中核控制系统工程有限公司
CHINA NUCLEAR CONTROL SYSTEM ENGINEERING CO., LTD.

CNCS

Independence Principles Used in the Design of the FPGA-based Safety I&C Platform NicSys8000N

NicSys® 8000N

安全级DCS 平台

Safety I&C Platform

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智慧科技 • 精控未来

Presentation Overview

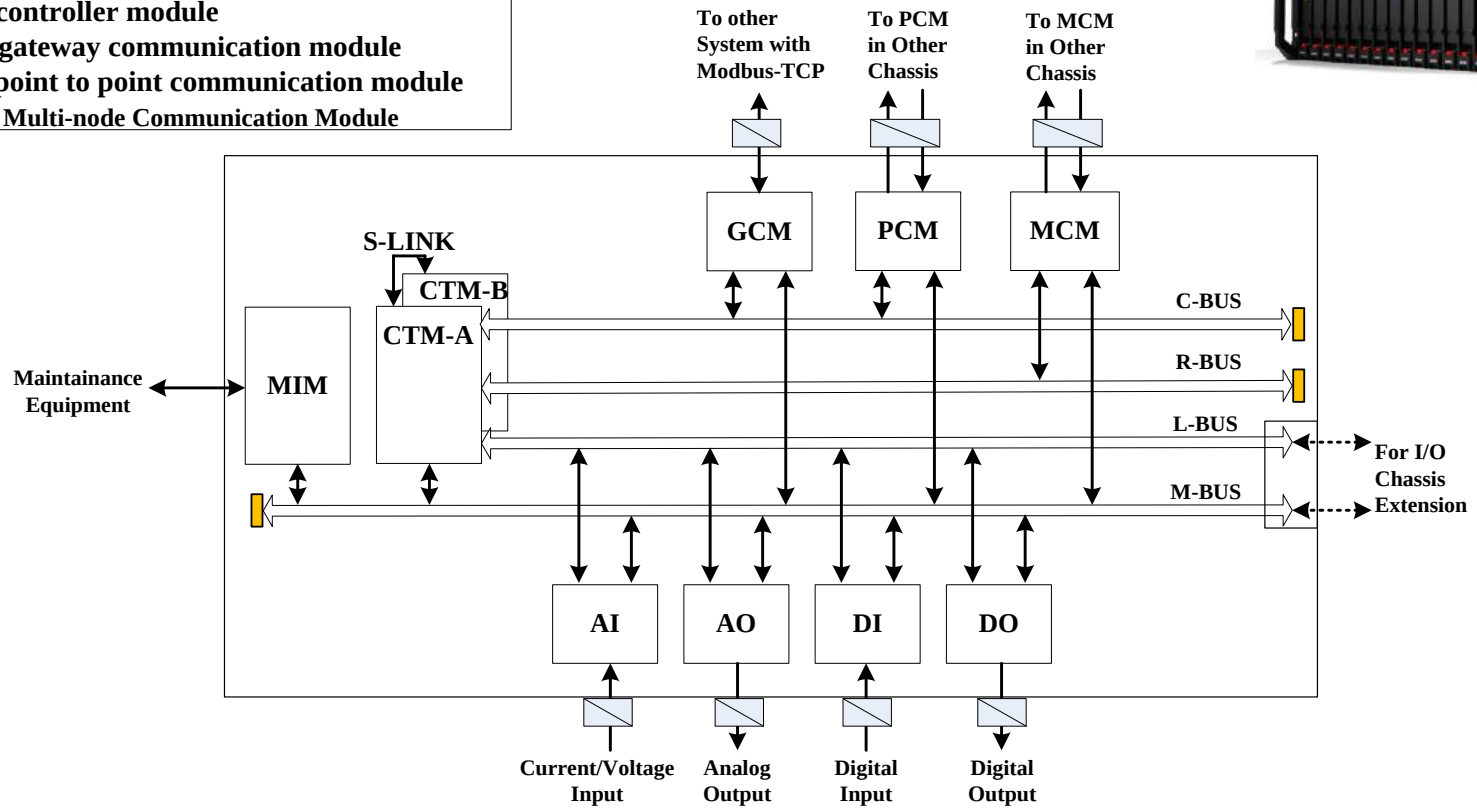
- Introduction
- Standard Requirements for Independence
- Advantages of FPGA technology about independence
- Isolation and independence principles used in the design of the FPGA-based safety I&C platform NicSys8000N
- Conclusion

Introduction

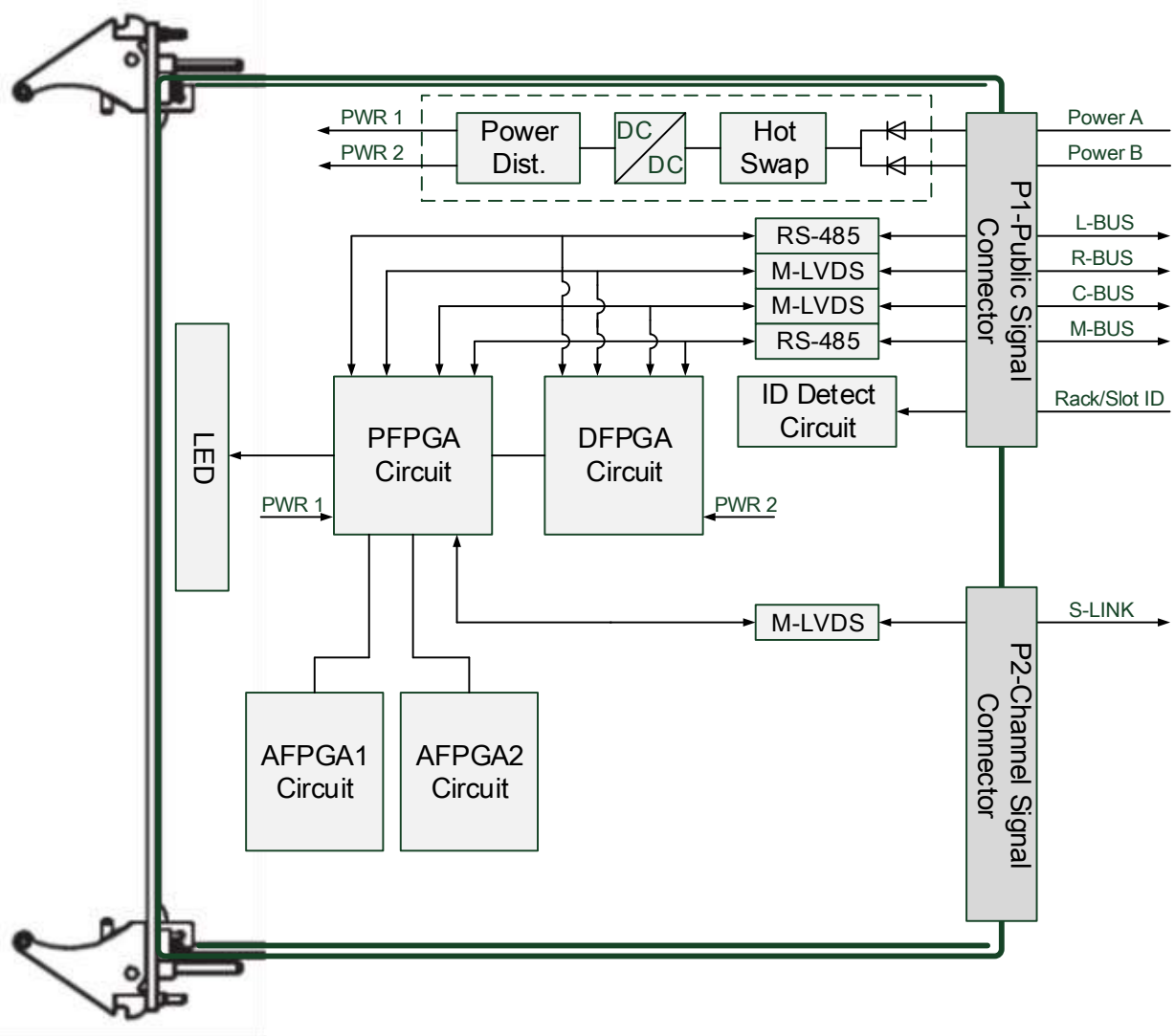
- The NicSys8000N platform is a **hardware-based** architecture system with **high reliability and integrity.**
- The key component in the NicSys8000N platform is the field-programmable gate array (FPGA). The FPGA logic components can be programmed to duplicate the functionality of basic logic gates (such as AND, OR, XOR and NOT). These logic components can be combined into complex combinational functions such as decoder or other math functions.

Structure of NicSys8000N platform

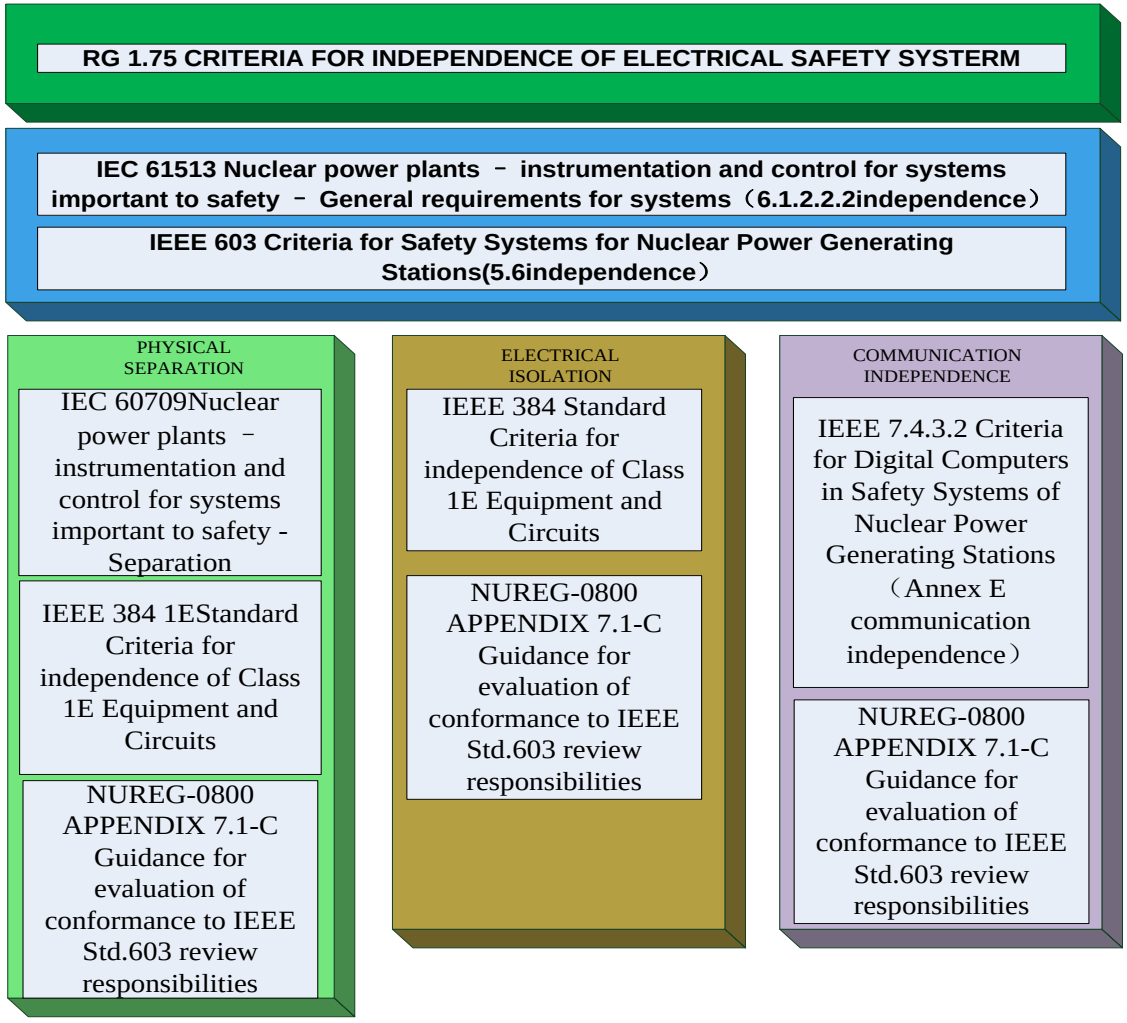
MIM: maintenance module
CTM: controller module
GCM: gateway communication module
PCM: point to point communication module
MCM: Multi-node Communication Module



Structure of Controller



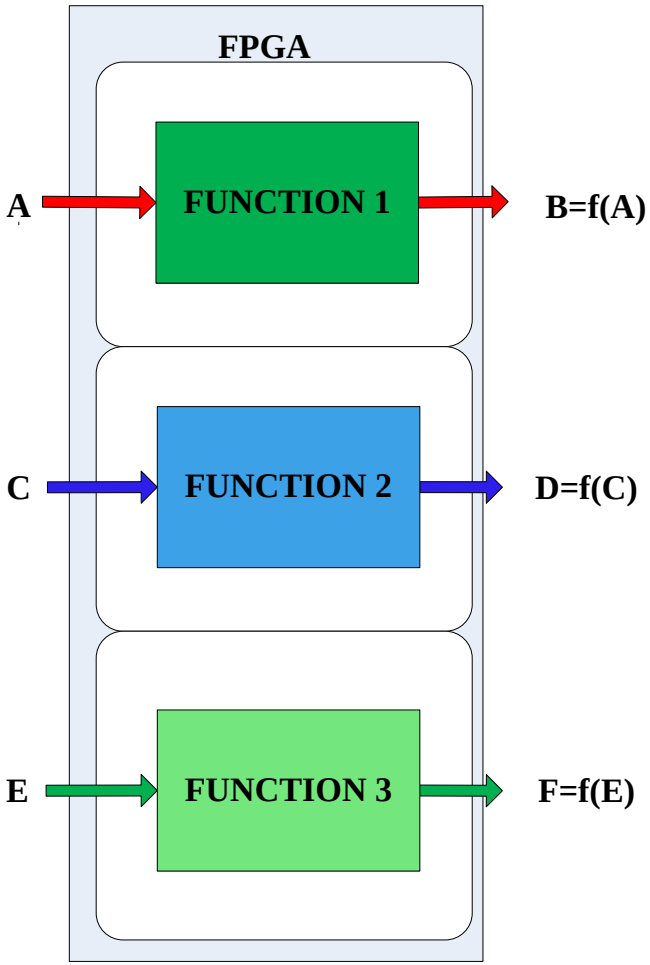
Standard Requirements for Independence



The Advantages of FPGA in Independence

- Parallel process
- Large and flexible dual port RAM
- Physical independence

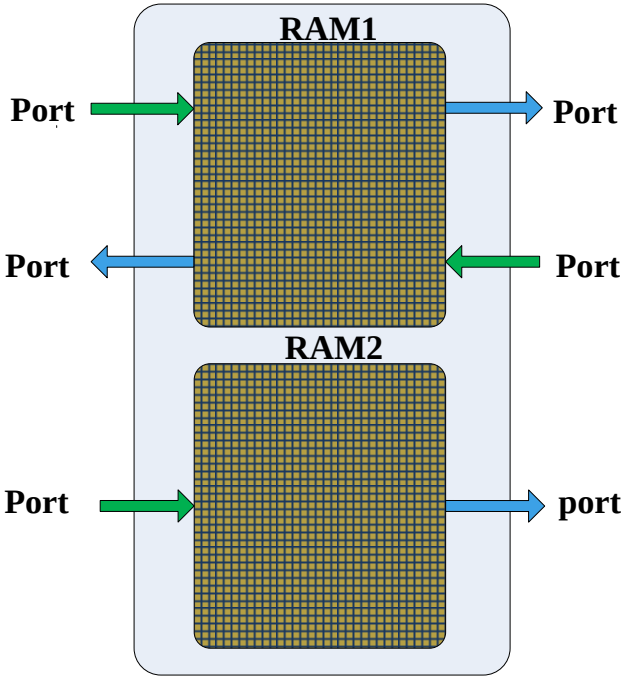
The Advantages of FPGA in Independence



Parallel process

- FUNCTION 1, FUNCTION 2 and FUNCTION 3 can be executed simultaneously and independently.

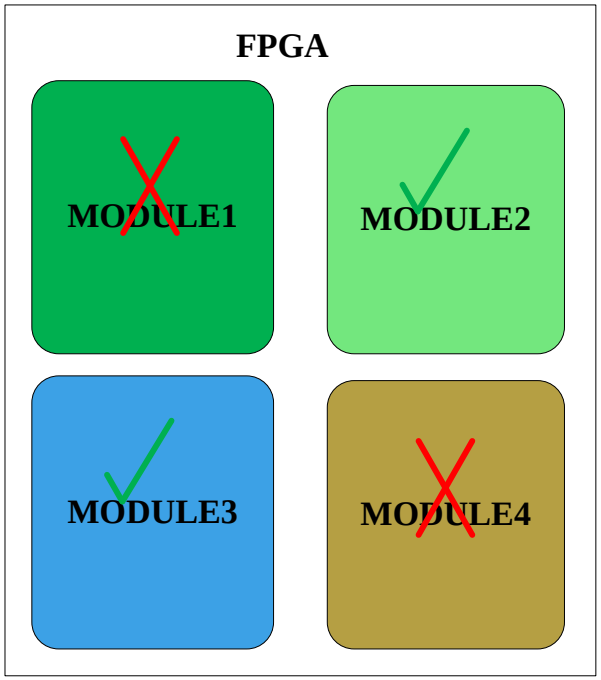
The Advantages of FPGA in Independence



Flexible dual port RAM

- You can design as you want:
  - ➢ The memory capacity
  - ➢ The number of ports and the type of ports (such as read or write)

The Advantages of FPGA in Independence



Physical independence

- Even there are several modules are failure, the others can be functioned normally.

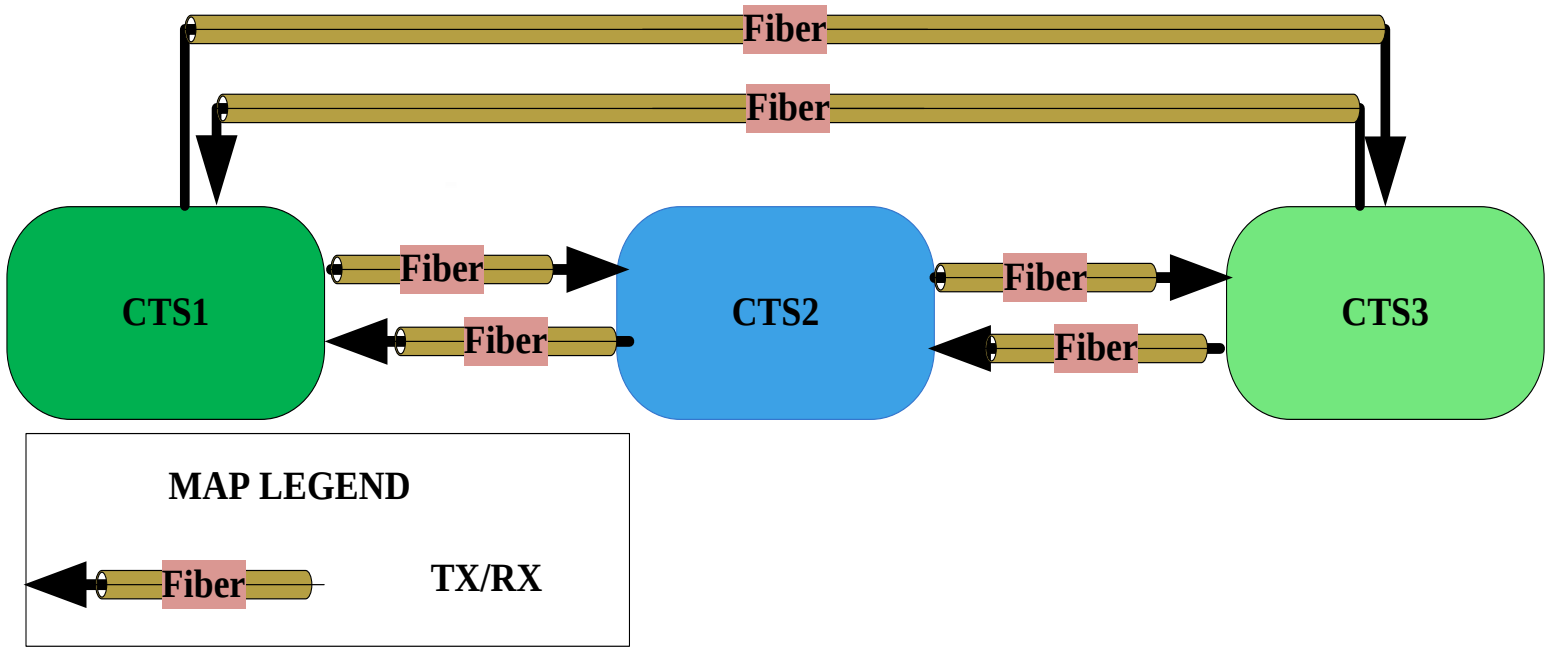
◆Independence Principles Used in the Design

Physical Separation

- Structural design ensure physical separation.
  The horizontal distance between the modules in the same chassis is strictly limited . The different chassises keep vertical distance in one cabinet .
- During engineering implementation ,physical separation between each part also be considered.

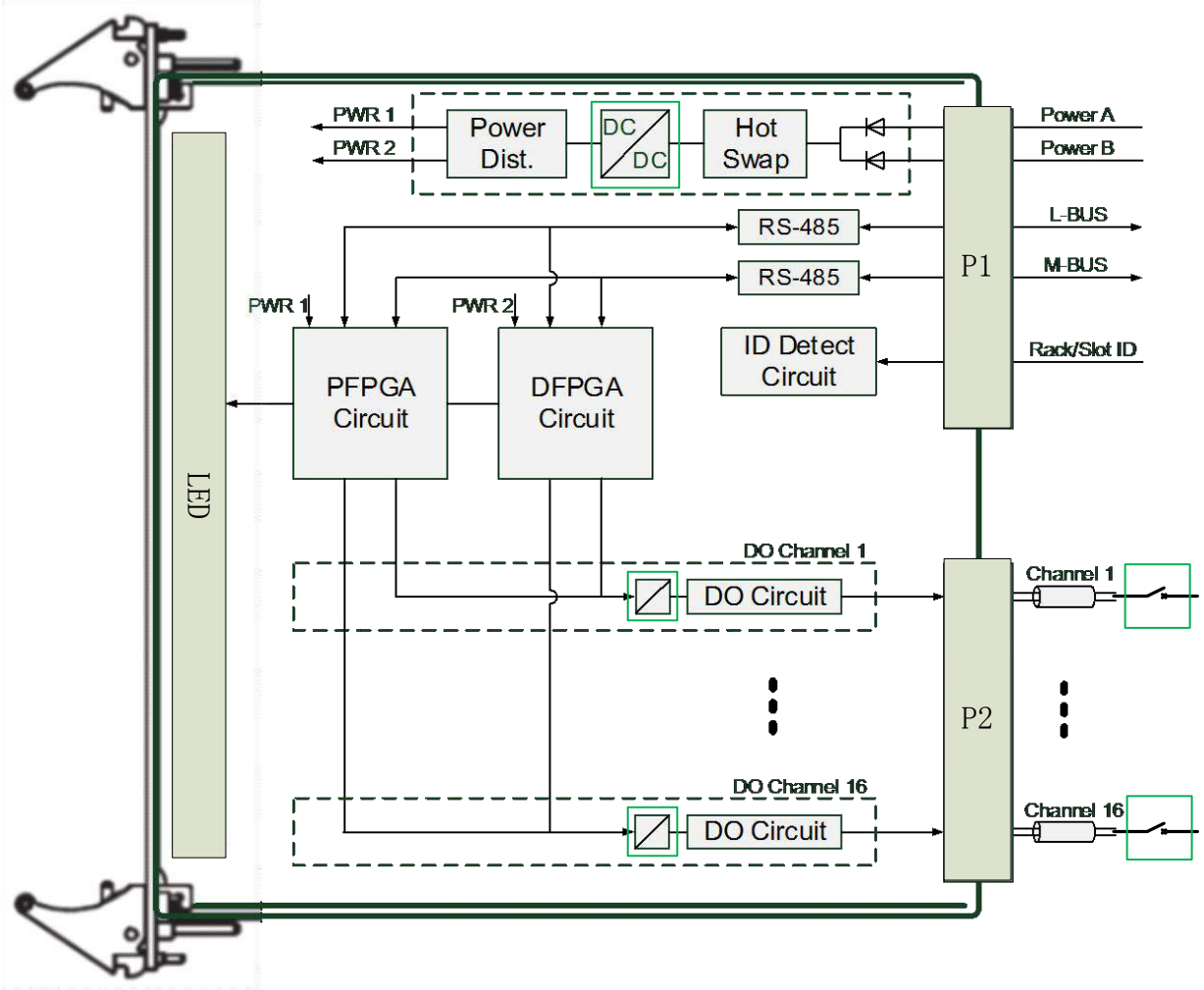
Independence Principles Used in the Design

Electrical Isolation of Communication Module



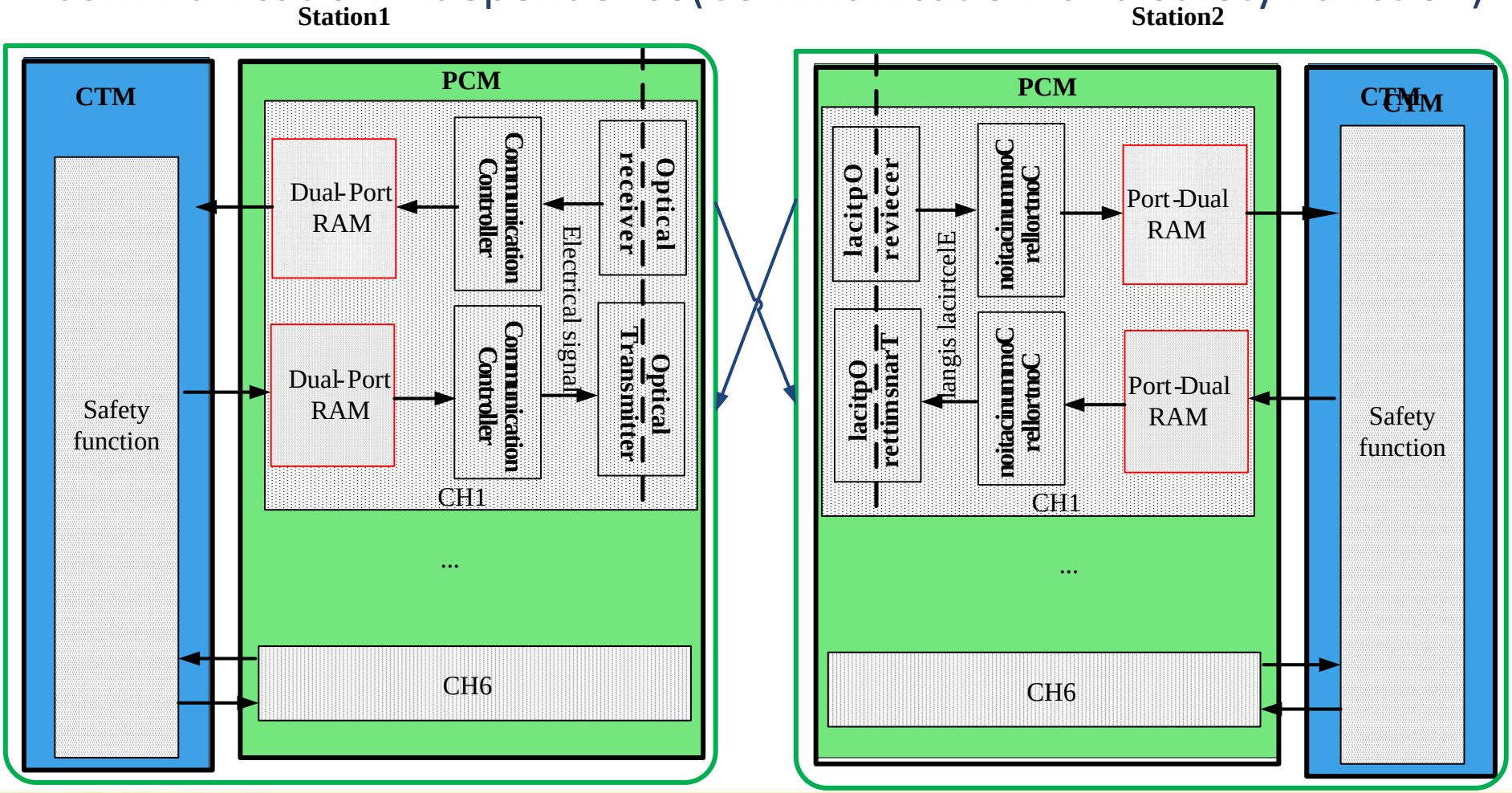
◆Independence Principles Used in the Design

Electrical Isolation of I/O Module



◆Independence Principles Used in the Design

Communication Independence(Communication and Safety Function)



◆Independence Principles Used in the Design

Communication Independence(Communication and Safety function)

1

- Communication and safety function is independent

2

- Designed up to six TX/RX fiber channels using large and flexible dual port RAM

3

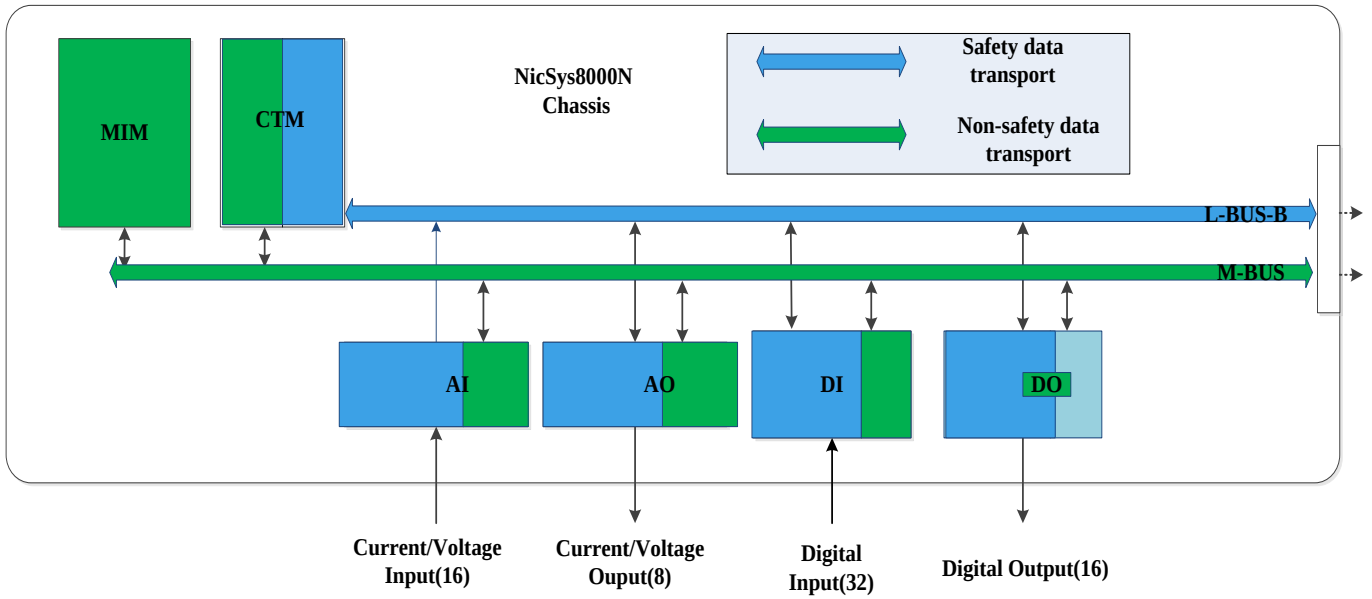
- Six channels work in parallel and independently

4

- Transport speed up to 100Mbps using pip-line technology

Independence Principles Used in the Design

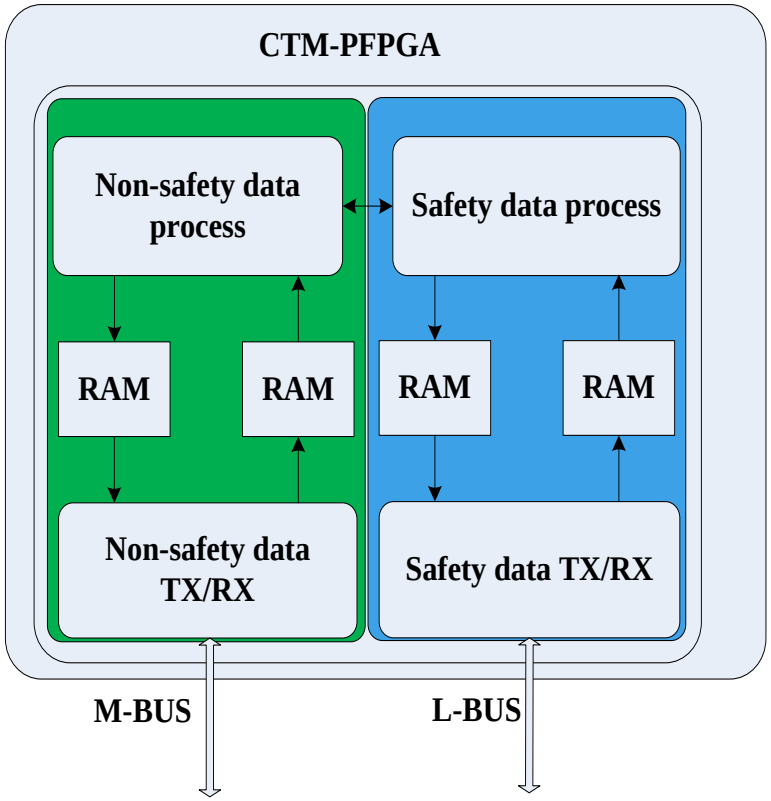
Communication Independence(Safety Data and Non-safety data)



Safety and non-safety communication exchange data through different channels.

Independence Principles Used in the Design

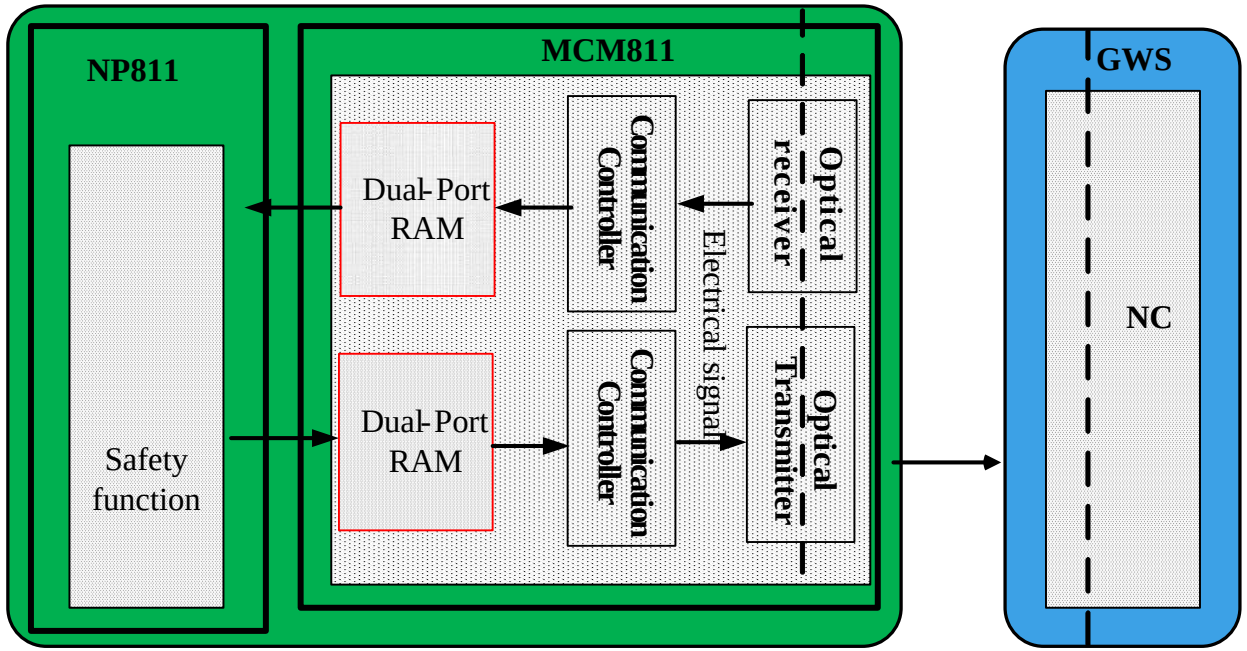
Communication Independence(Safe data and Non-safe data)



- Constrain Non-safety data process module and safety data process module in different regions
- Non-safety communication and safety communication use IO pins from different bank

Independence Principles Used in the Design

Communication Independence(different systems)



This communication module is used to communication safety system with other non-safety systems.

◆Conclusion

The design of NicSys8000N platform consider:

Physical separation

Electrical isolation

Communication independence

NicSys8000N platform is a safety instrumentation and control(I&C) system meeting the independence standard

Thank you !

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