

# Software Integrity Analysis Applied to IRIO EPICS Device Support Based on FPGA Real-Time DAQ Systems

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GRUPO DE INVESTIGACIÓN EN  
INSTRUMENTACIÓN Y  
ACÚSTICA APLICADA

# PROPOSAL

## ■ What do we present?

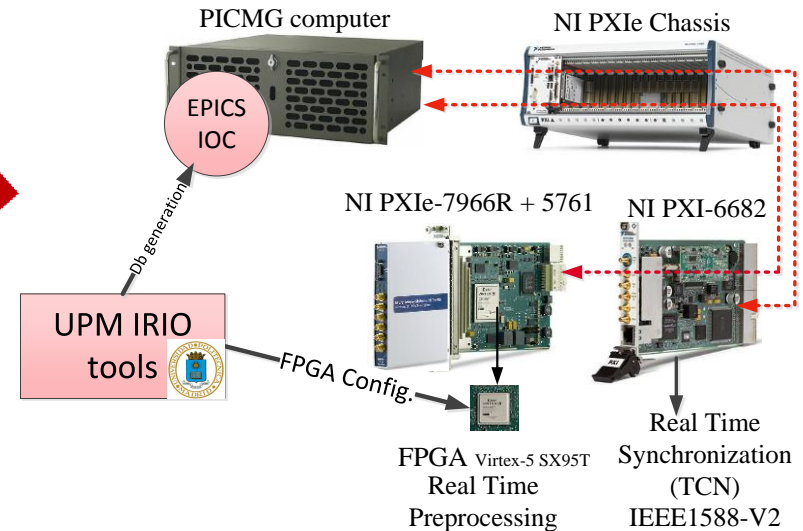
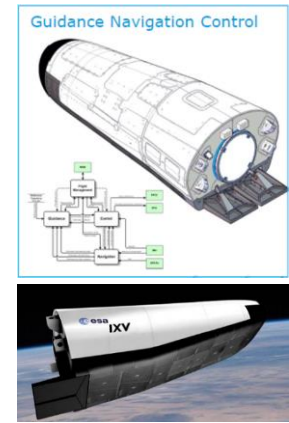
- SW Integrity analysis of a RT-DAQ system based on PXIe Fast Controller architecture
- We have applied methodologies used in the Aerospace Industry
- We use RAM, FMECA, FTA, MISRA-C, Specific Standards

## ■ System under analysis

- Industrial computer
- PXIe Chassis
- FlexRIO device
- IEEE 1588 Timing board
- IRIO tools for FlexRIO config. and EPICS IOC app implementation

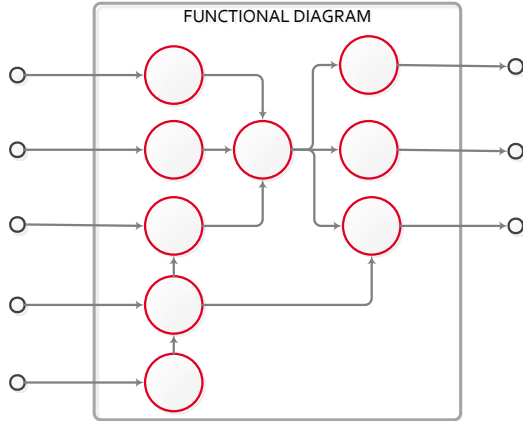
## ■ Example: IXV SW characteristics

- Critical SW (DAL-B)
- Hard Real Time
- Fault tolerance



# ANALYSIS METHODOLOGY

## ■ Functional diagram



## ■ Failure Mode Effect Criticality Analysis

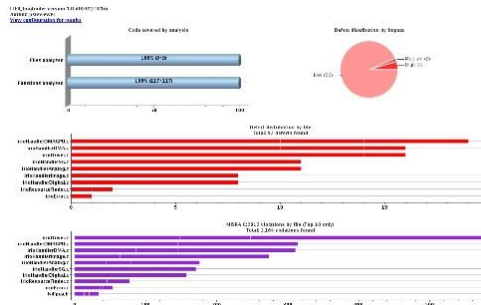
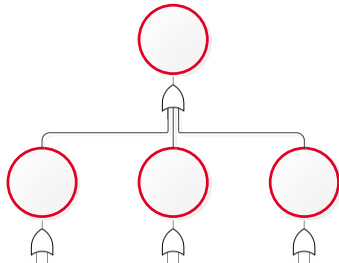
- We base the study on the aviation certification standard DO-178C
  - Partitioning is not required (hypervisor)
  - Isolation through different processes has been considered

## ■ Software standards, and good coding practices

- IEC 12207, IEC 60880, MISRA-C, etc.

## ■ Software Verification (Results)

## ■ Fault Tree Analysis



Run-Time Checks Summary for IRIO - Result\_Code\_Prover\_20160208\_095124 (Unit Mode)

Unit	Proven	Green	Red	Grey	Orange
instResource - Result_Code_Prover_20160208_095124	99.9%	1215	0	11	21
instCdma - Result_Code_Prover_20160208_095124	99.9%	2514	0	11	45
instItr - Result_Code_Prover_20160208_095124	99.9%	124	0	1	3
instResourceDigital - Result_Code_Prover_20160208_095124	99.9%	653	0	11	37
instResourceDMA - Result_Code_Prover_20160208_095124	99.9%	1473	0	11	71
instResourceFiber - Result_Code_Prover_20160208_095124	99.9%	838	0	11	45
instResourceIS - Result_Code_Prover_20160208_095124	94.1%	920	0	11	121
instResourceDMAGPU - Result_Code_Prover_20160208_095124	94.0%	1136	1	11	10
instResourceFiber - Result_Code_Prover_20160208_095124	99.9%	400	0	1	46
<b>Total</b>	<b>99.9%</b>	<b>9914</b>	<b>1</b>	<b>57</b>	<b>429</b>

Globaly Proven:99.9%

### Code Coverage

Result set	Code Coverage
instCdma - Result_Code_Prover_20160208_095124	100%
instItr - Result_Code_Prover_20160208_095124	100%
instResourceAnalog - Result_Code_Prover_20160208_095124	100%
instResourceDMA - Result_Code_Prover_20160208_095124	100%
instResourceDMAGPU - Result_Code_Prover_20160208_095124	100%
instResourceDigital - Result_Code_Prover_20160208_095124	99%
instResourceIS - Result_Code_Prover_20160208_095124	99%
instResourceIS - Result_Code_Prover_20160208_095124	100%
instResourceFiber - Result_Code_Prover_20160208_095124	100%