

Research Agenda for Embedded Systems

by *Gerrit Muller* Buskerud University College

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

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.

Distribution

This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

October 20, 2017
status: planned
version: 0.2

logo
TBD

Embedded Systems; From Small to Large



chip



GSM



MRI scanner



cardio X-ray system



television

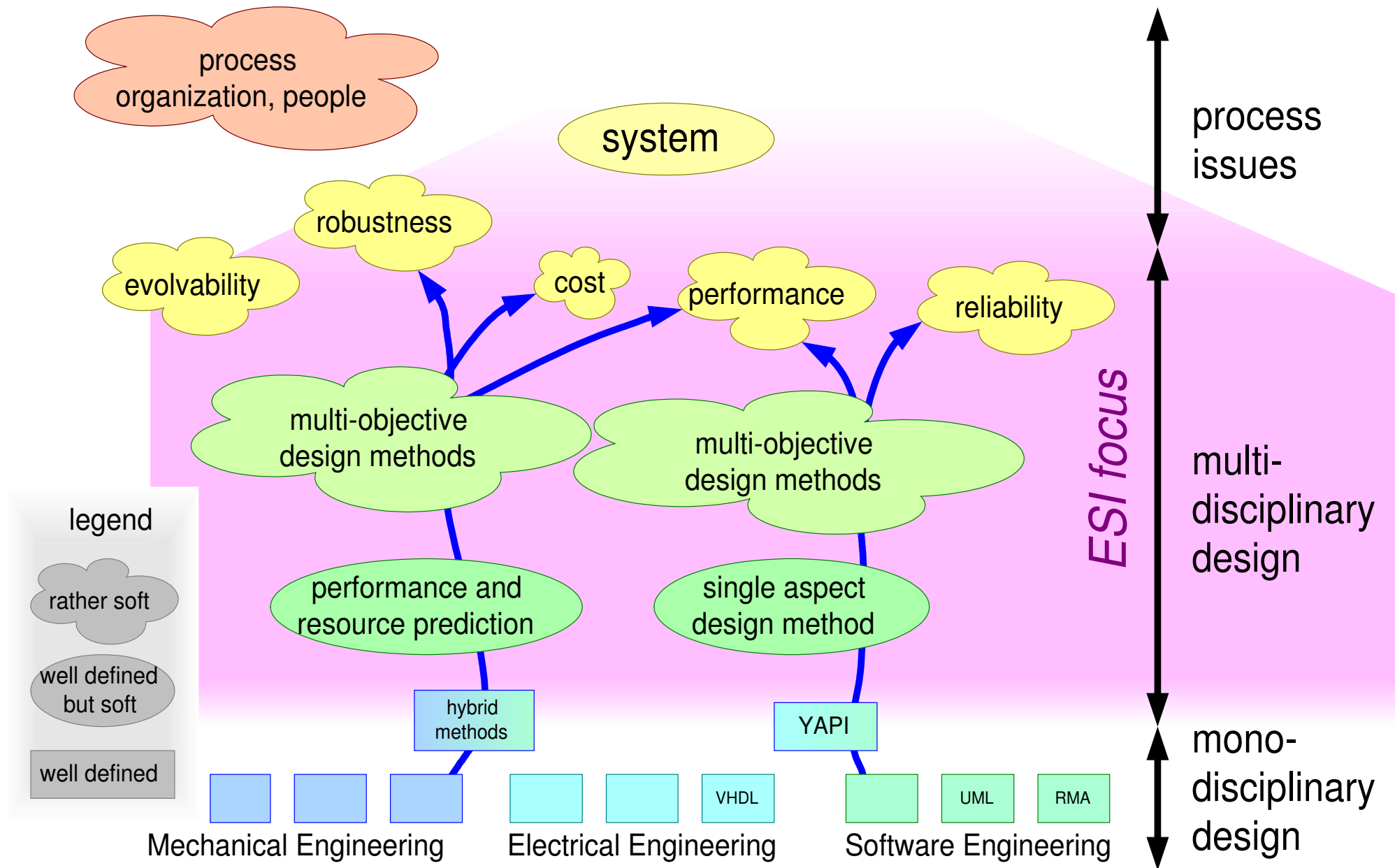


printer

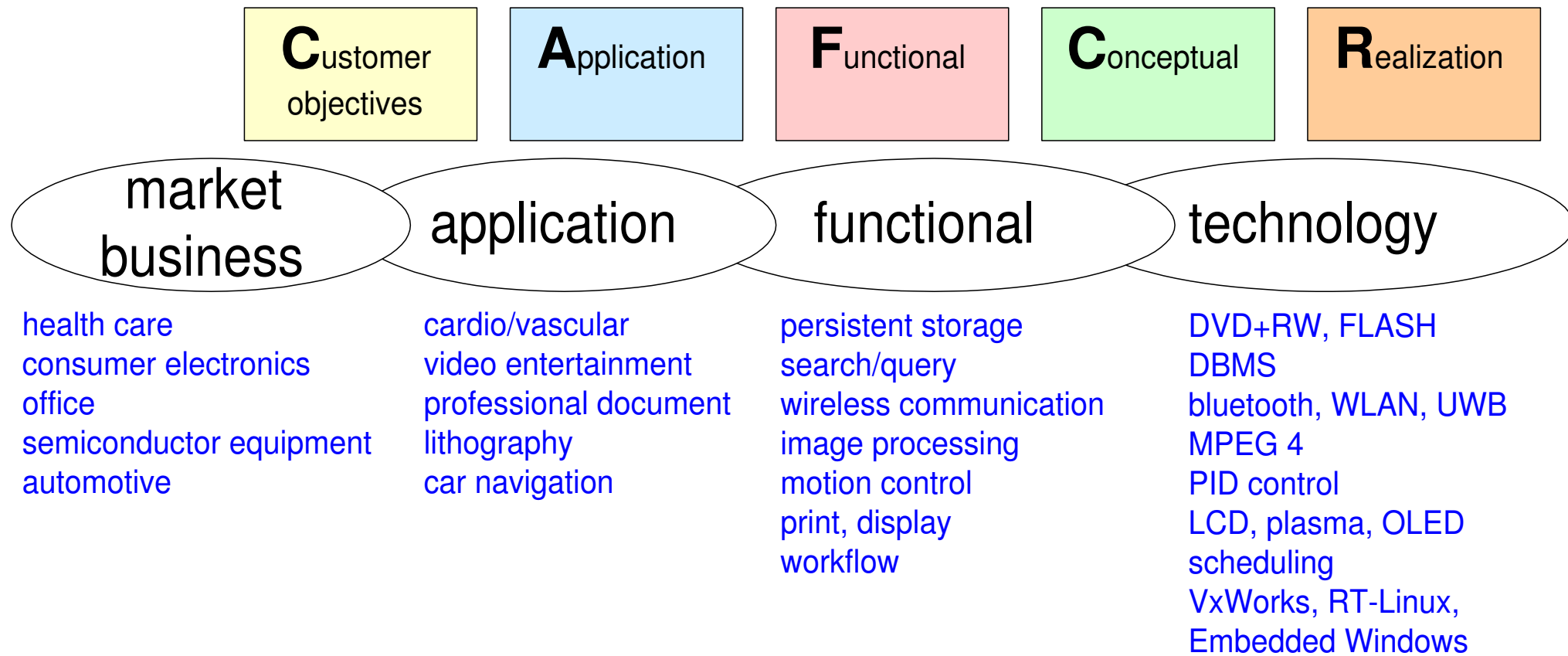


waferstepper

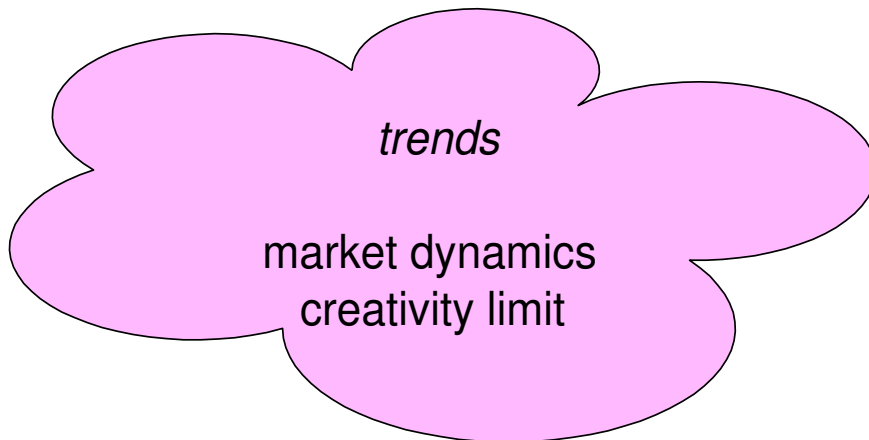
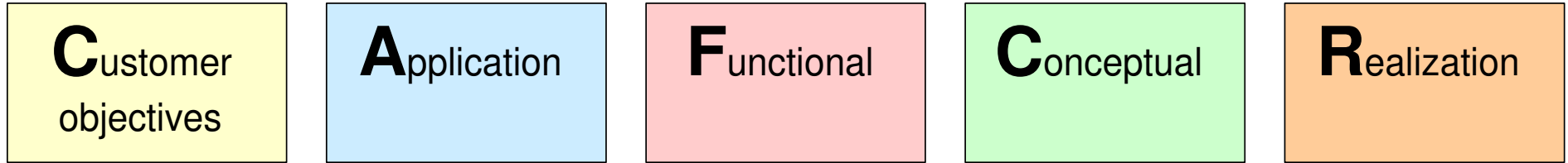
From Mono-Disciplinary to System



Domains Mapped on CAFCR



Trends and Hot Topics in Embedded Systems



Research Topics ESI

Customer
objectives

Application

Functional

Conceptual

Realization

performance
reliability

in relation with costs, interoperability, effort et cetera

generalization over multiple
market/business domains,
application domains,
and functional domains

software
electronics
mechatronics
physics

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*

Status quo in industry

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 organization 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.

More Specific Assumptions

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*

Industry as laboratory

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