7S Industry for Science (I4S)

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Outline

1. Introduction to the company: 7S services and products. Industry for Science. Capacities and expertise
2. Open Hardware motivation for 7S
3. Open Hardware: pros and cons
4. Discussion
Introduction to the company:

7S SERVICES AND PRODUCTS
7S expertise

- Technology based company specialized in:
  - Embedded software and hardware
    - High performance PCB design
    - Firmware (Efficient DSP/GPU, microcontrollers and FPGA programming).
    - Safety-critical and dependable system design (certification)
  - Reconfigurable hardware (FPGAs)
    - High performance design techniques
    - SoC and Codesign
    - IP-core design
    - High-level synthesis
  - Real-time signal processing
    - Real-time data analytics
    - Computer data processing algorithms acceleration
    - Embedded data processing system
Company products & services

IPcores

FPGA based boards

Biomedical portable systems for low vision
Company products & services

- **Products**
  - Own FPGA platforms: able to design FPGA processing boards and systems (XircaV4, S400, SB)
  - Custom electronic products: PCB design (general electronics).
  - IP cores (on-chip architecture, IP-core design and verification).

- **Services**
  - High-tech consulting & Advanced technical training
  - Electronics boards design and fabrication
  - Embedded and real-time software development
  - **HW/SW Certification** (DO-254, DO-178, IEC-61508 or IEC-26262)
Collaboration policy

• Subcontracting policies. Towards a service beyond subcontracting.
  – Open design and support for the customer (all materials are provided for the customer to make the full design available)
  – Flexibility in specifications and design cycle
  – Context of the design: Assimilation of previous designs by the customer.
7S Company

• Industry for Science
• Participation in diverse research projects (subcontracted by research institutions or as partners → RECOMP (EU grant), etc..

• Working team: high ratio of specialized Engineers and doctors.

Passion for challenges!
1) **VIRTEX-4 FPGA** (XC4VFX100-10FFG1152).
2) 2 independent banks of **DDR SDRAM** (512Mb).
3) 4 Pipelined **SRAM** memory chips 72-Mbit.
4) 1 **PCI Express** port 1x.
5) 2 tri-speed **Ethernet PHY transceiver** 100/1000.
6) 8 SMA connectors connected to 2 **Rockets IO**.
7) 20 expansion pins.
8) 1 RS-232 Serial port.
9) 1 User clock, 100 MHz and 125 MHz.
10) 2 LEDs y 2 push buttons.
11) 2 Flash memories (32MB) connected to CPLD.
12) CPLD to arbitrate the local bus.
13) 4-Kb IIC EEPROM.
14) 1 JTAG configuration port.
15) 1 LCD display: 2 lines x 8 characters.
16) 1 Buzzer.
17) IIC Fan Controller.
Xirca V4

Technical characteristics

- **12 layers**
  - (6 planes and 6 routing layers)
- Minimum separation between paths: **0.095mm**
- **1.6 mm thickness**
- **3654 drills**
- **9 different internal voltages**
- Encapsulated technology used:
  - **Flip Chip BGA (FF1152)**, separation 1.0mm
  - **CSP (Chip Scale Package)**, separation 0.5mm
  - **TSSOP, TQFP**, separation 0.6mm
Technical Characteristics

- **Controlled impedance** (DDR, ZBT, Ethernet Gigabit, PCI-express, MGT RocketIO...):
  - 50 ohms (single traces).
  - 100 ohms (differential pairs).
- Signal Integrity simulations (Hyperlynx):
  - LineSim
  - BoardSim
  - Ussing IBIS models
- **Paths length control** (DDR, Differential pairs).
IP Cores design

• High expertise on FPGA IP cores design.
  – VHDL/Verilog for circuits description.
  – High level languages descriptions based on ImpulseC or SystemC for improving productivity and time-to-market.

• Testbenches for verification.
  – Monitoring mechanisms are also possible in case of requiring test during run-time.

• Accurate functional software models for accuracy validation (including bit-width quantization analysis if necessary).

• IP cores generation & docs for certification purposes.
WR6 board: under development

- Collaboration with CERN (tractor institution).
- High performance Virtex-6 platform (XC6VLX130T, XC6VLX240T and XC6VLX365T chips)
  - ARM processor (AT91SAM9263) included for software engineers productivity acceleration.
  - Specifically designed for high speed connectivity.
  - Large number of IOs availables for peripheral boards.
  - Dependable platform → certification

- **It will be available as an open hardware platform on Q1 2012!**

- Please contact us for additional information
Industry for Science
Creating Technology
SEVEN SOLUTIONS AT
OPEN HARDWARE
OH motivation for 7S

• 7S created its own products in its first stage (2007)
  – High performance data processing boards based on FPGAs

• 7S had little success with this kind of products
  – No powerful/international commercial/marketing effort
  – Technology is only 20% (maximum) of business success (who you know, where your are ...; are important success opportunity factors)
Learn fast or die

• Thus “we were open to open hardware”
  – Provided that design cost were covered (by subcontracting or as post-design provider with certain guarantees)

• We think now even in opening our “own products” to gain major visibility
Open Hardware

• Several Advantages
  – General Hardware design forum/niche (OHR). Necessities meet engineers addressing shared designs.
  – For small engineers based companies. Reduction of engineer idle times.
  – Access to other developments beyond your company expertise.
    – For instance White Rabbit includes embedded software, HDL, PCB. Seven Solutions have been mainly responsible of PCB board but it has access to the whole project material.
Open Hardware

• Disadvantages
  – Too dynamic environment. Some companies pop in and pop out.
    – There is no integral product maintenance, unless a company interiorized all the subparts of a global project.
  – Quality certification and trust.
    – The design may have been distributed, therefore even if there are traceability marks, global quality is difficult to assess. **This needs an initial pioneer customer** (such as CERN to gain credibility of usage).
  – Different Inter-companies interdependencies. Beyond a *joint venture*. 
Walking together makes friends

• First joint venture:
  – White Rabbit relationship between partners is rather central
    – Through CERN.
    – Future ventures you know better each other, preferred roles and technological competences
  – Will this lead to future joint ventures?
    (there is the danger of heavier paper / bureaucracy load for a distributed effort than for a single large company)
Different motivations for OH

• A **small company** may want to gather higher visibility by opening its designs (for instance, 7S is thinking about making open FPGA high performance processing platforms)

• A **research institution** may want industrial partners to support its developments. Support for external customers is not an easy task for a research partner

• A **research institution** may want to spread its developments to the general community. Close intellectual property may not have sense without exploitation plans or partners
Need of an exploitation plan

- Potential roles of companies:
  - Active designers
  - Actual vendors (though not always original designers)
  - Customization
  - Broader support
  - Active role in searching for new application fields beyond research
A general community may help to regularize manpower and engineering workload.
Buisness model beyond design

• Exploitation of the White Rabbit technology
• Support of equipments
• Spread technology to other application fields (here larger companies with own market play a key role)
• Customization of open hardware designs
  – For instance, Seven Solutions (7S) is trying to test the White Rabbit hardware in the framework of safety critical systems (in RECOMP EU project)
Open Hardware. Discussion

Pros and cons

– Motivation for research institutions (external support and know-how spread)

– Potential roles of companies (active designers, actual fabrication and vendors, support, exploration of other application fields)

– Need of a tractor institution:
  • May partially or totally fund the design process (know how development)
  • First pioneer customer assess credibility on the whole product
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