Embedded Systems Working Group at EIC

Consensus operational framework

(20151026 rev)

There are many definitions for the terms "system" and "embedded system". The INCOSE association (International Council on Systems Engineering) reached consensus [11] at the definition of the term “system” proposed by Rechtin [14]:

"A system is a construct or collection of different elements that together produce results not obtainable by the elements alone"

For the term "embedded system" the definition proposed in *Automática e Instrumentación* [20] has been adopted:

"An embedded system is a combination of hardware and software aimed to support a finite and numbered set well-defined functions, often with real-time process capabilities, integrated into a larger system".

In order to characterize and classify the embedded systems building blocks we take into consideration the following criteria:

- Complexity
- Intellectual property approach
- Form factor

A real embedded system can be also a combination of several embedded systems building blocks. The communication between them will be held by an *interface mechanism*.

Classification by complexity

The classification proposed by the professor Raj Kamal[12] has been adopted. The embedded systems can be classified in the following way [20]:

- Small Scale Embedded Systems
  - Designed usually with a single 8- or 16-bit microcontroller
  - C (or similar) program compilation is done into the assembly, and executable codes are then appropriately located in the system memory.
  - Software fits within the memory available and keep in view the need to limit power dissipation when system is running continuously.
- Median Scale Embedded Systems
  - Designed usually with a single or few 16- or 32- bit microcontrollers or DSPs or Reduced Instruction Set Computers. High-end small scale embedded systems and low range sophisticated ones can be considered median scale embedded systems, such as the ones used in mesh networks nodes.
  - Programming tools: C/C++/Lua/Java or similar, no one (if DSP or similar), small or lean OS (like OpenWrt), and Source code engineering tool, Simulator, Debugger and Integrated Development Environment (IDE). Software tools provide the solutions to the hardware complexities.

- Sophisticated Embedded Systems
    - Enormous hardware and software complexities, Linux like operating systems and may need scalable processors or configurable processors and programmable logic arrays.
    - Certain software functions such as encryption and deciphering algorithms, discrete cosine transformation and inverse transformation algorithms, TCP/IP protocol stacking and network driver functions implemented in the hardware to obtain additional speeds by saving time.
    - The whole Computer Science in a small box, any programming language can be used,

Classification by intellectual property approach

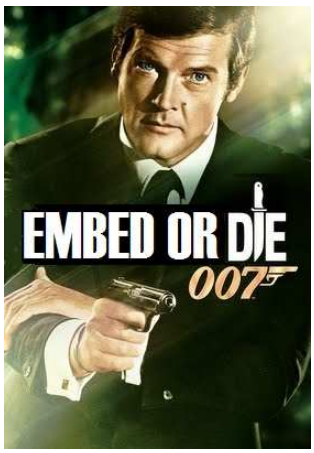
- Proprietary (Software and/or hardware)
- Open source (Software and/or hardware)

Classification by form factor [20]

- Standard form factor used
- Custom form factor used (including cut to size)

Mission of the Working Group

- Disseminate the state of the art and the applications of the embedded systems in the industry [1][4], the education field (from the early years with STEM education [16] to graduate studies [15]), and in the society in general [3] in a multidisciplinary way [18]. Physical integration of embedded systems into “things” can be boosted by the use of 3D printers.
- Promote networking and cooperation among engineers, professionals and actors through clusters, exploring the opportunities offered by “open” models and other forms of intellectual property. [5]
- Participate in the task of "developing a formal framework for cyber-physical systems based embedded systems in the context of the Internet of Things” [20], taking safety and security as a crucial issues [2][13], as Joseph Sifakis (Turing Award 2007) [7][8] and Sabine Jeschke [19] suggest, using theoretical hardware[12], software frameworks [6] [9], suitable tools [17] and formalisms [10].
- Promote strategies in order to combine prudence and common sense ("seny") with vitality and craziness ("rauxa") in order to rapidly align our industrial assets to the new industrial revolution.
- A synthesized message approach can be expressed with the following picture:



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