

Opportunities and challenges in embedded systems

by *Gerrit Muller* Embedded Systems Institute
e-mail: `gerrit.muller@embeddedsystems.nl`
`www.gaudisite.nl`

Abstract

The technological advances in processing, communication, storage, actuating and sensing enables a large amount of applications of embedded systems. The challenges of today to realize these opportunities are discussed, addressing six main issues: market dynamics, interoperability, reliability, power, security, and creativity.

The capabilities of the Embedded Systems Institute are discussed briefly.

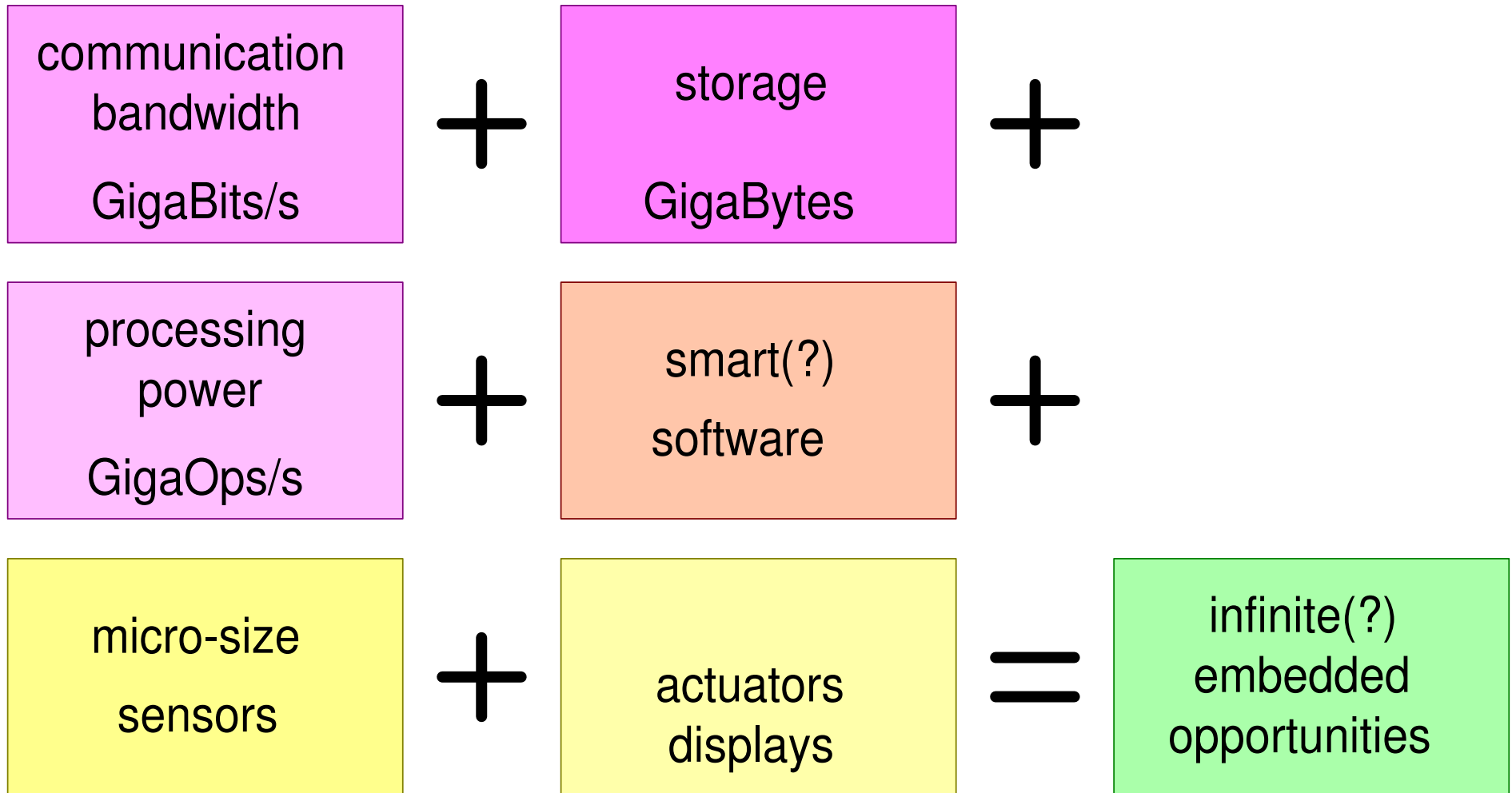
Distribution

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.

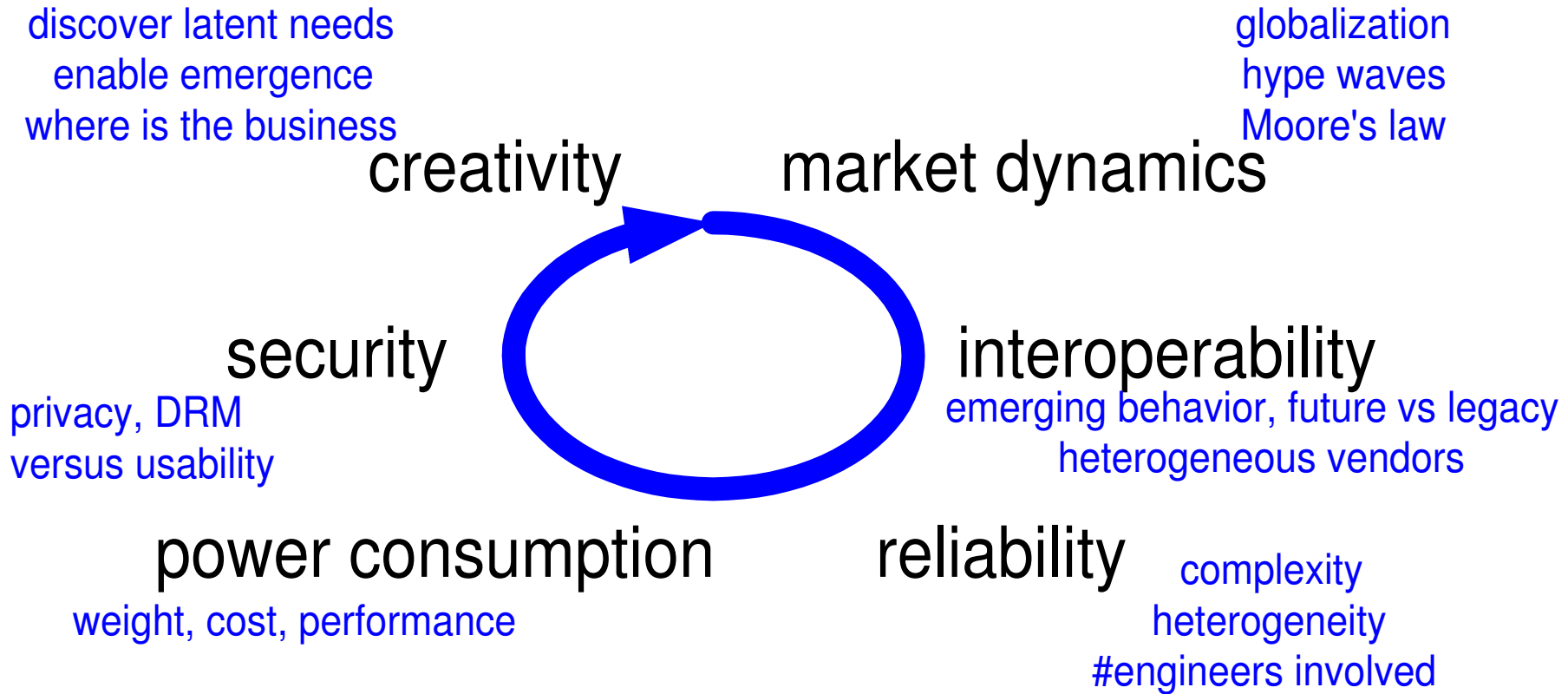
February 10, 2011
status: concept
version: 1.0

logo
TBD

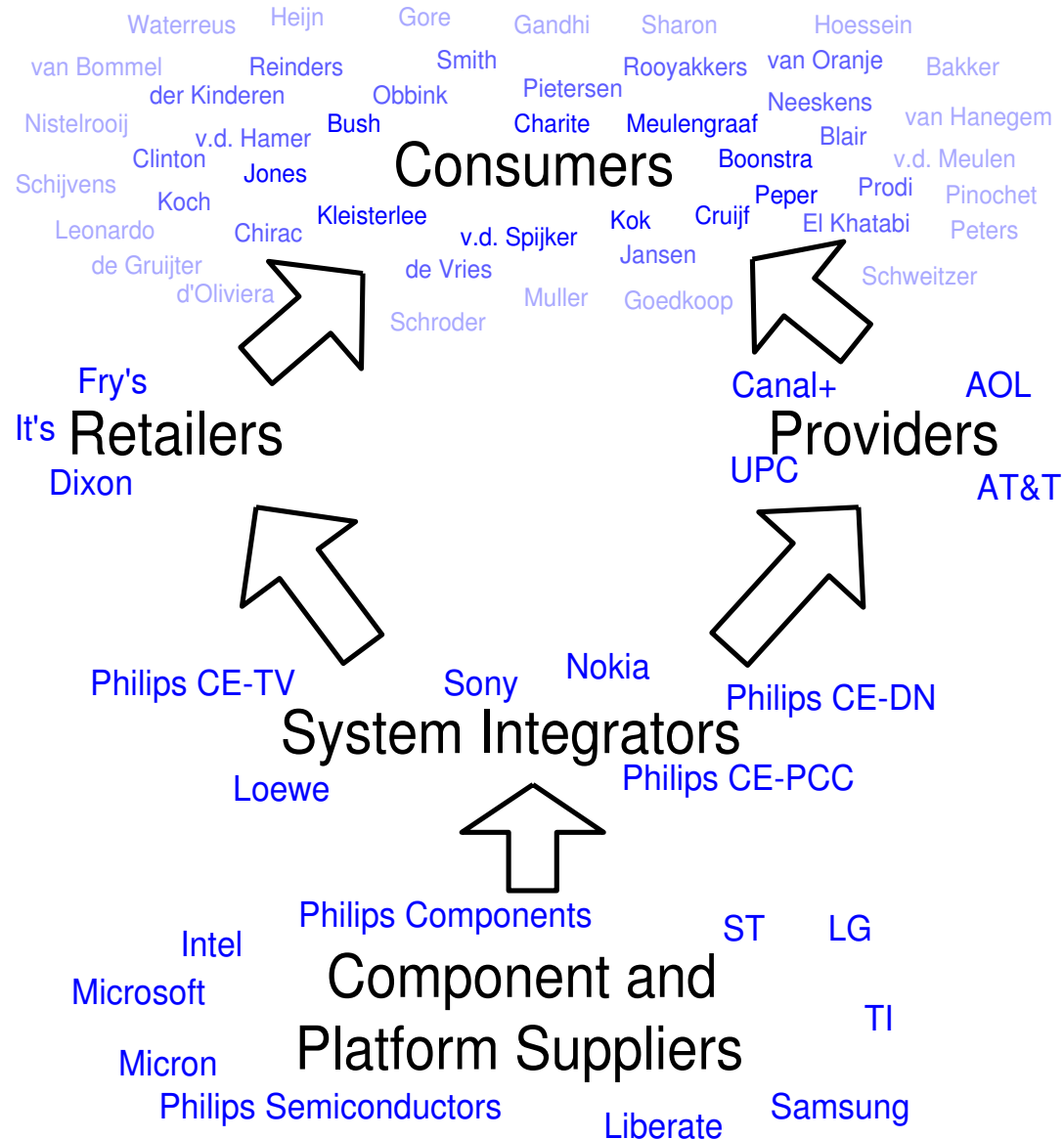
Giga embedded opportunities



Hit list of challenges

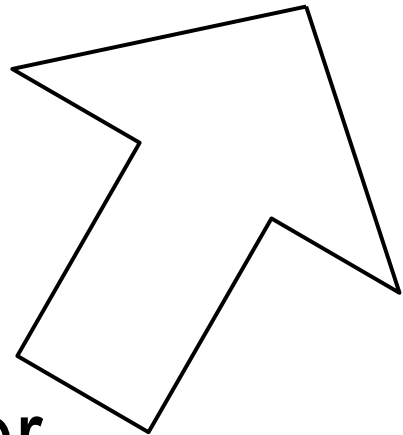
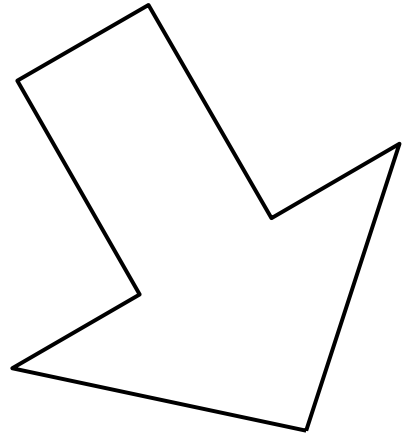


Value Chain in Consumer Electronics

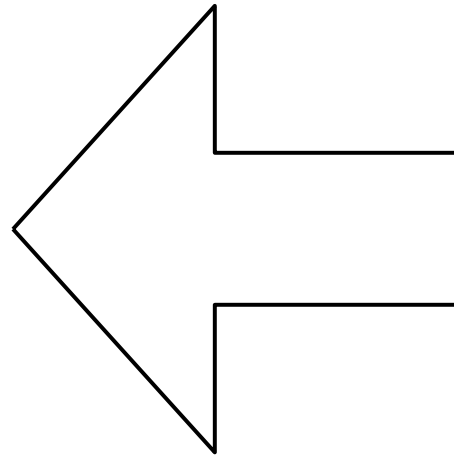


Trend: convergence

Telecom



Consumer



Computer

Integration and Diversity



GSM phone



firewall



dvd



audio
microset



pda



watch



sailboat



surveillance
camera



cable
modem



set top box



headphone



pen



garment



car



camera



speech



mp3



television



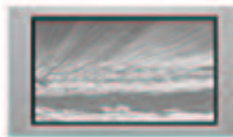
car navigation



computer



games



flat display

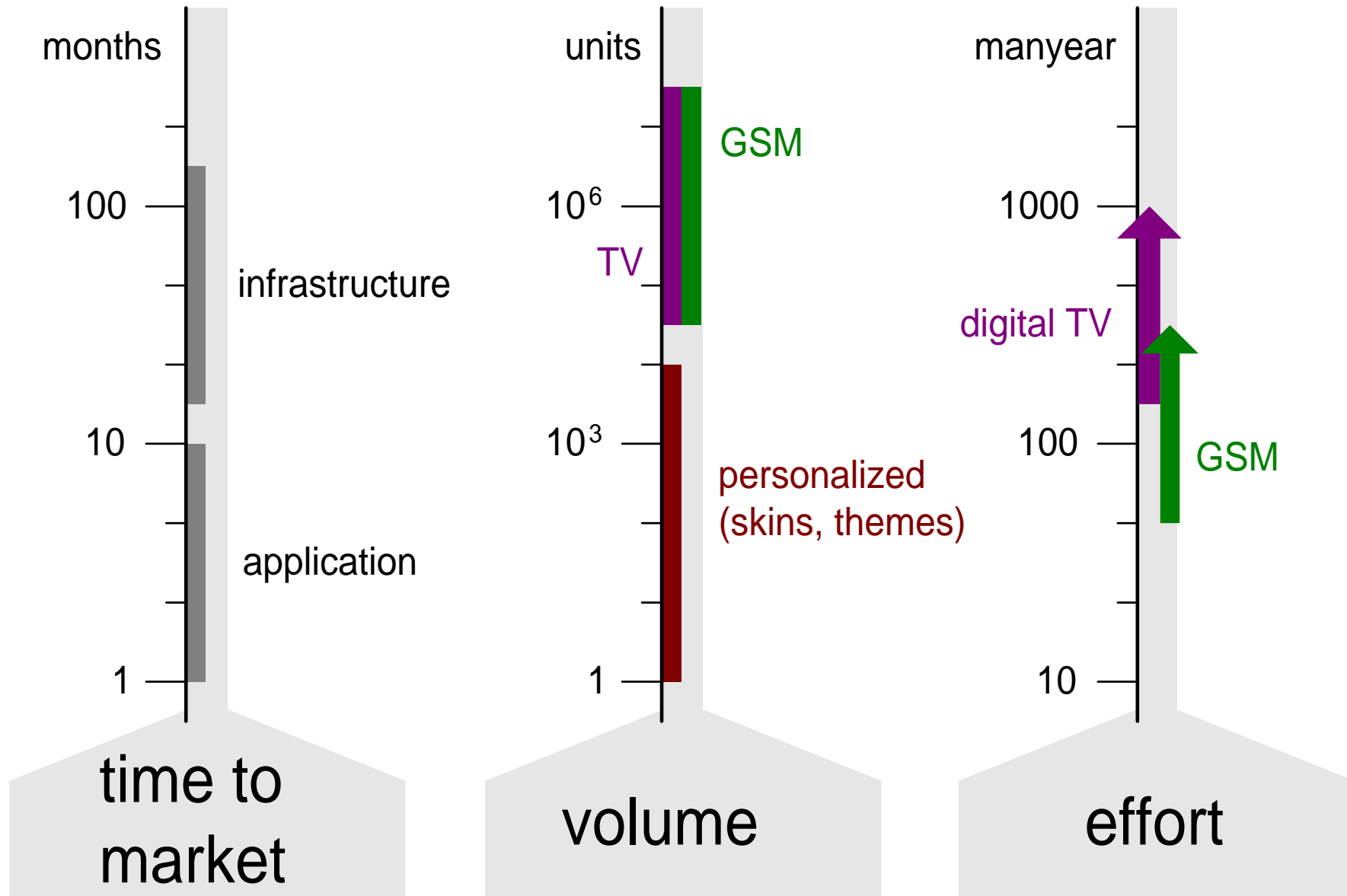


Communicator








Ambient Intelligence
living room

System Integrator Problem Space - Business








Is reuse **the** solution to effort?






trends

-  features
-  performance expectations
-  number of products
-  release cycle time
years → months
-  openness
interoperability

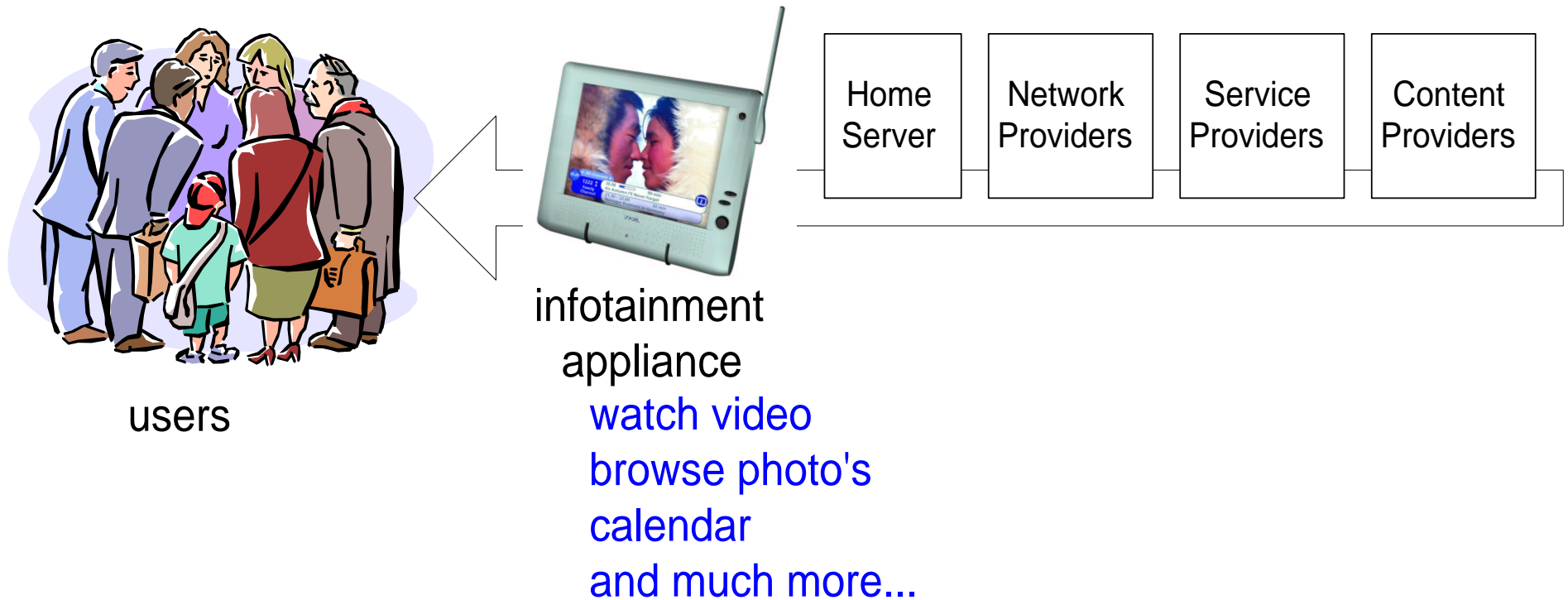
consequences

-  feature interaction
-  complexity
-  amount of software
-  integration effort
-  reliability

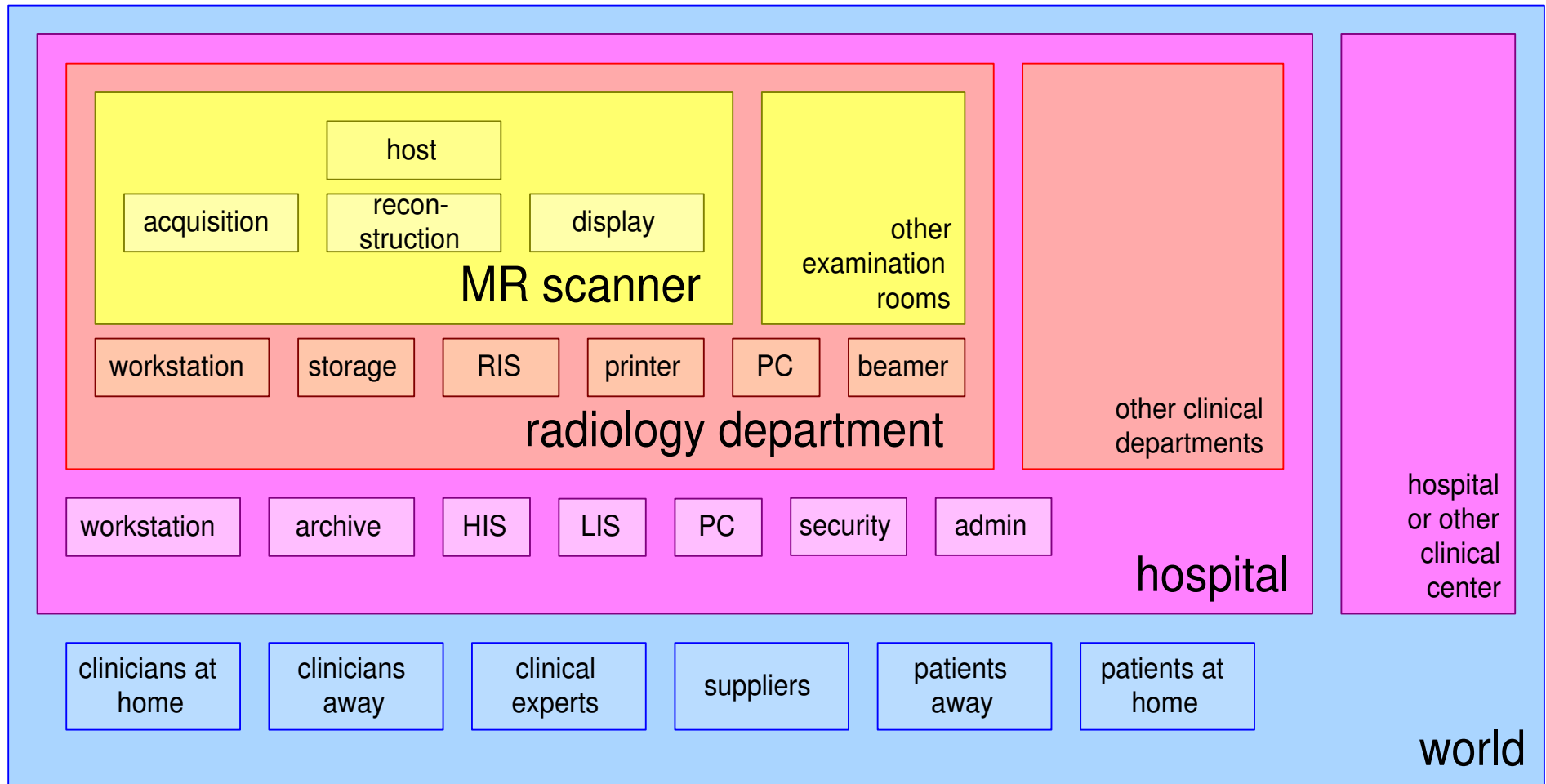
solutions

-  new methods
new tools
-  hardware performance
-  new software technology
-  new standards
-  reuse

Applications depend on chain of systems



Interoperability: systems get connected at all levels



Multi dimensional interoperability

integrating **multiple**

applications

clinical analysis
clinical support
administrative
financial
workflow

in **multiple**

languages

cultures

USA, UK,
China, India,
Japan, Korea
France, Germany
Italy, Mexico

delivered by **multiple**

vendors

Philips
GE
Siemens

based on **multiple**

media, networks

DVD+RW
memory stick
memory cards
bluetooth
11a/b/g
UTMS

and **multiple**

standards

Dicom
HL7
XML

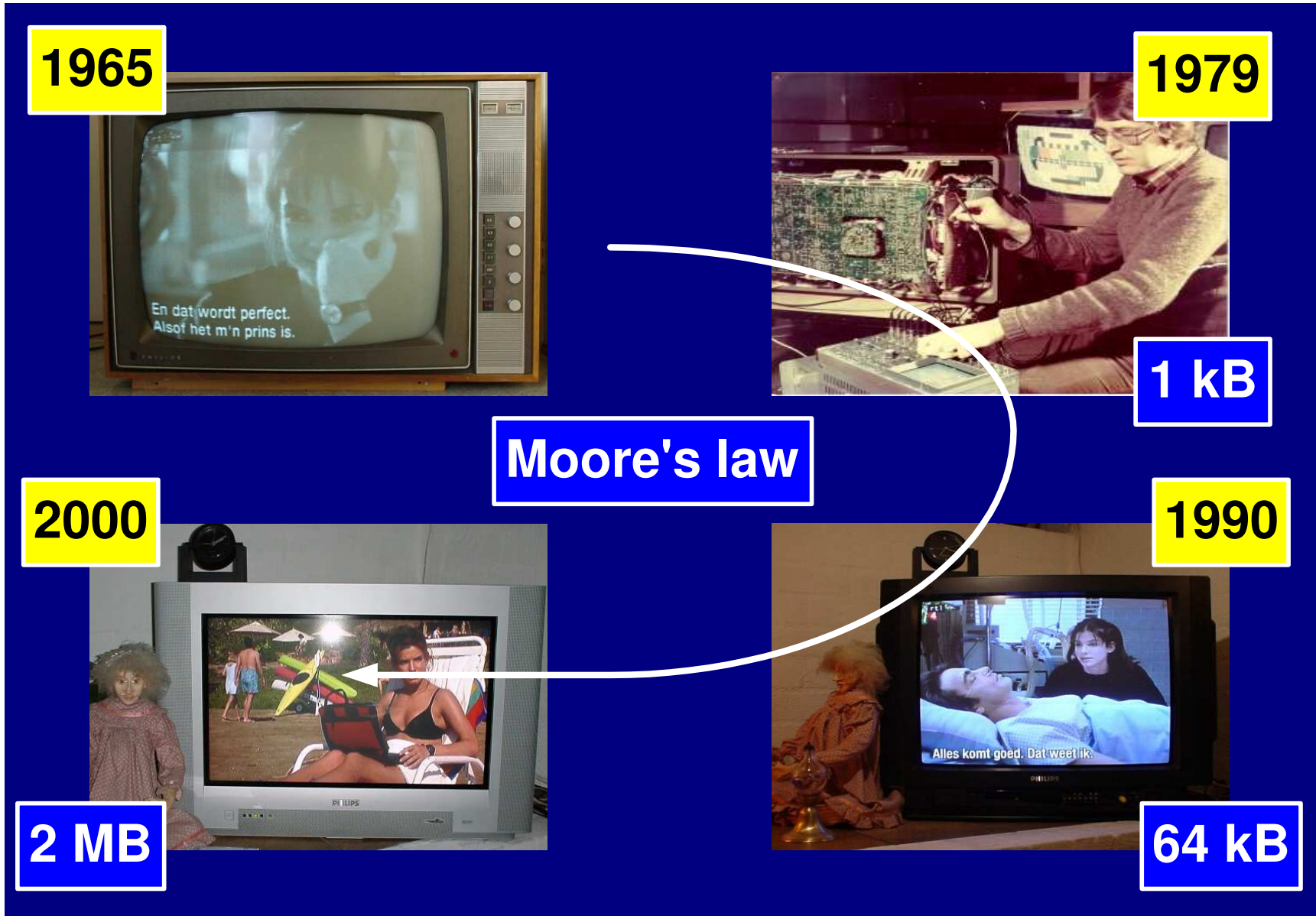
and **multiple**

releases

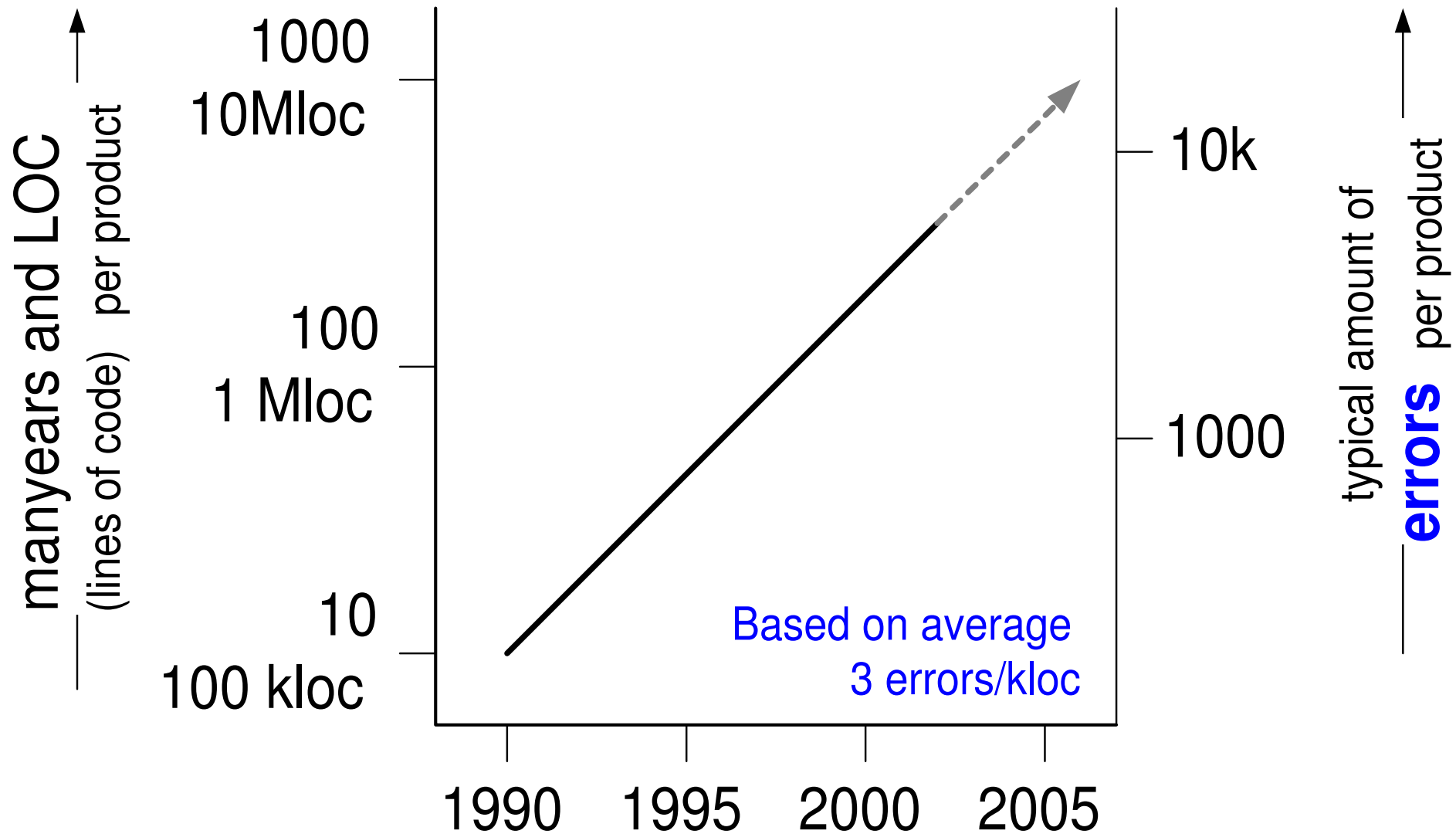
R5
R6.2
R7.1

SW increase in televisions

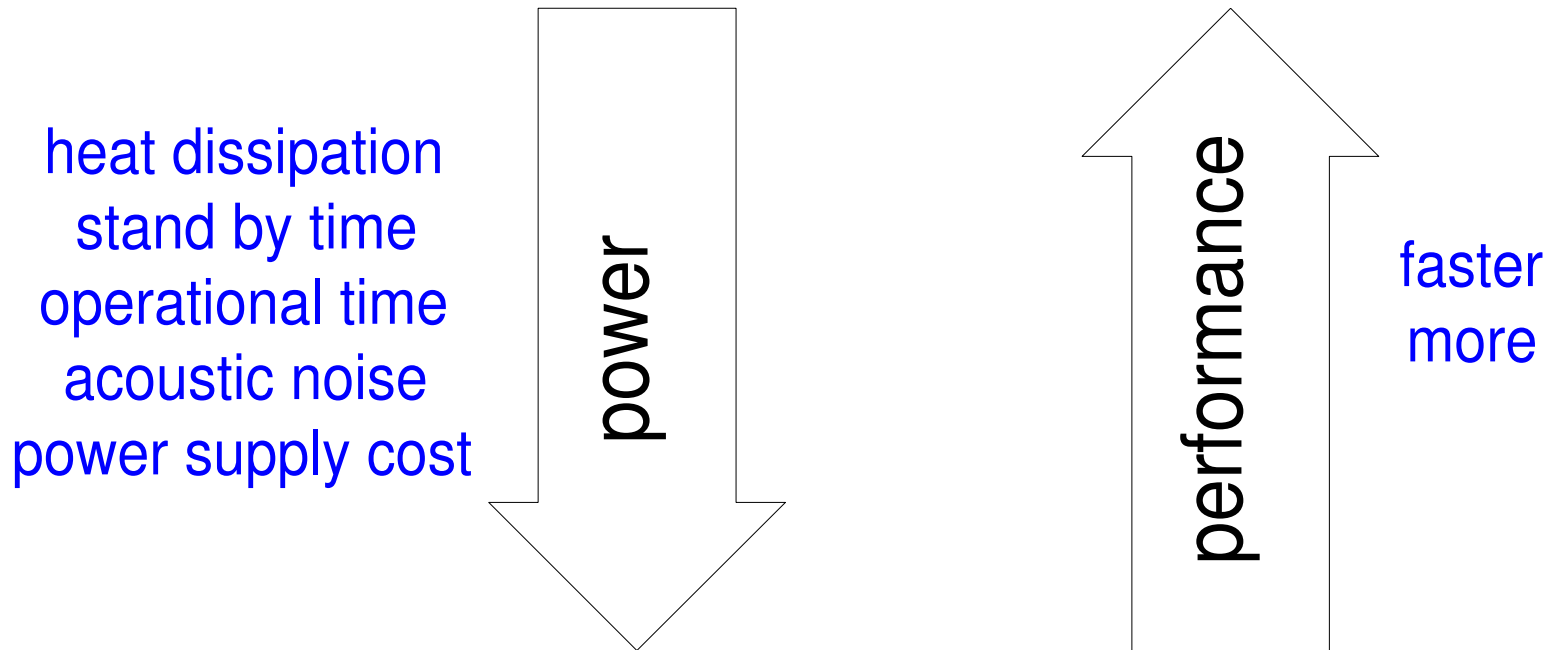
From: COPA tutorial, Rob van Ommering



Increase of software threatens Reliability

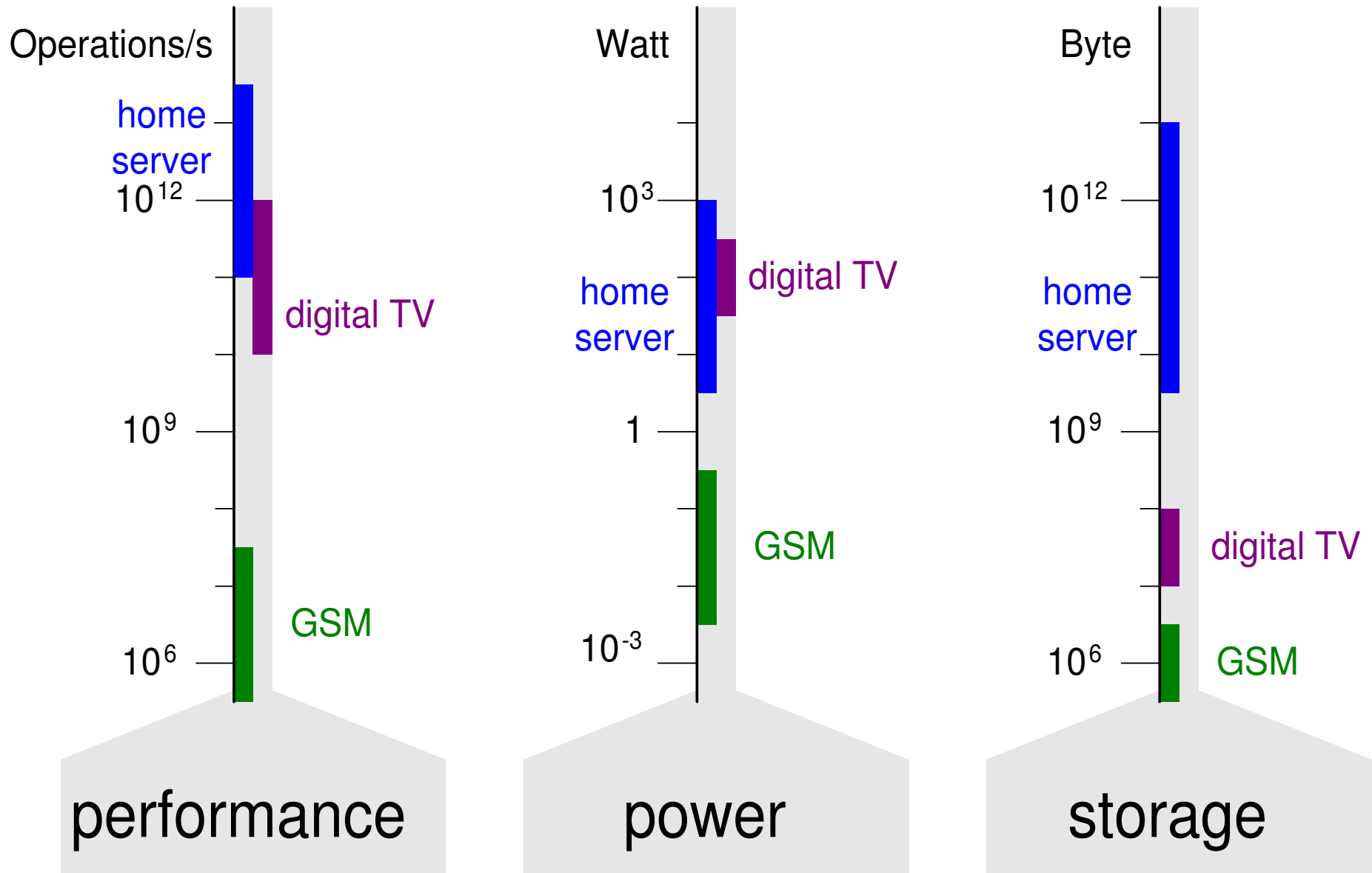


Power consumption and dissipation

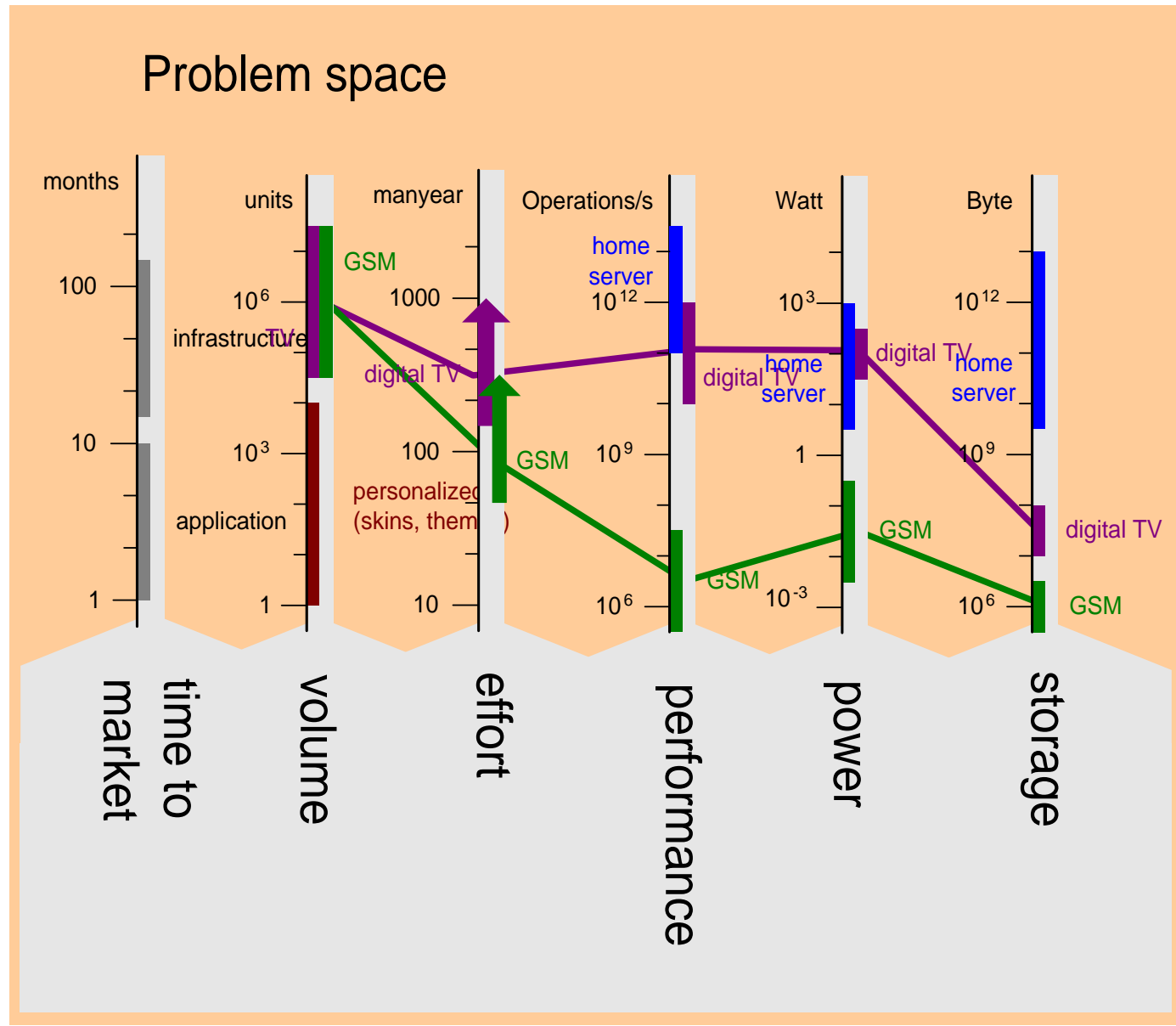


examples		
<i>3G phone</i> standby time operational time wireless video	<i>data centers</i> insufficient power in Amsterdam	<i>desktop</i> silent fanless <i>MRI gradients</i> : 66 mT/m kWatts: cost, noise, heat

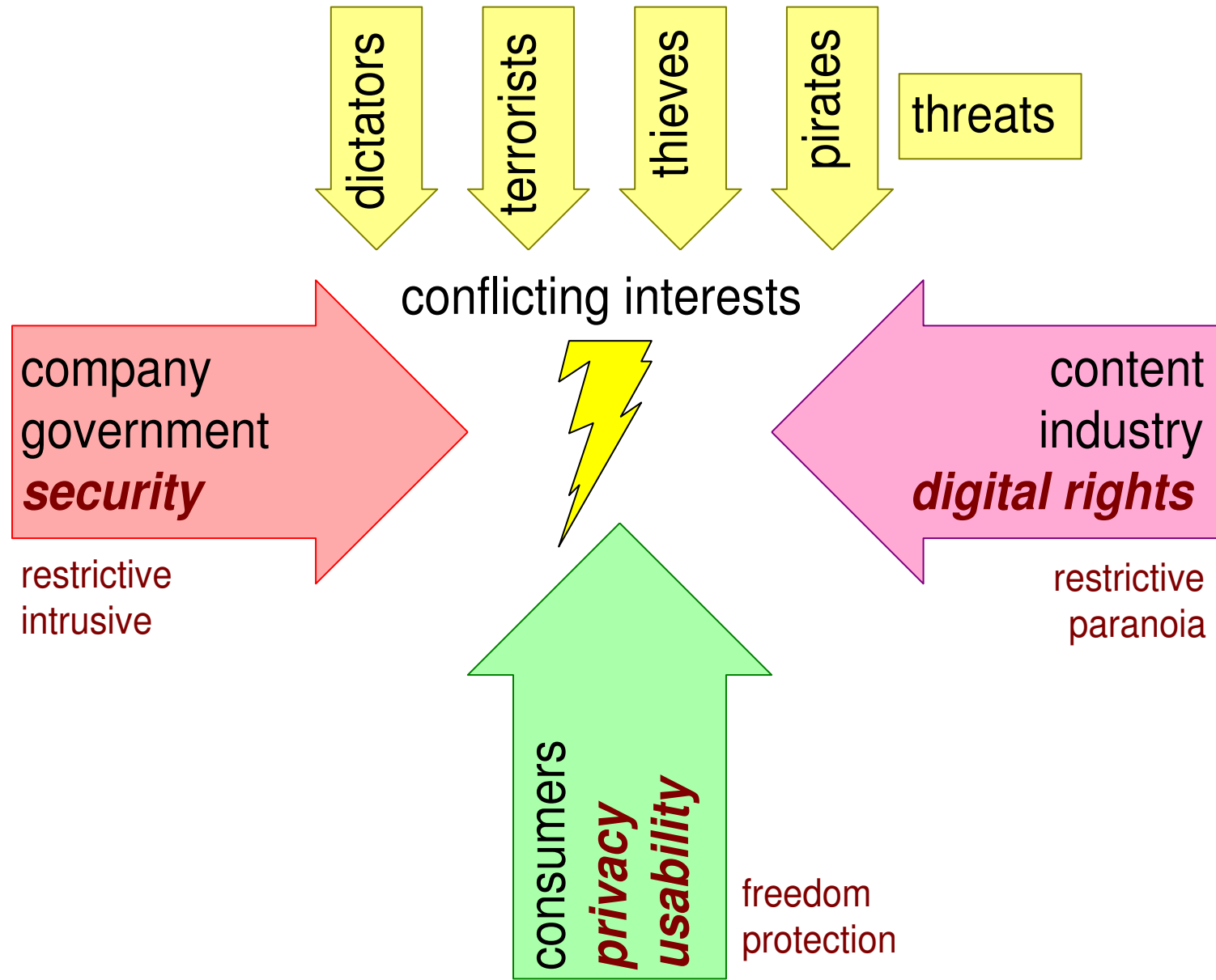
System Integrator Problem Space - Technology



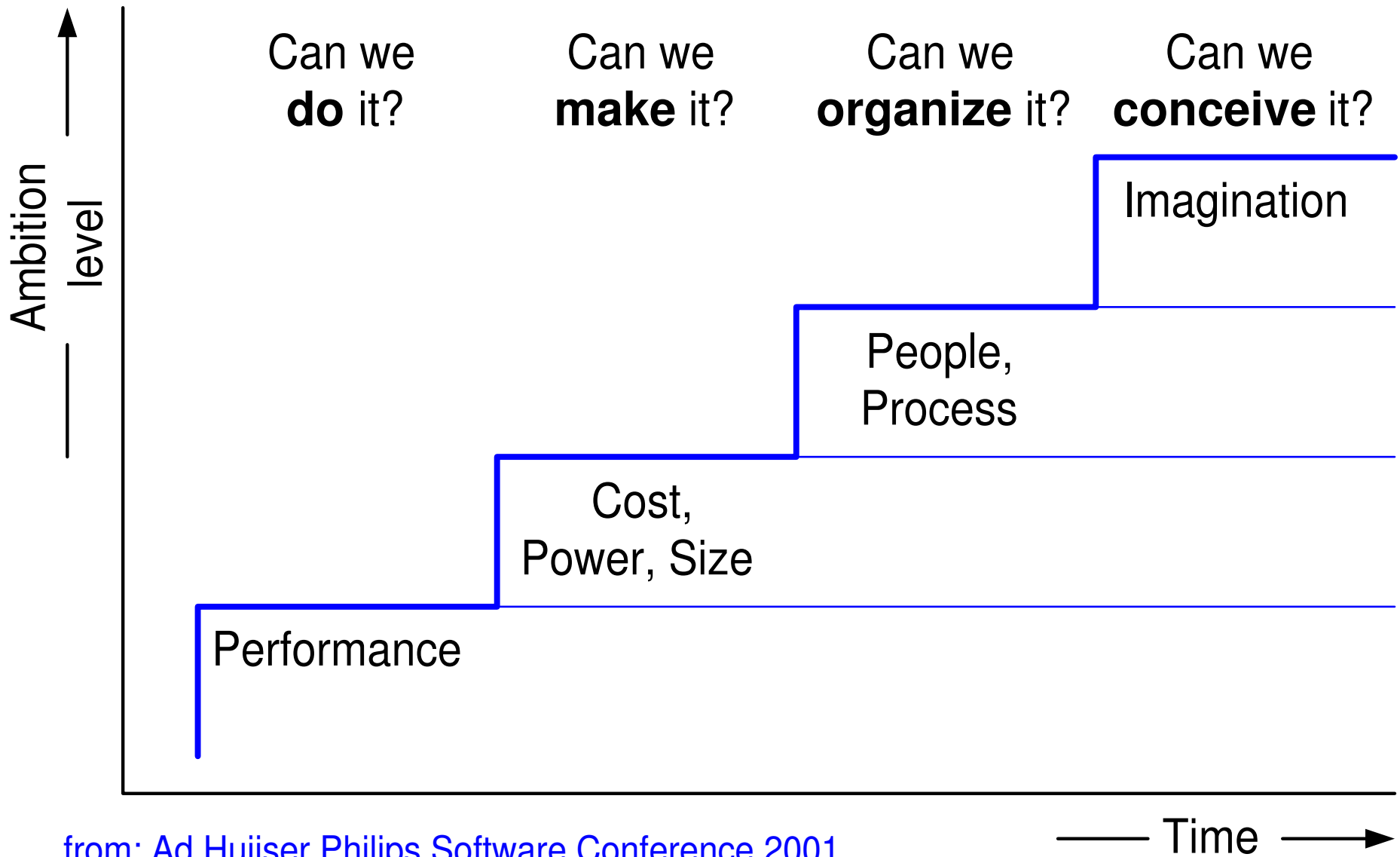
Profile of Digital TV and GSM



Security conflicting interests



Creativity as limiting factor



Role of Embedded Systems Institute ESI

