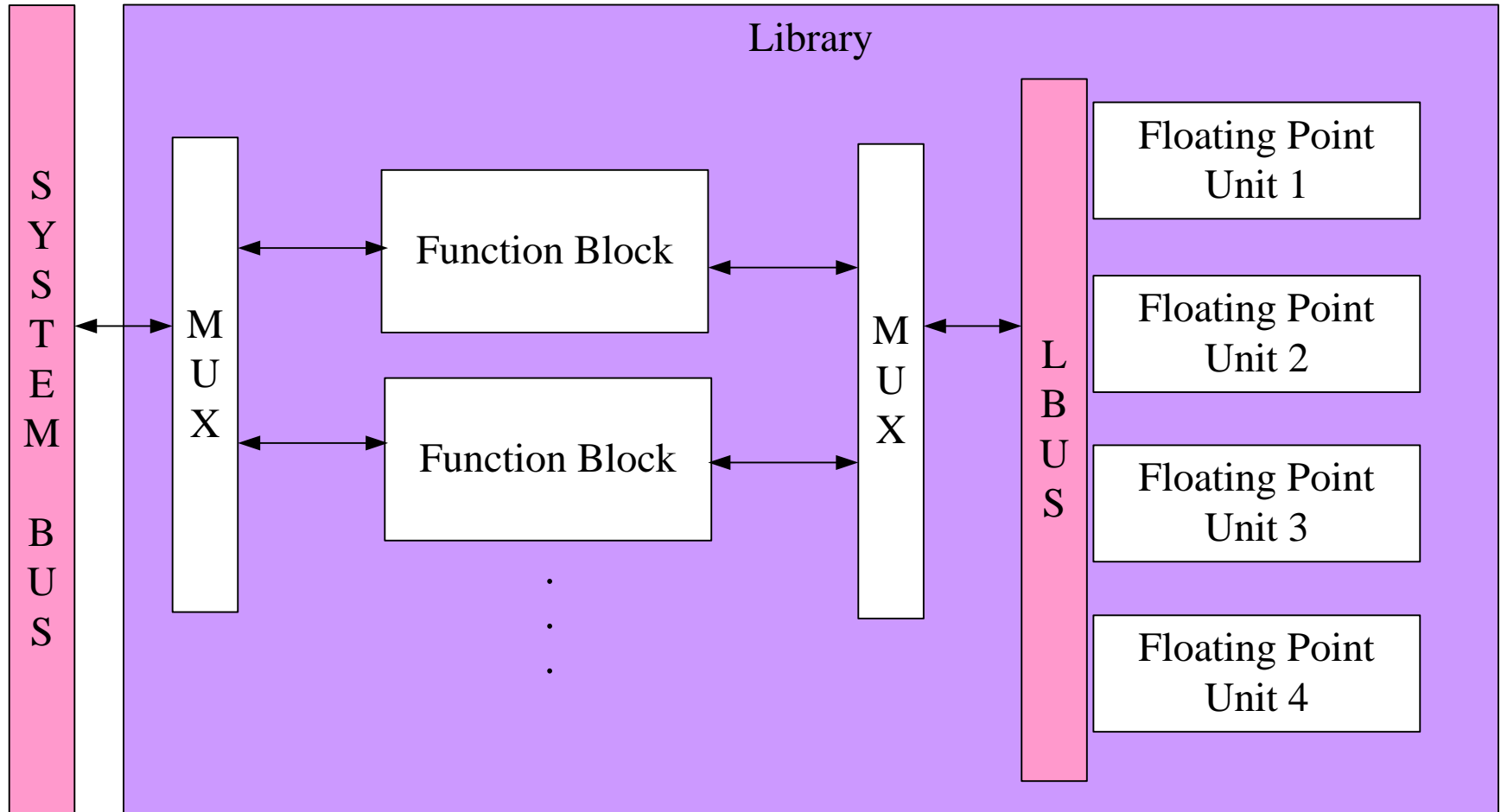
- NicSys8000N function block library has high reliability.



- The execution sequence of the function block
- The integrity of the algorithm configuration execution
- Function block has built-in self-test(BIST).

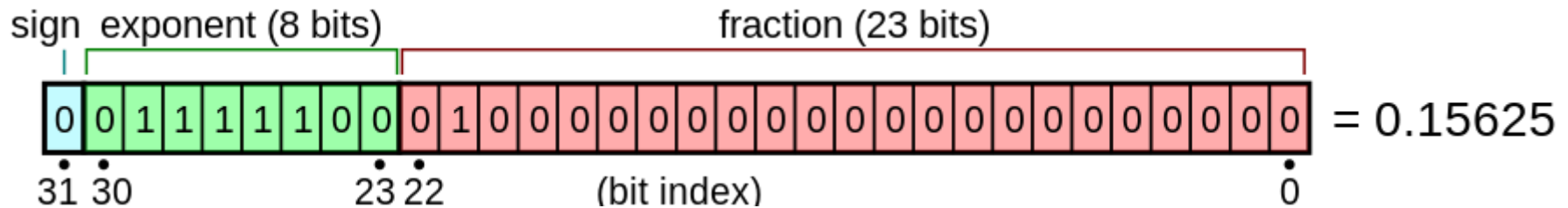


Function block library



Function block library

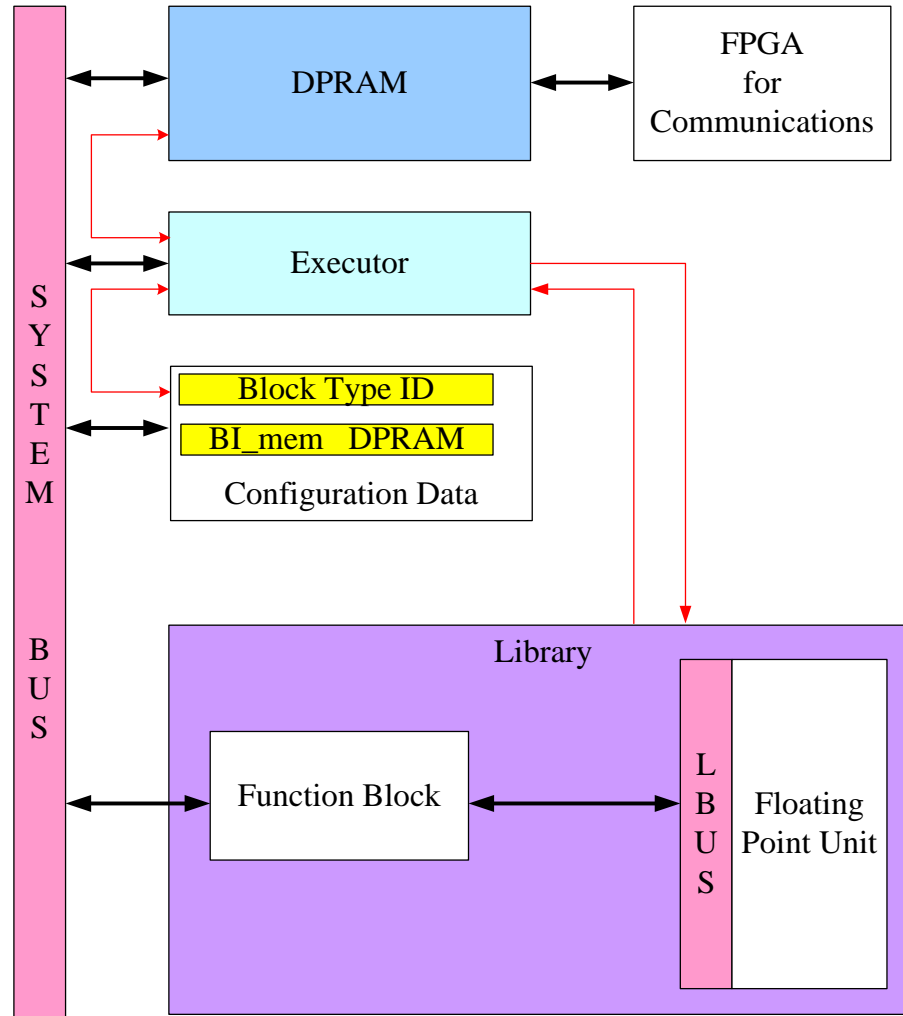
- Floating point format conforms to IEEE754 standard



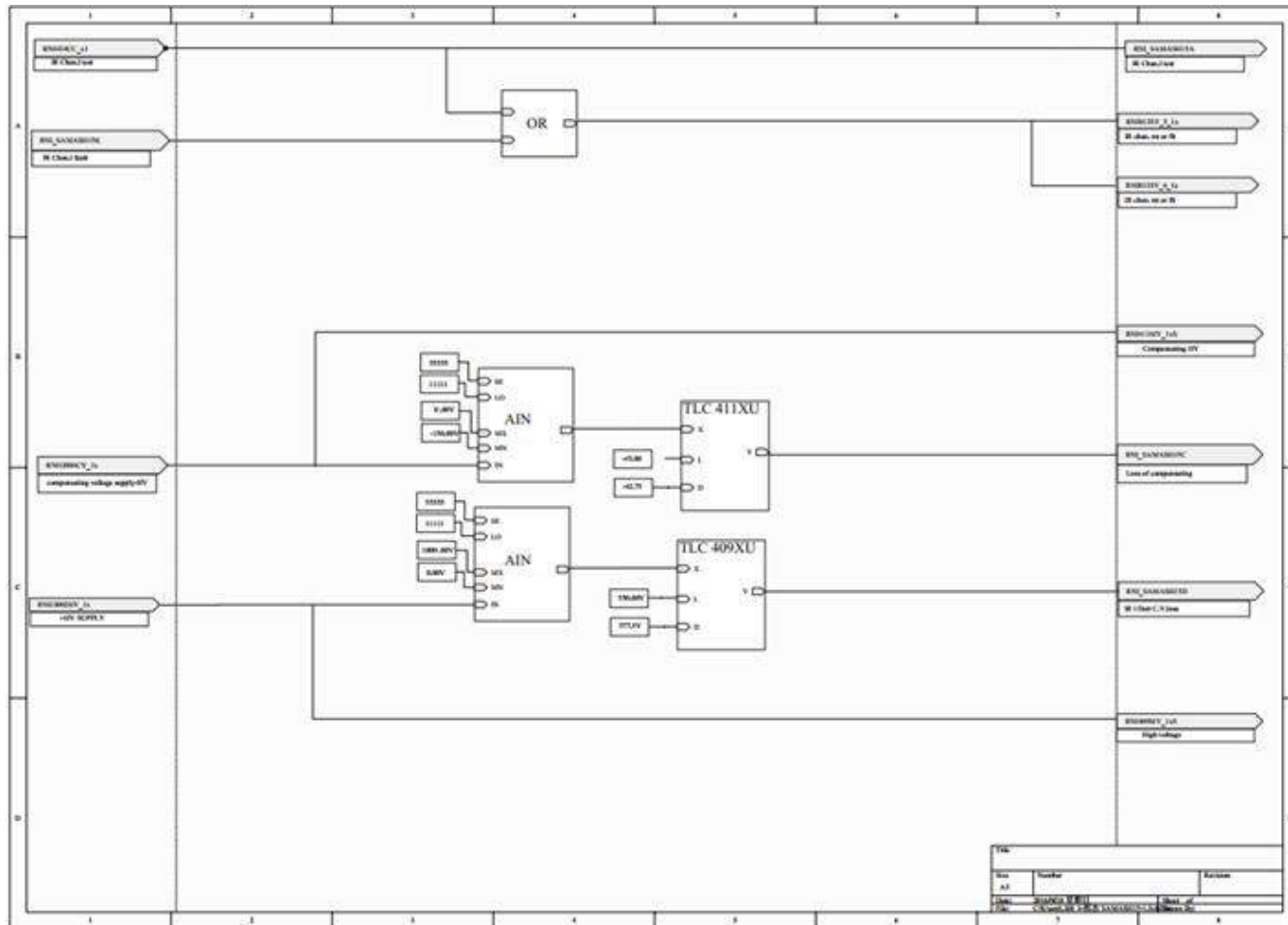
$$\text{value} = (-1)^{\text{sign}} \times \left(1 + \sum_{i=1}^{23} b_{23-i} 2^{-i} \right) \times 2^{(e-127)}$$



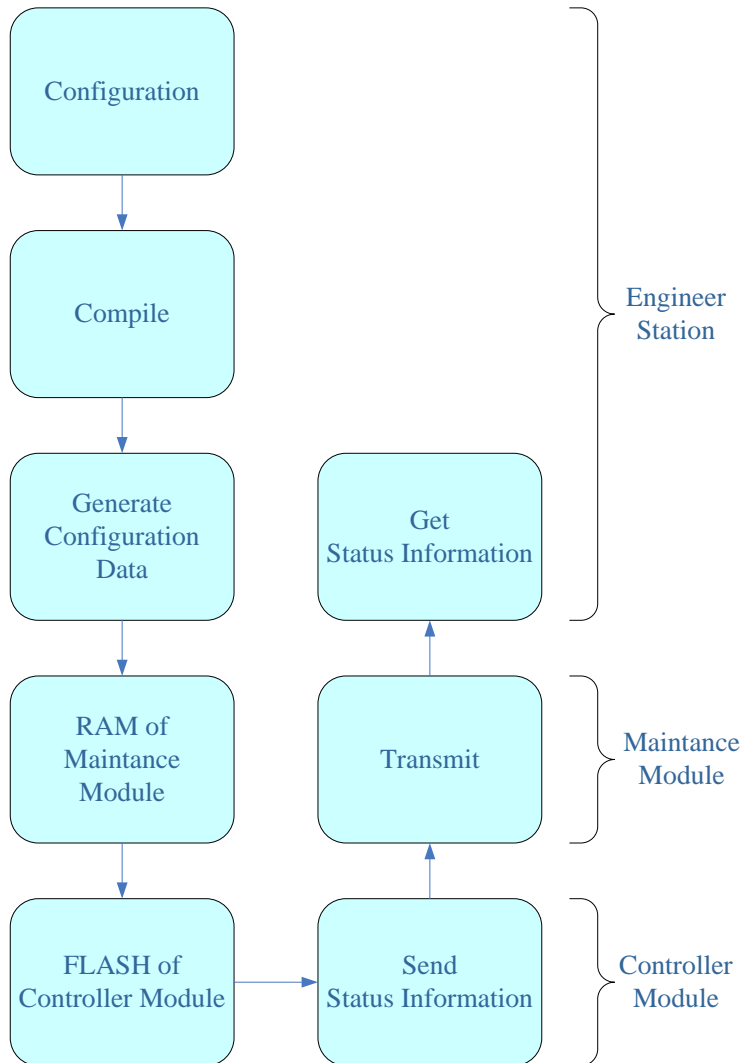
Executor



Example of an engineering application



Example of an engineering application



- Generate FBD
- Compile
- Download
- Save to the Flash of Controller
- Check
- Send status information of Download



Conclusion

The FPGA-based safety I&C platform NicSys8000N

- Realize complex algorithm configuration
- great speed and accuracy
- Short response time
- Easy to update
- High reliability



THANK YOU
and
QUESTION?

