NI@SAAB 2019-04-25

OTDSHI

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Systems Engineer Development Simulators

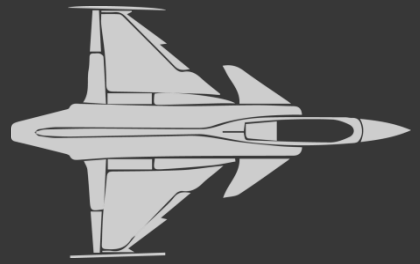
Agenda

- SAAB Simulation Department
- Gripen
- HIL Simulators
- NI hardware
- Visit in simulator

Simulator Department

SIMULATOR DEPARTMENT

- Systems simulators, supporting the Aircraft development and verification has been the base of the business
- Saab simulator center – nearly 60 years of simulator experience
- Today ~250 co-workers directly involved in simulator development and maintenance
- ~40 co-workers at hardware department

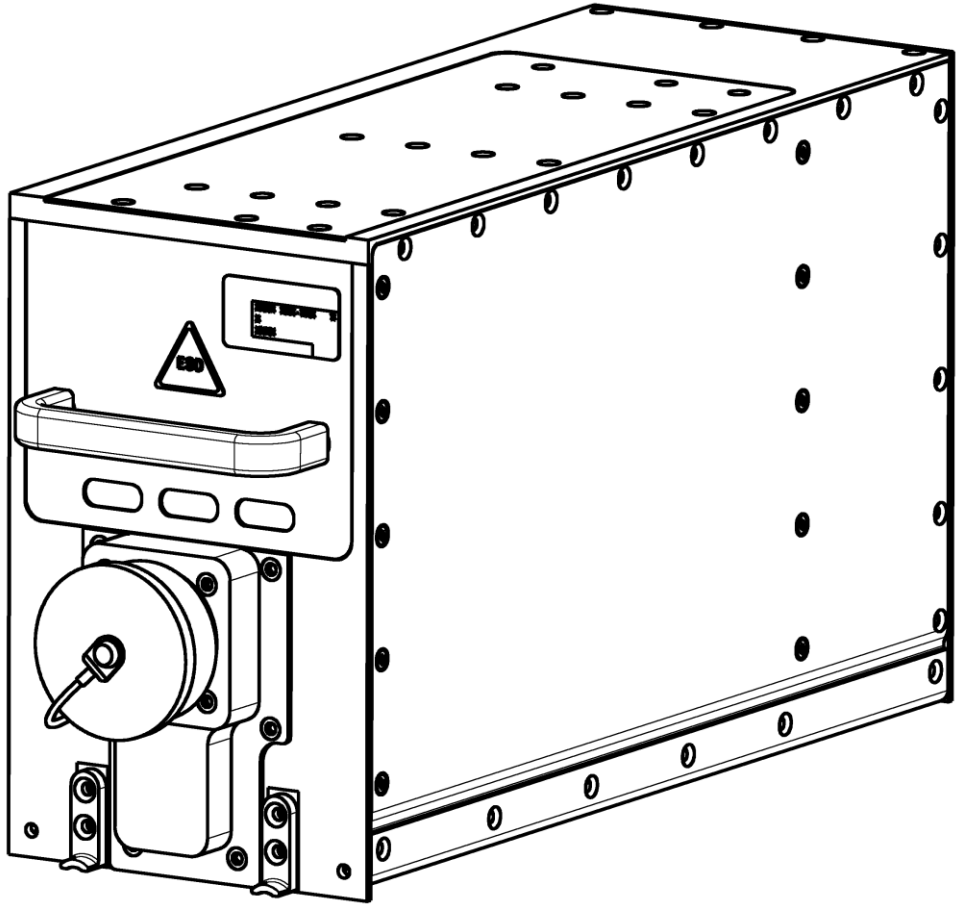


GRIPEN

Product that needs to be tested

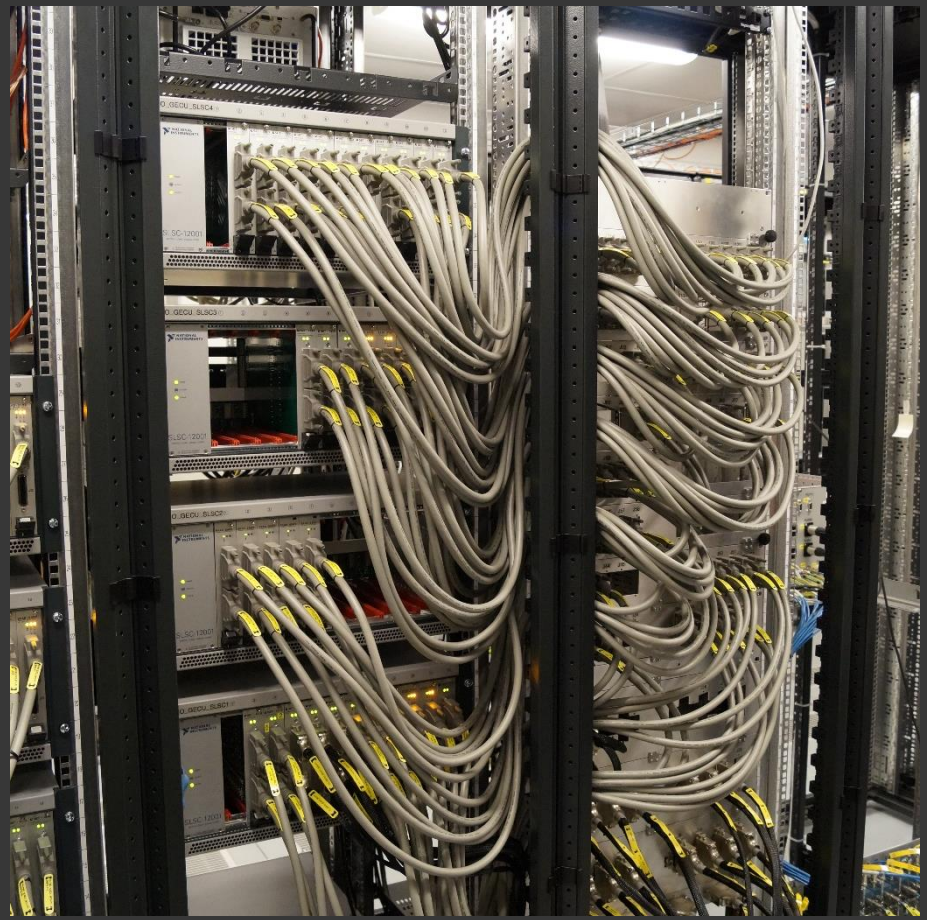
AIRCRAFT ECU

- Flying Computers
- Avionics System
- Tactical System
- Data communication
  - 1553-bus
  - CETH
  - RTHI
  - Analogue
  - Digital
  - Sensors



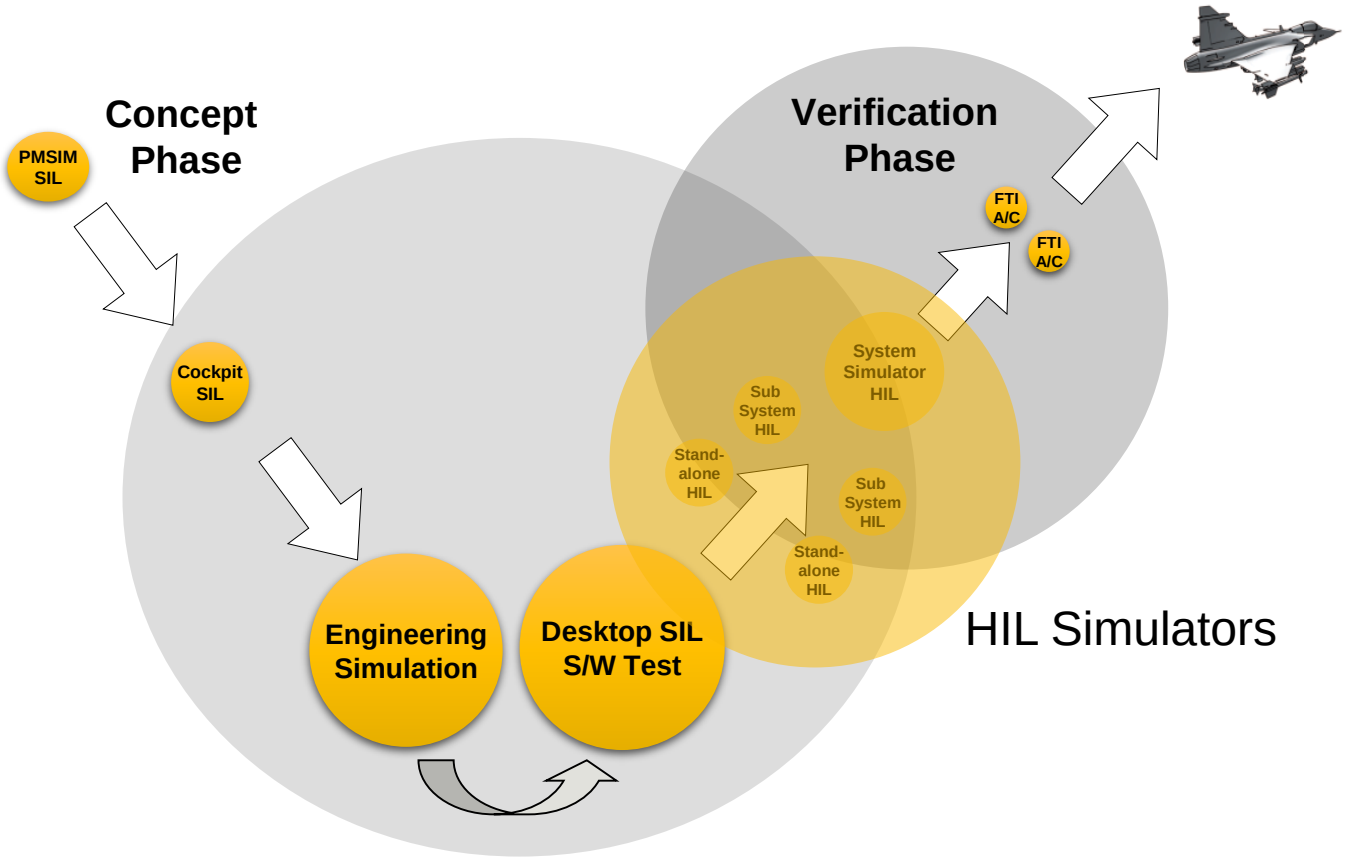
HIL

Hardware In the Loop

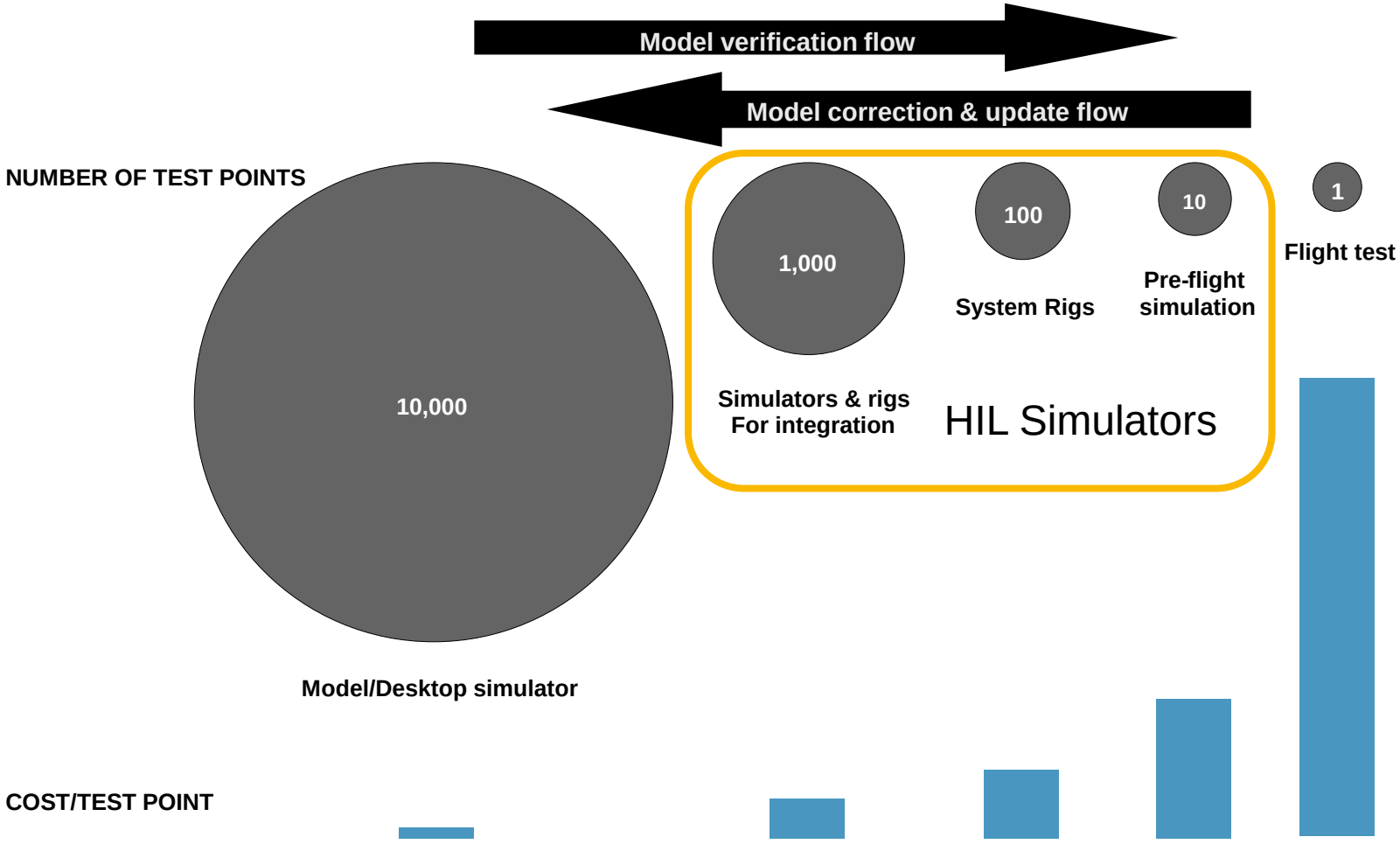


MODEL BASED SIMULATION

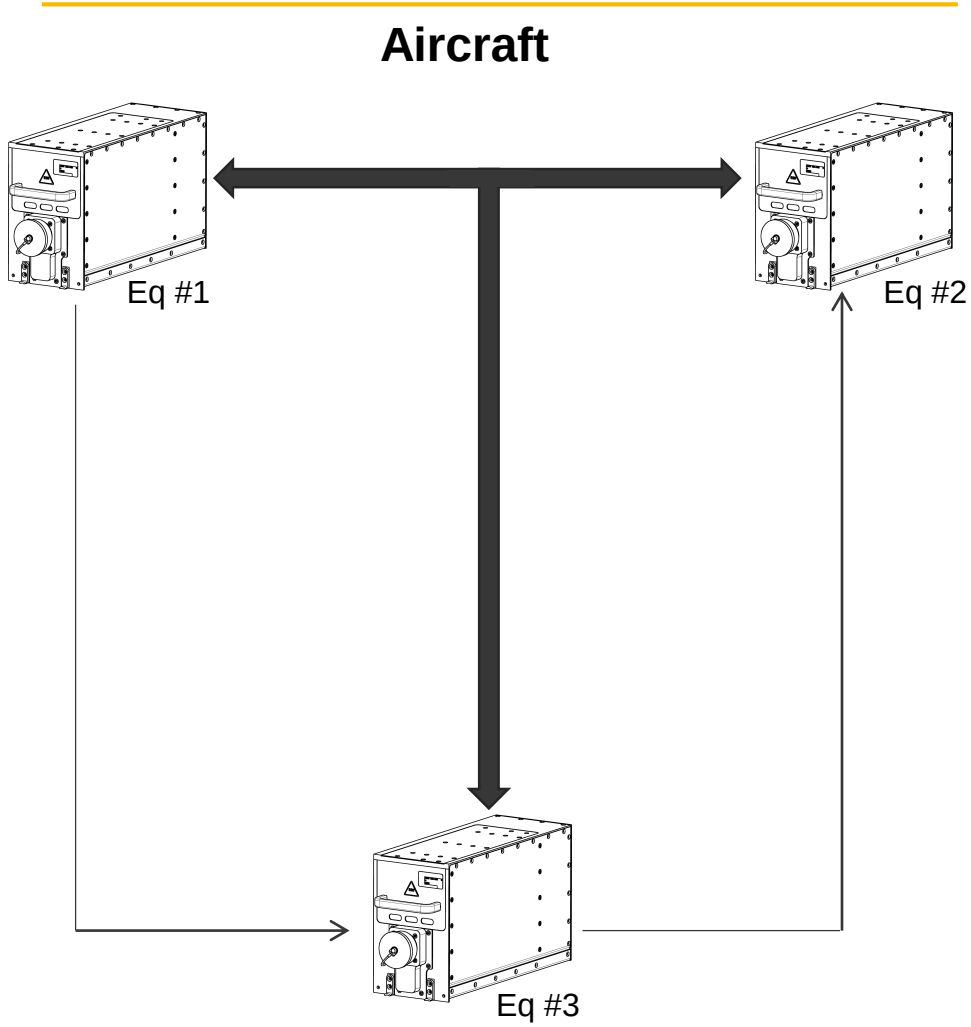
- Cheaper than flying
- Scenarios that isn't possible/desirable in a test aircraft
- Different simulation stations for different tests
- Different needs during different stages in the development phase

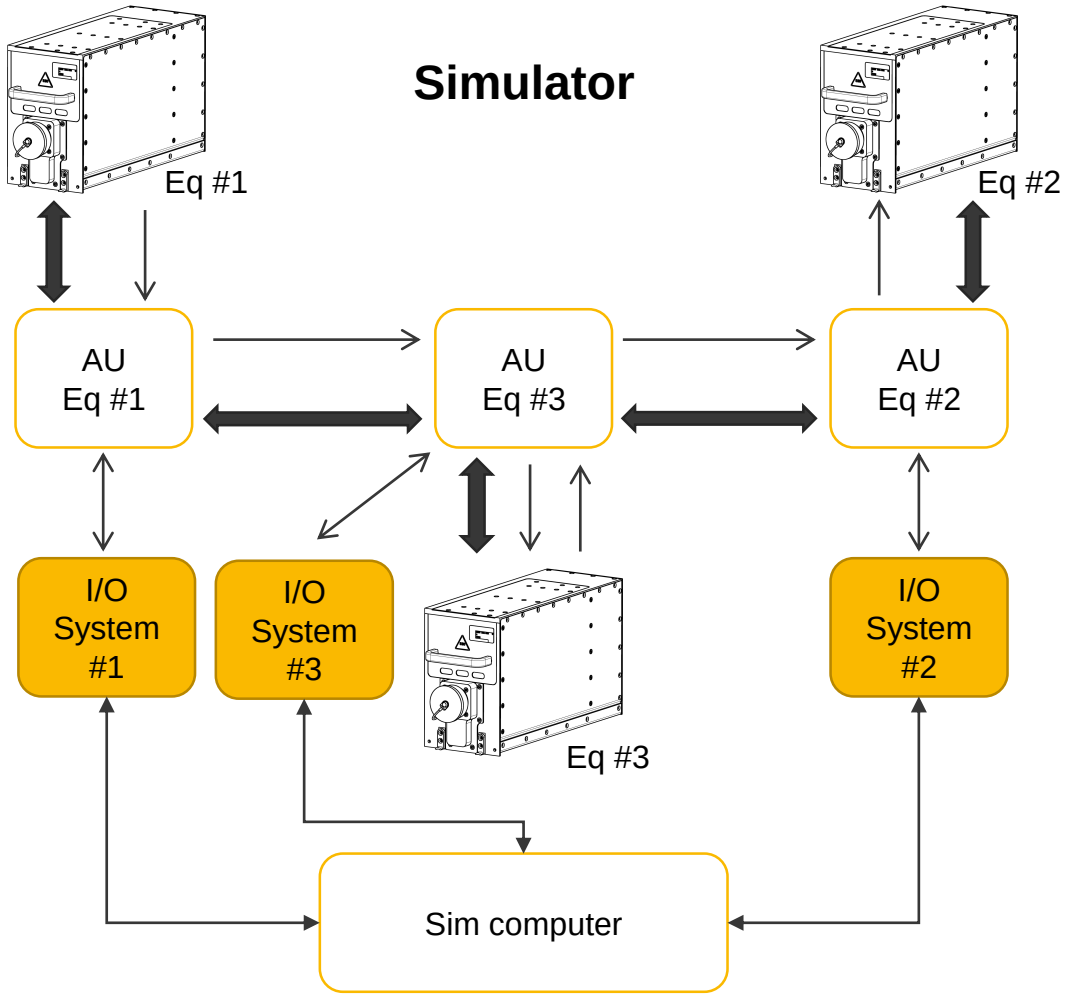


VERIFICATION COST



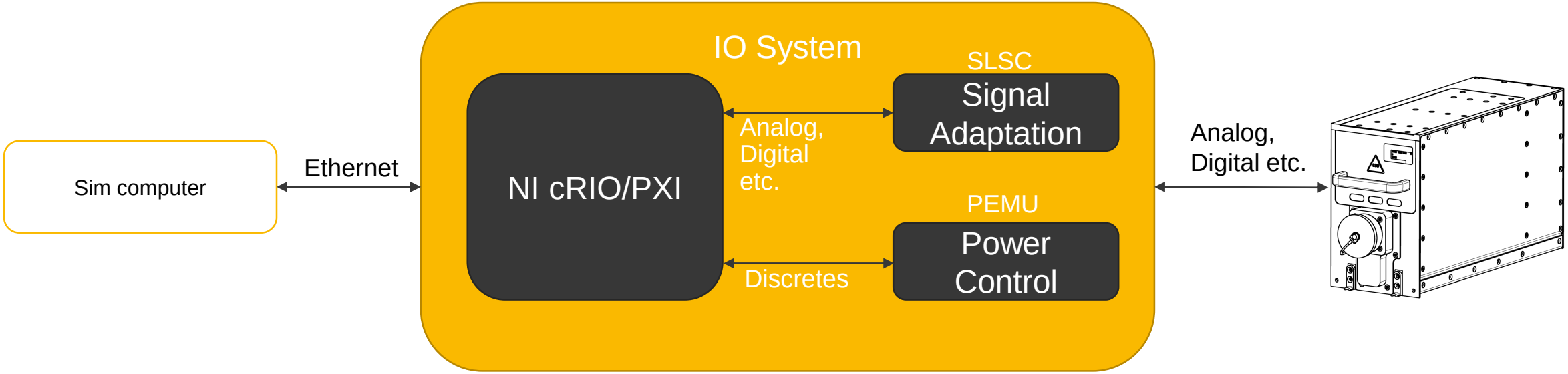
SIMULATOR VS AIRCRAFT





I/O SYSTEM GENERAL

- Converts zeroes and ones to electrical signals
- Many types of signals is used



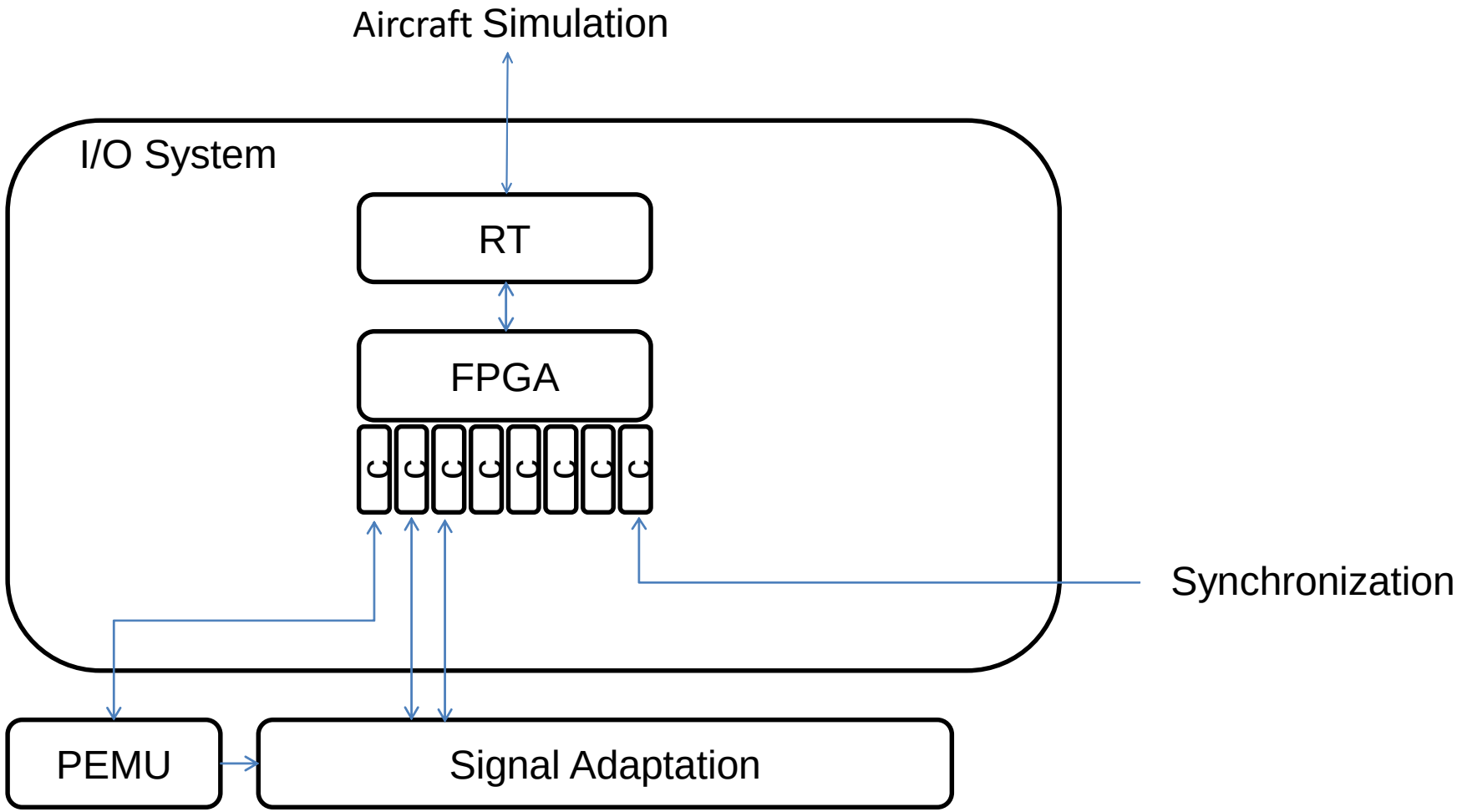
Hardware Architecture of the I/O System

NI Equipment

COMPACT RIO (cRIO)

- Chosen to be used as I/O-system in our simulators and rigs.
- Consists of a chassis and c-modules.
- The c-modules have different functions.
- CPU for Ethernet communication.
- FPGA for communication with the c-modules.
- Real-time OS (Linux).
- cRIO NI 9035 is the chosen standard chassis. RT controller, FPGA and eight c-module slots in one chassis.

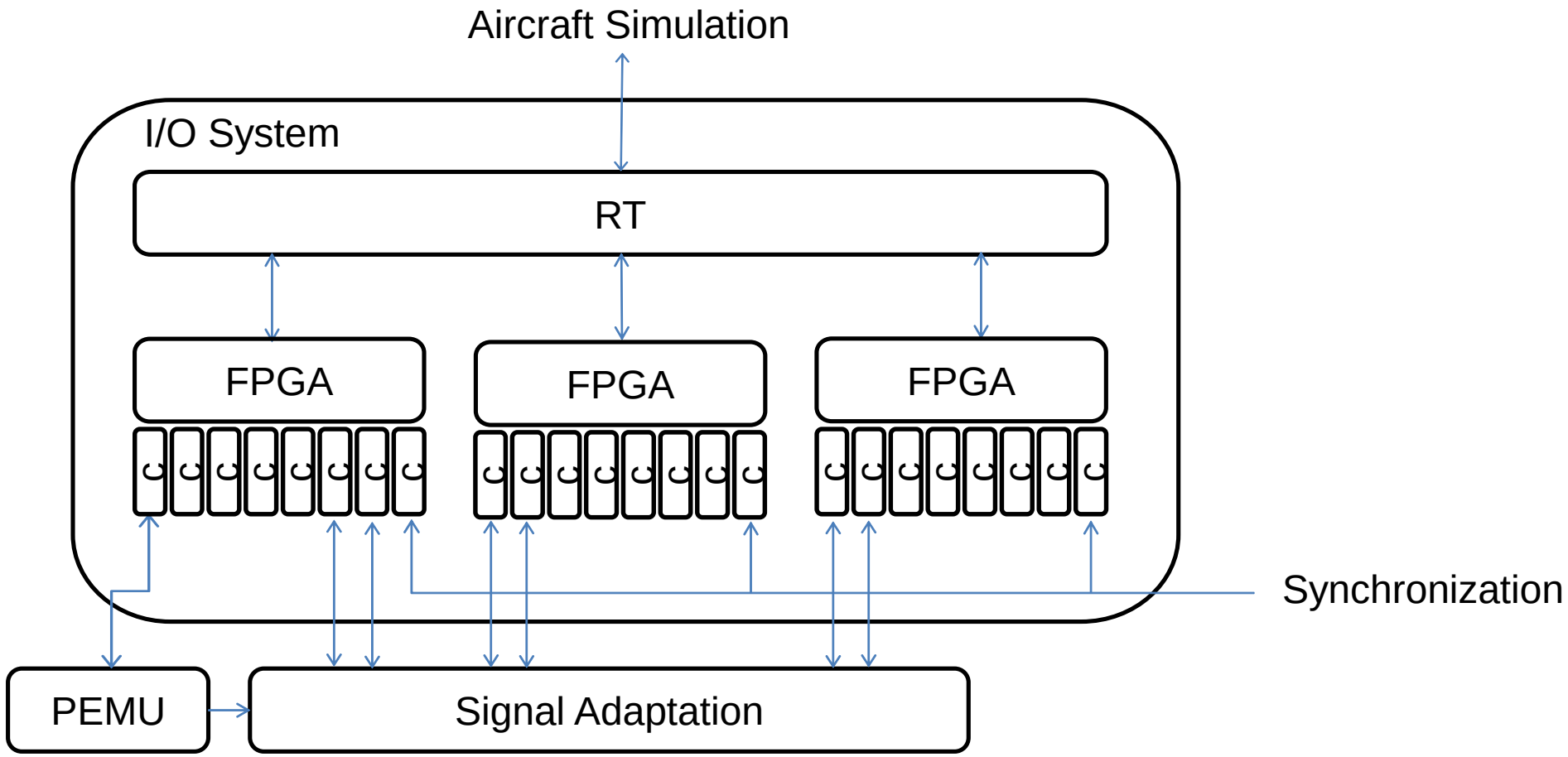
I/O SYSTEM BASED ON cRIO



PXI AND MXI-EXPRESS

- Chosen when larger number of I/O signals are required.
- RT controller in PXI chassis.
- FPGA and c-module slots in one cRIO MXI-Express chassis. We have chosen NI 9159 chassis, which have 14 c-module slots.
- Possibility to daisy chain up to six MXI-Express RIO chassis in a single chain and connect up to eight chains to a single controller.

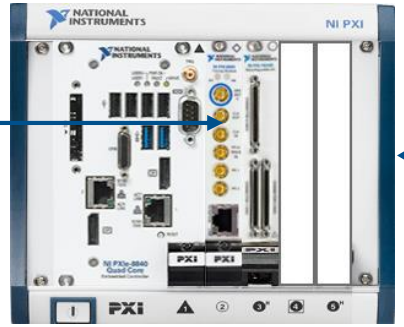
I/O SYSTEM BASED ON PXI AND MXI



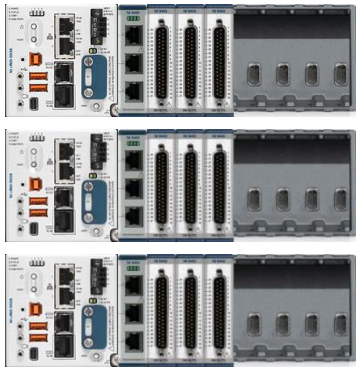
SYNCHRONIZATION

GPS

PXIe

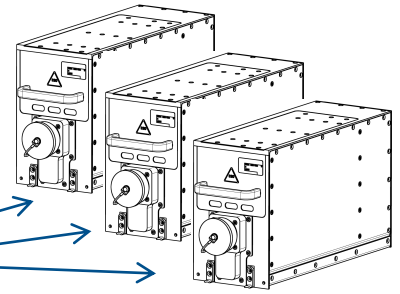


SYNC Transmitter



SYNC Receiver

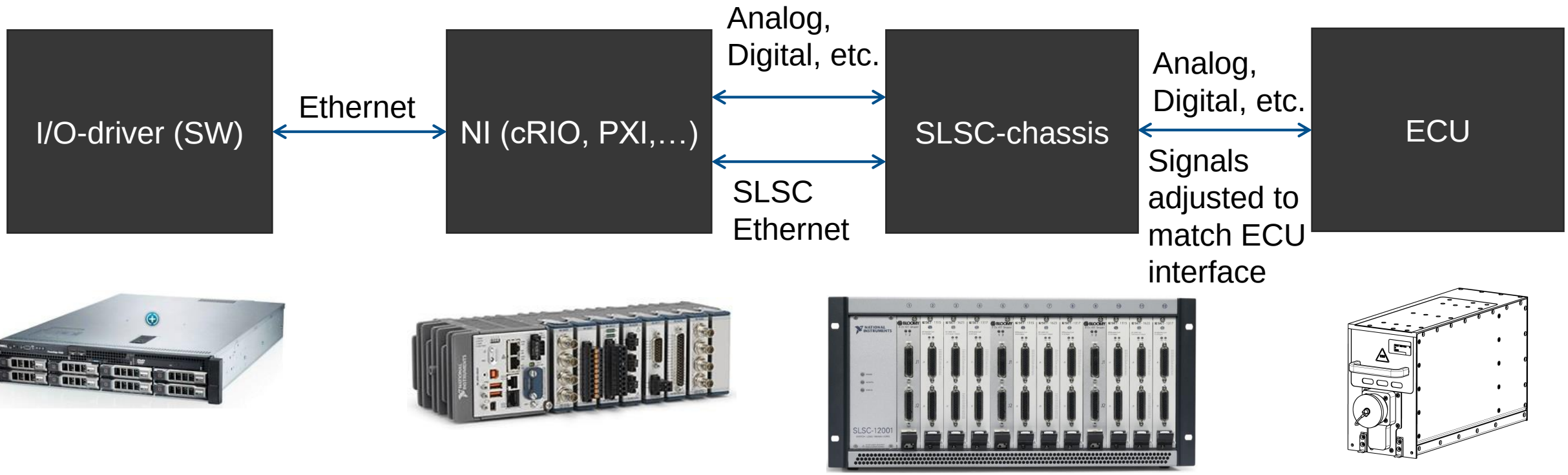
I/O System



SLSC

Switch Load and Signal Conditioning

SLSC



NI SLSC Modules

- Examples of modules used by SAAB
  - Digital I/O
  - Opto-isolated I/O
  - Resistance simulator
  - Capacitance simulator (Saab specific)

SLSC Opto isolated digital input

- Also called opto in or optical in.
- 32 channels
- 3 to 60V input
- Optocoupler input
- Current limitation 4mA
- Bandwidth 100kHz

SLSC Opto isolated digital Output

- Also called opto out or optical out.
- 32 channels
- Up to 60V output
- Optocoupler transistor output
- Max current 100mA
- Bandwidth 50kHz (can be increased at lower currents)

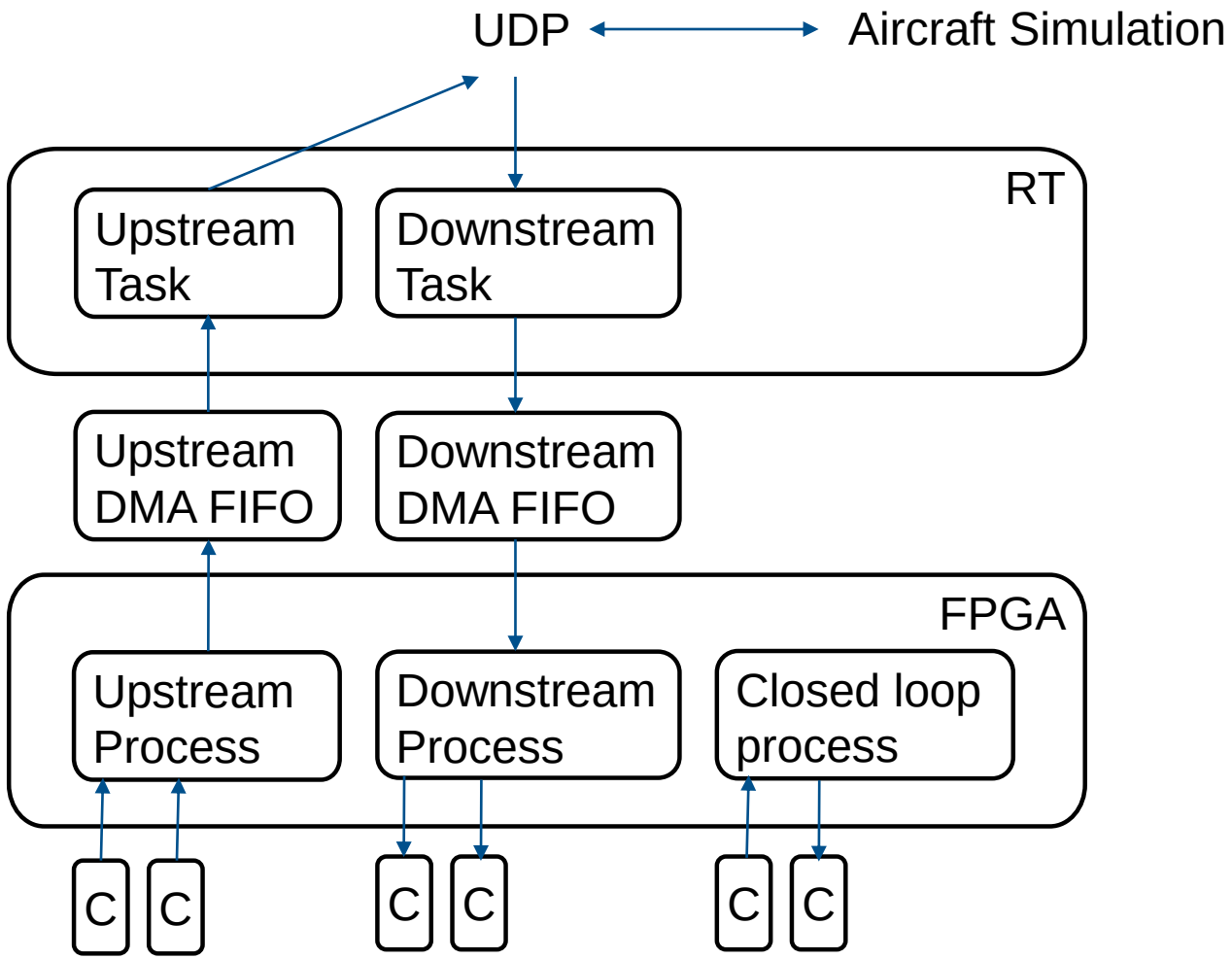
SLSC Resistor simulator

- Simulates a resistor
- 16 channels
- Range: 10 Ohm to 10 kOhm
- Handles for example PT100 and PT1000 simulations.
- Handles up to 30VDC
- Power handling 1W/5W

Software Architecture

Communication with simulator

COMMUNICATION WITH SIMULATOR



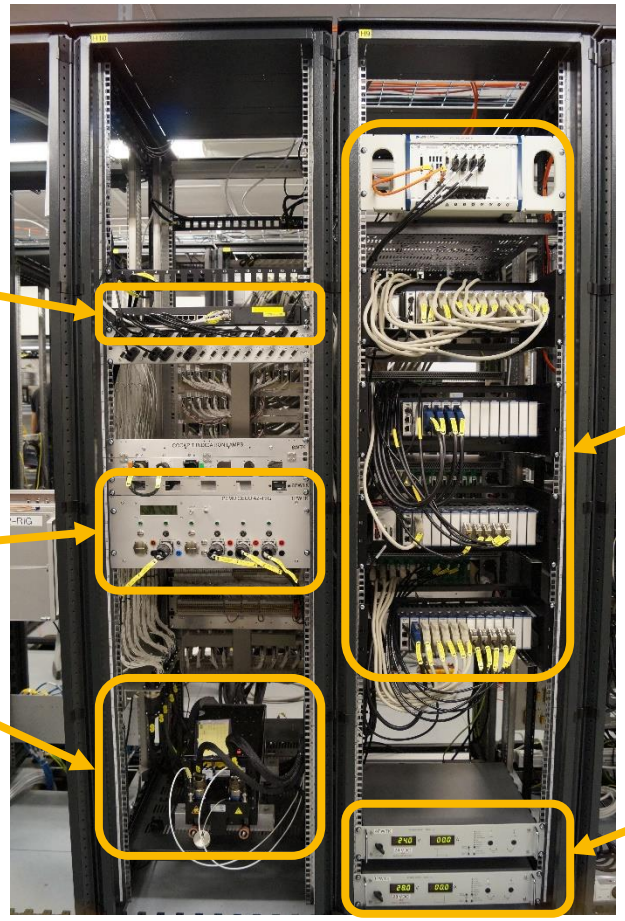
Visit in HIL-simulator

EXAMPLE OF ADAPTER UNIT IN RIG

Serial Communication

Power and Environmental Monitoring Unit

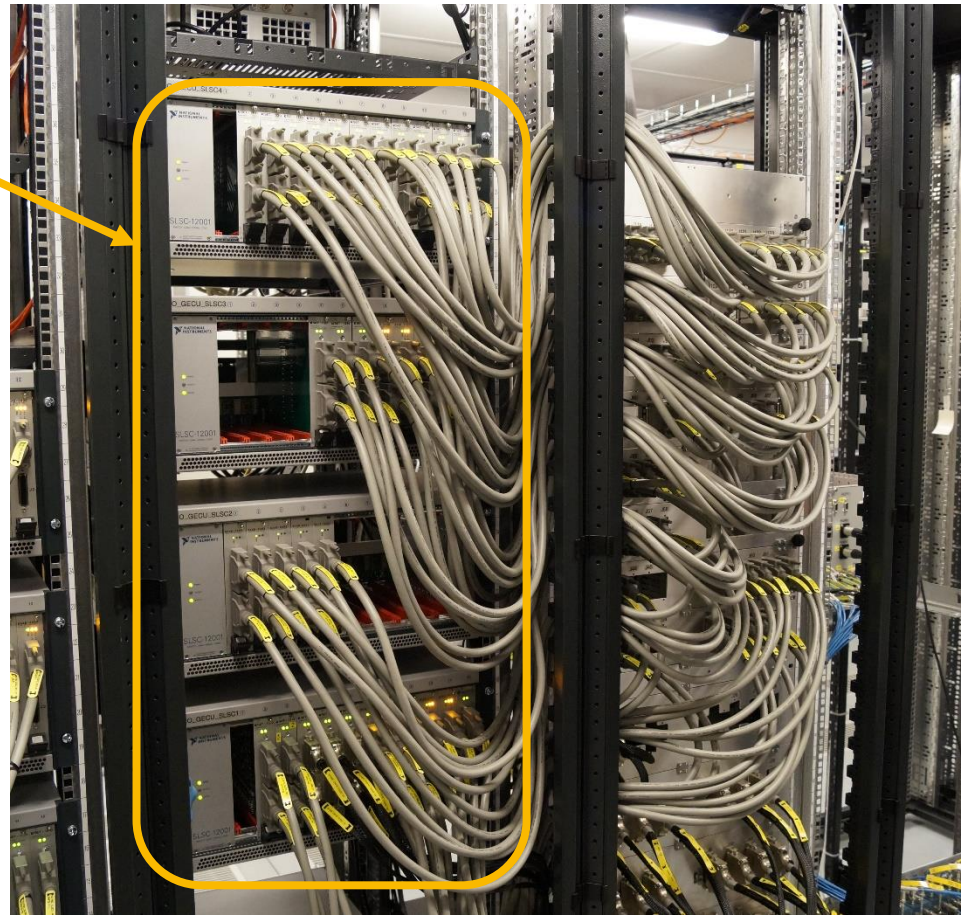
ECU



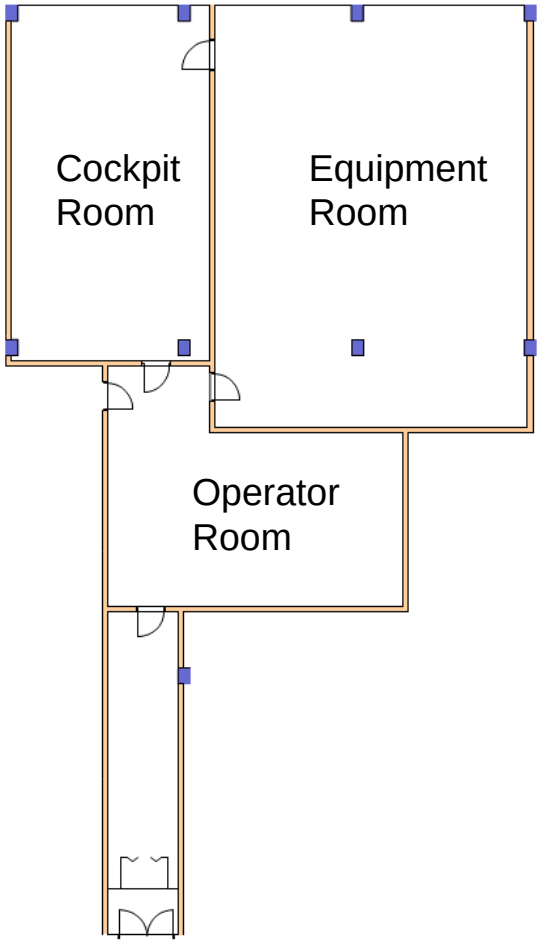
I/O-System

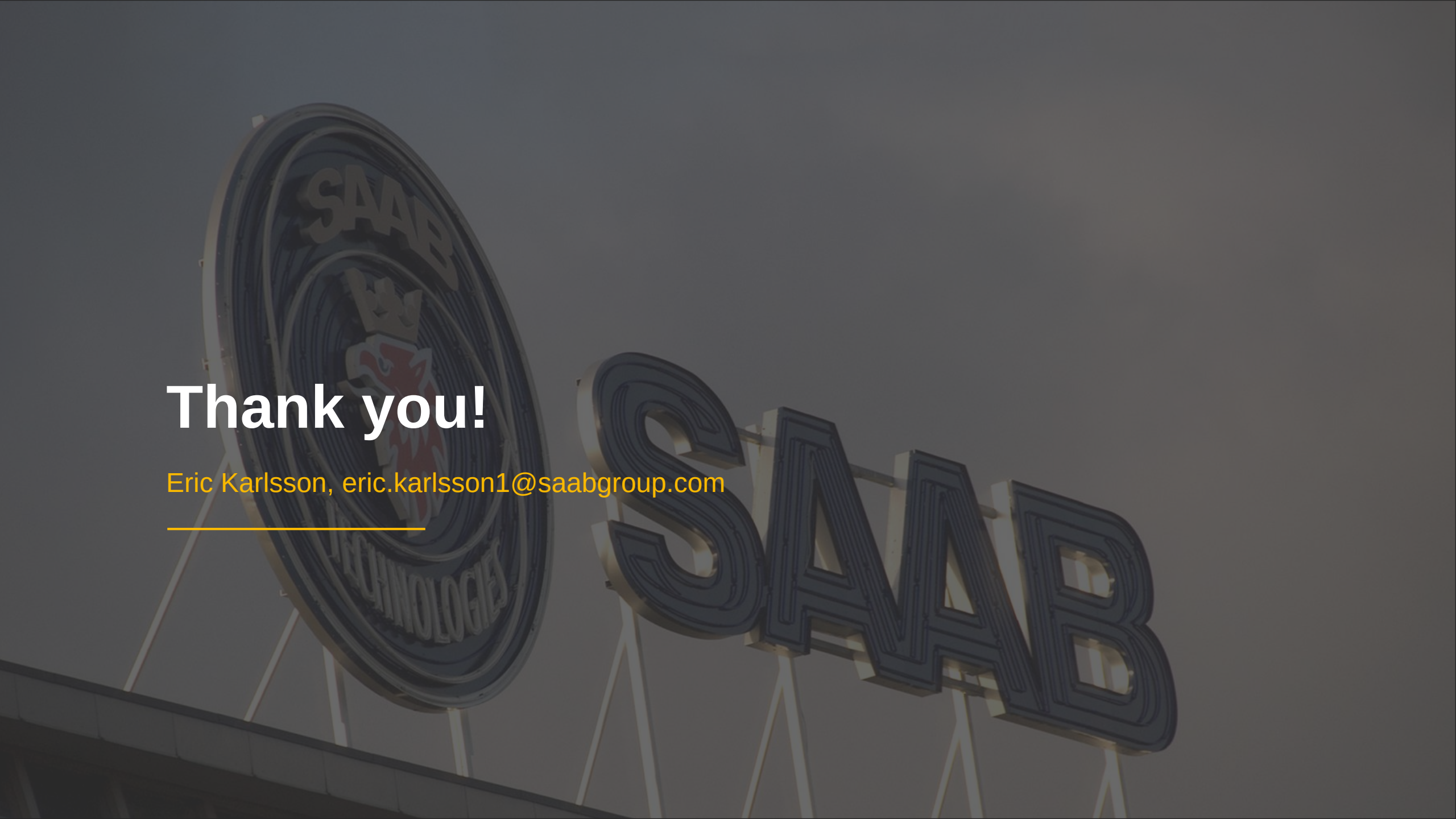
Power Supply

Signal Adaptation



MAP OF THE FACILITY





Thank you!

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