

# Research Agenda for Embedded Systems

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TBD

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## Abstract

The world of embedded systems research is quite large. This document identifies the trends and hot topics in the world of embedded systems. Next it proposes a subset of this world as the working area for the Embedded Systems Institute.

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# 1 Introduction

This is a very preliminary document outlining the research agenda of the Embedded Systems Institute. It should facilitate the discussion about this research agenda.

# 2 Context of Embedded Systems Research

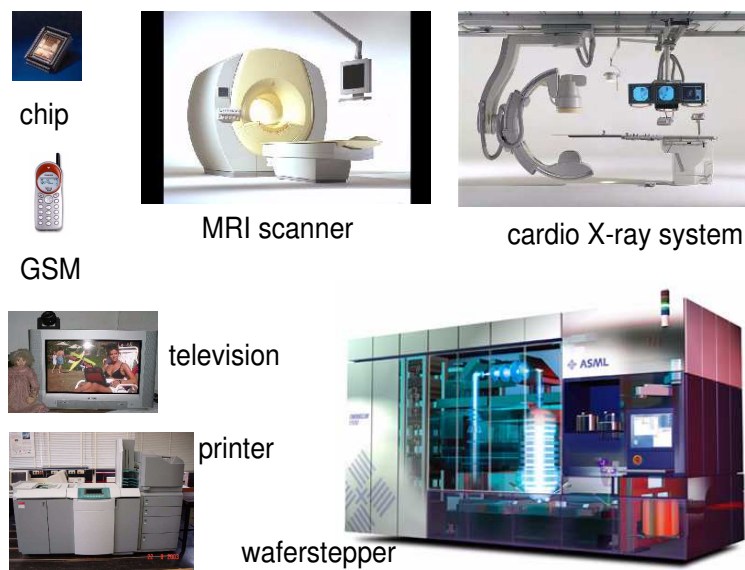


Figure 1: Embedded Systems; From Small to Large

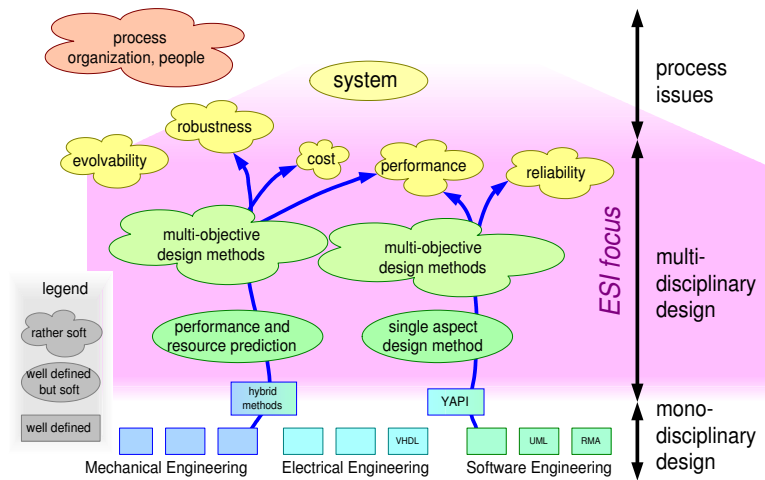


Figure 2: From Mono-Disciplinary to System

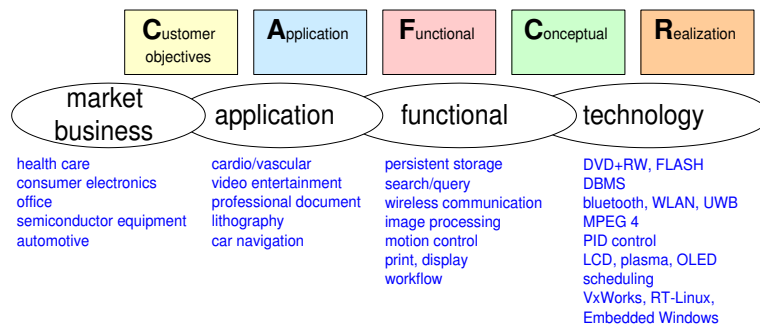


Figure 3: Domains Mapped on CAFCR

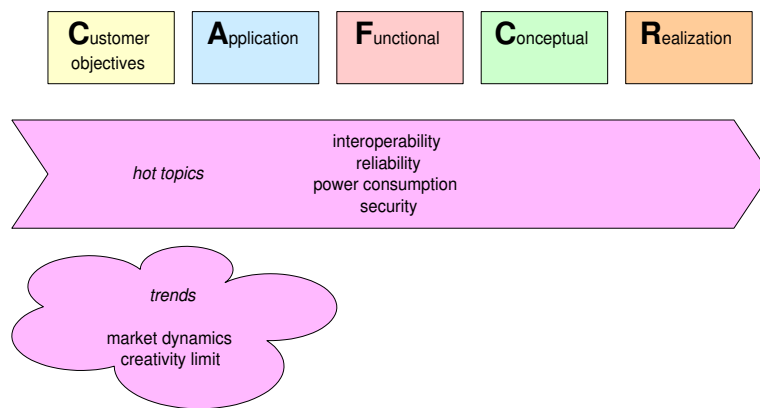


Figure 4: Trends and Hot Topics in Embedded Systems

### 3 Position of ESI

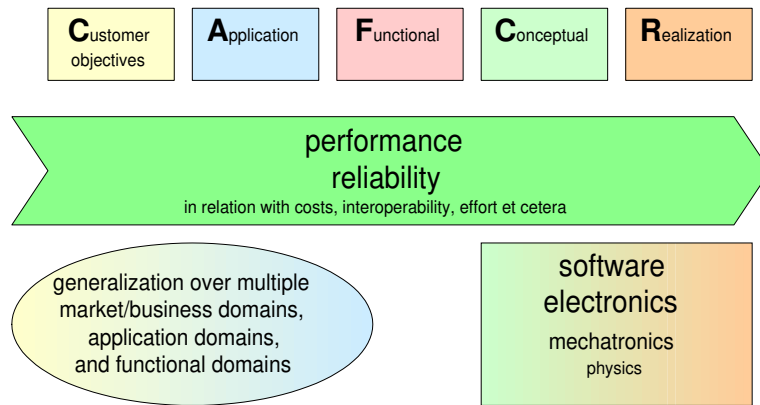


Figure 5: Research Topics ESI

## 4 Assumptions

1. *Methods* that fulfil *multiple objectives* exist to *create embedded systems*
2. These methods help to *speed up* the *creation* process, *reduce* the *risks*, and *increase* the *product quality*
3. These *methods* are *generic* for multiple *market/business domains* , *application domains* and *functional domains*
4. These *methods build upon* the *software* and *electronics technologies* , and to a lesser degree these methods build upon the more *conventional technologies* , such as *mechatronics* and *physics* .
5. These *methods* need an *intelligent adaptation* to the *specific domain*

Figure 6: Assumptions

The current working methods result in acceptable working systems, but:

- the integration and test phase is often too long and exceed the original planning
- too many product creations fail
- the qualities emerge more than they are designed in

Organizational focus is mono-disciplinary

Process and orgnaization have a big impact on product creation

Many technical decisions are based on local technical considerations.  
Many business decisions are based on local business considerations.  
Technical and business decisions must be linked.

Figure 7: Status quo in industry

*CAFCR* and *qualities* are a useful framework for a further decomposition of methods

The *working field* can be narrowed by focusing on a *subset* of *qualities*

*ESI* must concentrate on *qualities* where *knowhow* is present in the *institute* and in the *network-partners*

*ESI* must concentrate on *qualities* that are *challenging* from *technology viewpoint*

*ESI* must concentrate on *qualities* that are *valuable* from *business viewpoint*

The *value* of *ESI* is in the *multi-disciplinary* achievement of these *qualities*

*Submethods* over *all CAFCR* views are needed to achieve the *qualities*

This type of *research* requires *partners* that have the *in-depth technology domain know-how*

This type of *research* requires *partners* that have the *in-depth application* and *business domain know-how*

Figure 8: More Specific Assumptions

*Method research* requires *practical experience*

*Application* of the method is *80%* of the effort, *reflection* and *abstraction* at most *20%*

*Industry as laboratory* is a research method where the *creation methods* are *applied* in *actual industrial context*

The application of methods in the actual industrial context is necessary to:

1. *build up experience*
2. *verify assumptions* about improvements of methods

To research new methods a *hypothesis* is required about the method improvements

Figure 9: Industry as laboratory

## 5 Acknowledgements

Jaap van der Heijden provided feedback on assumptions.

## References

- [1] Gerrit Muller. The system architecture homepage. <http://www.gaudisite.nl/index.html>, 1999.

## History

**Version: 0.2, date: May 26, 2004 changed by: Gerrit Muller**

- added a few more assumptions
- created an article version, without any text yet
- added acknowledgements

**Version: 0.1, date: May 24, 2004 changed by: Gerrit Muller**

- added assumptions

**Version: 0, date: April 15, 2004 changed by: Gerrit Muller**

- Created, no changelog yet