



<http://www.axiom-project.eu>

# The AXIOM Project

## (Agile, eXtensible, fast I/O Module)

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# Project Consortium

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# Outline

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- Introduction
- Project Objectives
- The AXIOM HW Platform
- The AXIOM Programming Model
- Application Domains
- Conclusions

# Introduction

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- New, 3-year project
- Started in February 2015
- Consortium
  - 3 academic partners
    - University of Siena, BSC, FORTH
  - 4 industrial partners
    - Evidence, Herta Security, SECO, VIMAR

# Project Objectives

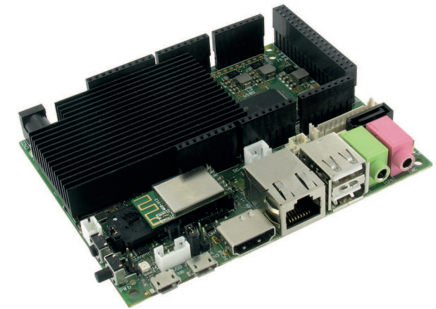
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- Flexible, energy efficient and modularly scalable small/affordable ARM + FPGA board
- Multi-core+Acceleration+Multi-board programmability with the OmpSs
- Arduino shields for interfacing with the Cyber-Physical (CPS) world
- Aimed contribution to standards (OpenMP, SGET)

# Project Objectives (cntd)

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- UDOO development board
  - Funded by two partners
  - ARM quad-core, Arduino 2 I/F
- AXIOM will push further this idea
- **Goal: European-designed and -manufactured single board computer: The heart of future smart applications**



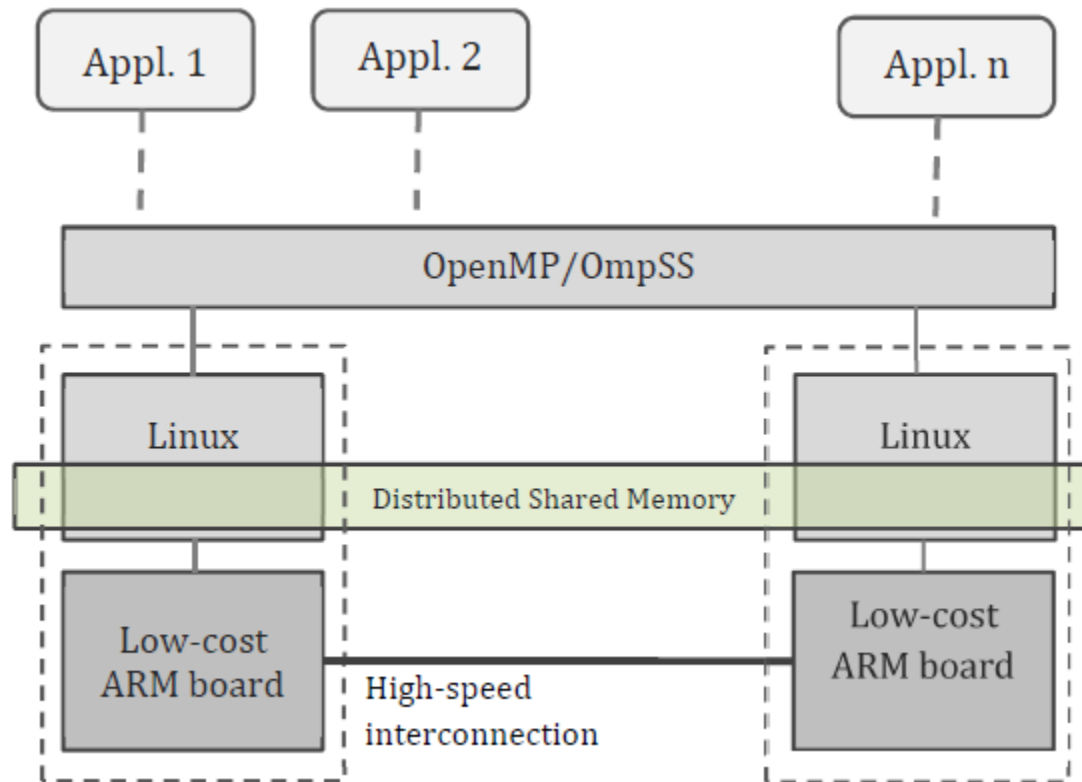
# The AXIOM HW Platform

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- AXIOM Platform Genesis
  - Energy efficiency
  - Xilinx Zynq chip
  - PCI Express, DDR3 Controller
  - Standard connectors (e.g. SATA) for board-2-board interconnections
  - Memory System --> We started with a basic DSM system: several new ideas are under research

# The AXIOM HW Platform (cntd)

## ○ Memory System

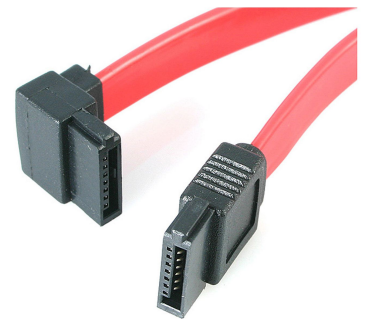




# The AXIOM HW Platform (cntd)

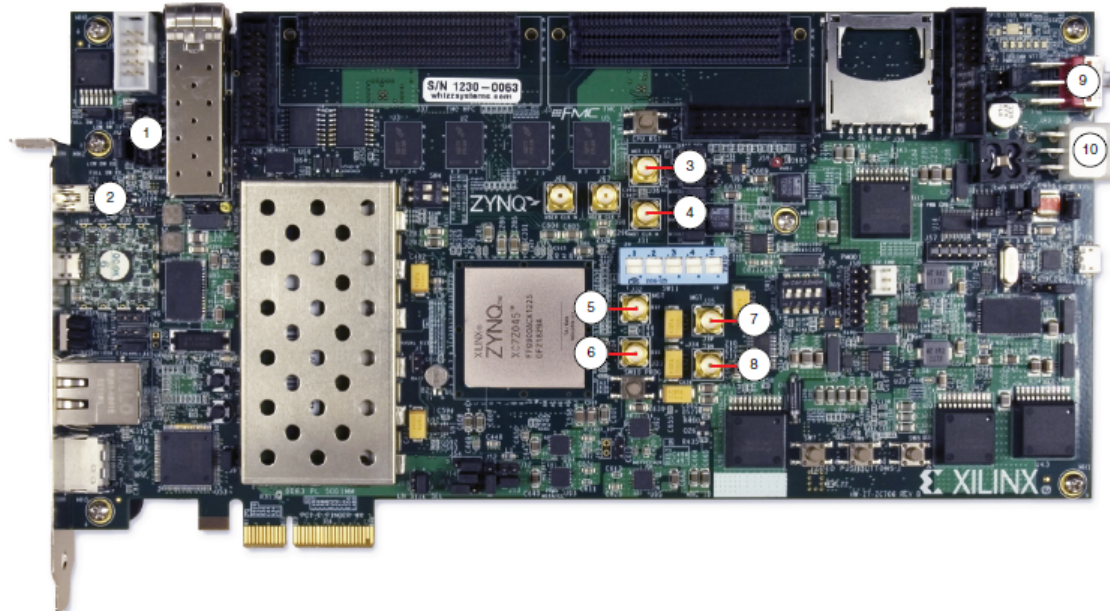
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- Board-2-board interconnection
  - Cheap SATA connectors
  - High-speed links
    - 6+ Gbit/sec
- Low-level communication interface to support OmpSs@cluster and DSM-like programming approaches



# The AXIOM HW Platform (cntd)

- Prototyping board (ZC706)
  - Zynq 7045 SoC (2-core ARM+Kintex7 fabric), 16 high-speed transceivers



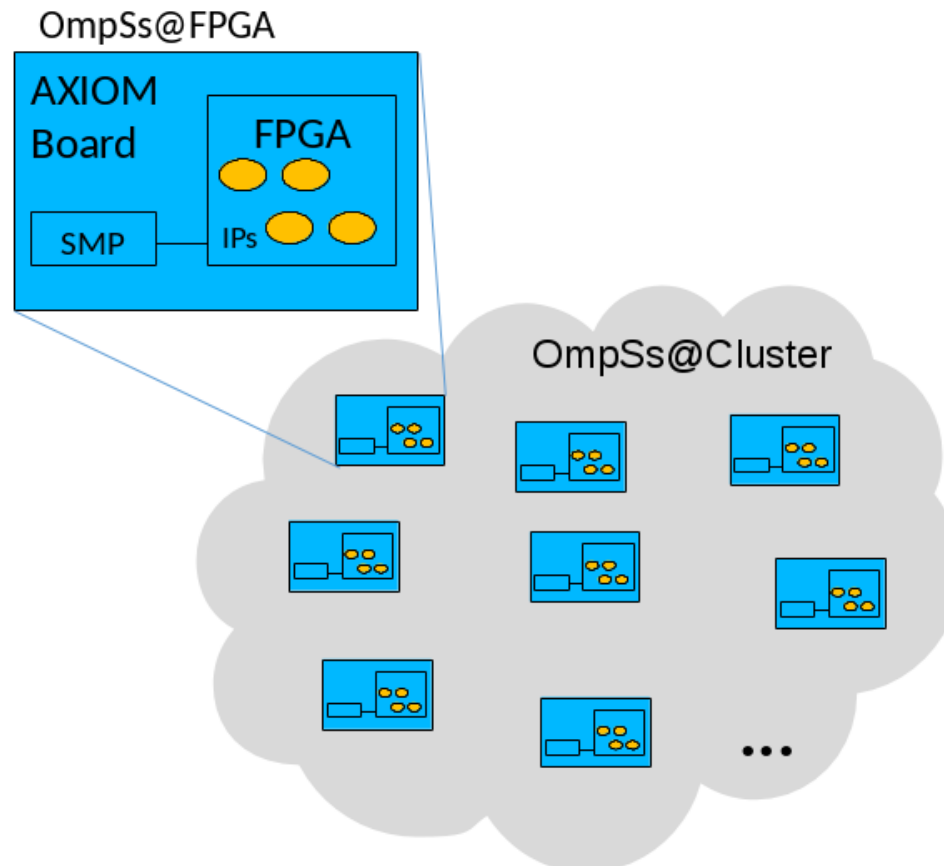
# The AXIOM Programming Model

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- AXIOM will leverage the OmpSs framework
  - Mercurium compiler (C/C++, Fortran)
  - Nanos++ runtime system
  - Task-based programming model
- Intra-node programming: OmpSs@FPGA
- Inter-node programming: Explore OmpSs@Cluster and DSM-like solutions

# The AXIOM Programming Model (cntd)

- OmpSs@FPGA + OmpSs@Cluster



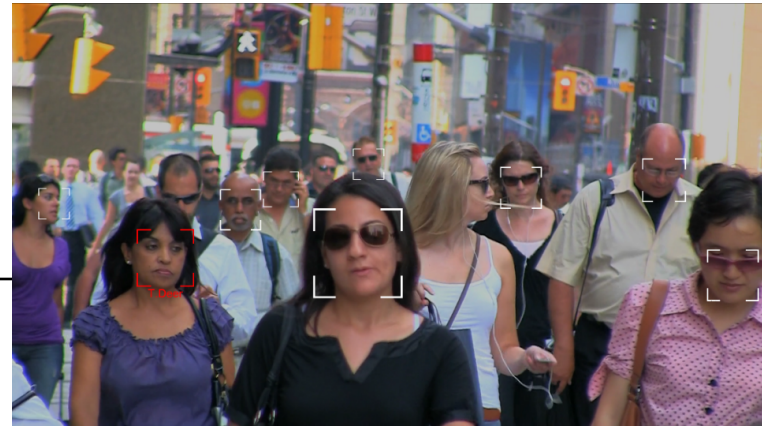
# The AXIOM Programming Model (cntd)

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- OmpSs on DSM-like systems
  - Reliable and efficient DSM mechanism
  - OmpSs@FPGA: intra-node programming
  - OmpSs@Cluster: single OmpSs intra-node running over a transparent DSM system
- Integrated to Linux, Open-Source

# Application Domains

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- Video surveillance
  - Intelligent multi-camera, computer vision, signal processing, pattern recognition
- **Challenges:** useful information extraction from huge video amounts
- **Applications:** Homeland security, traffic control, accident prediction and detection, etc

# Application Domains (cntd)

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- Smart home
  - Ambient intelligence and automatic control for property/residence management
  - Different type of data are gathered by sensors
  - Data are analysed to control certain built-in mechanisms (e.g. room lighting)



# Conclusions

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- AXIOM will provide a **European-designed and -manufactured single board computer**
- Scalable platform with high-speed board-2-board interconnects
- Intra- and inter-node programmability with the OmpSs framework
- AXIOM CPSs will be the heart of future smart applications