

framatome

From Function Diagrams to Silicon: How Framatome is Coupling Cutting-Edge Engineering Software with FPGA Controllers for Safety Applications

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Budapest, October 14, 2019

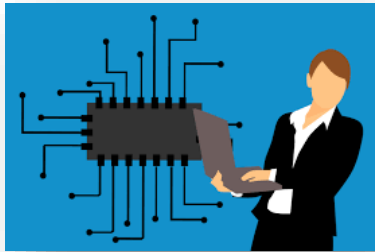


Similarities & Differences

VHDL

Performance

Simplicity



Bitstream

Qualification

Response time

Electronic
Engineers

FPGA world

NPP Automation world

Automation
engineers

CPU



Generic
qualification

Know-how,
experience,
habits

Software

Function block diagrams

Our Challenges

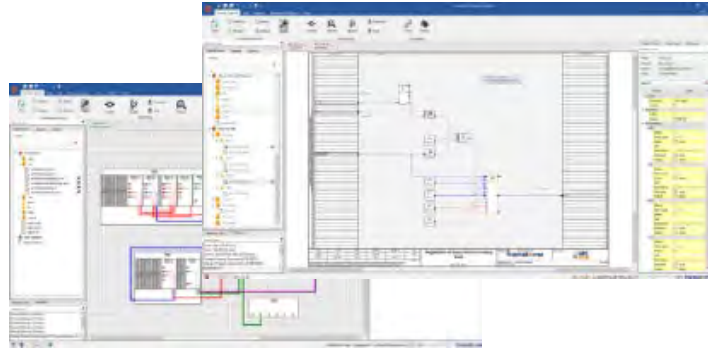
« Design a very compact but scalable, high performance, safety-related programmable logic controller... with which safety I&C engineers can feel at home »

TELEPERM XS Compact

2017

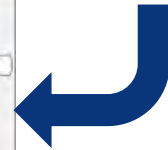


Prototypes



Engineering Tools

I&C Application Program



TELEPERM XS Compact Subrack

2019



Processing

Qualification Boards



I/O



Full Demonstrator



Maintenance

- The processing module implements a generic processing unit able to compute all I&C Function Blocks.
- The safety I&C application is designed and generated using dedicated software made by Framatome.

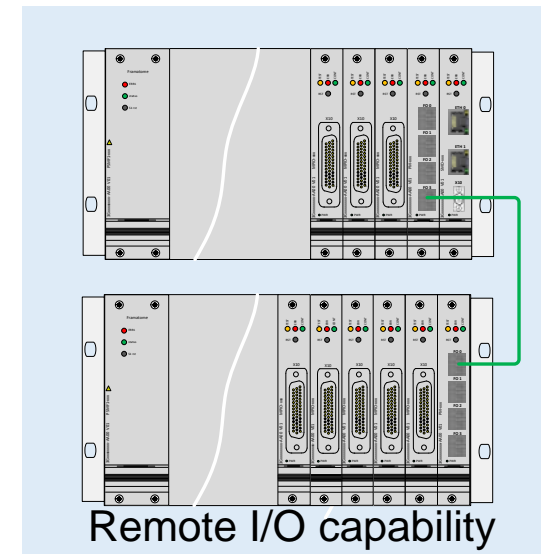
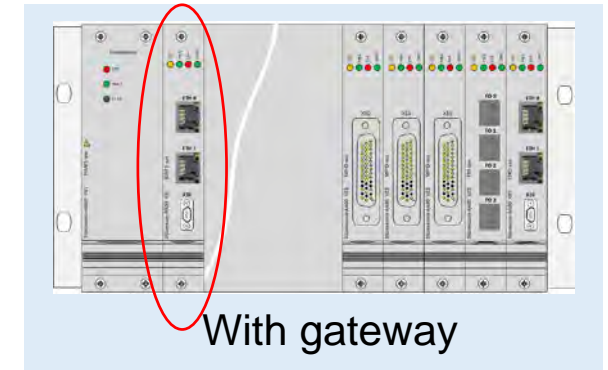
TELEPERM XS Compact

Technical information

- Remote I/O capability: 1 master + 3 slave racks
- Maximum I/O capabilities

	1 MPIO	17 MPIO (1 full rack)	17 MPIO (4 racks AU with 3 RIO racks)
AI	2	34	142
AO	2	34	142
DI	4	68	284
DO	4	68	284

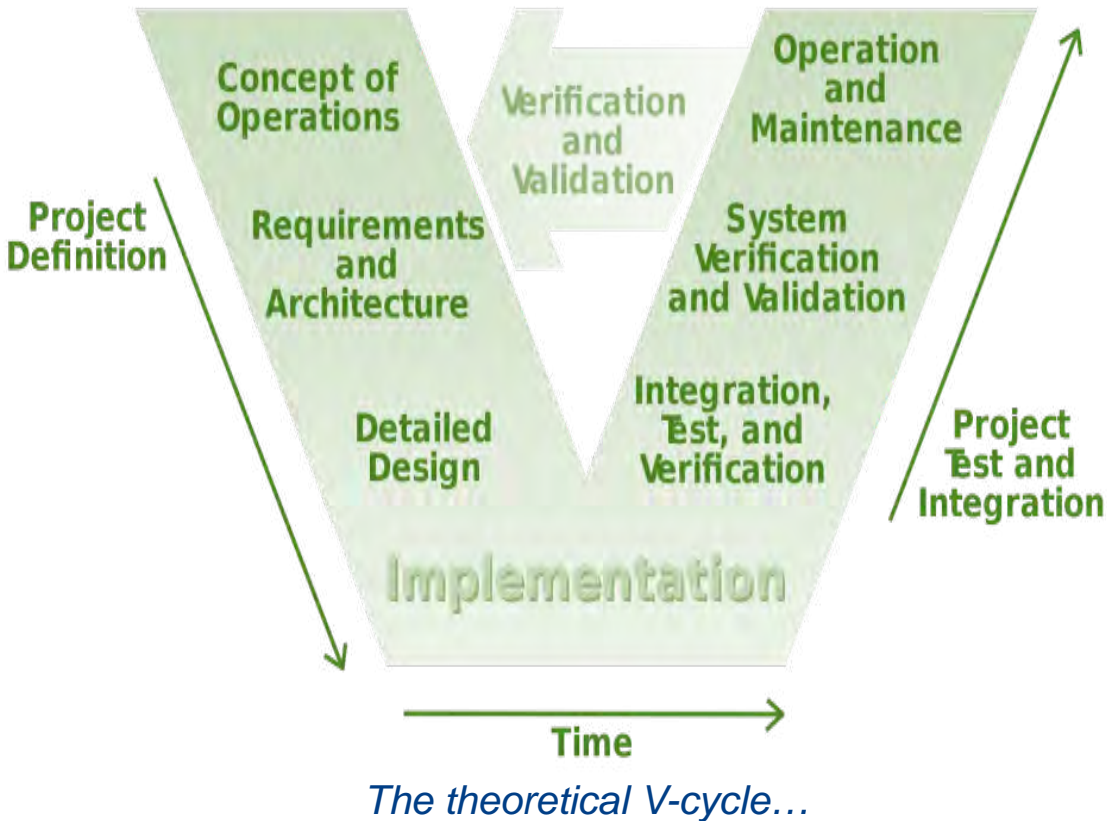
- Network extension : up to **16** network links per rack
- Fastest cycle time: **6ms**
- 79** different types of function blocks available
- Standard 3U/19" racks



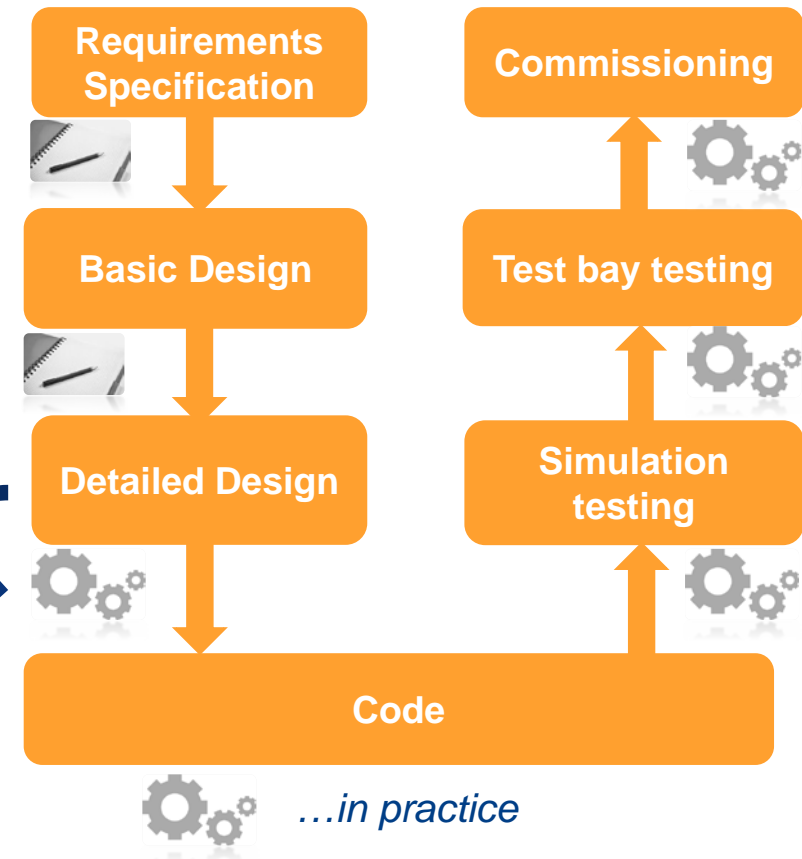
Key Customer Benefits

- ▶ 100% in-house development:
 - Long-term availability
 - Support with licensing
 - No external IP
- ▶ Fully integrated into TELEPERM XS family - e.g. interoperability with conditioning modules
- ▶ Secure by design
- ▶ Fits into standard cabinets
- ▶ Strong separation of safety classes
- ▶ Scalability with remote I/O and network
- ▶ **Application programming using Function Block diagrams only: users do not need any knowledge of VHDL/Verilog**
- ▶ **Application and parameters can be changed, corrected, upgraded without touching the hardware**

I&C Systems Engineering Process @ Framatome



Fully automatic



Objective: With our FPGA-based solution, users do not have to write a single line of VHDL

Cutting-Edge Engineering Software

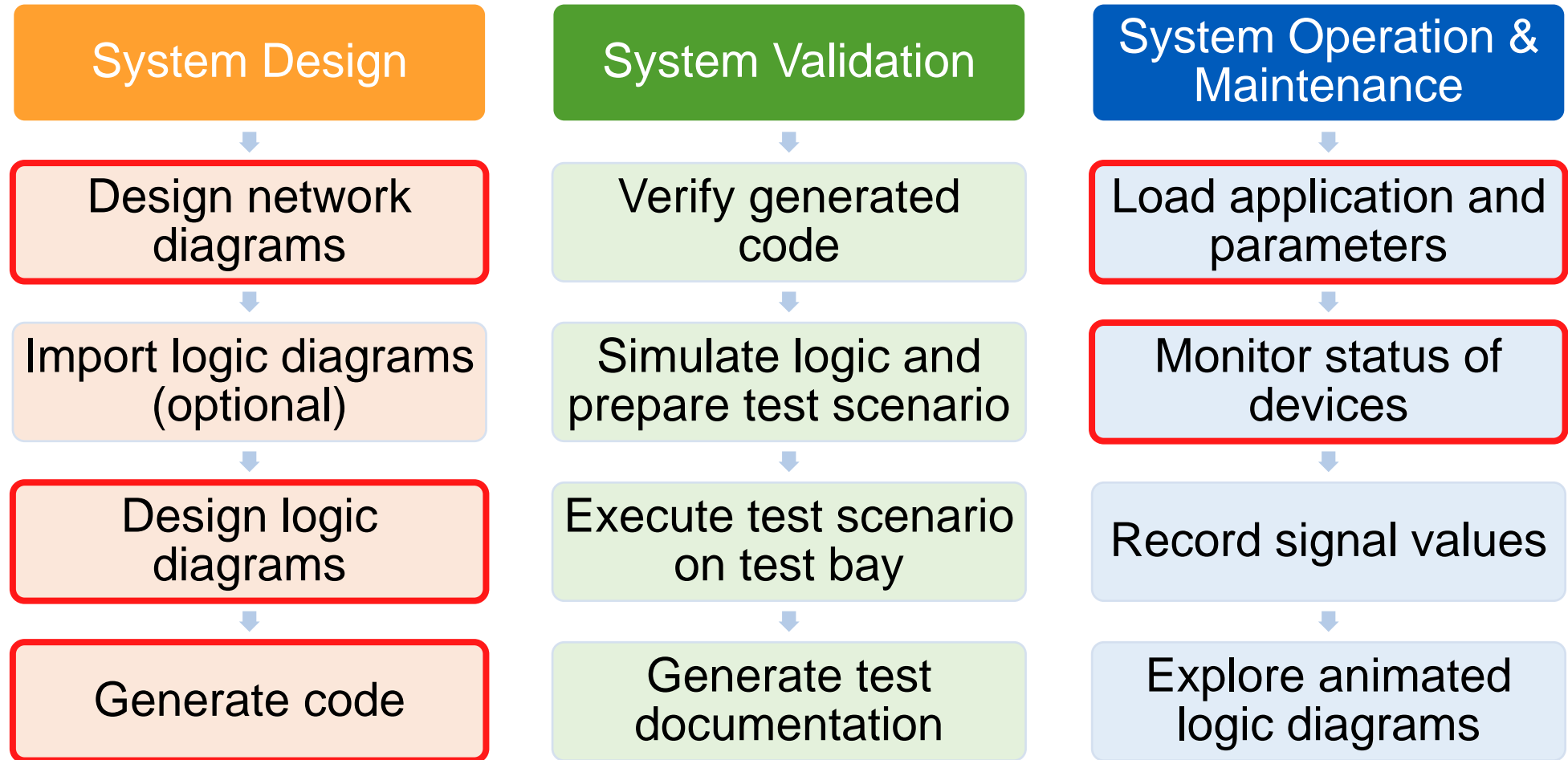
All the software to design, generate, simulate, validate and operate a Teleperm XS Compact-based I&C system in a convenient and efficient manner

- Simple to use, modern and convenient look-and-feel
- Collaborative: simultaneous engineering by many application developers
- Helps the system designer and operator in daily operations with new capabilities:
 - Fully integrated configuration management
 - Traceability right down to the function block
 - Functional views
- Covers the complete lifecycle of an I&C system
- In line with the most stringent safety standards
- Provides state-of-the-art cybersecurity features

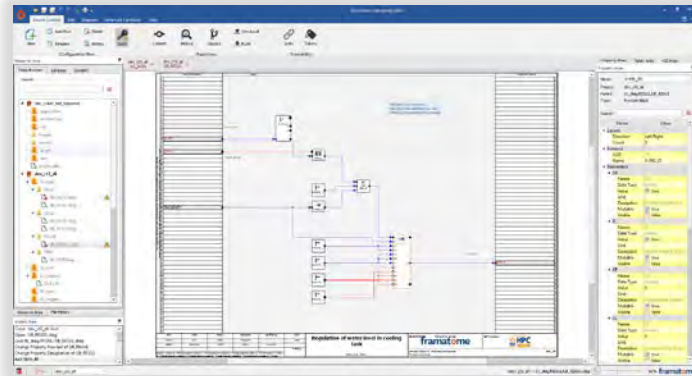


Integrated Tools for All I&C Engineering Needs

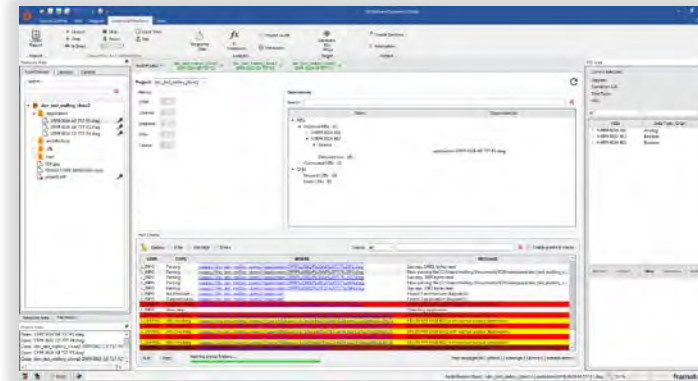
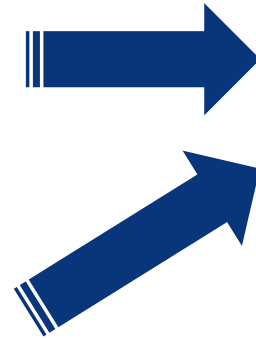
WORK IN PROGRESS



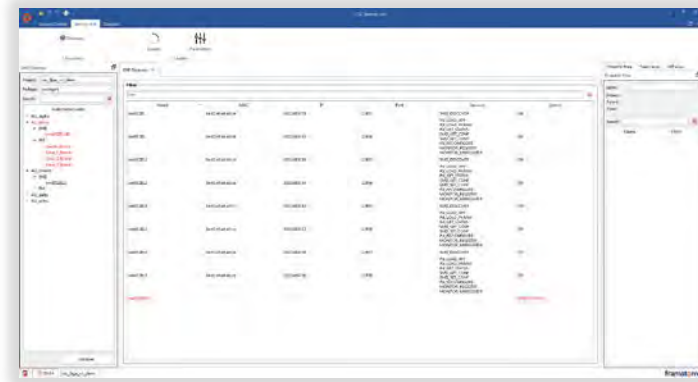
Graphically Designing & Installing an Application



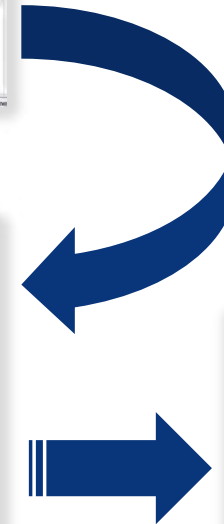
Application design



Code generation & checking



Loading files on target

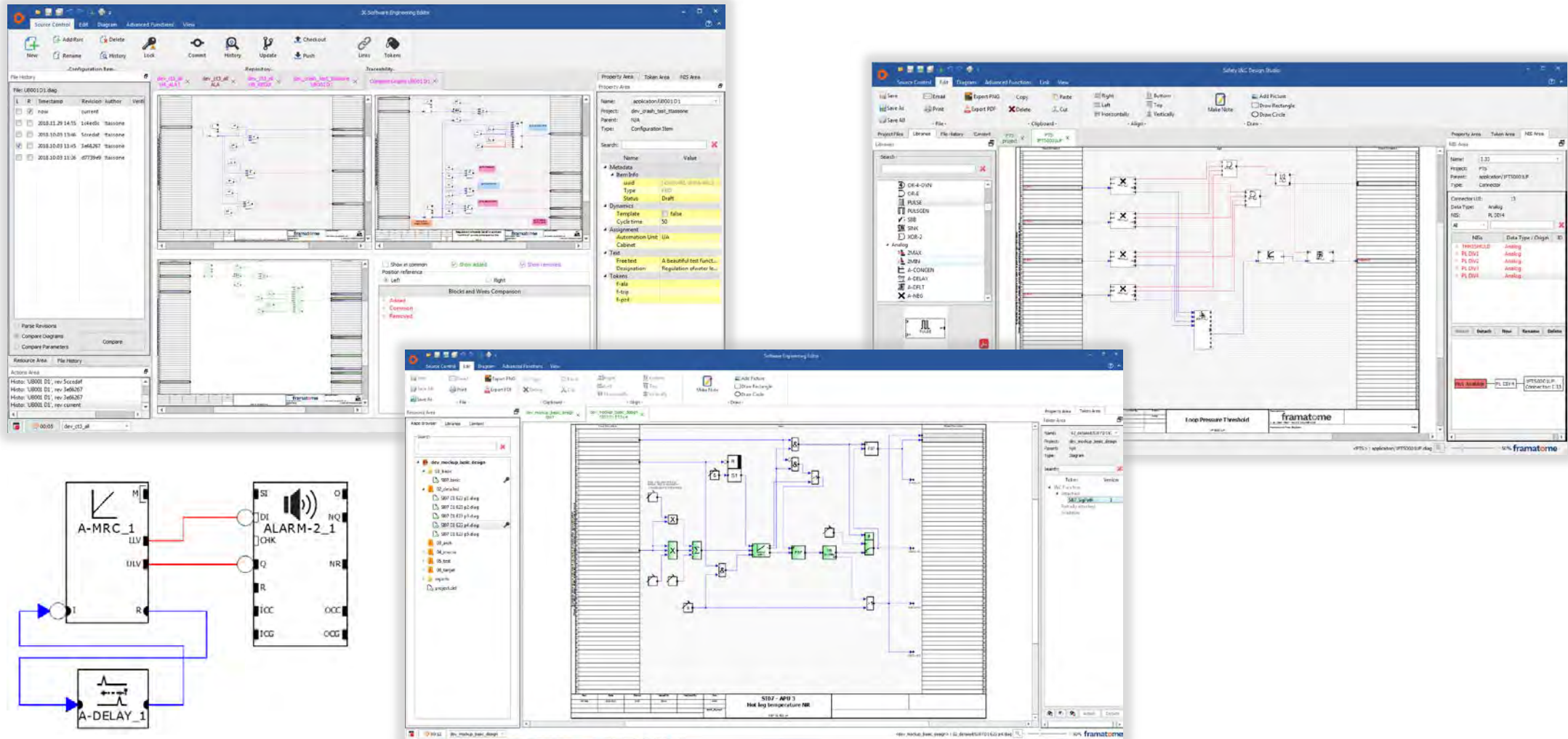


End-to-end authentication
of changes

Design network diagrams

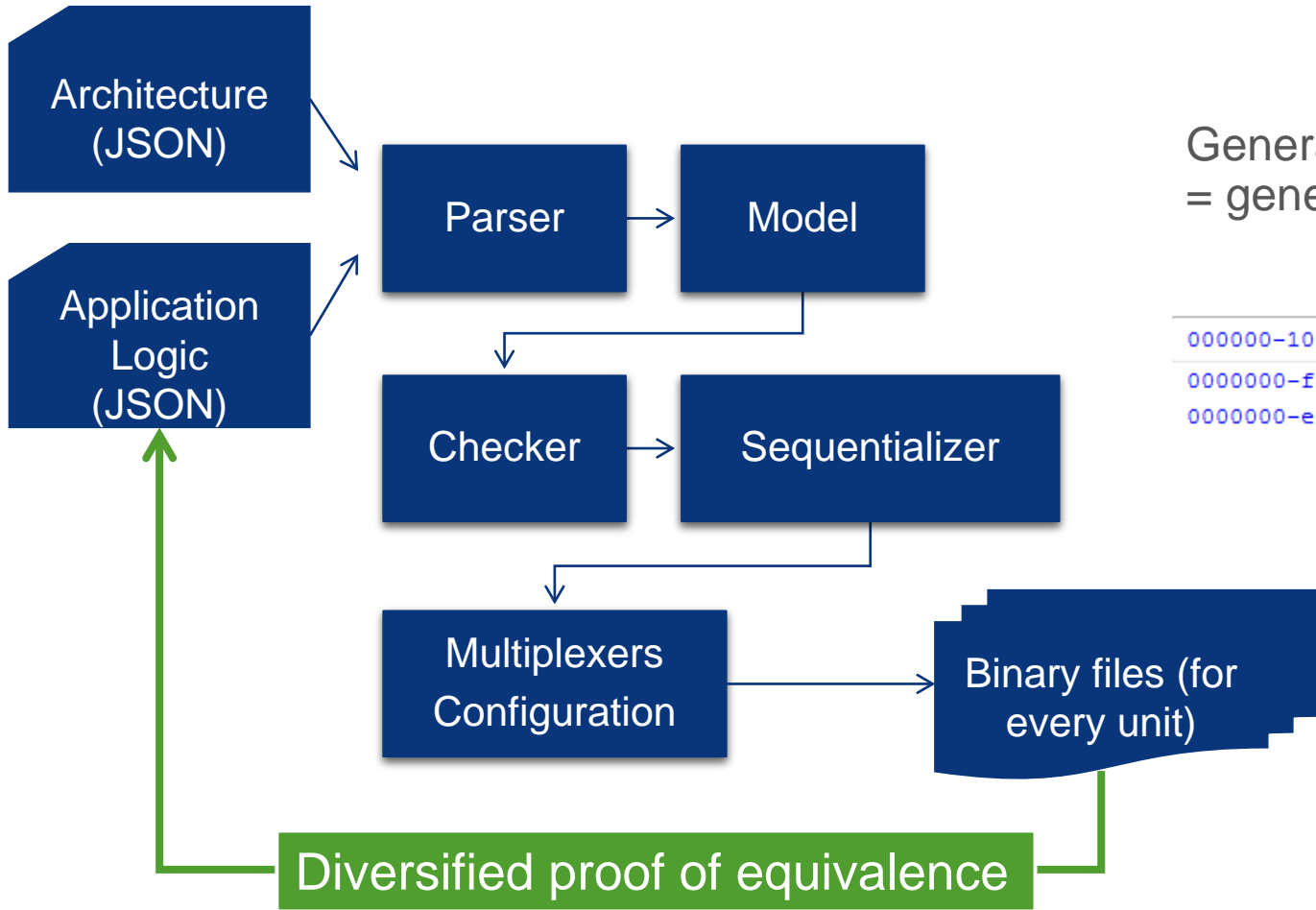
Design logic diagrams

Drawing Diagrams with Design Studio



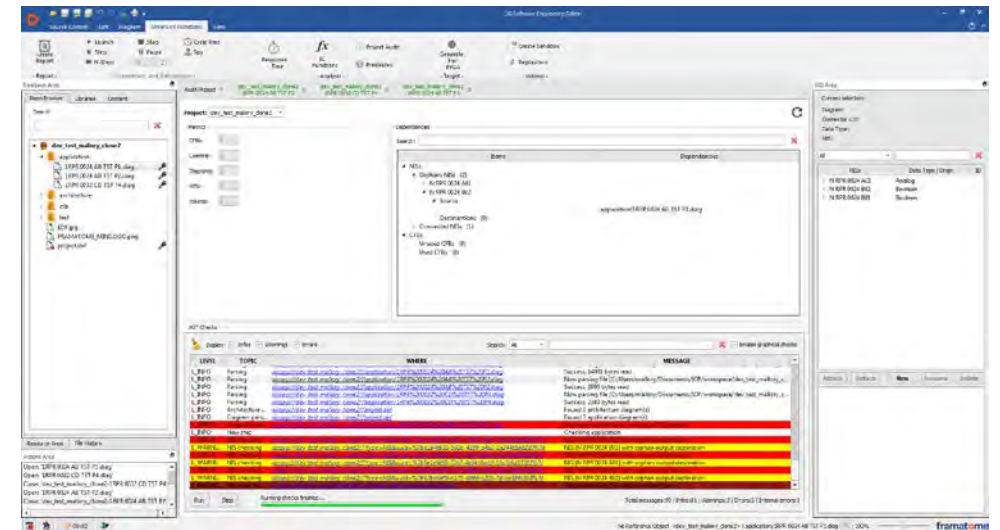
Generate code

Automated Code Generation



Generating code for TELEPERM XS Compact (FPGA) = generating static tables to configure multiplexers !

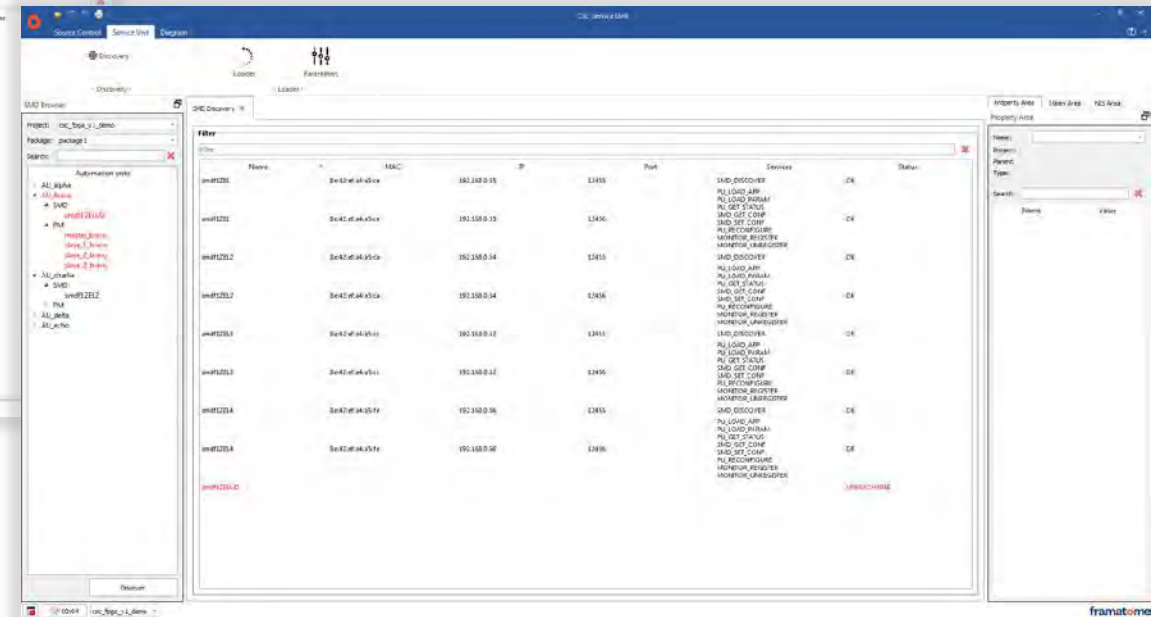
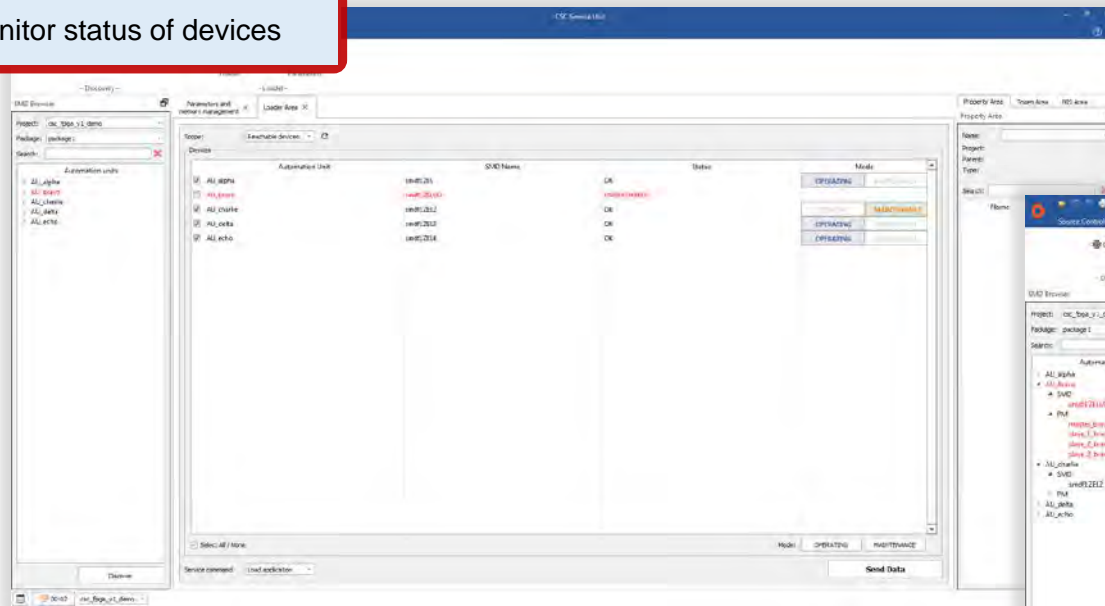
```
00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
000000-104 01 61 28 00 08 06 06 0b 06 06 0b 06 06 0b 03 01 .a (.....
0000000-14 03 01 04 03 01 03 01 06 08 0f 06 0d 06 06 0d 06
0000000-e4 0d 06 0d 0d 03 01 03 01 07 0e 09 00 .....
```



Load application and parameters

Monitor status of devices

Deployment on the System



- Bitstream does not change
- Service-dedicated TCP/IP network
- Centralized or local service unit - flexible architecture (TELEPERM XS concept)
- App. and parameters loaded through a ciphered tunnel to SMD after release activation
- App. and parameters can be loaded separately

Framatome's FPGA-based safety PLC is:

- Part of the Teleperm XS family
- Compatible with Teleperm XS modules
- Compact and high performance
- Designed with nuclear standards in mind
- In an advanced phase of design

The accompanying new engineering software:

- Is modern and convenient to use
- Does not require the use of VHDL or FPGA vendor tools to design and test I&C applications
- Covers the complete I&C system lifecycle
- Makes Teleperm XS Compact as flexible as CPU-based PLCs

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