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ARTEMIS

Education in Embedded Systems Design: a perspective

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ARTEMIS and Education

Artemis should “Advise on all structural, educational and regulatory matters required for a systemic approach to ensure an environment allowing for successful innovation in the market place and sustainable growth for the industrial sectors relying on Embedded Systems”.

An educational challenge

The starting point: Embedded systems (electronics and software) are becoming increasingly pervasive thanks to the availability of the underlying component technologies and communications infrastructures;

The request: an educational programme meeting technical challenges that include system design, seamless connectivity, reliability, security and quality of service.

An educational challenge

A moving target: embedded systems are evolving very fast and in many directions – shift towards ***connected and distributed*** embedded systems creates new opportunities but growing design complexity!

An educational challenge

The basic need: a ***systems approach*** that ***from the start*** affords ***functional and non-functional requirements*** ⇒ understand the interactions of the system with its physical and network environments.

Multiple disciplines

A look at skills required...:

- ❖ **Functionality / application design**
- ❖ **Platform / architecture design**
- ❖ **Mapping / system design**
- ❖ **Hardware & software / component design**

**Tackle the key challenges of
embedded systems field...**

Multiple disciplines

Possible skills required:

- ❖ **Computer science**
- ❖ **Real-time computing**
- ❖ **Systems architecture**
- ❖ **Control**
- ❖ **Security and privacy**
- ❖ **Networking**
- ❖ **Sensors and actuators... etc.**

The ideal team at work:

- ❖ **One individual cannot master all of the required skills** ⇒ need to identify roles with good interfaces
 - ❖ **Application designer with specific application domain knowledge hands over executable functional specification to system architect**
 - ❖ **Platform designer with specific platform infrastructure knowledge hands over high-level programming services to system architect**
 - ❖ **Component designer with specific compiler expertise hands over core and compiler to system architect**
 - ❖ **System architect with specific market knowledge implements the best solution in the given amount of time**

How to reach those skills:

❖ Education

- ❖ Fundamental EE & CS skills
- ❖ Social skills (team work)

❖ Special skills for embedded systems?

- ❖ Combination of EE & CS?
- ❖ Application domain knowledge?

❖ Academia and industry should partner

- ❖ Industry should provide access to development environments
- ❖ Share development
- ❖ Create standards and ecosystems

A moving target means...

- ❖ **A flexible, visionary educational programme: based not (only...) on in-house competence but on present educational needs;**
- ❖ **A project-oriented education:**
 - ❖ Combination of “conventional” courses and real-life projects;
 - ❖ Teaching *how to work on a project*, not only *how to solve a problem*
- ❖ **Mobility of *lecturers* as well as of *researchers* and *students***
 - ❖ Share experiences, course material...
 - ❖ Create “virtual teams” geographically dispersed.