SoCe

System-on-Chip engineering

- The SoCe Difference -

FPGA based Solutions for Communications in Critical Systems
The SoCe Difference: Innovation for Your Advantage

• SoCe offers technology based on reconfigurable devices (FPGAs) and specialized design services for Energy, Defense and Aerospace Sectors

• SoCe 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)

• SoCe FPGA boards are designed for High Performing Embedded Computing in rugged critical systems (Software-Defined Radio, Electronics Intelligence, etc.)
The **SoCe** Difference: Eco-System (Technology Partners)

- **SoCe** Headquarters (Bilbao) - [http://www.soc-e.com](http://www.soc-e.com)
- **Xilinx** - Alliance Program Member
- **Reconfigurable Technology Vendor** - Worldwide leader (San José - USA)
- **UCA** - International Users Group
- **Corporate Member** - Raleigh – USA
- **SMT Mounting Partner** - Tecnicas Electronicas Reunidas S.L. (Vitoria - Spain)
- **Aerospace Technology** - (Madrid - Spain)
- **Universities and Research Centers** - (Basque Country)
The SoCe Difference: Interoperability Events

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

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

- **IEEE 1588:**
  - Munich (Germany) ISPCS 2011. Product validated: Precise Time Basic on S6.

- **IEEE awarded SoCe & UPV/EHU Zynq HSR/PRP:**
  - Vienna (Austria) IECON 2013. “System-on-Chip Implementation of Reliable Ethernet Networks Nodes“
The SoCe 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

**SoCe 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)"

  - "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"
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

<table>
<thead>
<tr>
<th>Name</th>
<th>Dev.</th>
<th>Description</th>
<th>Sectors</th>
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</thead>
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<tr>
<td><strong>HSR/PRP Switch</strong></td>
<td>S6, Zynq-7S</td>
<td>Redundant Ethernet with IEEE1588</td>
<td>Energy, Transportation, Automation, Aerospace</td>
</tr>
<tr>
<td><strong>Unmanaged Ethernet Switch (UES)</strong></td>
<td>S6, Zynq-7S</td>
<td>Multiport Ethernet Switch with IEEE1588 Transparent Clock. Combinable with <strong>HSR/PRP Switch</strong></td>
<td>ISM, Industrial Ethernet, Aerospace</td>
</tr>
<tr>
<td><strong>Managed Ethernet Switch (MES)</strong></td>
<td>S6, Zynq-7S</td>
<td>Multiport Ethernet Switch with 1588 Transparent Clock, managed (VLAN, manual access to MAC table) Combinable with <strong>HSR/PRP Switch</strong></td>
<td>ISM, Industrial Ethernet, Aerospace</td>
</tr>
<tr>
<td><strong>Industrial Ethernet IPs</strong></td>
<td>S6, Zynq-7S</td>
<td>Profinet IP, Ethernet IP</td>
<td>Energy, ISM, Wireless</td>
</tr>
<tr>
<td><strong>Irigb and IEEE 1588-2008 v2 IPs</strong></td>
<td>S6, Zynq-7S</td>
<td>Sub-microsecond synchronization using Ethernet. <strong>Three IPs for different IEEE 1588 modes</strong></td>
<td>Energy, ISM, Wireless</td>
</tr>
<tr>
<td><strong>Full IEEE 1588 solution for Zynq</strong></td>
<td>Zynq</td>
<td>IP an software. Seamless integration with <strong>UES</strong> for 1588-aware solution on Zynq</td>
<td>Energy, ISM, Wireless</td>
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## Modules and Development Platforms

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEToem</td>
<td>Ready to use HSR/PRP/1588 solution for Fast Ethernet <strong>copper</strong></td>
<td>• 4 integrated Ethernet Phyters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Industrial grade</td>
</tr>
<tr>
<td>SMARToem family</td>
<td>Ready to use HSR/PRP/1588 solution for Fast Ethernet <strong>copper/fiber</strong></td>
<td>• Up to 6 integrated Ethernet Combo Phyters</td>
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<td></td>
<td></td>
<td>• Industrial grade</td>
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<tr>
<td></td>
<td></td>
<td>• Compatible (size, pins) with other modules</td>
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<td></td>
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<td>• Design open to customer</td>
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<tr>
<td>NETBox</td>
<td>Development-kit and ready to use HSR/PRP <strong>RedBox</strong></td>
<td>• JTAG, PMODs,</td>
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<tr>
<td></td>
<td></td>
<td>• Graphic Display</td>
</tr>
<tr>
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<td>• Industrial grade</td>
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</tbody>
</table>
Modules and Development Platforms

SMARToem family
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
Unmanaged Ethernet Switch (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
Case of use 1.: ELECTRIC SUBSTATION AUTOMATION: Process-Bus implemented using HSR and Station and Inter-bay Buses using PRP
CASE OF USE 2: TRANSPORTATION: Train Bus and Vehicle Bus implemented using HSR

SoCe Industrial: (case of use 2)
High Performance Embedded Computing for Critical Systems

Software-Defined Radio and DSP 3U VPX boards:

SDR\textsubscript{tx}  
SDR\textsubscript{rx}  
SDR\textsubscript{proc}  
Lab\textsubscript{VPX} and Light\textsubscript{VPX} chassis