SIEMENS

Competence in Space

Siemens Convergence Creators - Space

ProUST FE Extension –
Final Presentation

Hans Martin Steiner

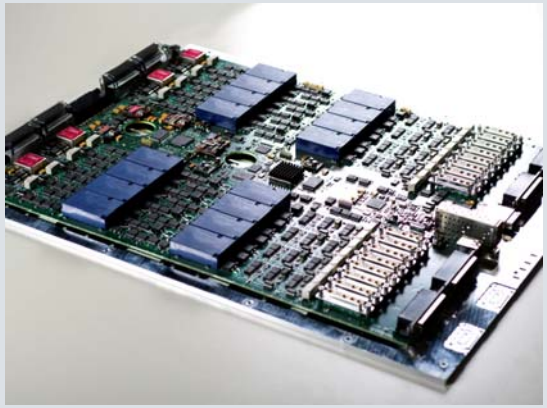
Dec. 2017

Agenda

SIEMENS

- ProUST Product overview
- Project Key Dates
- ProUST-FE Extension contents
- Validation missions
- Summary

ProUST family members



ProUST SLP

Second Level Protection

ProUST FrontEend

ProUST UniverSAS

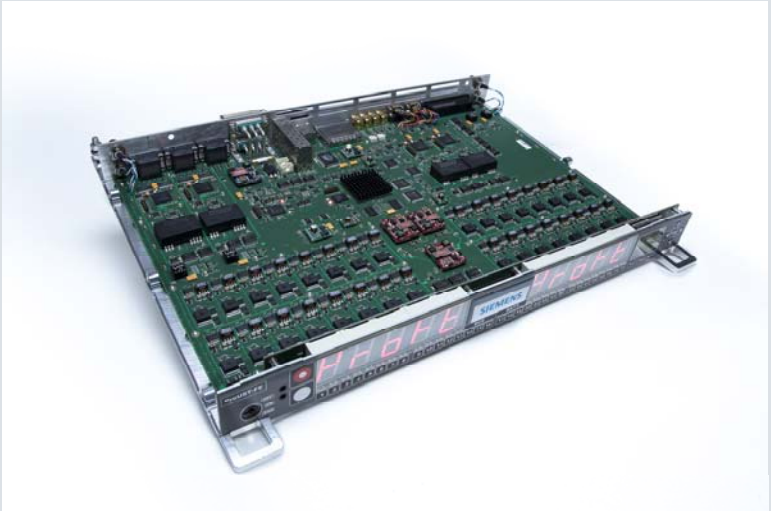
highly configurable Power Supply

FrontEnd Equipment – Interfaces that work

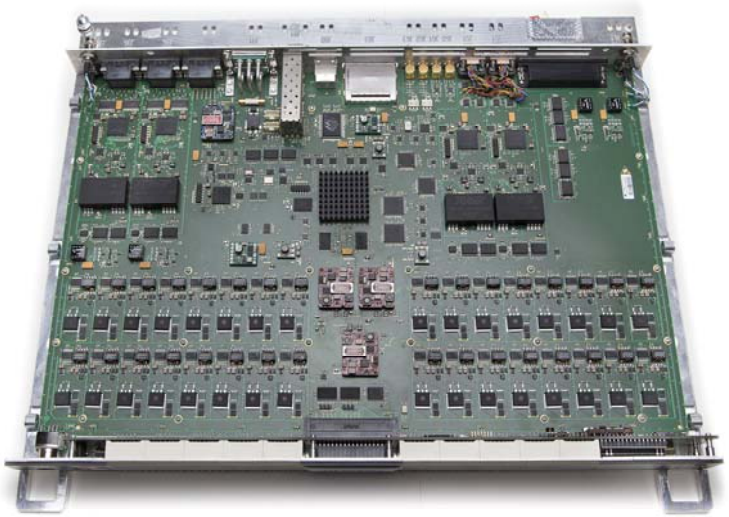
SIEMENS

ProUST FrontEnd for discrete and serial interfaces

- Features covered by ProUST FrontEnd:
  - 4 Space-wire, a high-speed link based on IEEE1355
  - 4 MIL-1553, a 1 Mbps link widely used in aerospace
  - 4 generic serial buses, e.g. IDL
  - 2+2 fast ADC/QUC
  - Parallel High Speed LVDS
  - 8-lane PCI e connection for realtime –IO (< 4 µs latency
  - Analogue input and Output
  - Digital I/O for e.g. TTL, LVDS, RS422, …
  - Other S/C Data buses such as CHLINK (Image Data Link), SDLC tec
  - Platfrom Approach

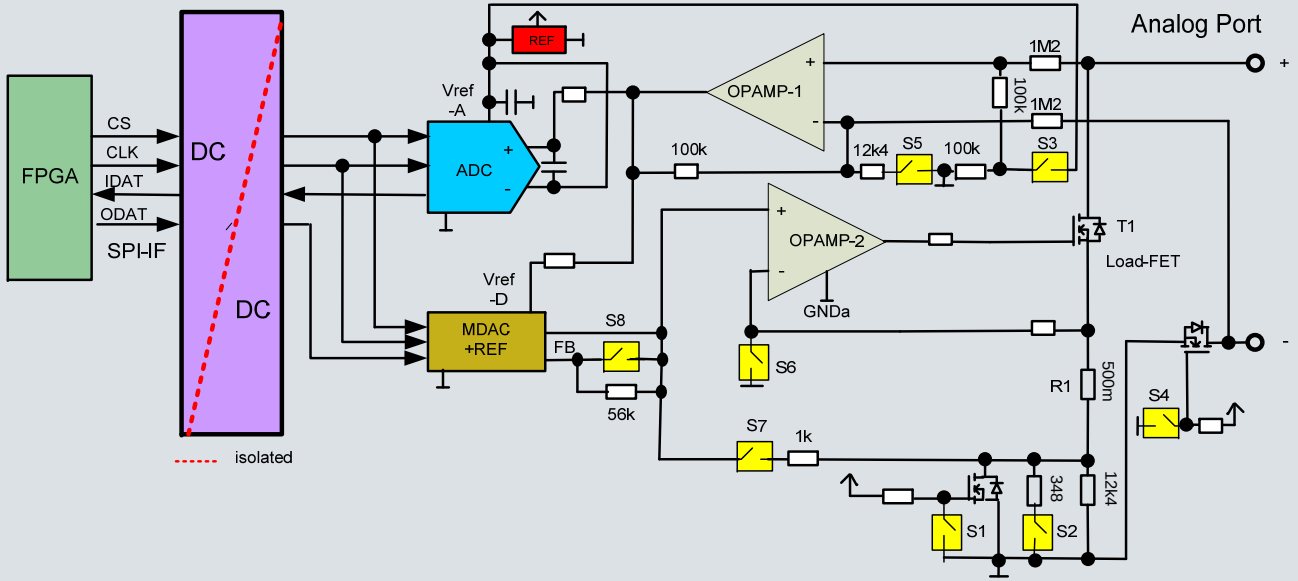


Reconfigurable DAQ

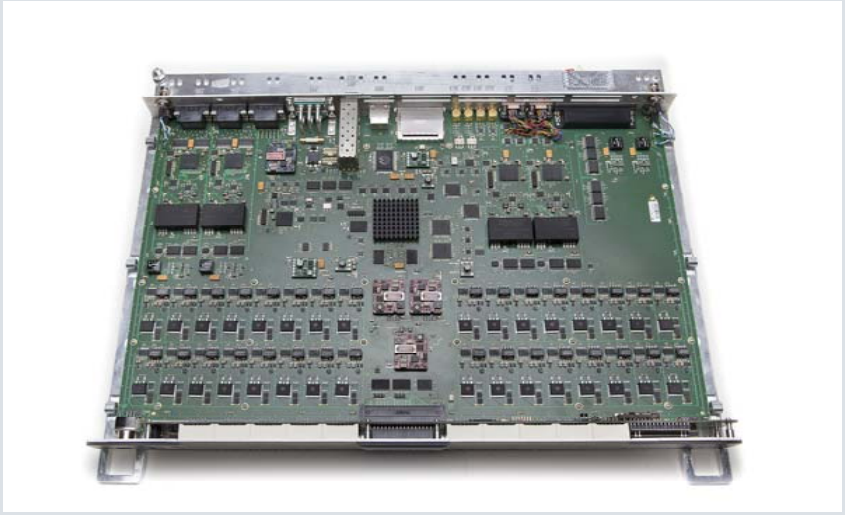


32 Generic “**Pyro**”-interfaces
12+ programmable analogue functions

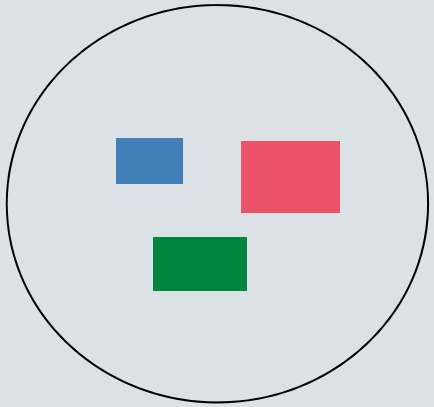
- analog voltage input
- analog voltage output
- resistor simulations (Thermistors)
- resistor measurement
- current source
- LCL
- …

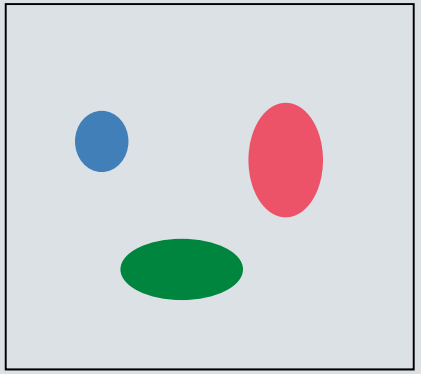


ProUST Frontend



Platform design principle





Module-Reuse

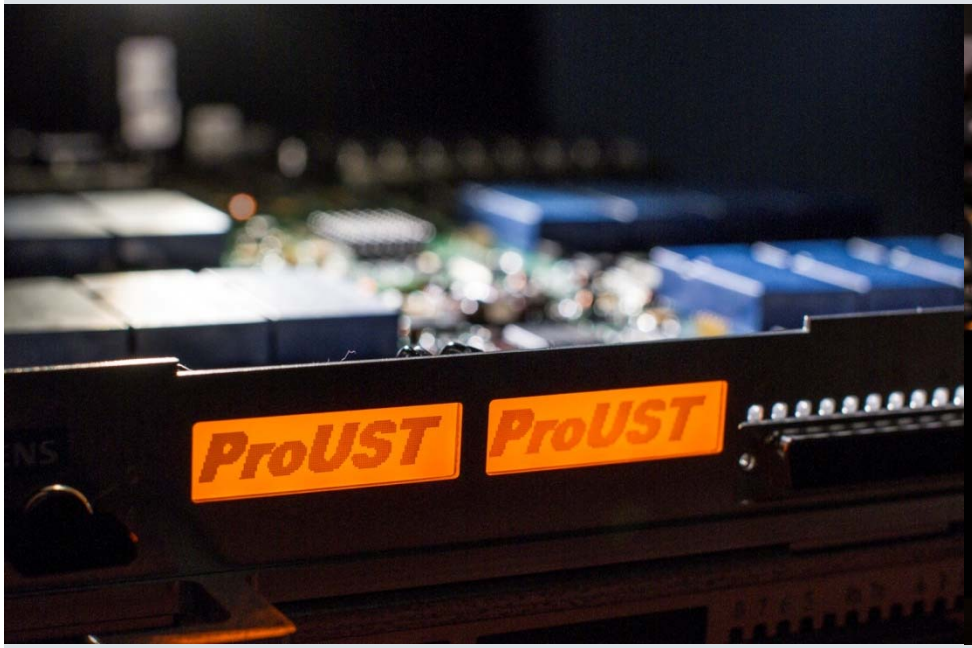
Platform-Reuse

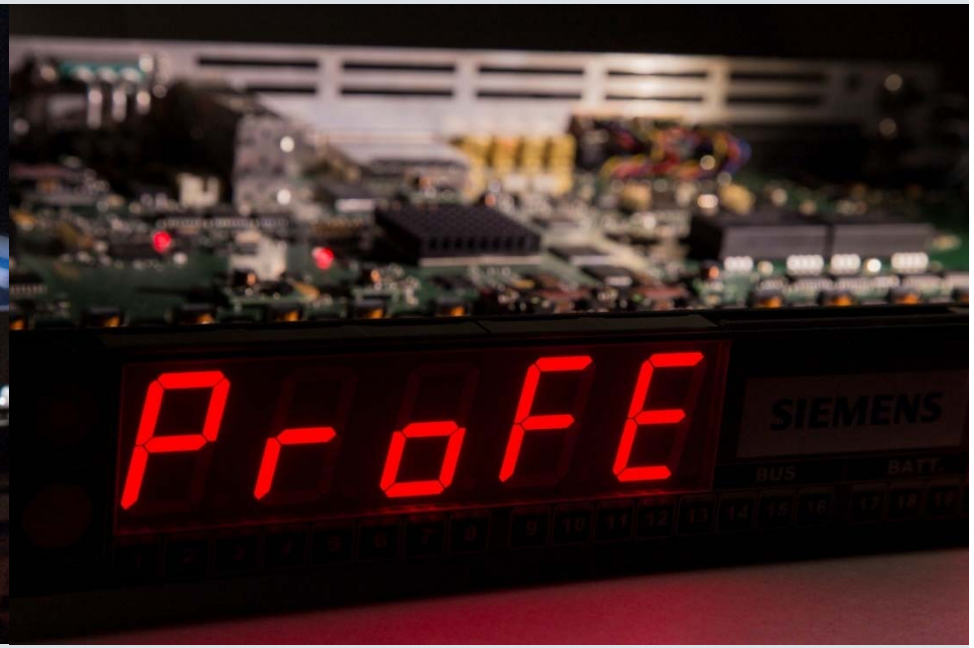
- **Cutting diversity**
- **Flexible technologies at variable parts**
- **Industry standards at constant parts**

ProUST, the philosophy

- Create high-density generic platforms
- Maximize flexibility and reliability
- Optimize costs

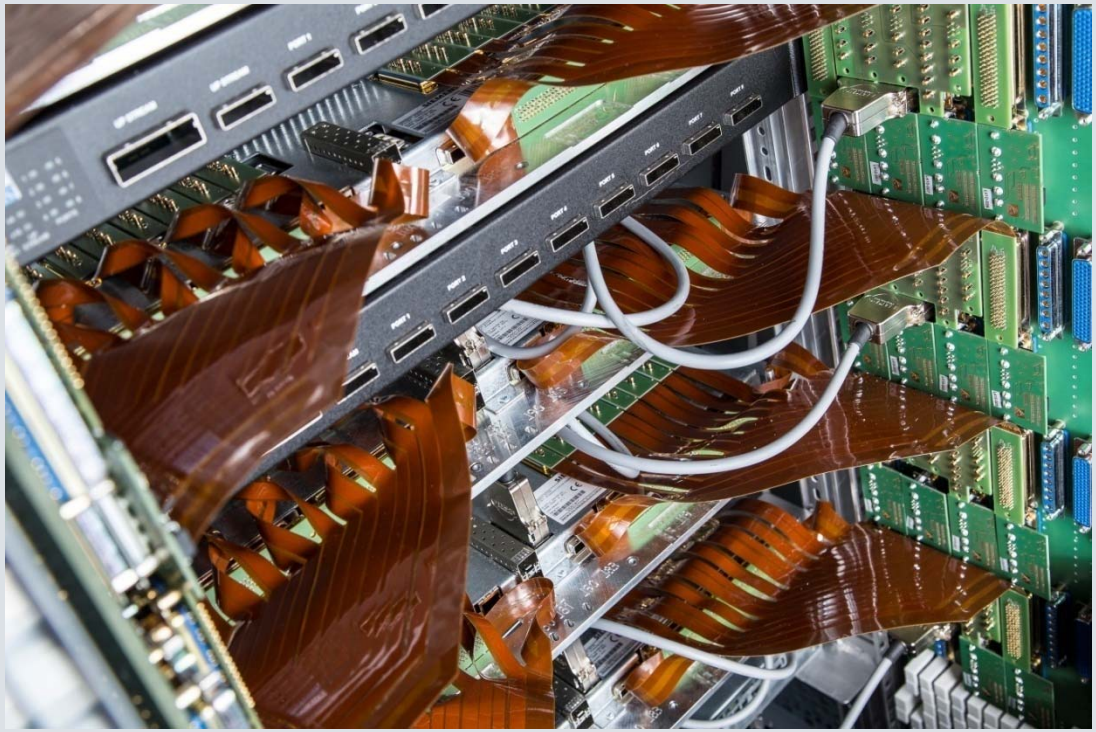
- => Unified reconfigurable EGSE

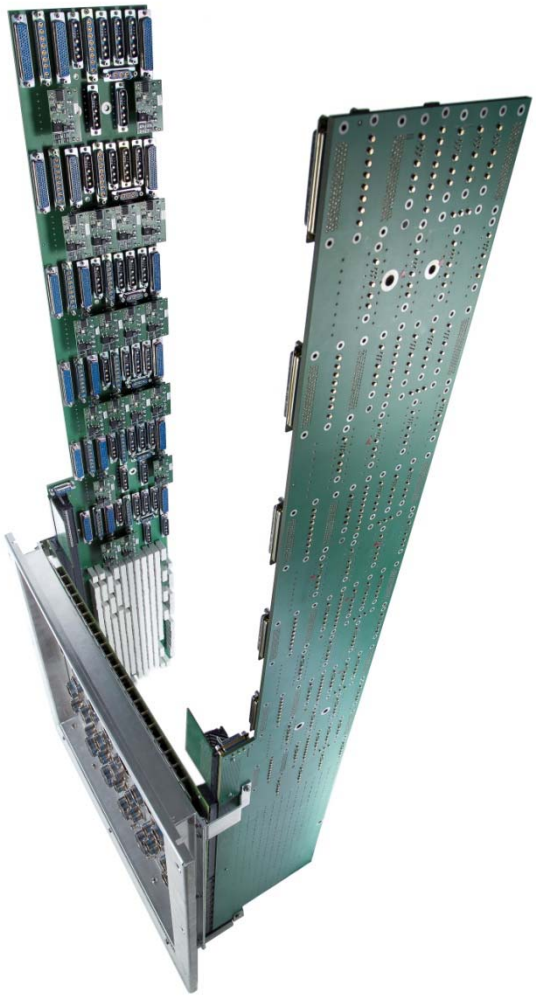




Towards Series Production of EGSEs

- High-density rack-wiring with XXL-PCBs
- Flex-cables

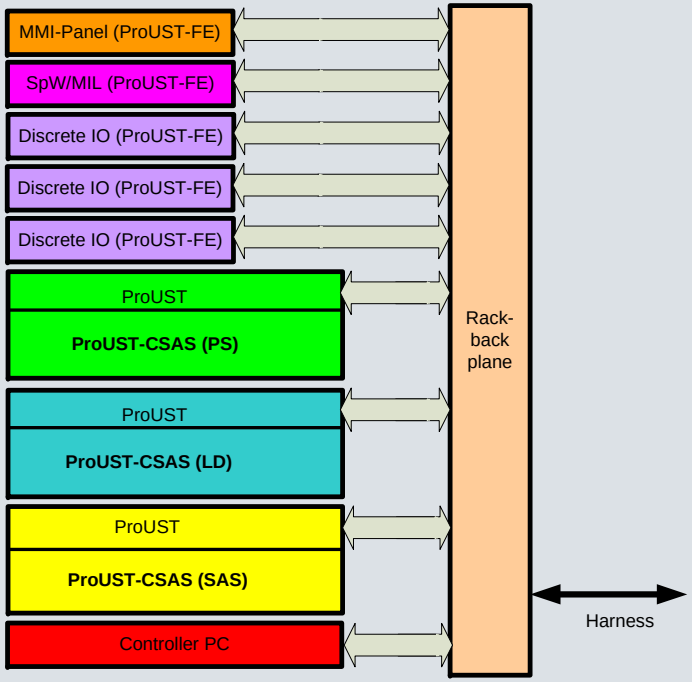




„Chameleon SCOE“

Transform EGSE as you like

UniverSAS

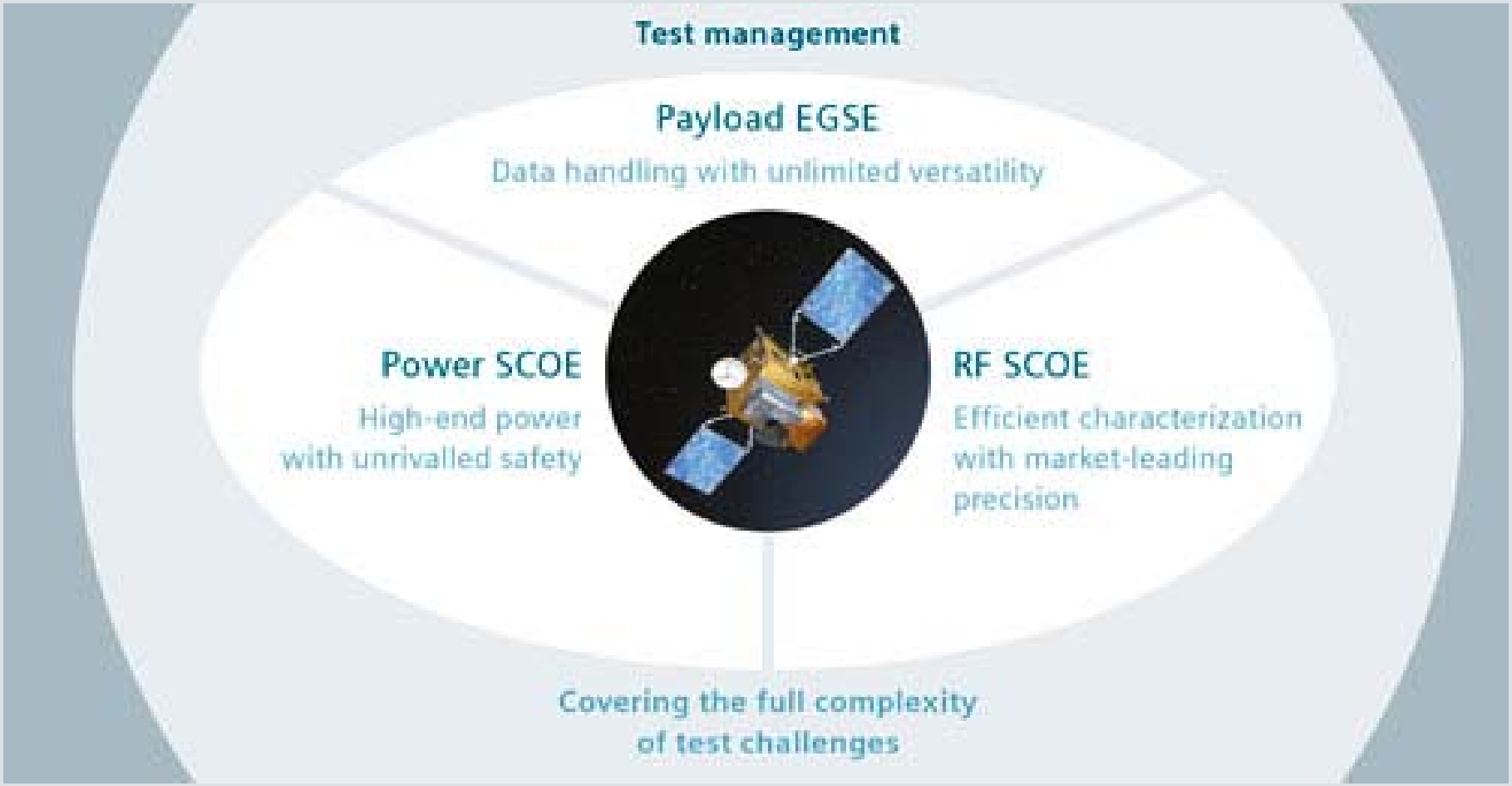


Platform to the Extreme

ProUST univerSAS

Our Electrical Ground Support Equipment Portfolio

SIEMENS



Key Features of our EGSE Systems and Services

SIEMENS

- Consider EGSE as part of S/C and P/L Integrator‘s Infrastructure
- EGSE, including HW and SW needs to be Generic, mission (family) independent
  - Cost, Risk and Schedule reduction
- Minimum S/C and P/L Test (AIT/AIV) Time
  - Full Automation Test and Calibration
  - Reliability and Availability of EGSE/SCOE
  - Simple and easy to be used
- High Flexibility and Scalability
  - Offer low cost SCOE to be integrated into customers environment (w. o. Test-Procedures) up to Overall Turnkey system (e.g. Galileo FOC P/L EGSE)
  - Low cost missions up to High Complex Missions
  - COTS Instruments may be provided as CFIs
- Maximum Safety – S/C or P/L must under no circumstances be damaged
- Fully Customer oriented
- Geo Return Balancing (AT, CZ and RO)

ProUST-FE Extension - Project Key Dates

SIEMENS

September 2014	Kick-Off for the ProUST-NG
March 2015	Design Review (Milestone MS1)
October 2015 – September 2016	*Delay of project due to delay in validation missions*
July 2016	Mission MTG DHS Acceptance Set1
August 2016	Mission MTG PDD Acceptance Set1
September 2016	Mission EDRS RF-Suitcase Acceptance
September 2016 – April 2017	*Delay of project - no mission available for TM/TC SCOE*
April 2017	Reduction of scope for the TM/TC SCOE
June 2017	QR1 (Milestone MS2) and QR2 (Milestone MS3)
October 2017	Final Settlement (Milestone MS4)
November 2017	Final Presentation at ESA

ProUST-FE extension contents

SIEMENS

1. Enhanced serial capabilities

a) Real-time SpaceWire switch (SpW-Router)
b) SpaceWire RMAP protocol
c) MIL extension to operate in Multi Remote Terminal Mode
d) MIL error injection and SpW Error Injection
e) Serial interfaces extension (UARTs, ISD/OSD)

2. Reconfigurable analogue interfaces

a) “PYRO” HW development
b) Pulse qualification
c) Enhanced Front Panel for ProUST-FE

3. High speed data acquisition

High-speed ADC (up to 500Msps) and Quadrature up-converter (up to 400MHz) “Fast ADC/DAC”

4. Crossbar and TM/TC SCOE

a) Crossbar for switching and routing standard baseband TM and TC interfaces
b) TM/TC SCOE
   - Note that the full TM/TC SCOE implementation has been descoped from the project (CCN2), only kernel functionality which is needed for the Crossbar has been implemented and tested.

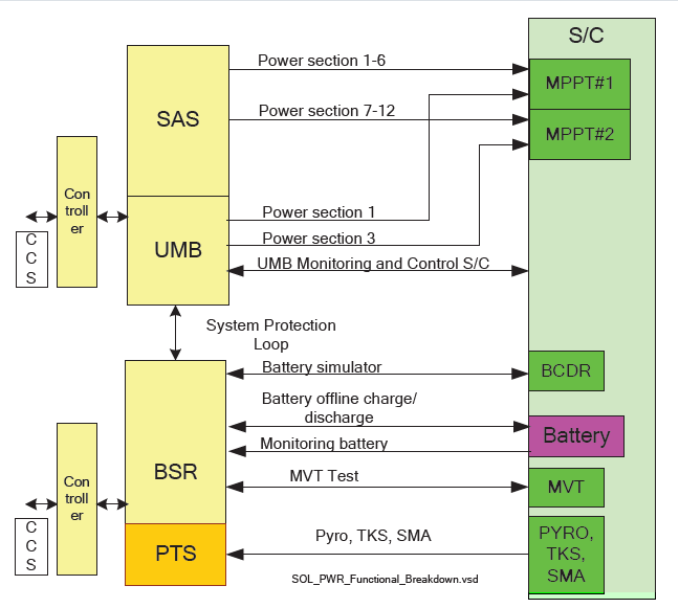
5. Second Level Protection Flexibility

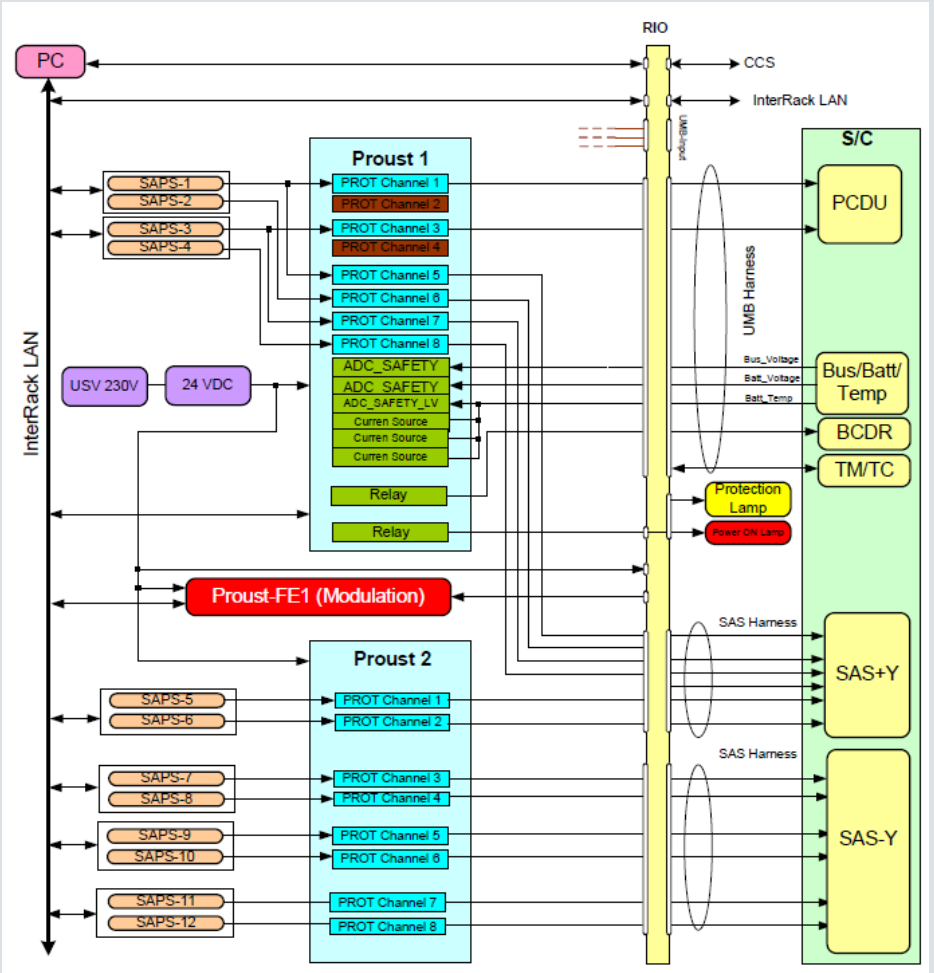
6. Real-Time Framework

a) HW-Layer: Direct access to discrete I/F
   Access times in ns-range, synchronisation across devices (SCIF-timing)
b) SW-Layer: GUI Demo application for validation of the Real-Time Framework

Validation Missions: Solar Orbiter Power SCOE

- Power Supply
- Validation of Analogue Interfaces
- Validation of Pulse Qualification





Validation Missions: MTG DHS SCOE (1)

SIEMENS

- Overall 57 ProUST-FE units in 5 systems
- Spacewire including Error Injection
- MILBUS including Error Injection
- Discrete Interfaces
- UART
- ISD/OSD

Validation Missions: MTG DHS SCOE (2)

Validation Missions: MTG PDD SCOE

SIEMENS

EmergOFF, SL
Poseidon (back)
ASA

PTP

HRDFEP

Console
LAN Switch (back)
DCV
RF-MU
SCU
PC/SCOE controller
MITU

VNA

Ka-Band RF FE

- Spacewire Router (DDU-FE)
- Based on ProUST-FE Extension

DDU-FE

Validation Missions: EDRS RF-Suitcase

- Validation of EDRS-C with TCR Ground segments
- ProUST-FE Ext TM/TC Crossbar validation
- ProUST-FE Ext TM/TC SCOE Kernel validation

Summary

SIEMENS

- Extension of the product ProUST-FE with features required by missions
- Successful implementation of S/C protocols and functions
- Validation in ongoing missions
- Adaption of Content Schedule to needs
  - Delay of Final milestones
  - Descoping of TM/TC SCOE
- Project completed successfully

Space Business

SIEMENS

Thank you for your Attention