SoCe

System-on-Chip *engineering*
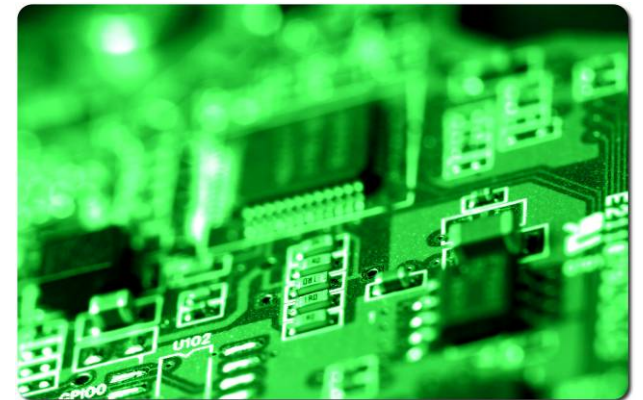
- The SoCe Difference -

FPGA based Solutions for
Communications in Critical Systems
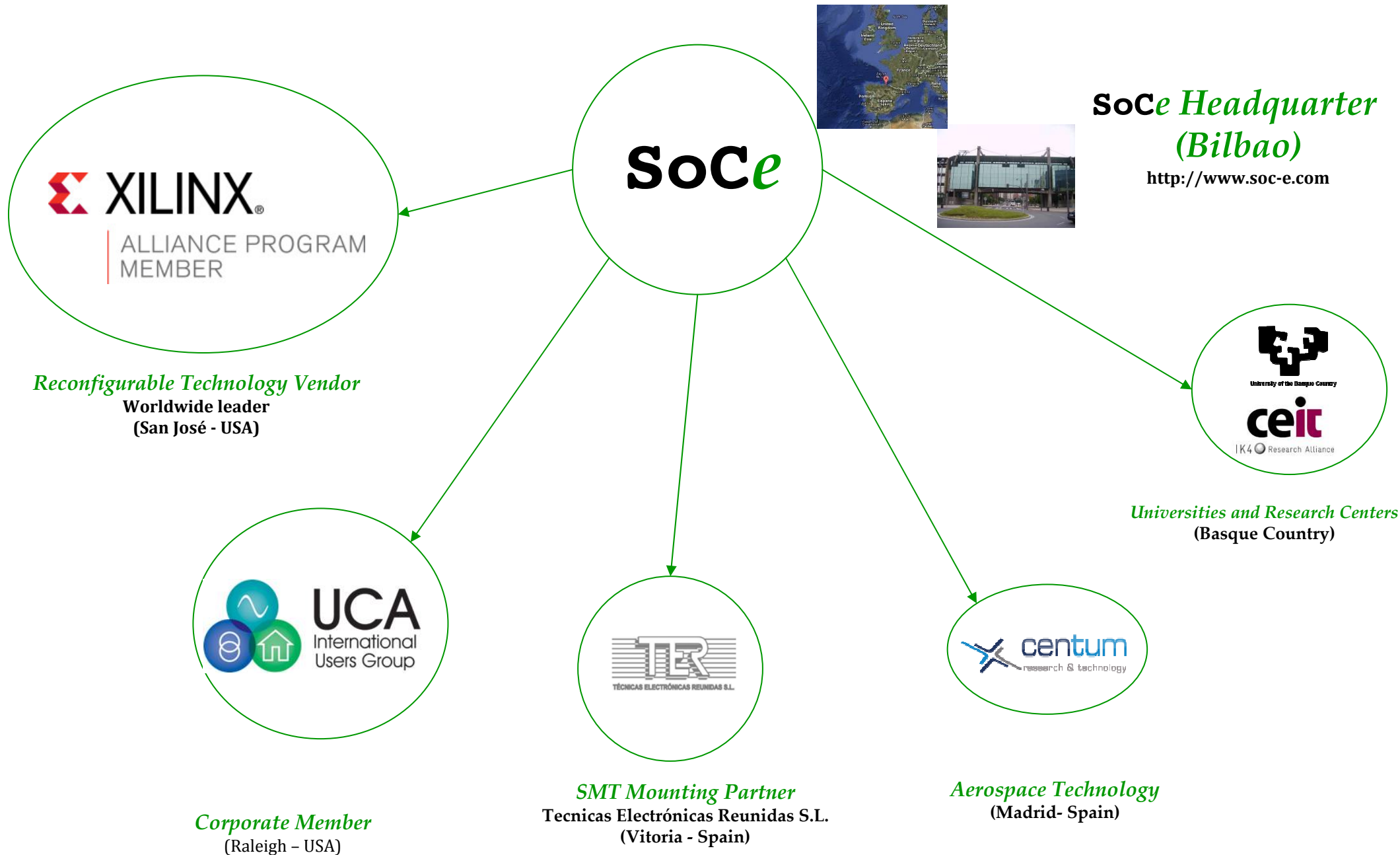
XILINX®

ALLIANCE PROGRAM
MEMBER

The **SoC***e* Difference: Innovation for Your Advantage

· **SoC***e* offers **technology** based on reconfigurable devices (**FPGAs**) and specialized design services for Energy, Defense and Aerospace Sectors

· **SoC***e* **IP cores** are focused on communications for critical systems. **These IPs are ready-to-use solutions** to integrate sub-microsecond Ethernet based synchronization or Reliable Ethernet in any equipment (IEEE 1588, PRP or HSR**,** among other standards)

· **SoC***e* **FPGA boards** are designed for High Performing Embedded Computing in *rugged* critical systems (Software-Defined Radio, Electronics Intelligence, etc.)

# The SoC*e* Difference: Eco-System (Technology Partners)

SoC*e* Headquarter (Bilbao)

http://www.soc-e.com

XILINX ALLIANCE PROGRAM MEMBER

Reconfigurable Technology Vendor
**Worldwide leader
(San José - USA)**

Universities and Research Centers
(Basque Country)

UCA International Users Group

TÉCNICAS ELECTRÓNICAS REUNIDAS S.L.

centum research & technology

Corporate Member
(Raleigh – USA)

SMT Mounting Partner
**Tecnicas Electrónicas Reunidas S.L.
(Vitoria - Spain)**

Aerospace Technology
(Madrid- Spain)

The **SoC*e*** Difference: Interoperability Events

- **HSR/PRP:**

    - **Winterthur 2012**: Product validated: HSR/PRP on S6.

    - **CIGRÉ 2012:** Paris 2012. Product validated: HSR/PRP on S6 in customer product.

- **IEEE 1588 and HSR:**

    - Lemgo (Germany) ISPCS 2013. Products validated: 1588 Transparent Clock over HSR on Zynq, S6 and customer product.
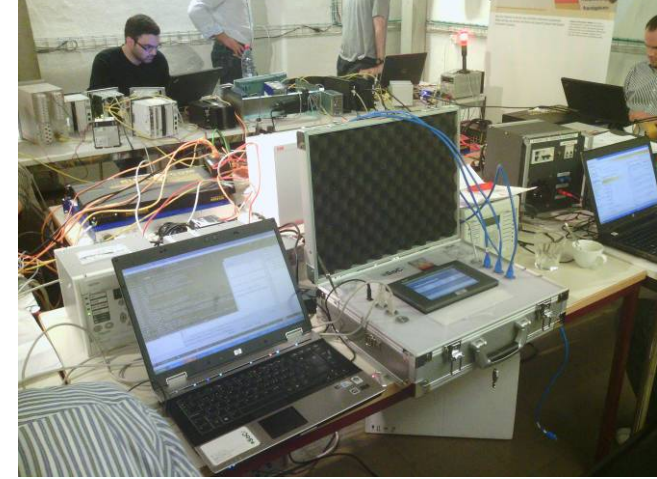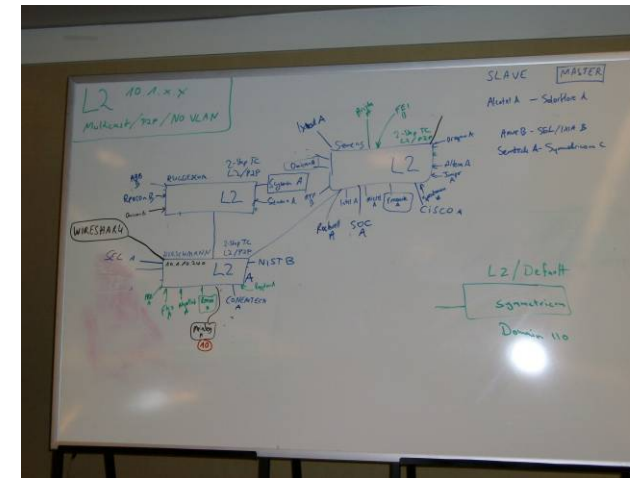
The **SoC*e*** Difference: Interoperability Events

- **IEEE 1588:**

    - Munich (Germany) ISPCS 2011. Product validated: Precise Time Basic on S6.

    - San Francisco (USA) ISPCS 2012. Product validated: 1588Tiny IP S6.

- **IEEE awarded SoC*e* & UPV/EHU Zynq HSR/PRP:**

    - Vienna(Austria) IECON 2013. "System-on-Chip Implementation of Reliable Ethernet Networks Nodes"

IECON 2013
39th Annual Conference of the IEEE Industrial Electronics Society
Vienna, Austria, November 10–13, 2013
Certificate of appreciation to
Dr. Armando ASTARLOA
for your best paper in session
TT04 2 - System-on-Chips, Design, Simulation and Verification

The IECON 2013 Program Co-Chairs, Peter Palensky, Luis Gomes, Mo-Yuen Chow

The SoC*e* Difference: Research & Development

• **UCA International Users Group Corporate Member.** UCA coordinates users and vendors in the deployment of standards for real-time applications for several industries with related requirements

· **SoC*e* 2013 Top Scientific-Technical Contributions**:

- **22nd IEEE International Symposium on Industrial Electronics (ISIE):**

  - "IEEE 1588 Transparent Clock Architecture for FPGA-based Network Devices"

- **39th Annual Conference of the IEEE Industrial Electronics Society (IECON 2013):**

  - "SHA-3 based Message Authentication Codes to Secure IEEE 1588 Synchronization Systems"
  - "System-on-Chip Implementation of Reliable Ethernet Networks Nodes"
  - "Memory Requirements Analysis for PRP and HSR Hardware Implementations on FPGAs"
  - "Duplicate and Circulating Frames Discard Methods for PRP and HSR (IEC62439-3)"

- **28th edition of Conference on Design of Circuits and Integrated Systems (DCIS 2013)**

  - "High-availability Seamless Redundancy for Train Ethernet Consist Network"

- **23rd International Conference on Field Programmable Logic and Applications (FPL 2013):**
  - "SDR Control Interface: An FPGA based infrastructure for control of VPX Software Defined Radio systems"
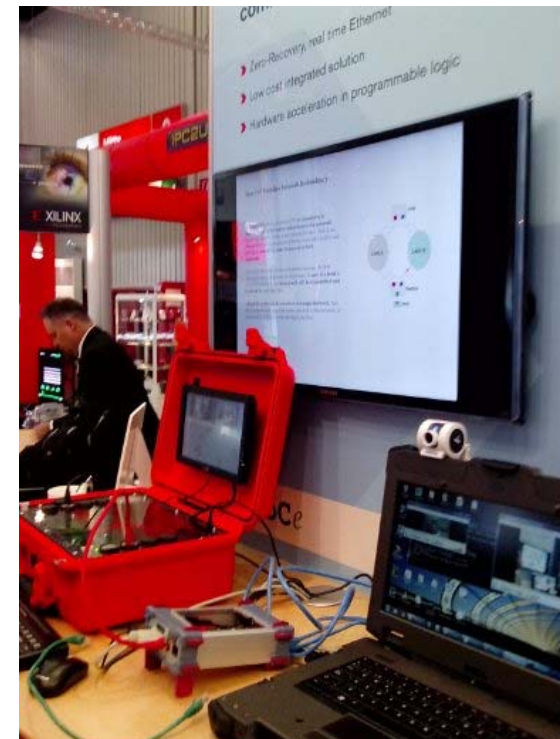
SoC*e* Field of Experience: Industrial Communications
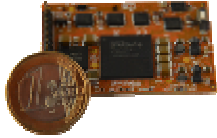
IEC 61850 and Substation-Automation Challenge:

• **Unify and upgrade networks => Ethernet L2 => Reliability? (IEC 61850 Goose msg. at L2)**

• IEC 62439-3-Clause 5 **HSR**: Zero-delay switchover time in Ethernet Ring topologies. Real-Time Ethernet

• IEC 62439-3-Clause 4 **PRP**: Zero-delay switchover time in conventional Ethernet topologies

• IEC 61588 **1588**: Sub-microsecond synchronization of systems connected using Ethernet. Vital for time stamping of Sampled Values (IEC61850-9-2) of voltage and current
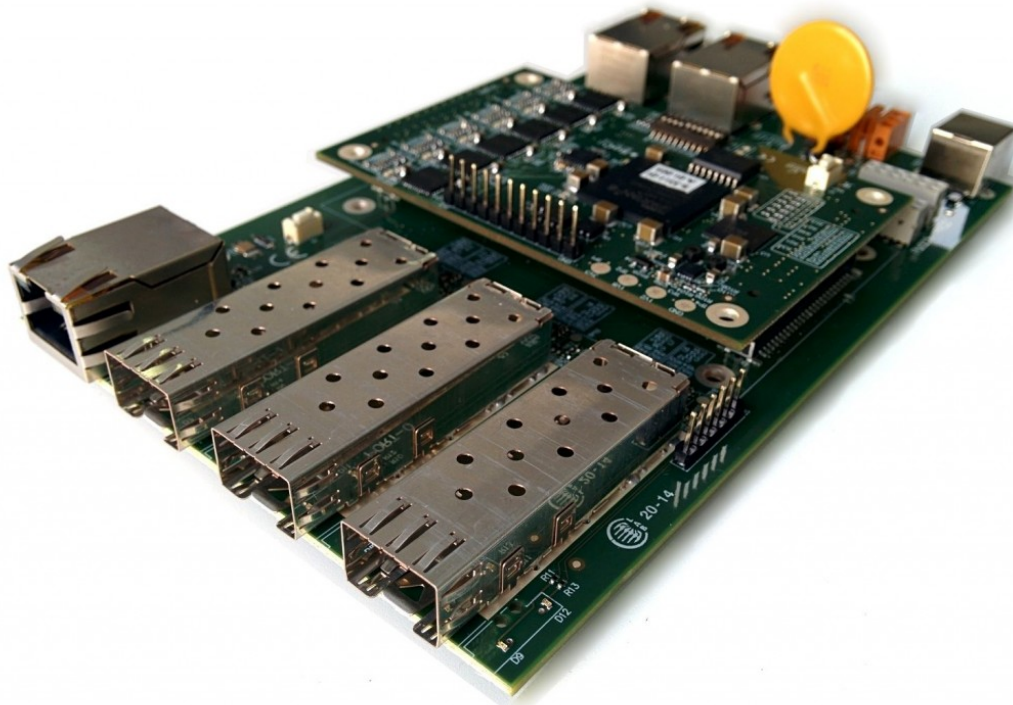
IP Cores

Name	Dev.	Description	Sectors
HSR/PRP *Switch*	S6, Zynq-7S	Redundant Ethernet with IEEE1588	Energy, Transportation, Automation, Aerospace
Unmanaged Ethernet *Switch* (UE*S*)	S6, Zynq-7S	Multiport Ethernet Switch with IEEE1588 Transparent Clock. Combinable with HSR/PRP *Switch*	ISM, Industrial Ethernet, Aerospace
Managed Ethernet *Switch* (ME*S*)	S6, Zynq-7S	Multiport Ethernet Switch with 1588 Transparent Clock, managed (VLAN, manual access to MAC table) Combinable with HSR/PRP *Switch*	ISM, Industrial Ethernet, , Aerospace
Industrial Ethernet IPs	S6, Zynq-7S	Profinet IP, Ethernet IP	Energy, ISM, Wireless
Irig*b* and IEEE 1588-2008 v2 IPs	S6, Zynq-7S	Sub-microsecond synchronization using Ethernet. **Three IPs for different IEEE 1588 modes**	Energy, ISM, Wireless
Full IEEE 1588 solution for Zynq	Zynq	IP an software. Seamless integration with UE*S* for 1588-aware solution on Zynq	Energy, ISM, Wireless

SoC*e* Industrial: Solutions

Modules and Development Platforms

Name		Description	Key features
NET*oem*		Ready to use HSR/PRP/1588 solution for Fast Ethernet **copper**	• 4 integrated Ethernet Phyters •Industrial grade
SMART*oem* family		Ready to use HSR/PRP/1588 solution for Fast Ethernet **copper/fiber**	• Up to 6 integrated Ethernet Combo Phyters •Industrial grade •Compatible (size, pins) with other modules •Design open to customer
NET*Box*		Development-kit and ready to use HSR/PRP **RedBox**	•JTAG, PMODs, •Graphic Display •Industrial grade

SoC*e* Industrial: Solutions

Modules and Development Platforms
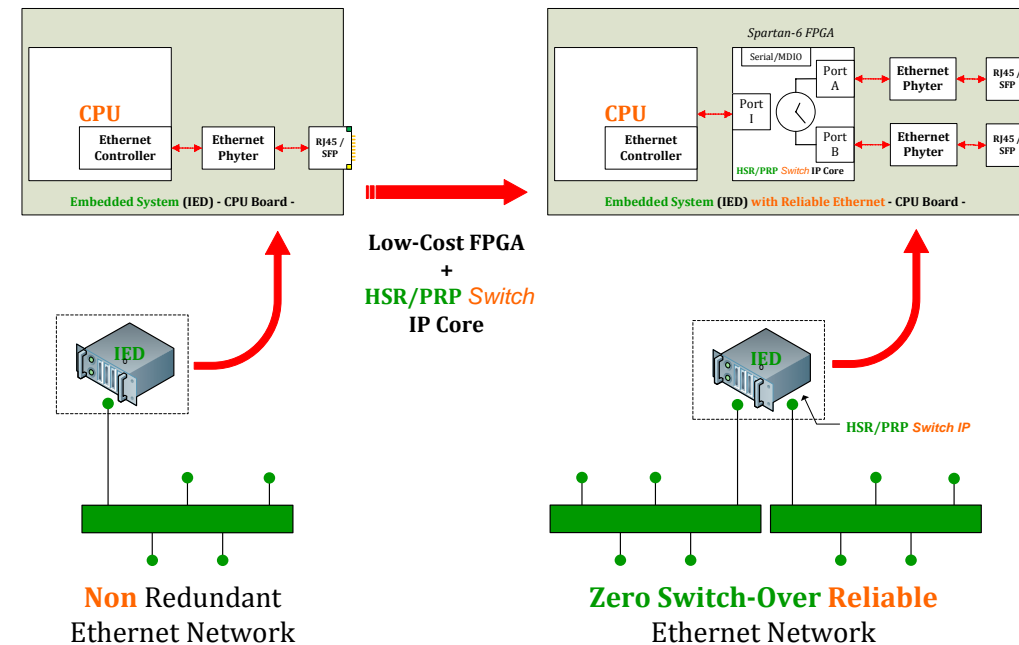
SMART*oem* family

SoC*e* Industrial: Products
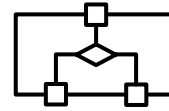
⌗ HSR/PRP *Switch* IP Core

HSR/PRP *Switch* is a HDL IP Core for the implementation of **both the HSR** (IEC 62439-3-Clause 5) and **PRP** (IEC 62439-3-Clause 4) protocols **in a single device**.

- **100M / 1GE / Copper - Fiber**

- **Full IEEE 1588-2008 V2** support

- **Fully scalable** in number of ports and features

- RSTP, VLAN, SNMP, DAN, RedBox, Quadbox

- **Reference Designs** for Spartan-6 and **Zynq** devices

- One-shoot or **Royalty Based** model

CPU
Ethernet Controller
Ethernet Phyter
RJ45 / SFP
Embedded System **(IED)** - CPU Board -

Low-Cost FPGA
+
HSR/PRP *Switch* IP Core

IED

Non Redundant Ethernet Network

Spartan-6 FPGA
Serial/MDIO
CPU
Ethernet Controller
Port I
Port A
Port B
Ethernet Phyter
Ethernet Phyter
RJ45 / SFP
RJ45 / SFP
HSR/PRP *Switch* IP Core
Embedded System **(IED) with Reliable Ethernet** - CPU Board -

IED
HSR/PRP *Switch* IP

Zero Switch-Over Reliable Ethernet Network

SoC*e* Industrial: Products

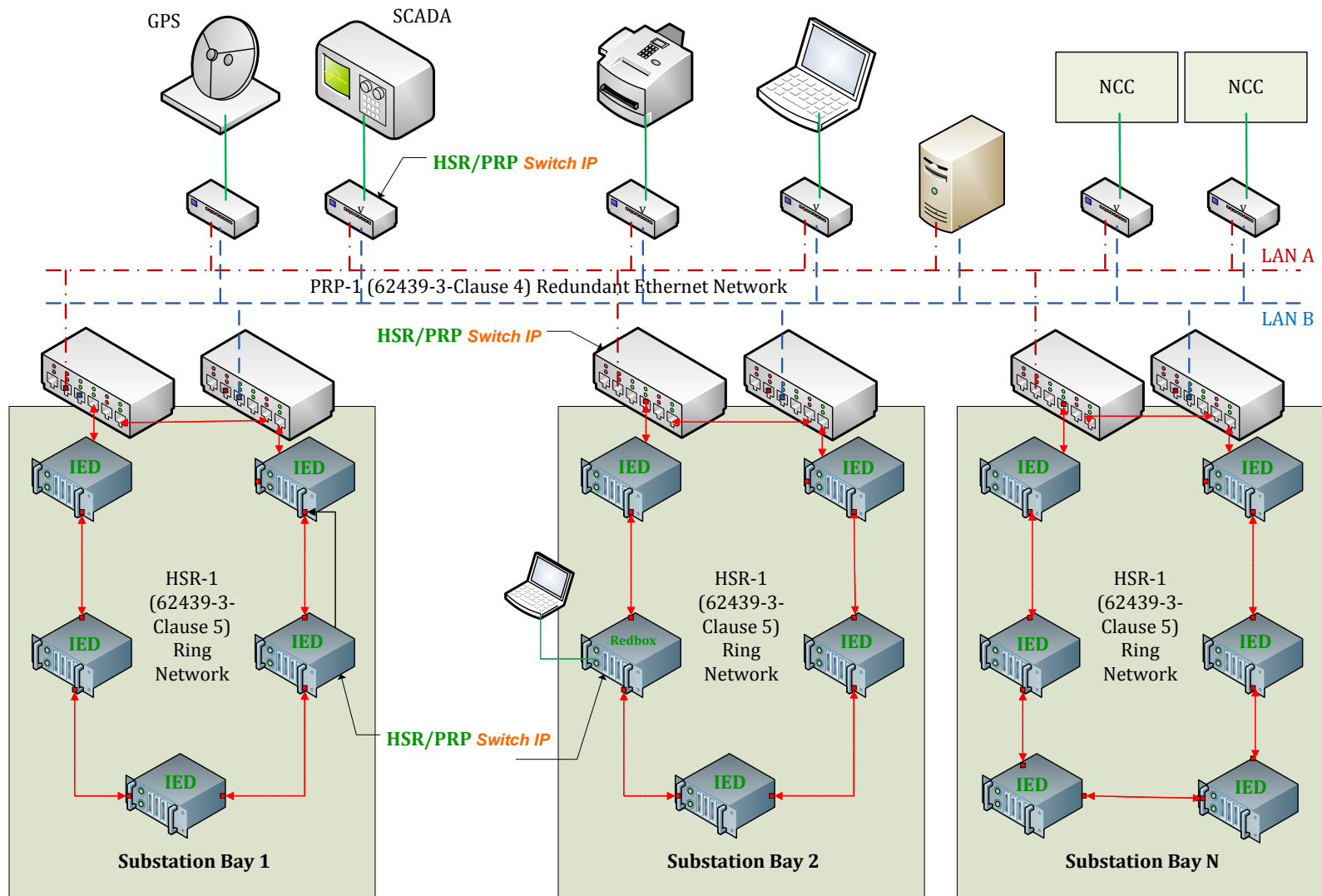❖ **Unmanaged Ethernet *Switch* (UES) IP Core**
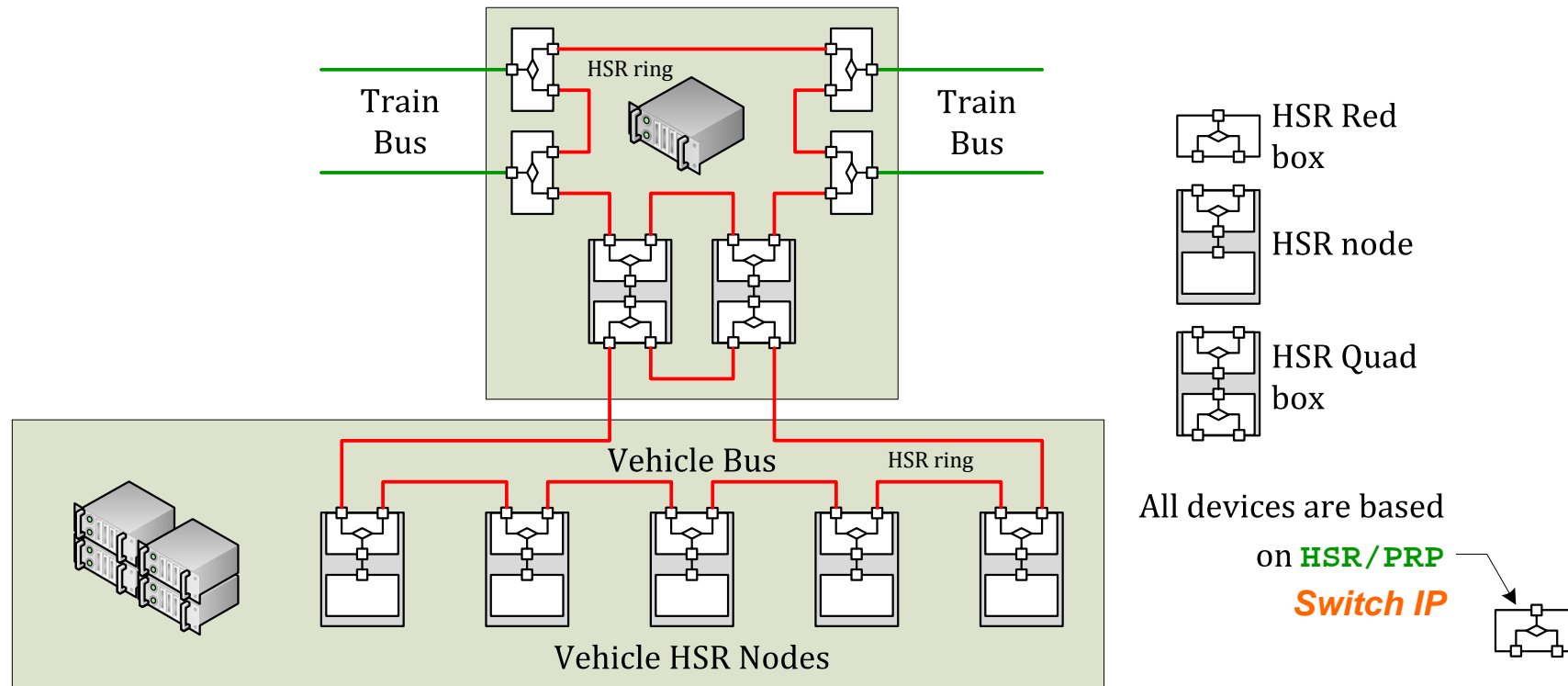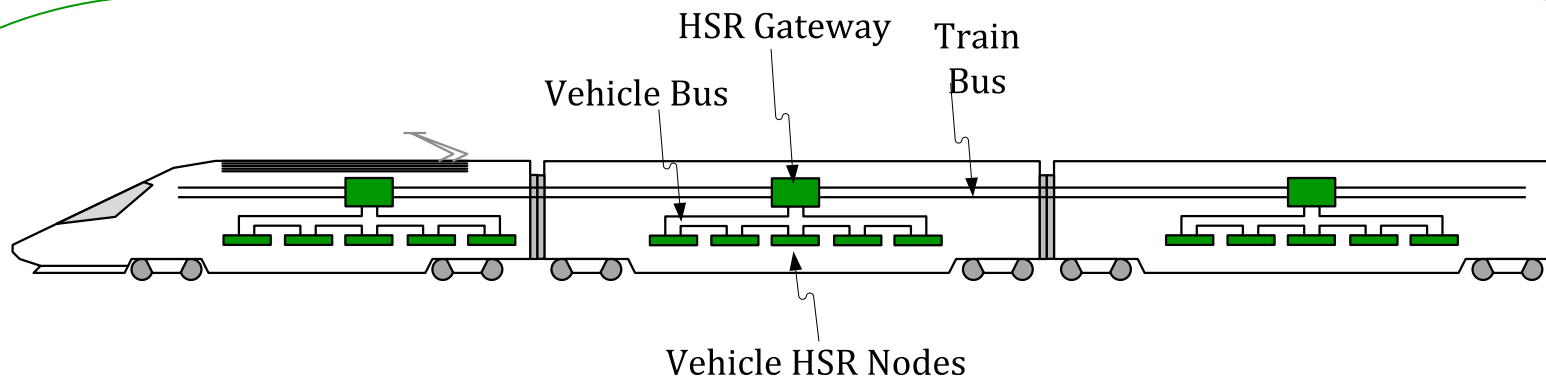
Key features:

UES IP core key features:

- **High Performance Ethernet Switch :** Full-crossbar matrix among ports implemented to allow maximum throughput

- **IEEE 1588 Transparent-Clock support**

- **Plug-and-Play:** No configuration required

- **Extensible:** Zynq version available

- **Flexible:** Fully scalable and configurable to obtain the best functionalities-size trade-off. The following parameters are available for the designer:
  - Number of ports
  - MAC address table length
  - Buffers queue length
  - IEEE Transparent Clock functionalities

- Combinable with **HSR/PRP *Switch* IP Core**

SoС*e* Industrial : (case of use 1)

GPS
SCADA
HSR/PRP *Switch IP*
NCC   NCC

LAN A

PRP-1 (62439-3-Clause 4) Redundant Ethernet Network

LAN B

HSR/PRP *Switch IP*

| IED | IED |

HSR-1 (62439-3-Clause 5) Ring Network

| IED | IED |

| IED |

HSR/PRP *Switch IP*

Substation Bay 1

| IED | IED |

HSR-1 (62439-3-Clause 5) Ring Network

Redbox | IED |

| IED |

Substation Bay 2

| IED | IED |

HSR-1 (62439-3-Clause 5) Ring Network

| IED | IED |

| IED | IED |

Substation Bay N

Case of use 1.: ELECTRIC SUBSTATION AUTOMATION: Process-Bus implemented using HSR and Station and Inter-bay Buses using PRP

HSR Gateway

Train Bus

Vehicle Bus

Vehicle HSR Nodes

Train Bus

HSR ring

Train Bus

Vehicle Bus

HSR ring

Vehicle HSR Nodes

HSR Red box

HSR node

HSR Quad box

All devices are based

on **HSR/PRP**

Switch IP

CASE OF USE 2: **TRANSPORTATION**: Train Bus and Vehicle Bus implemented using HSR

SoC*e* Industrial : (case of use 2)

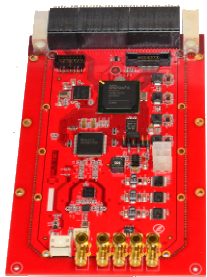# **SoC***e* **Product Portfolio:** **Rugged**

High Performance Embedded Computing
for Critical Systems
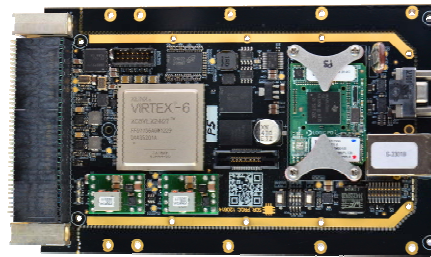
Lab*VPX* and
Light*VPX* chassis

Software-Defined Radio and DSP 3U VPX
boards:

SDR*tx*
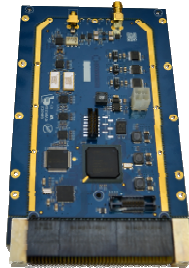
SDR*rx*

SDR*proc*

SoCe

System-on-Chip *engineering*, S.L.
Zitek Bilbao - ETSI
Alda. Urquijo s/n
48013-Bilbao (Bizkaia)
Spain

Phone: +34 944420700
E-mail: industrial@soc-e.com
WEB: www.soc-e.com