Dal seminterrato... alle stelle...

Sistemi Embedded basati su tecnologia FPGA, esempi e applicazioni

Milano, 28/10/2010

SanitasEG
DIGITAL SYSTEMS, RESEARCH AND INNOVATION

La Società

- Società di Ricerca&Sviluppo
- Dal 2000 nel mercato dei sistemi embedded
- Applicazioni scientifiche, telecom, industriali per videosorveglianza, avioniche e spaziali
- Collaborazioni scientifiche e tecnologiche
  - Partner storico del gruppo di ricerca COmputing SYstems for SPACE (COSYSpace) dell'INAF (Istituto Nazionale di Astrofisica)
  - Politecnico di Torino
  - Università di Milano
  - INFN
- 8 progettisti

Sinergia

Sanitas EG

- Studi di fattibilità
- Applicazioni industriali, telecom, avioniche, videosorveglianza e spaziali
- Prototipi di piattaforme HW(FPGA, DSP, micro processori)
- System on chip su FPGA
- Sviluppo PCB
- Firmware e software

risultati pubblici della ricerca

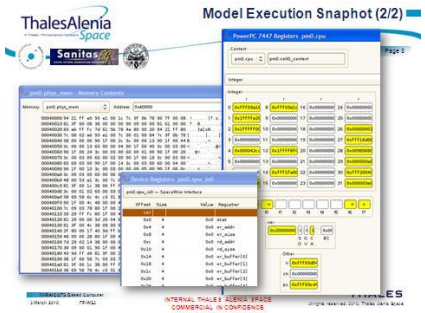
know-how tecnico

INAF

- Ricerca di base ed applicata
- Seminari e laboratori universitari
- Sistemi e modelli di calcolo
- Applicazioni spaziali
- Effetti delle radiazioni e testing

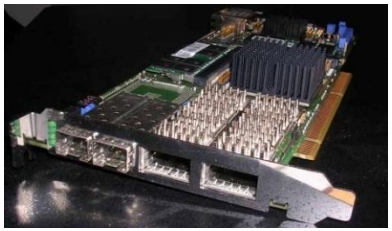
Alcuni successi

- Model of the Hi-Reliable COTS Based Computer platform by using the SIMICS simulator. The virtual platform is based on the PowerPC 7447/7448

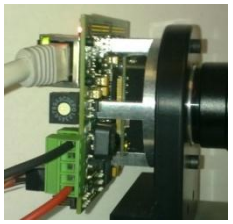


- Megapixel CMOS Ethernet camera for security and surveillance applications (2008-2010)

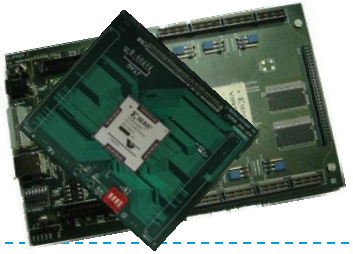
- 10 GBit Ethernet Board for QoS and IDS (2008-2006)



- CCD readout electronics for industrial applications (2009)



- System for SEU fault emulation in SRAM FPGAs (INAF collaboration for ESA)



- Hardware platform for Siderale experiment (2009)
- Hardware platform for Radiation Testing - ESA contract (2007, 2008)
- Avionic module in FPGA (2004)
- FPGA design flow compliant with a specific avionic standard (2004)
- Hardware platform for radiation testing - ASI research grant (2001-2003)
- Frame grabber for industrial applications (2003)
- Multi-Axial Controller for industrial applications (2002)
- Multimedia Controller IP Core development and prototyping (2000)

Due esempi di sistemi embedded

Videosorveglianza: Megapixel Eth camera

- Hardware:
  - CMOS
  - FPGA
  - DSP
- Software
  - Applicazioni FPGA
  - Driver di acquisizione su DSP- ARM
  - Porting di Linux

Sistemi per le reti: 10 GEthrnet Board

- Hardware
  - Interfacce 1-10G Eth
  - Interfaccia PCIX
  - FPGA con PPC
  - Memorie DDR2 e TCAM
- Software
  - Comprocessore per PPC
  - Programmazione in C SOC
  - Interfaccia driver PCI

Megapixel: the challenge

Megapixel PRO:

High definition and great detail

Full digital tecnology

IP interface

Megapixel CONS:

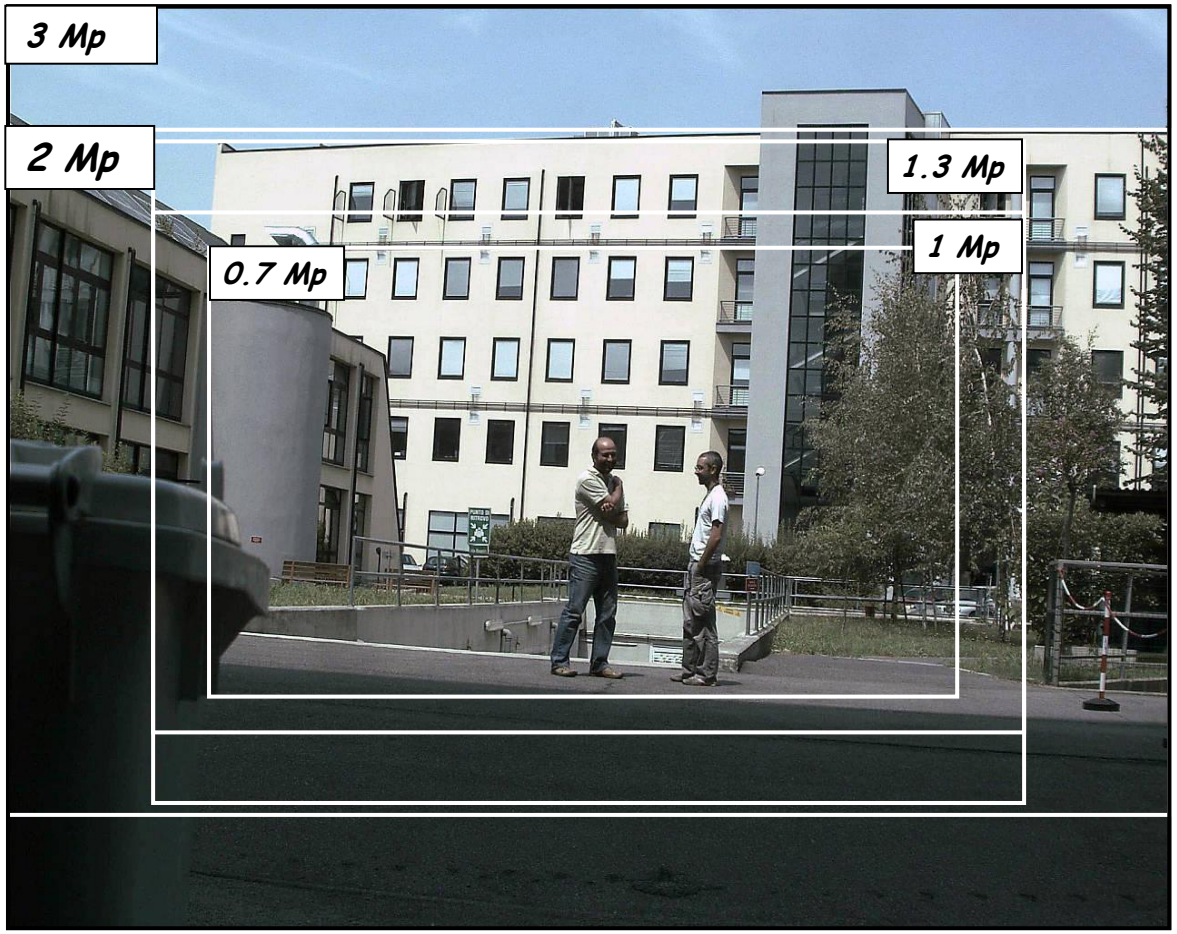
High bandwidt

Large storage units

Higher cost (resp. to analog)

Gigavision approach:

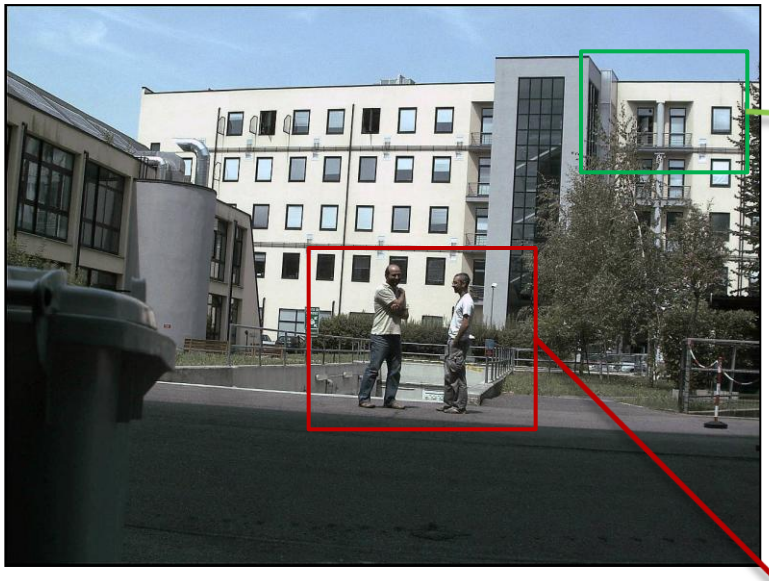
Context based Multiflux



Megapixel Image

Context based Multiflux

Complete scene: resized to 1 MP 10 fps



Area of interest 2: CIF 10 fps

Area of interest 2: VGA 25 fps

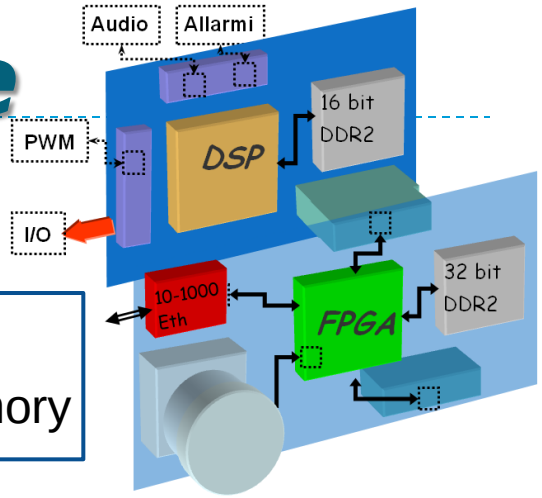
Complete scene:

- On board analitycs identifies areas of interest

Areas of interest

- On camera dynamic position selection
- Separated video streaming (codec selectable)
- Full resolution and adaptive exposure
- Selectable frame rate

Harrier Eye: architettura dual stage



HI RES CMOS

256 Mbyte DDR Video Memory

256 Mbyte System Memory

HW Analitics

Video acq Engine

Sensor control

Metadata

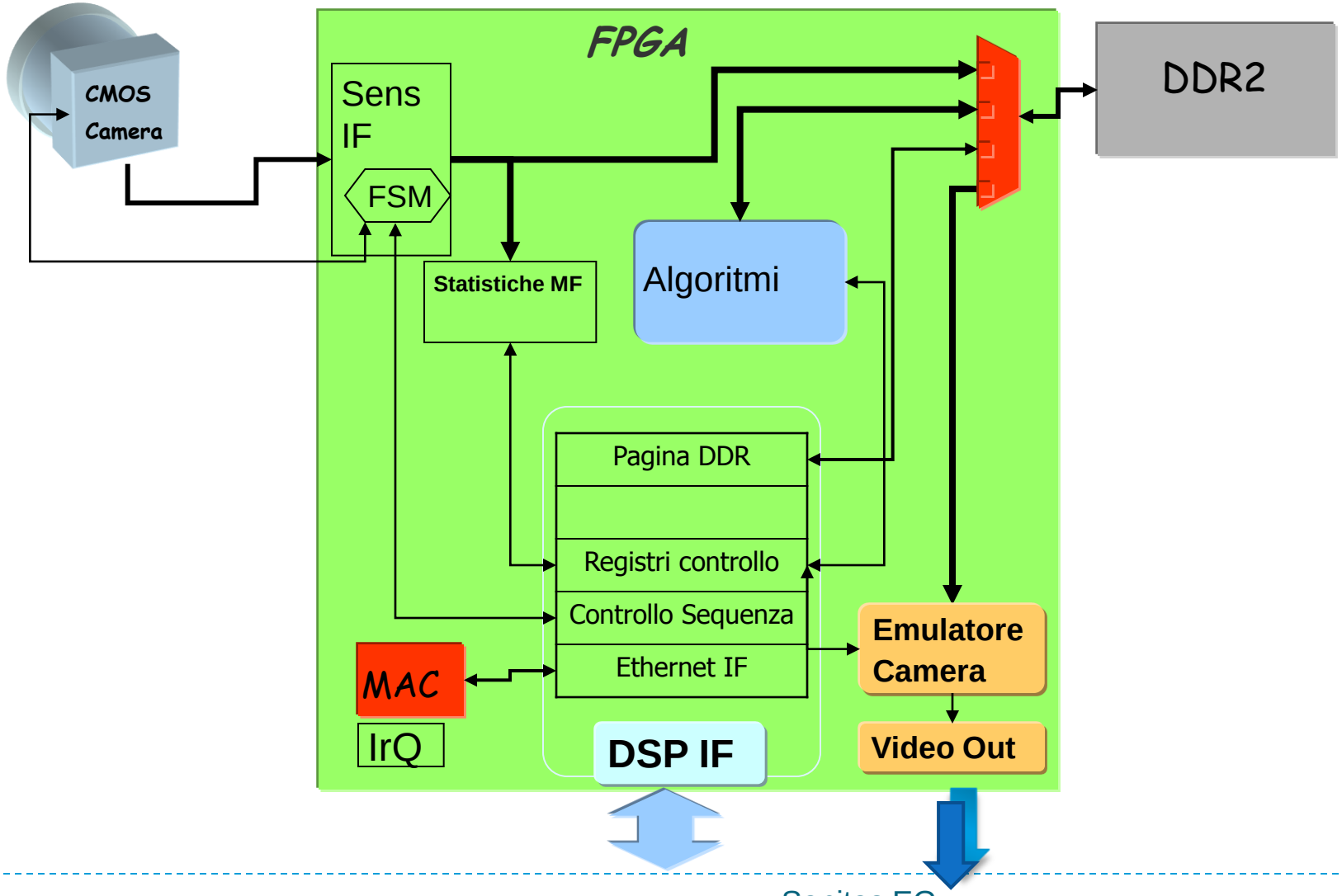
Video

DSP:
Video Compression
Software analitycs
User interface

First stage: custom Hardware + dedicated high speed memory

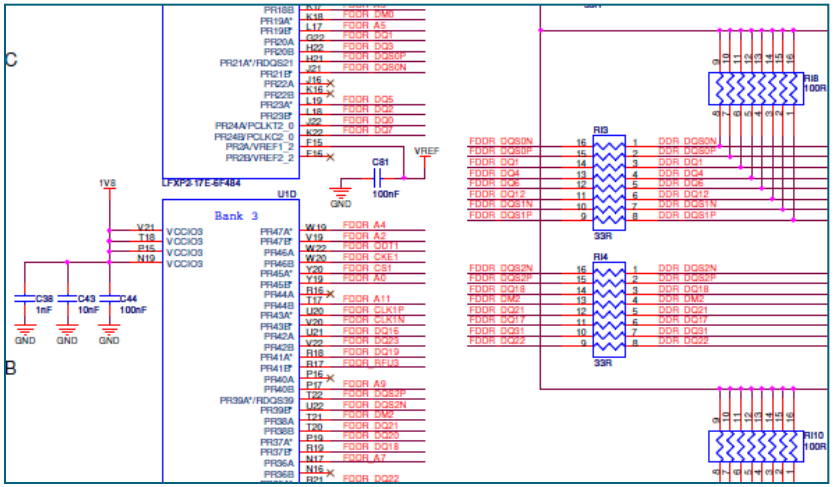
Second stage: standard DSP + dedicated software (acquisition interface and high level analitycs)

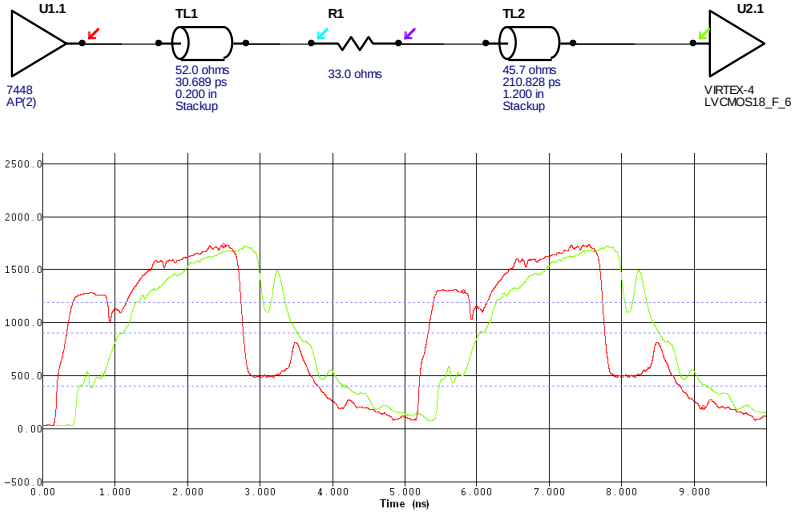
Architettura Piattaforma FPGA

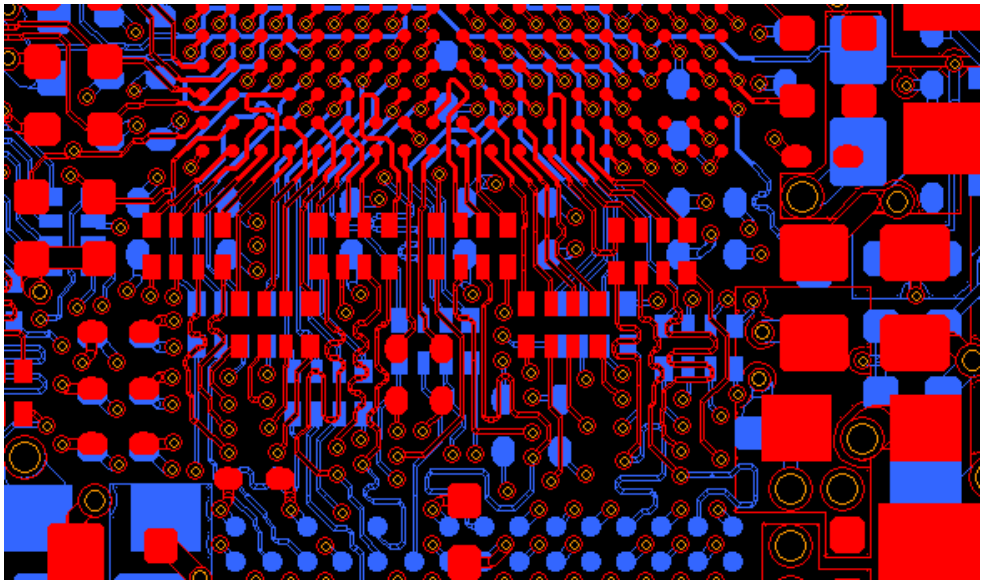


Progettazione elettronica

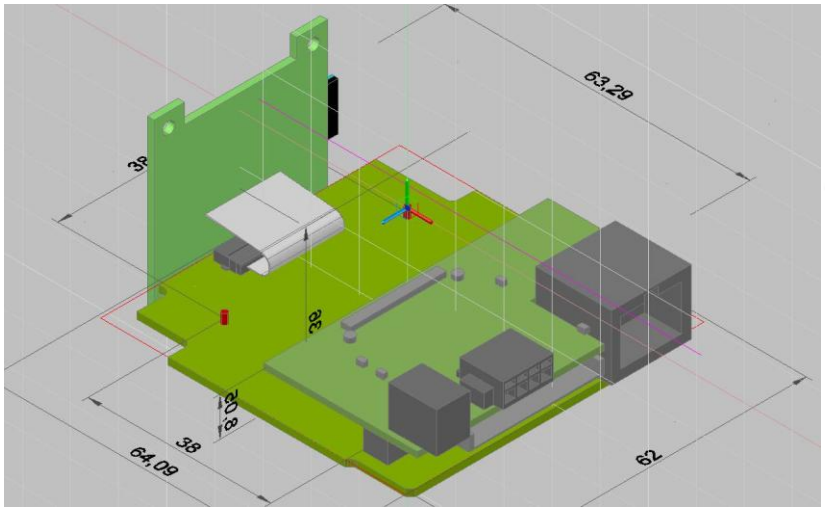
- Schemi elettrici
- Layout
- Programma di collaudo

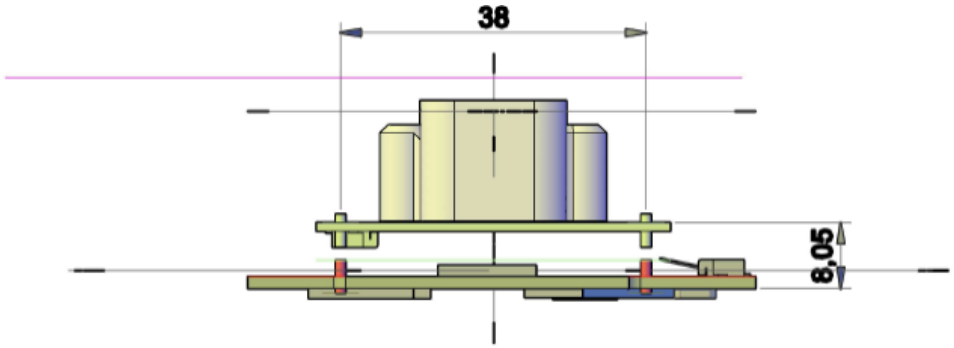


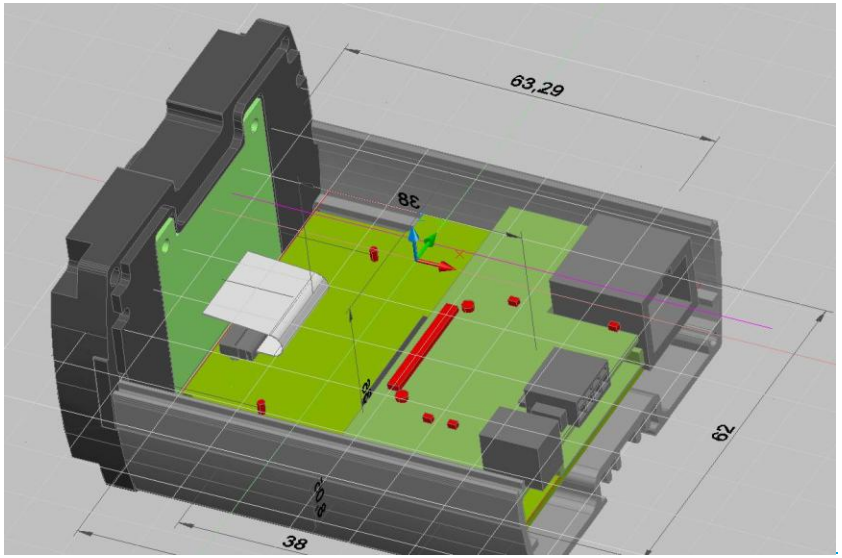


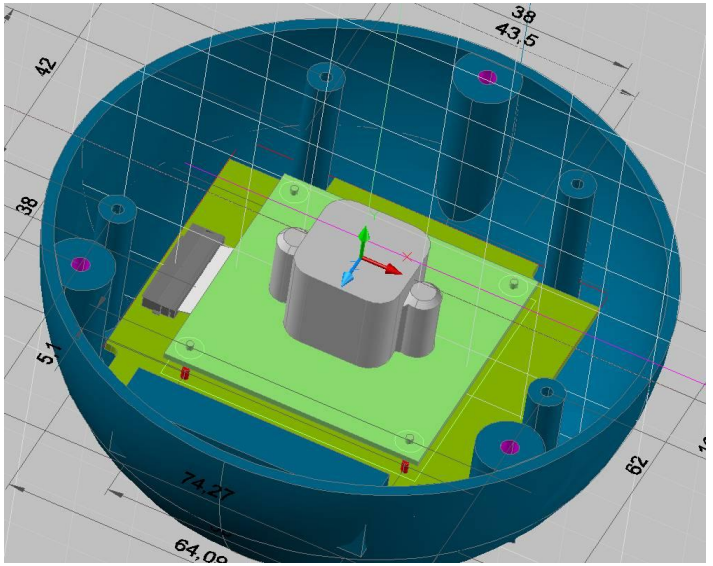


Realizzazione del prodotto





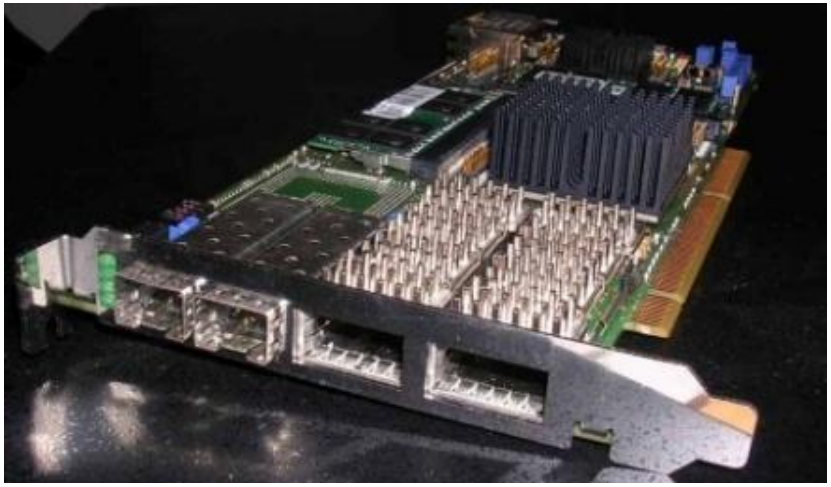


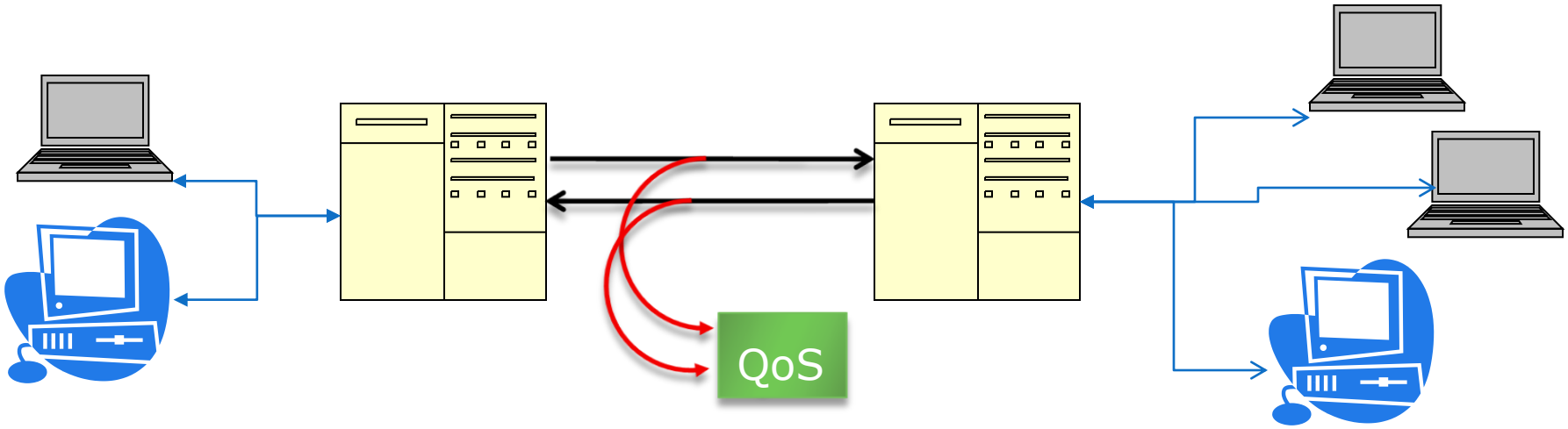


Produzione e vendita

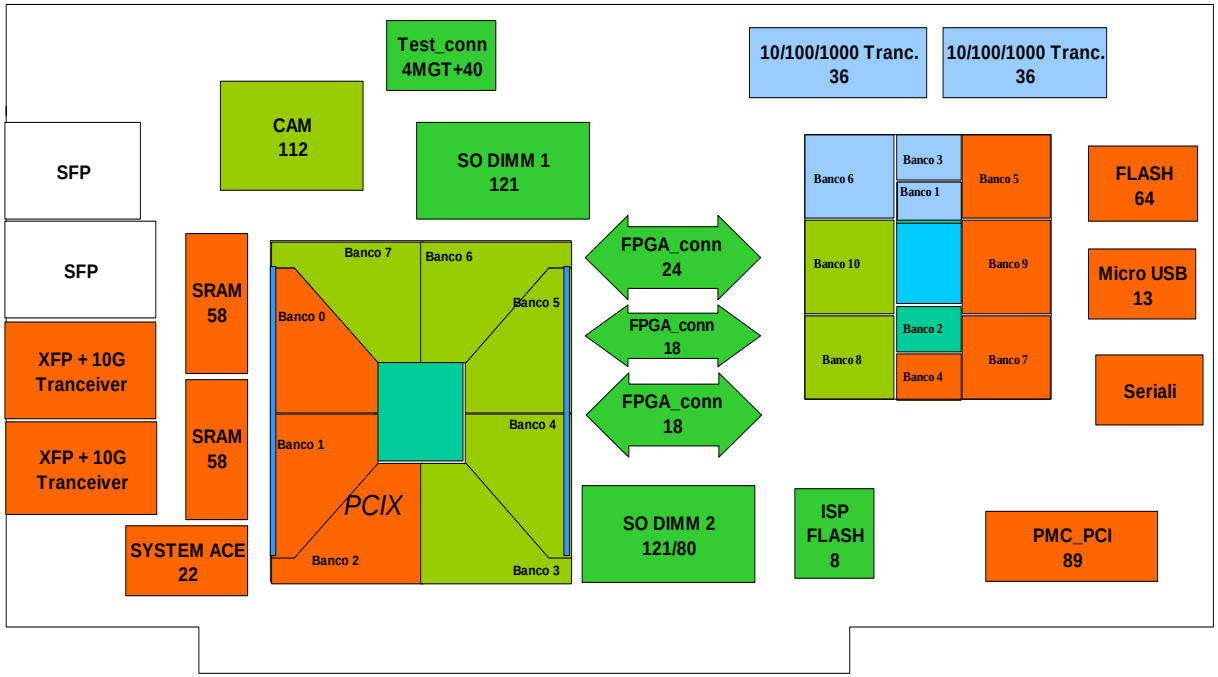
10 GEthernet PCIX Board

- Analisi QoS (Qality of Service) in linea
  - Grande quantità di dati
  - Bassa latenza sulla linea





Architettura della scheda

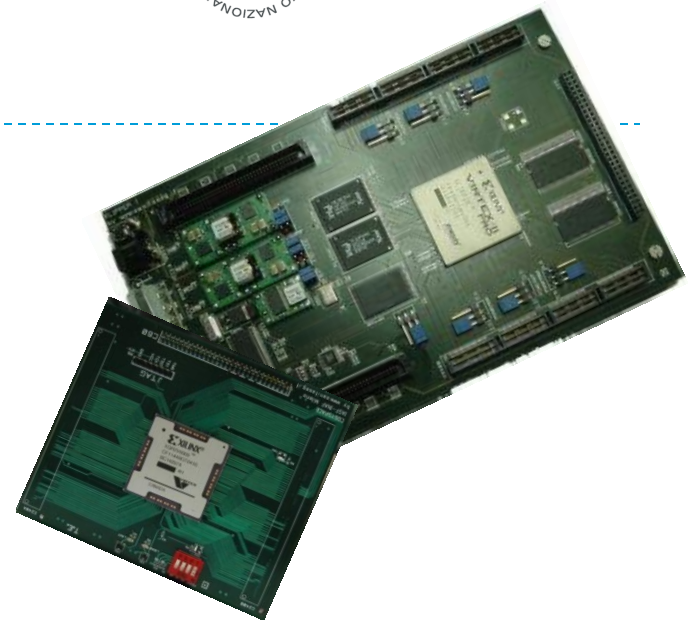


- FPGA V2P50
  - PPC integrati
- FPGA V4
- 2 SODIMM
- 2 10G XFP
- 2 1G SFP
- PCIX 133 Mhz
- TCAM
- FLASH/SRAM
- PMC PCI

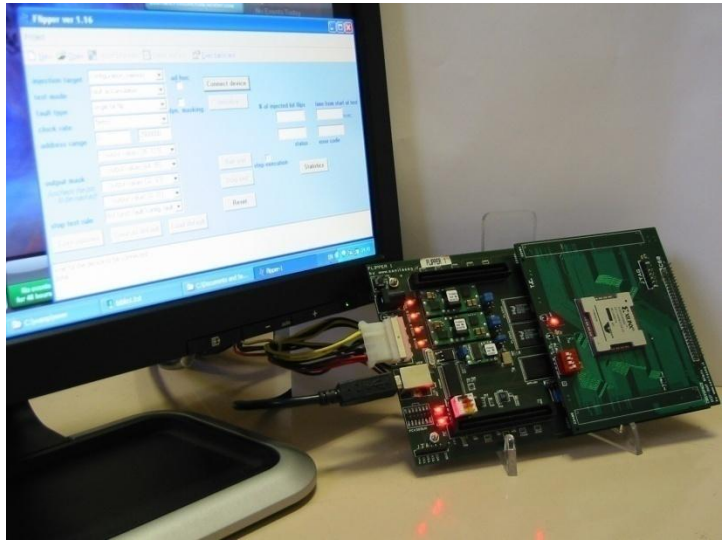
Principali Tecnologie di progetto

- Eth camera
  - Interfaccia CMOS/CCD
  - GEthernet data link
  - PCB HIGH SPEED design
  - Alimentatori DC-DC integrati (icluso PoE)
  - DSP UBL & UBOOT
  - Driver VIDEO LINUX
- 10G Eth Board
  - Interfacce 10G Eth
  - Interfacce 1G Eth ottico/rame
  - Interfaccia PCIX
  - Interfaccia Multiporta DDR2
  - Interfaccia TCAM
  - Integrazione PPC 405 e 440
  - Utilizzo debugger Lauterback

FLIPPER

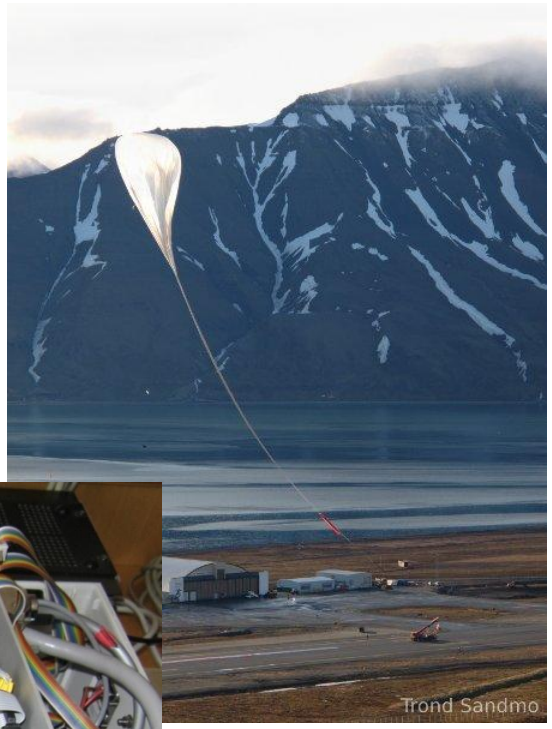


- Hardware platform and a software application running on a PC
- Bit-flip injections within the FPGA configuration memory by means of partial re-configuration
- DUT device: XQR2V6000 hosted on a piggy-back board
- Test vectors and reference values imported by the software application from an external HDL simulator
- Funded by ESA



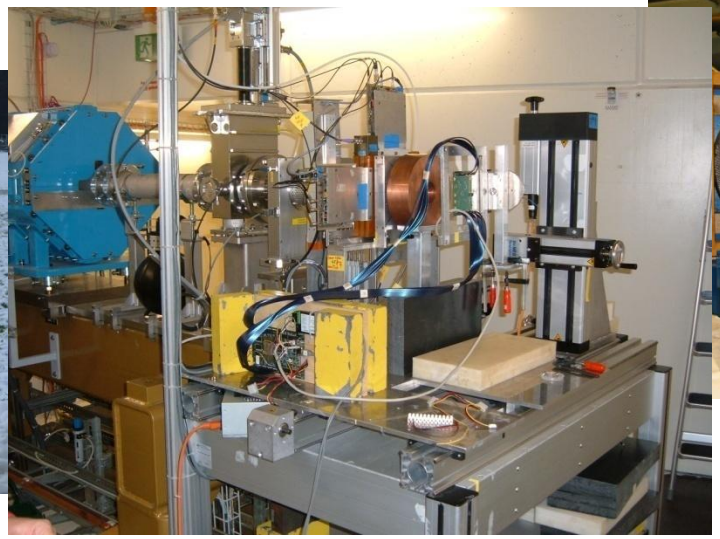
SIDERALE

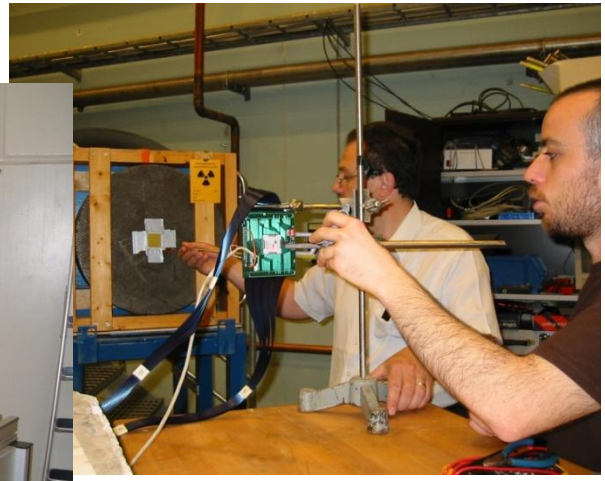
- Piggy back payload a bordo della missione ASI SoRa (So-unding Ra-dar), Svalbard, Luglio 2009
- Realizzazione della piattaforma per il volo partendo da un prototipo di laboratorio (Astrosiesta di Sergio D'Angelo 08/10/09)



Test di irraggiamento

- Realizzazione della piattaforma per il test in acceleratore
- Conduzione delle prove
  - SIRAD, LNL, Padova, 2004
  - Uppsala, Svezia, 2007
  - PSI, Svizzera, 2008





Attività future di collaborazione

- Nuova versione di FLIPPER

  Contratto ESA

- Scheda processore per HiRel on board system

  Contratto THALES Italia "  "

GRAZIE!