

# Opportunities and challenges in embedded systems

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## 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.

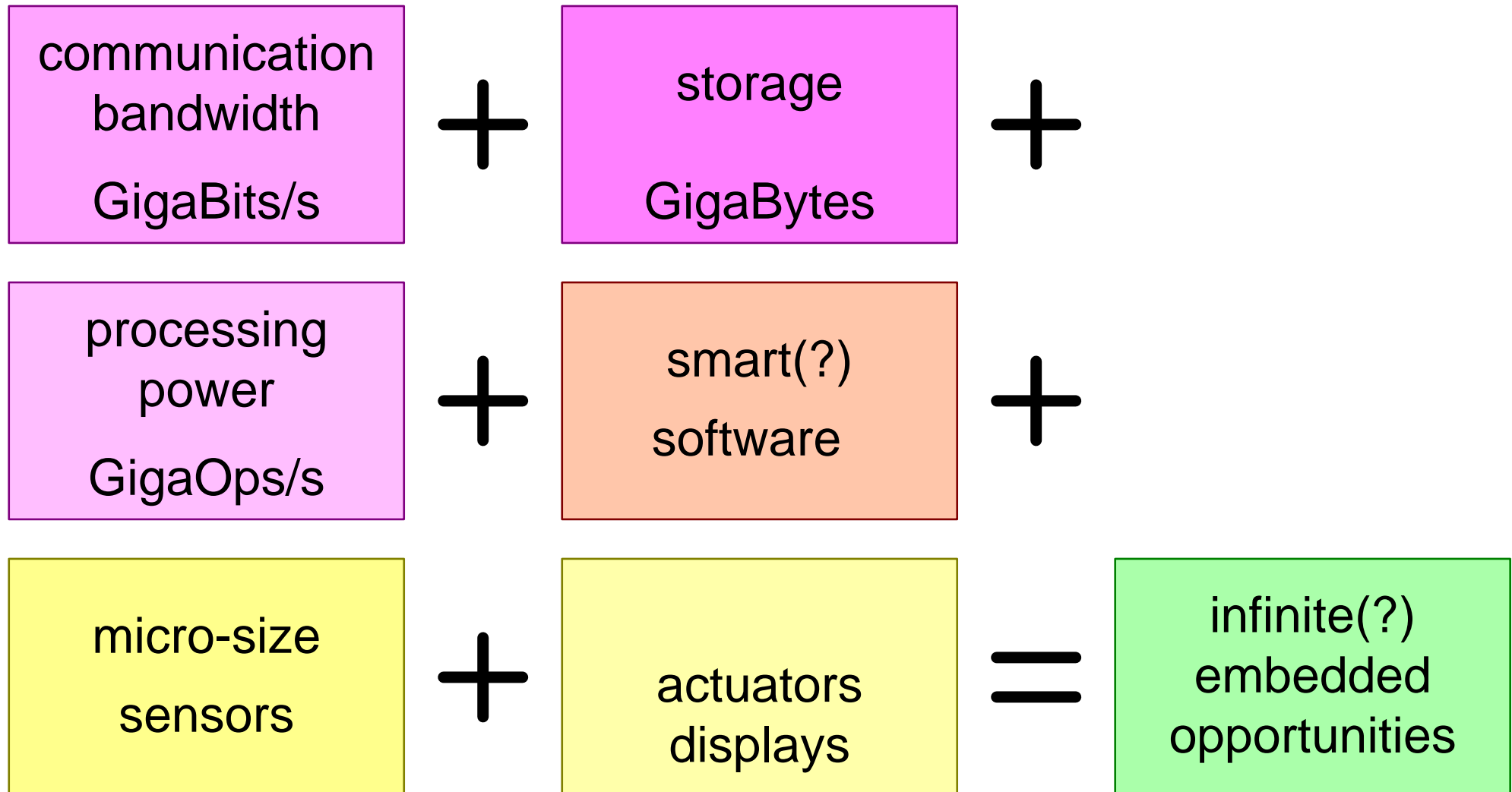
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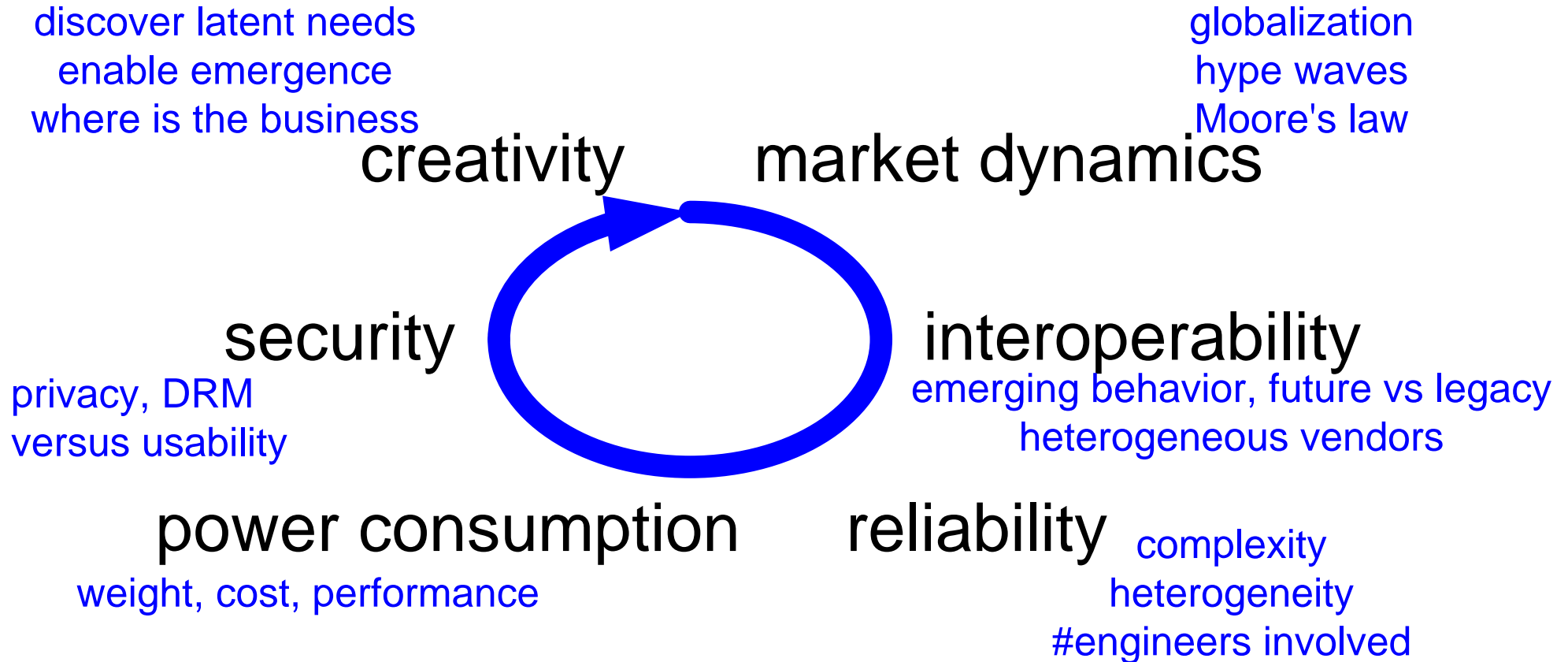
logo  
TBD

# Giga embedded opportunities

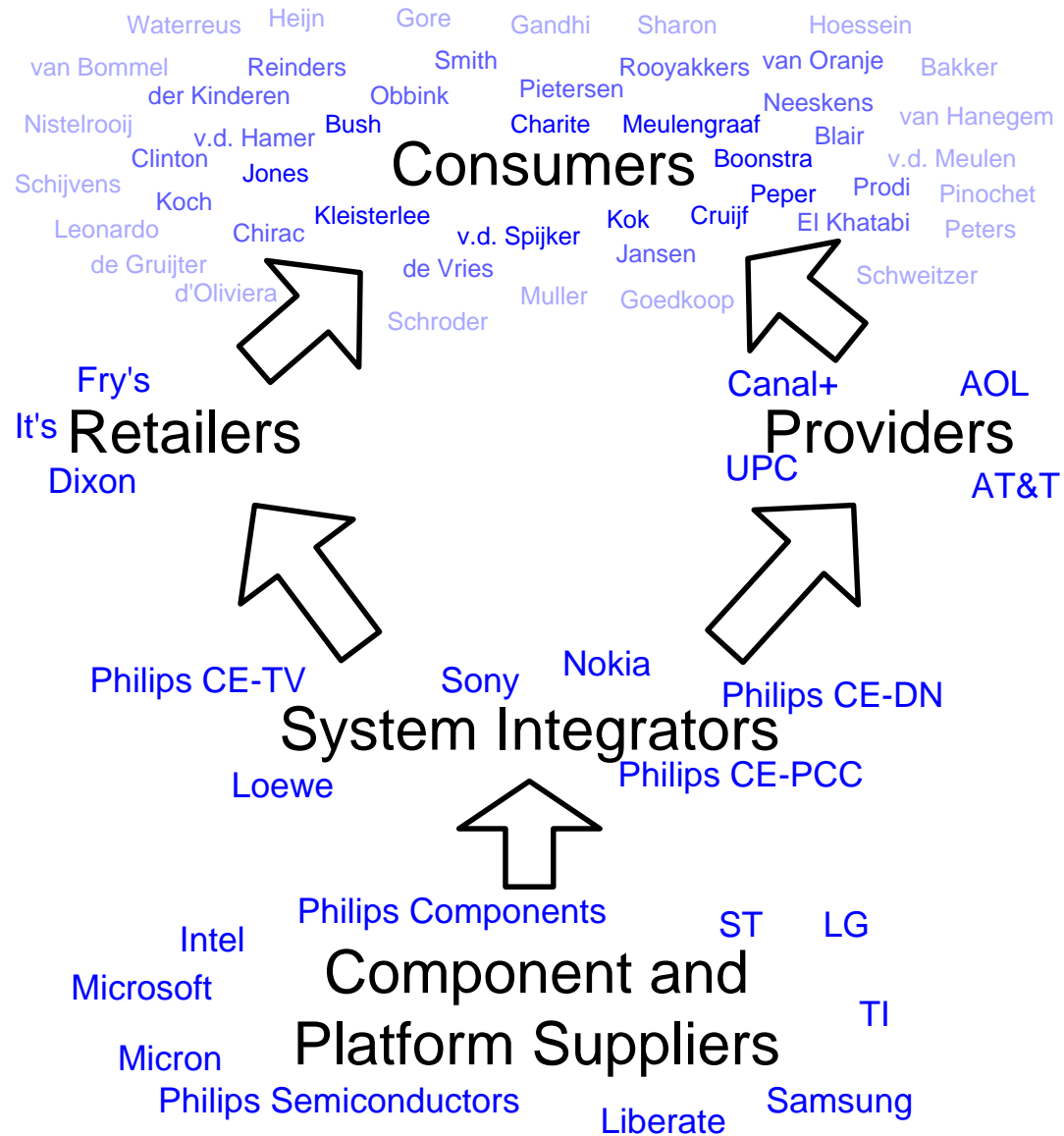


# Hit list of challenges

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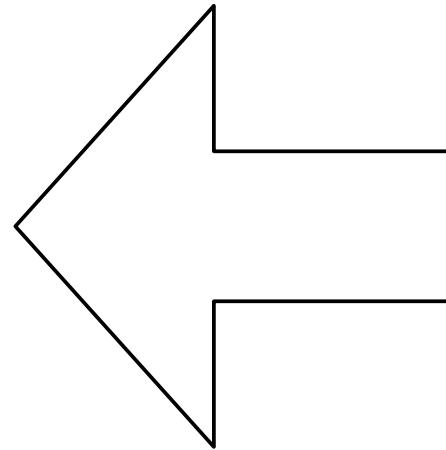
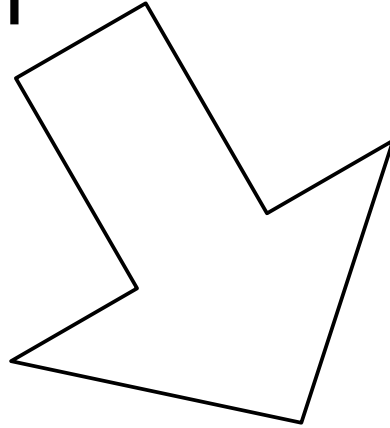
# Value Chain in Consumer Electronics



# Trend: convergence

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Telecom



Computer

Consumer

# 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



Communicator



Ambient Intelligence  
living room



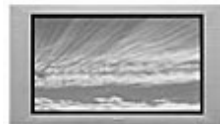
car navigation



computer

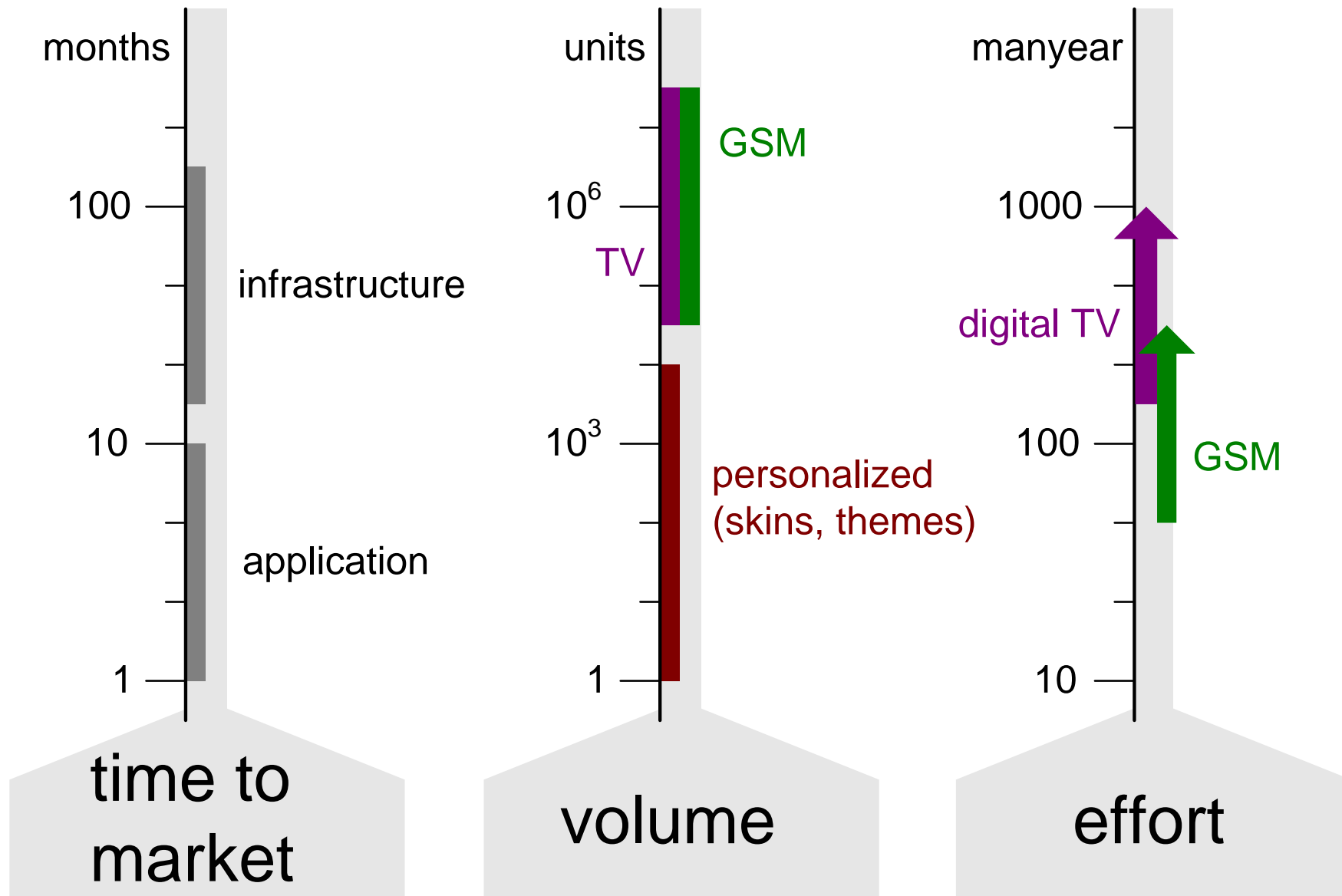


games



flat display

# 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

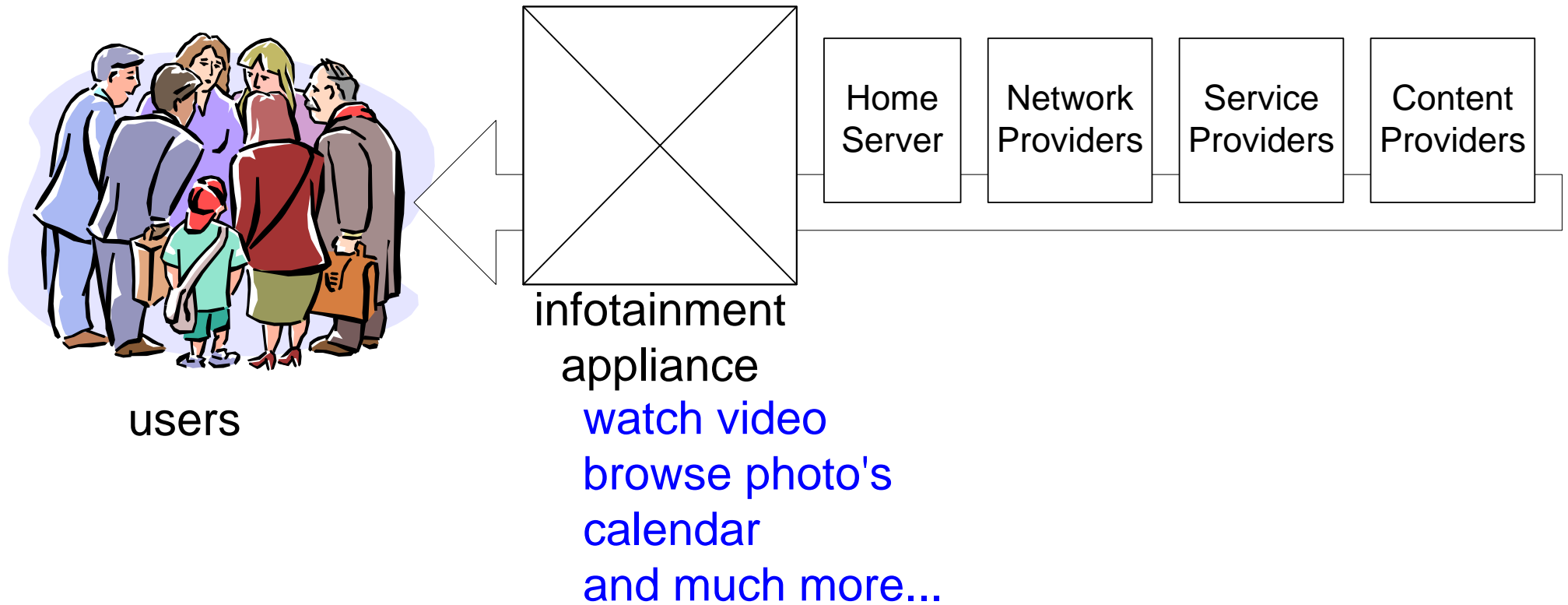


new standards

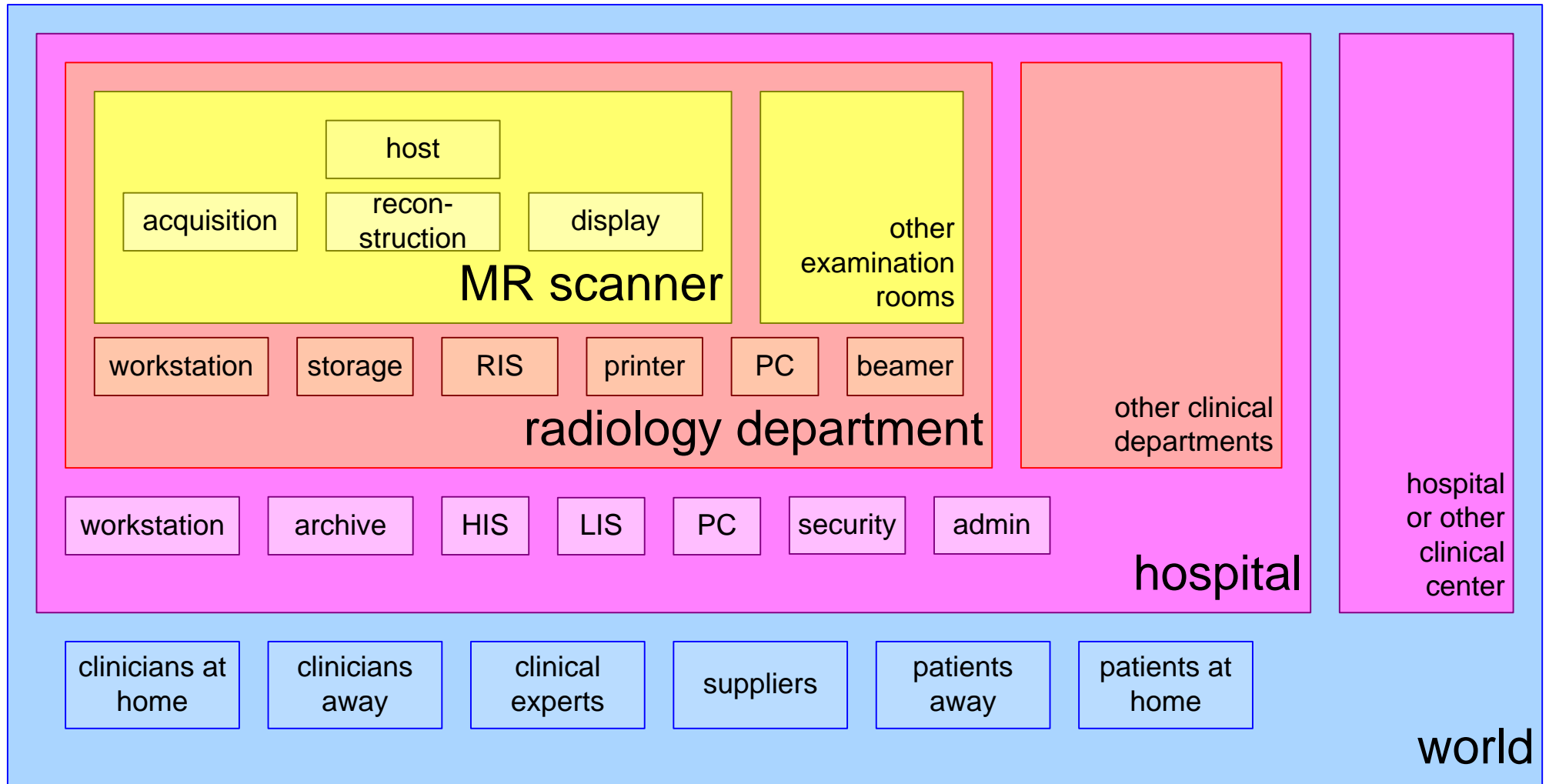


reuse

# Applications depend on chain of systems



# Interoperability: systems get connected at all levels



# Multi dimensional interoperability

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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

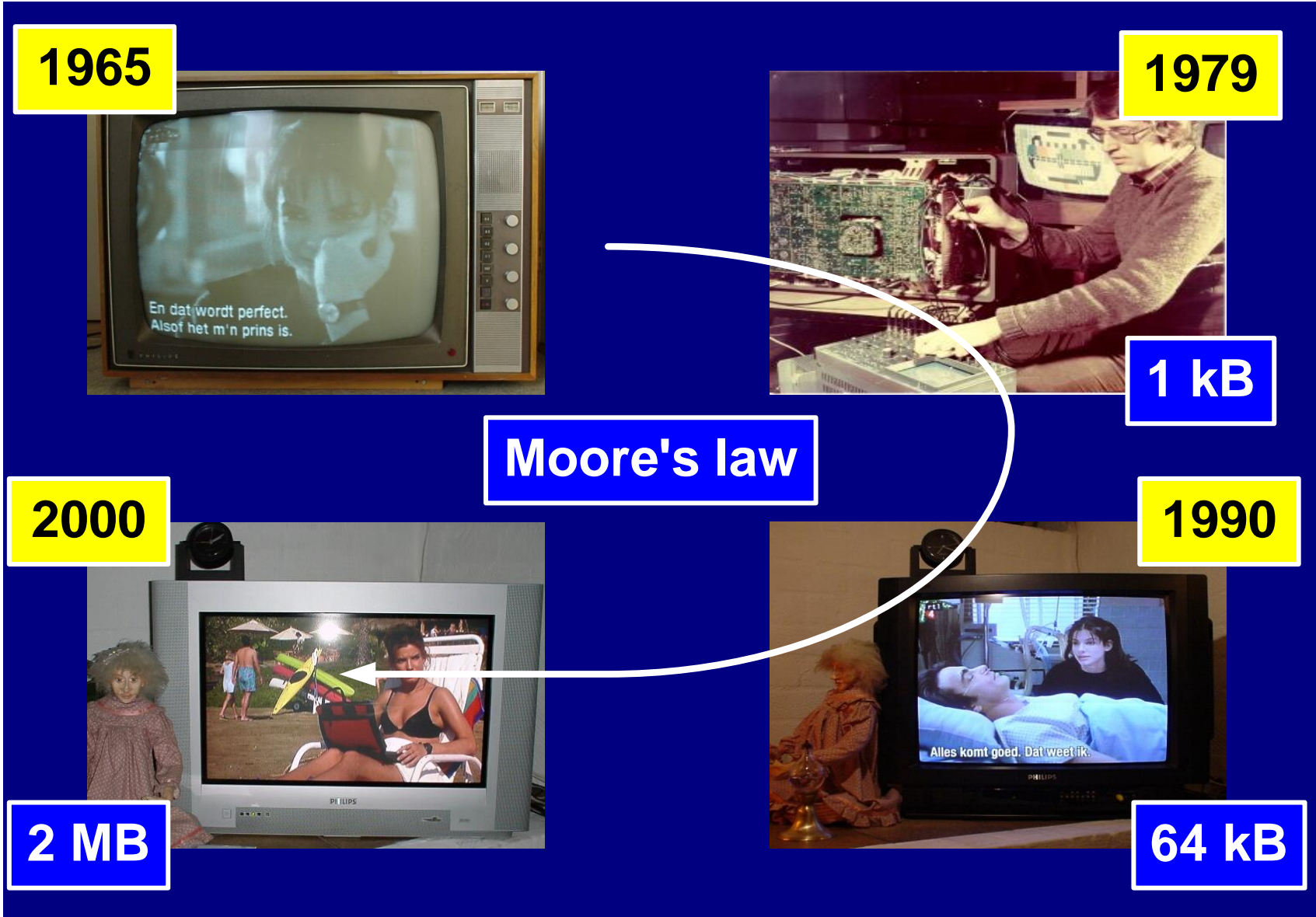
and **multiple**

releases

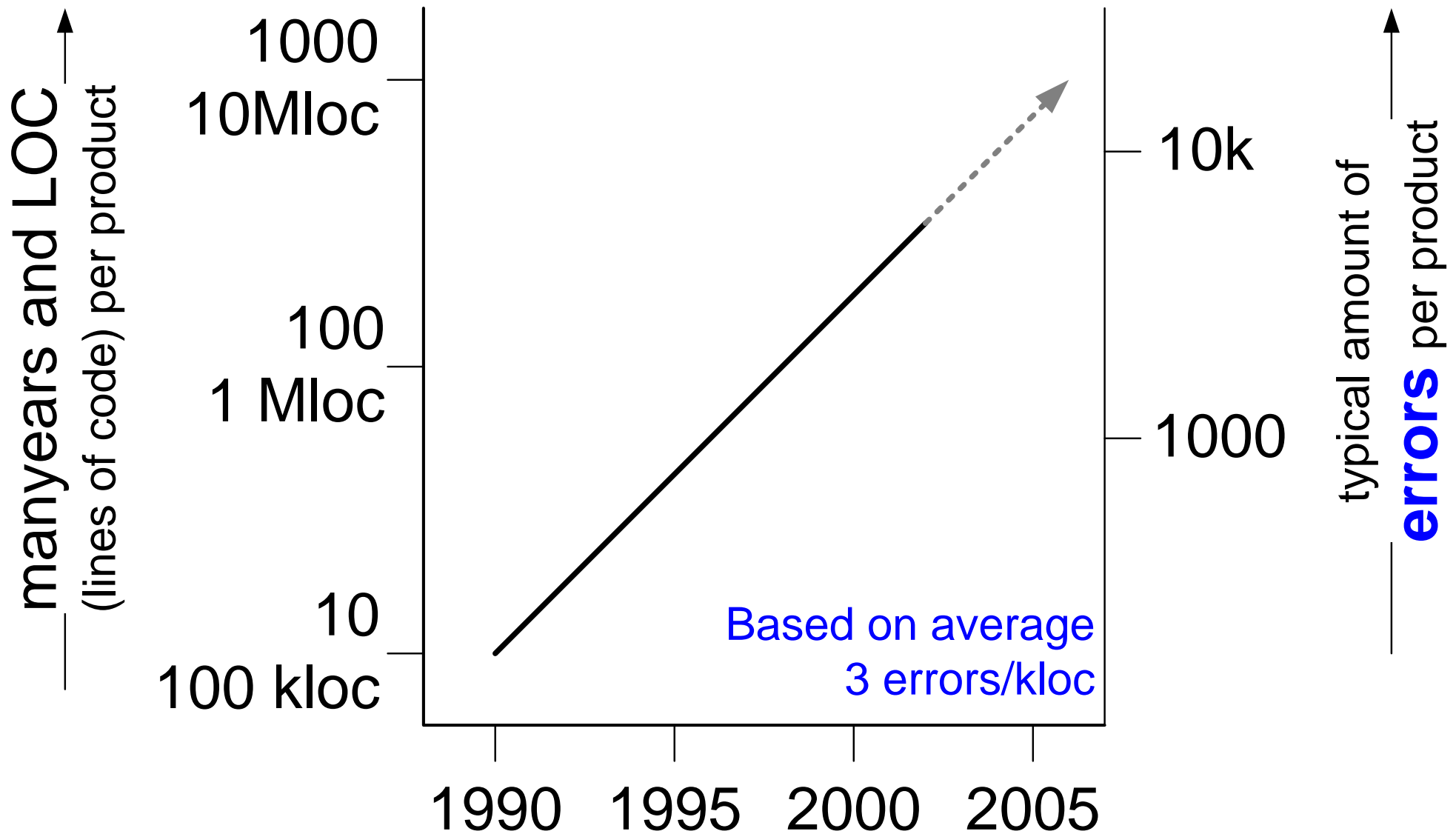
R5  
R6.2  
R7.1

# SW increase in televisions

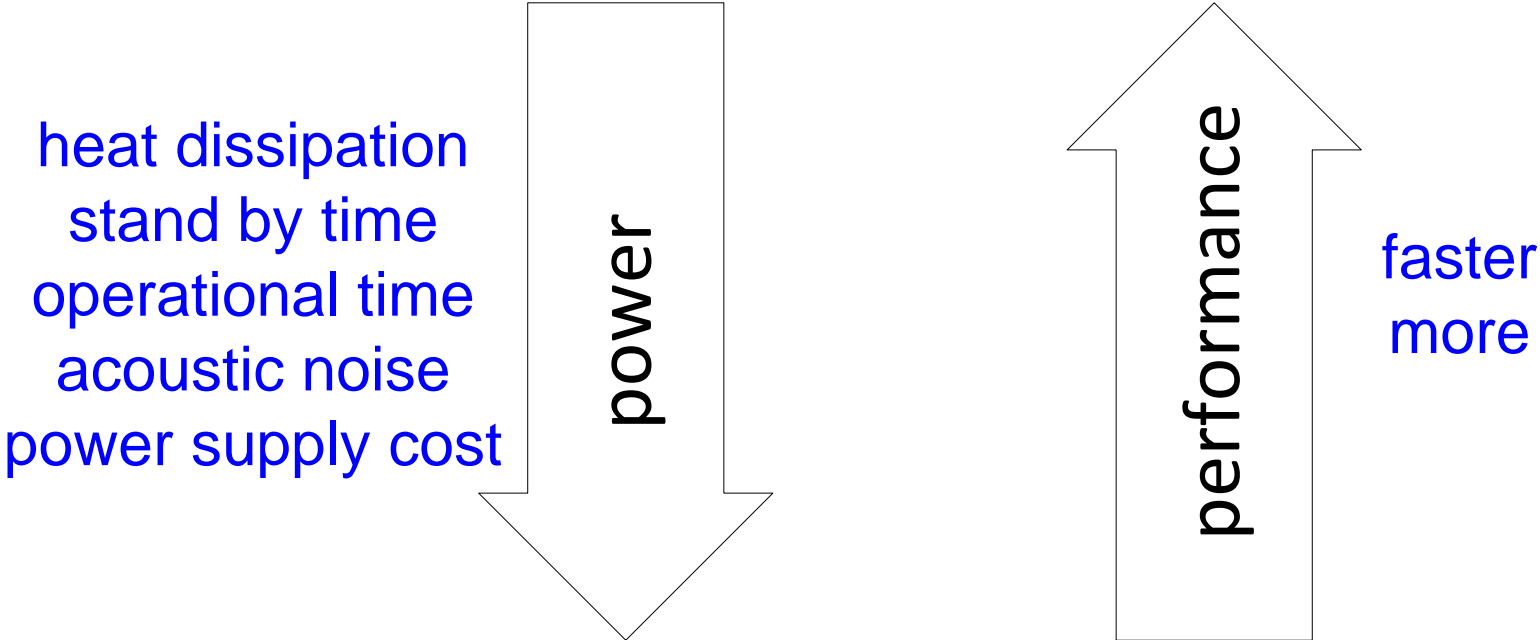
From: COPA tutorial, Rob van Ommering



# Increase of software threatens Reliability

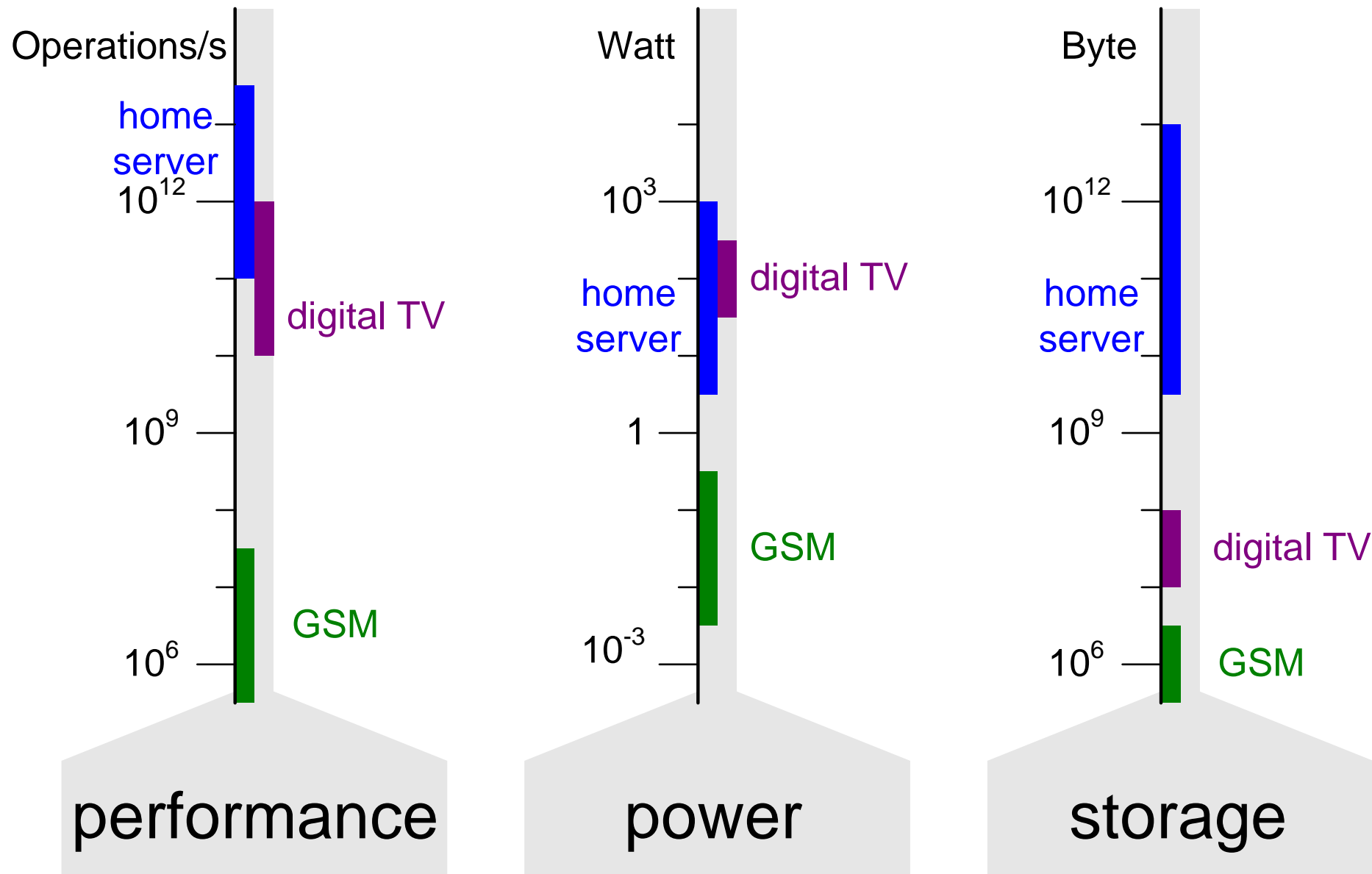


# Power consumption and dissipation

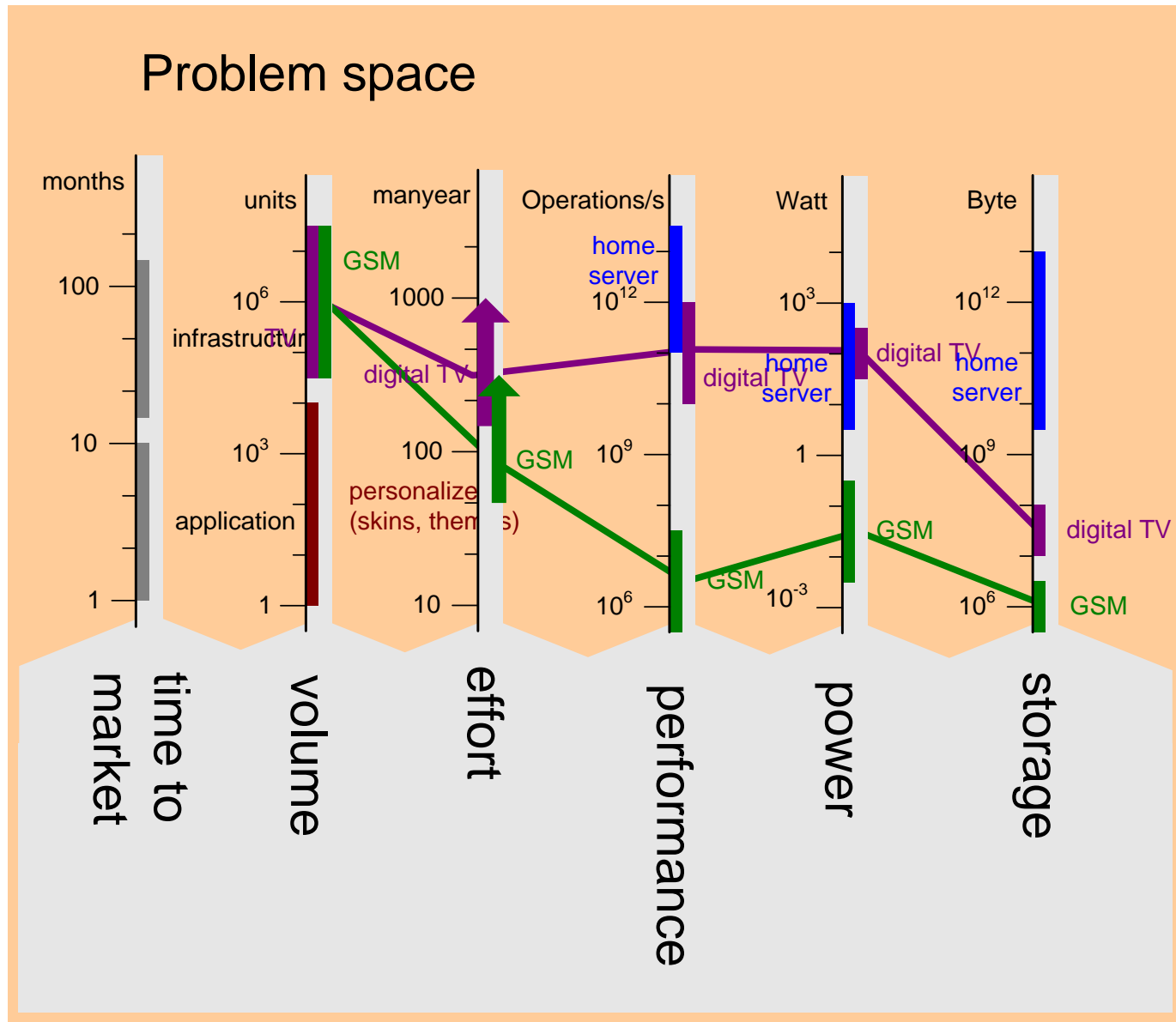


<i>3G phone</i>	examples	<i>desktop</i>
standby time operational time wireless video	<i>data centers</i> insufficient power in Amsterdam	silent fanless  <i>MRI gradients: 66 mT/m</i> kWatts: cost, noise, heat

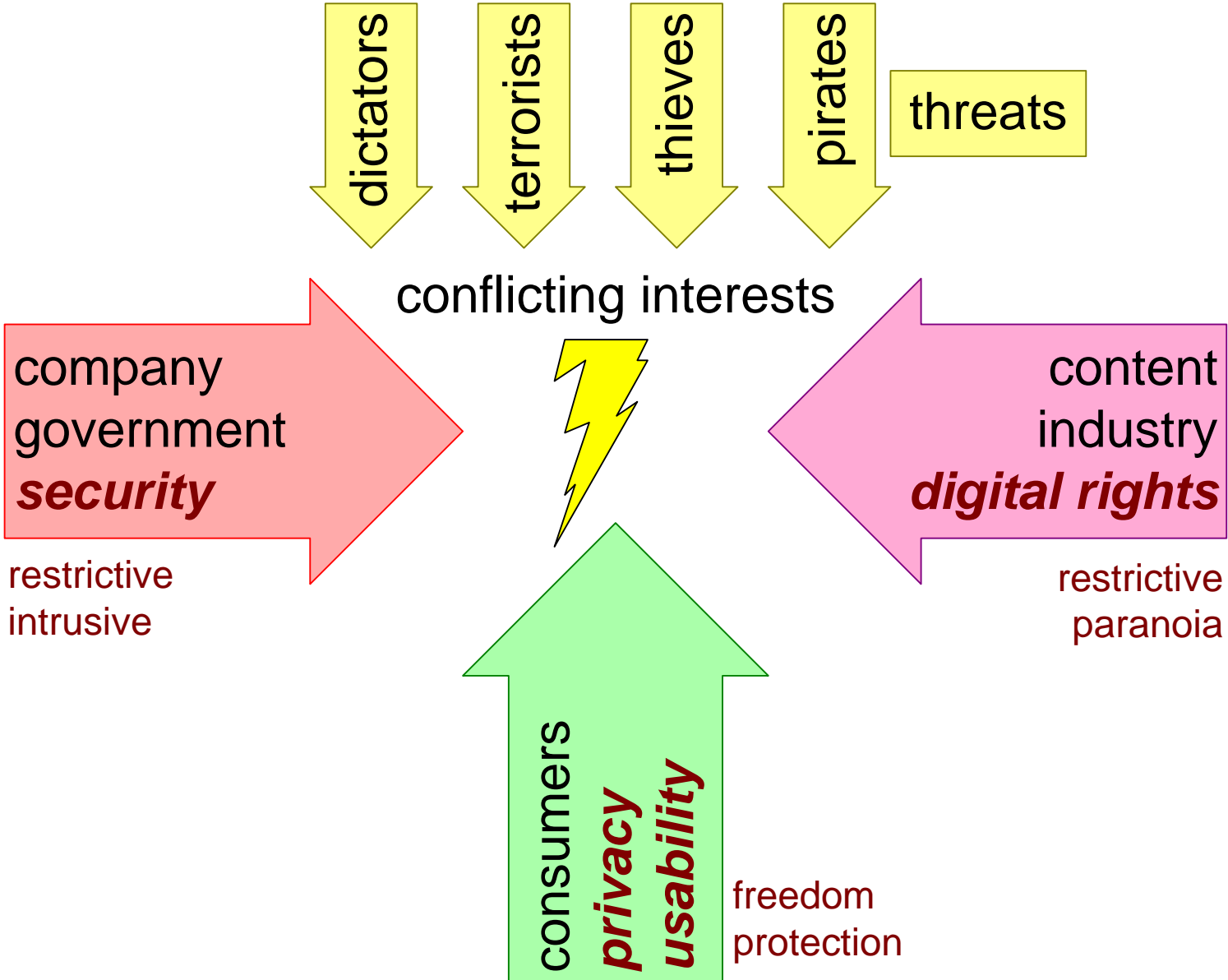
# System Integrator Problem Space - Technology



# Profile of Digital TV and GSM



# Security conflicting interests



# Creativity as limiting factor

