Research Agenda for Embedded Systems

by *Gerrit Muller* University of South-Eastern Norway-NISE
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.

September 1, 2020
status: planned
version: 0.2

logo
TBD

Embedded Systems; From Small to Large

chip

GSM

MRI scanner

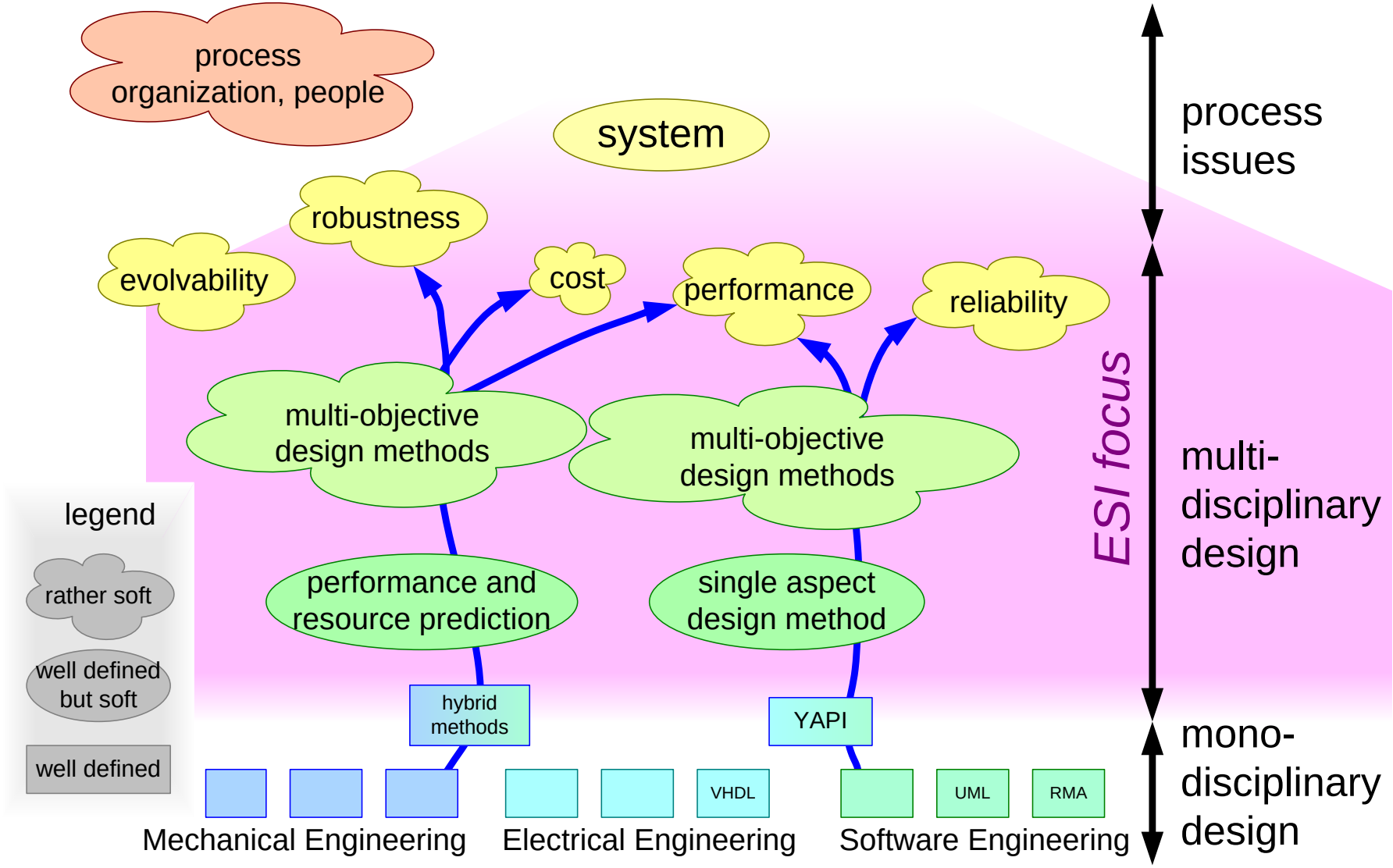
cardio X-ray system

television

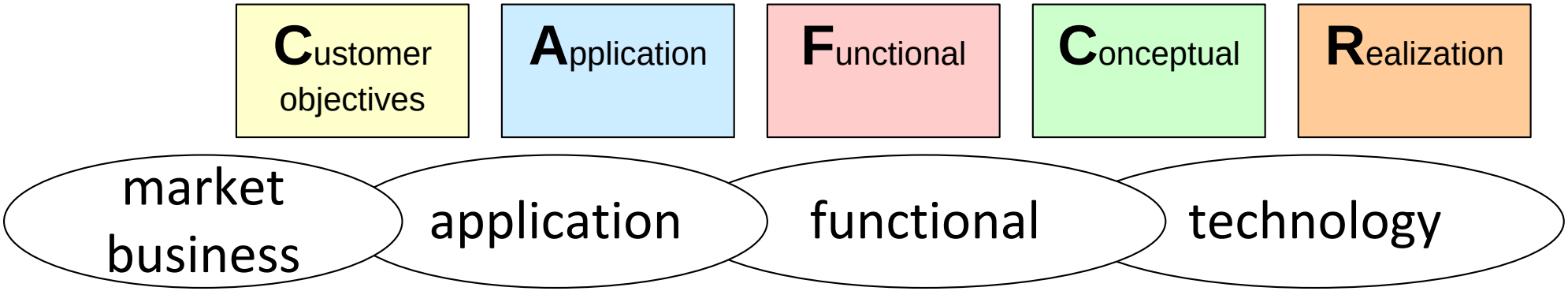
printer

waferstepper

From Mono-Disciplinary to System

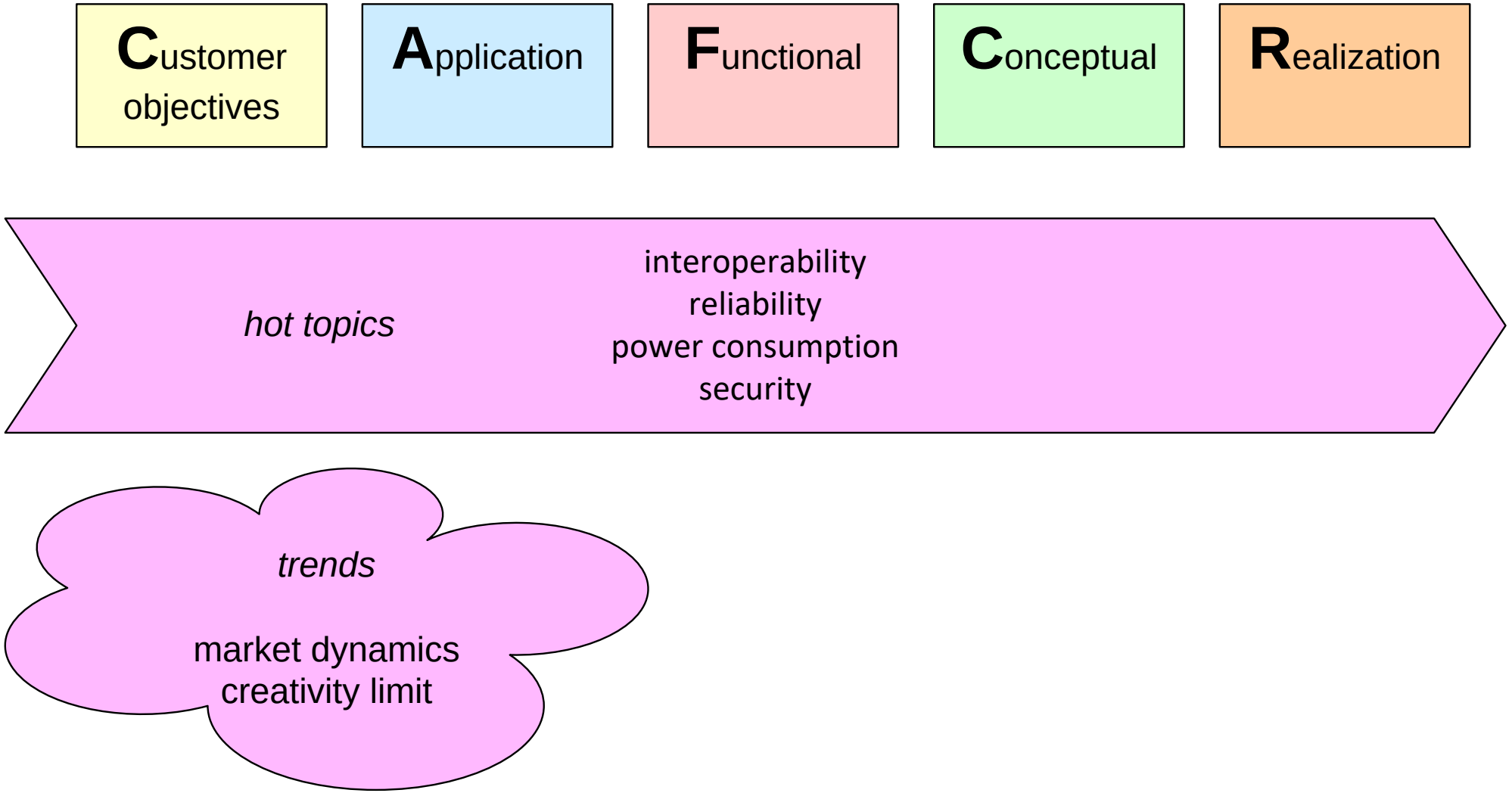


Domains Mapped on CAFCR



market business	application	functional	technology
health care	cardio/vascular	persistent storage	DVD+RW, FLASH
consumer electronics	video entertainment	search/query	DBMS
office	professional document	wireless communication	bluetooth, WLAN, UWB
semiconductor equipment	lithography	image processing	MPEG 4
automotive	car navigation	motion control	PID control
		print, display	LCD, plasma, OLED
		workflow	scheduling
			VxWorks, RT-Linux, Embedded Windows

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 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.

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