

# Light Weight Architecture revisited: the way of the future?

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## Abstract

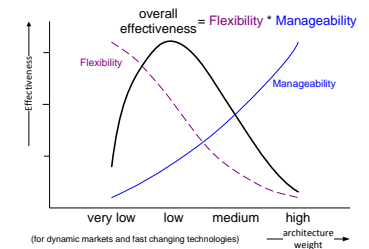
Technological developments change the consumer electronics market into a very dynamic market. CE manufacturers are used to realize product innovation by means of standardization, inside products as well as between products. Standardization and innovation are often conflicting activities. An approach is discussed to optimize the balance, based on "light-weight architectures".

The weight of an architecture determines how easy an architecture can be realized, changed and applied. An heavy architecture has many mandatory rules, which apply always and everywhere, with a large degree of detail. An heavy architecture provides a lot of certainties and control, but is more difficult to adapt to changing circumstances.

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status: finished  
version: 0.0



# What is Architecture?

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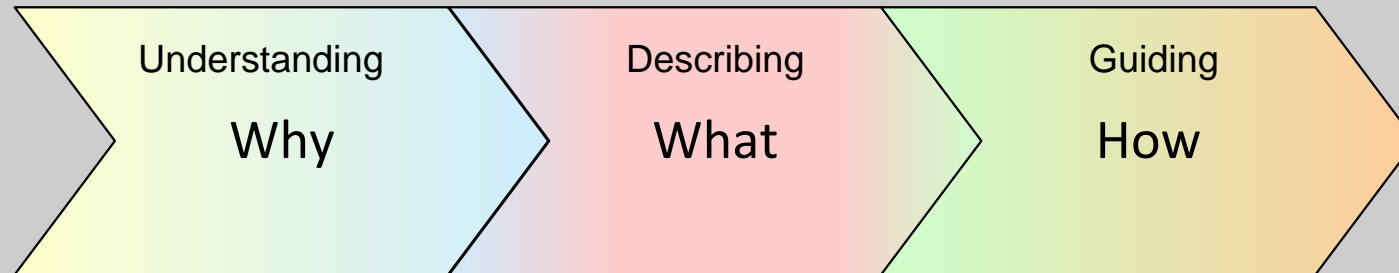


*Do the right things*

*Do the things right*

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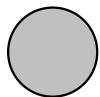
## 1. *Do the right things*; The Dynamic Market



## 2. *Do the things right*; Light-weight Architecture

This appliance may only be used for non commercial use  
accuracy +/- 200 g

On/Off



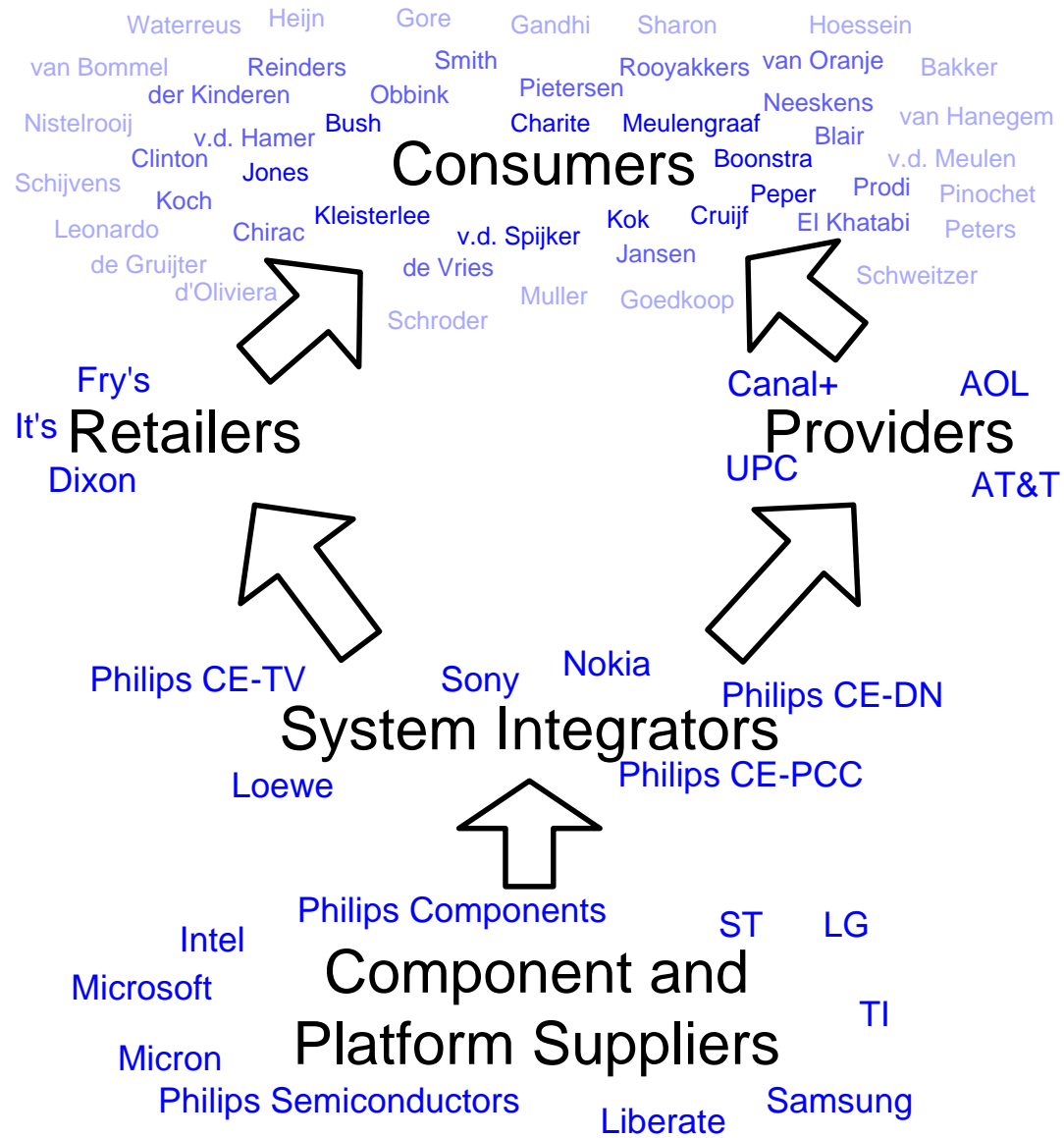
**25 Kg**

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# Part 1:

## Do the right things; The Dynamic Market

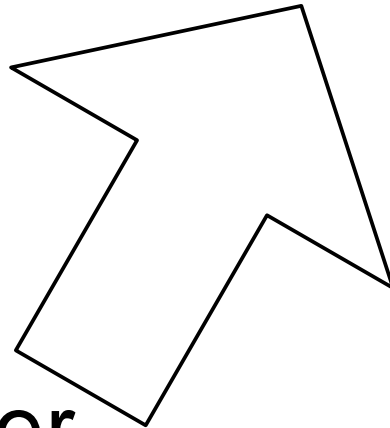
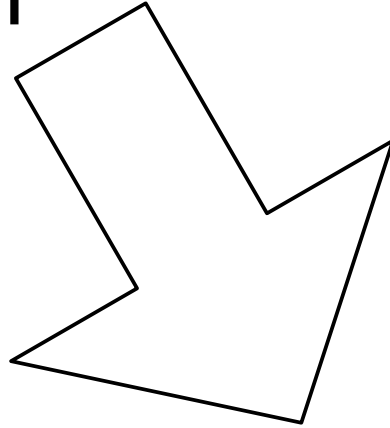
# Value chain



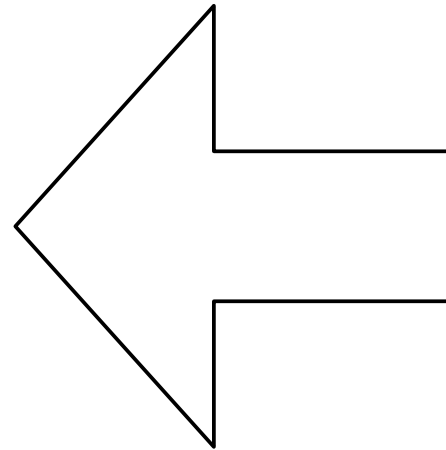
# Convergence

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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



Communicator



Ambient Intelligence  
living room



car navigation



computer



games



flat display

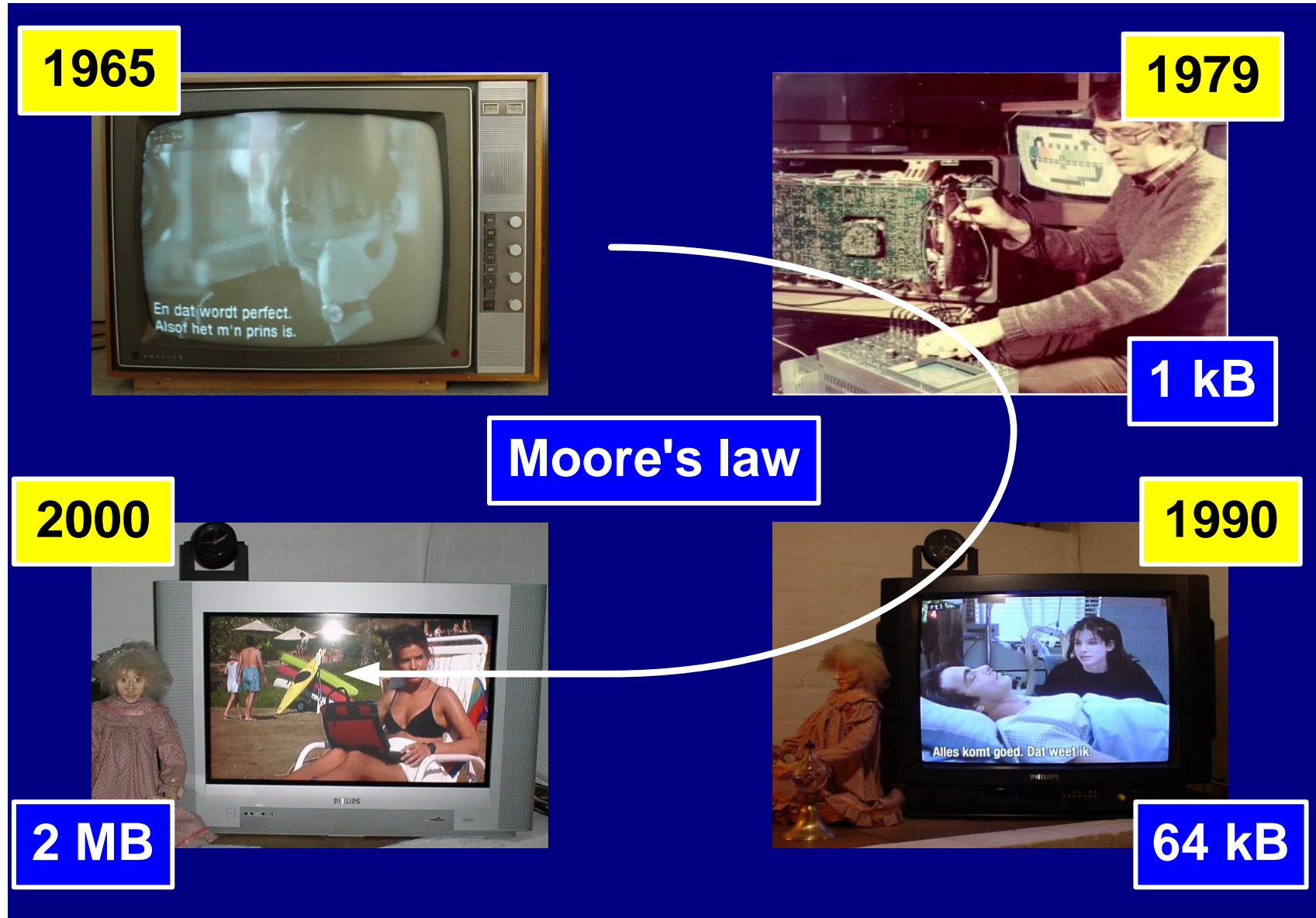
# Uncertainty (Dot.Com effect)



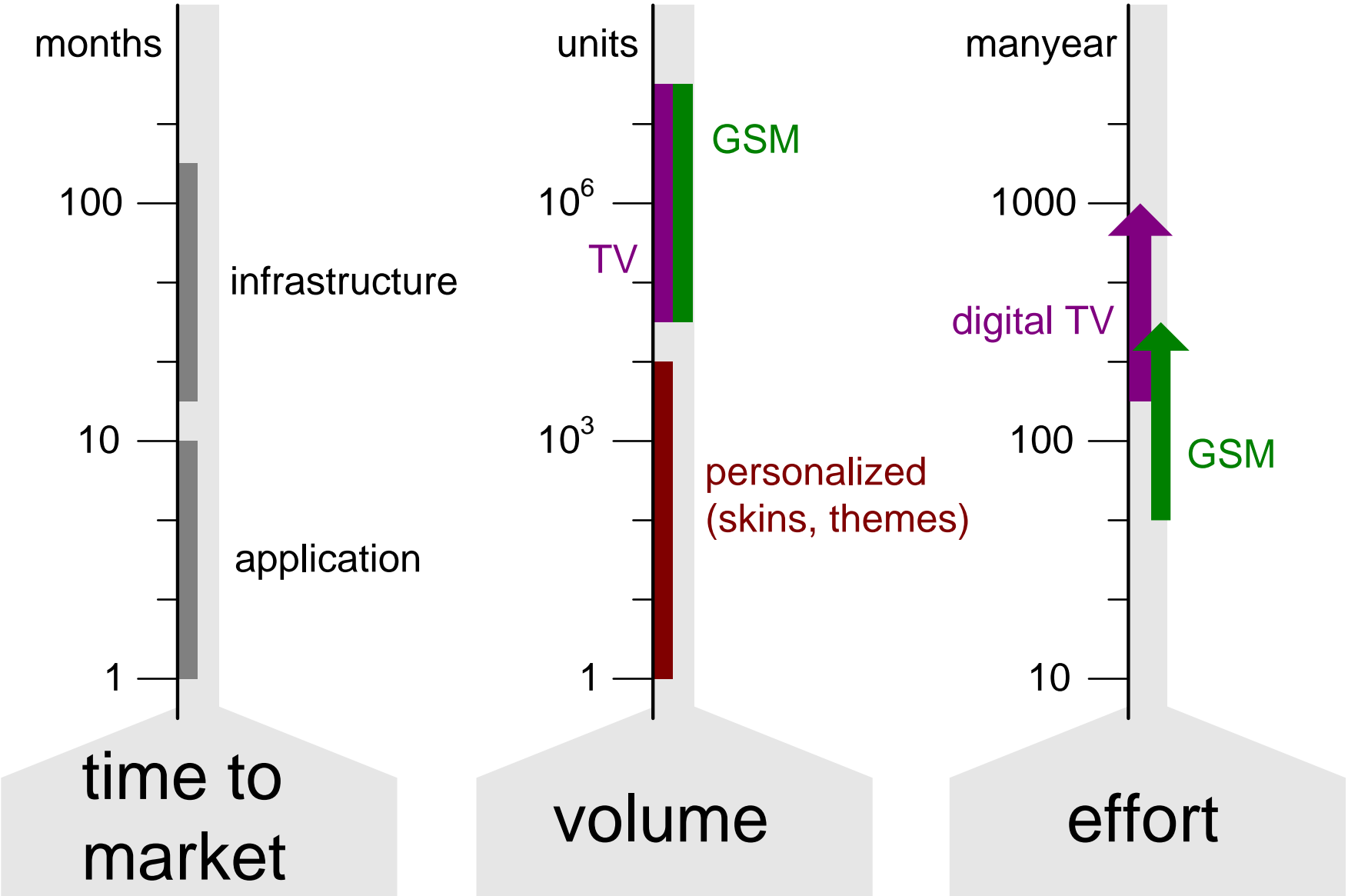
source: BigChart.com  
dd march 19, 2001

# Moore's law

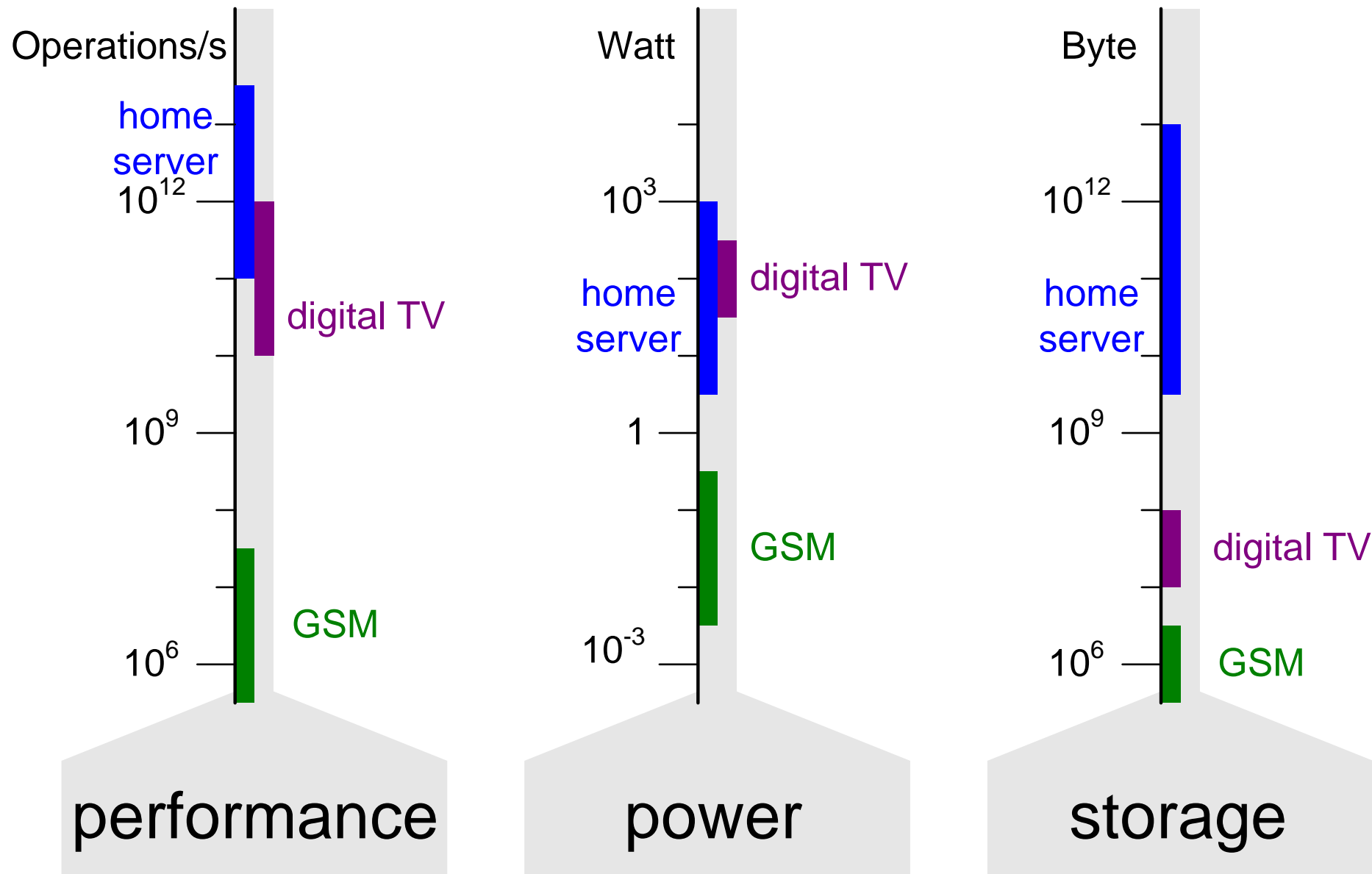
From: COPA tutorial, Rob van Ommering



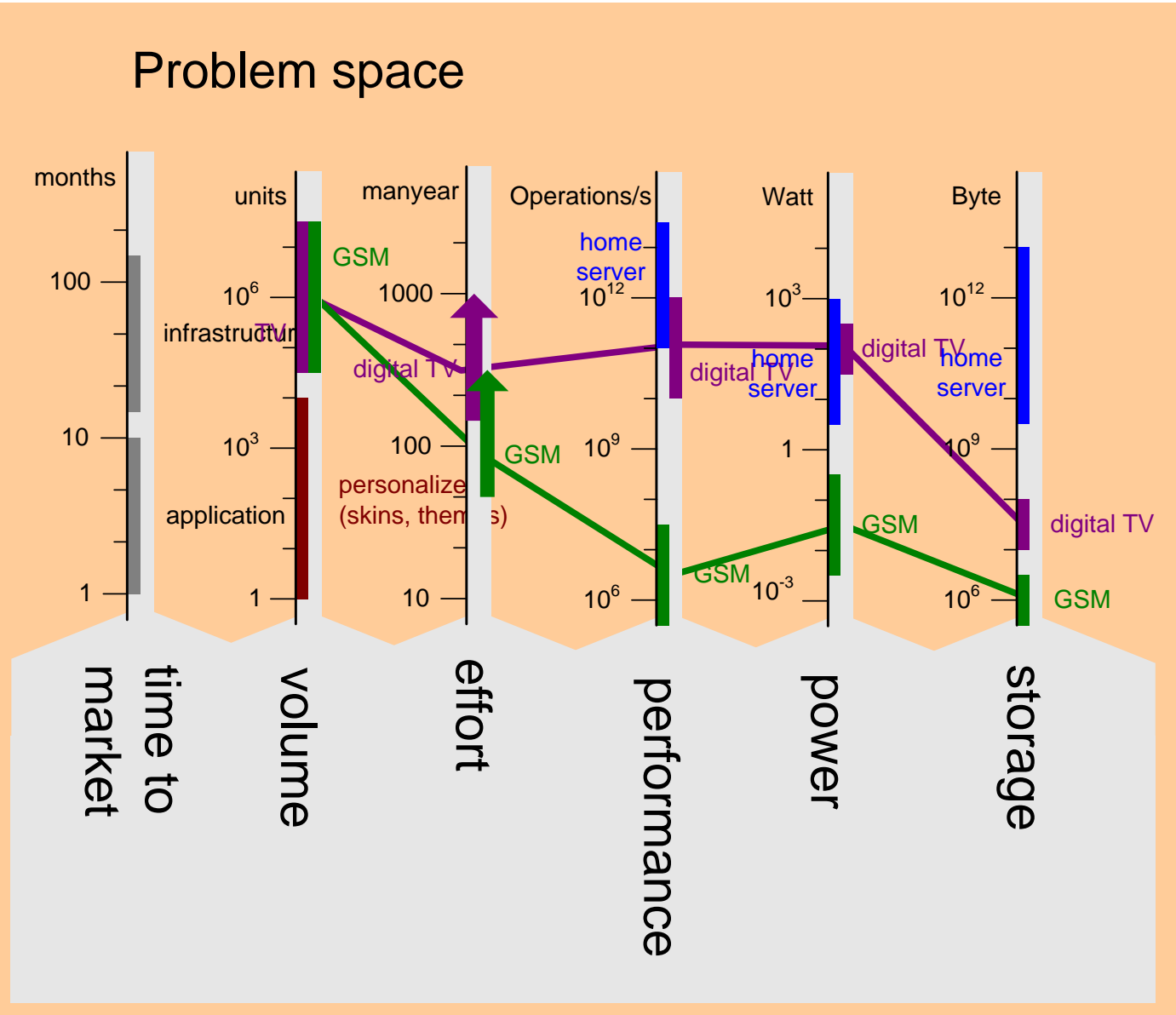
# System Integrator Problem Space - Business



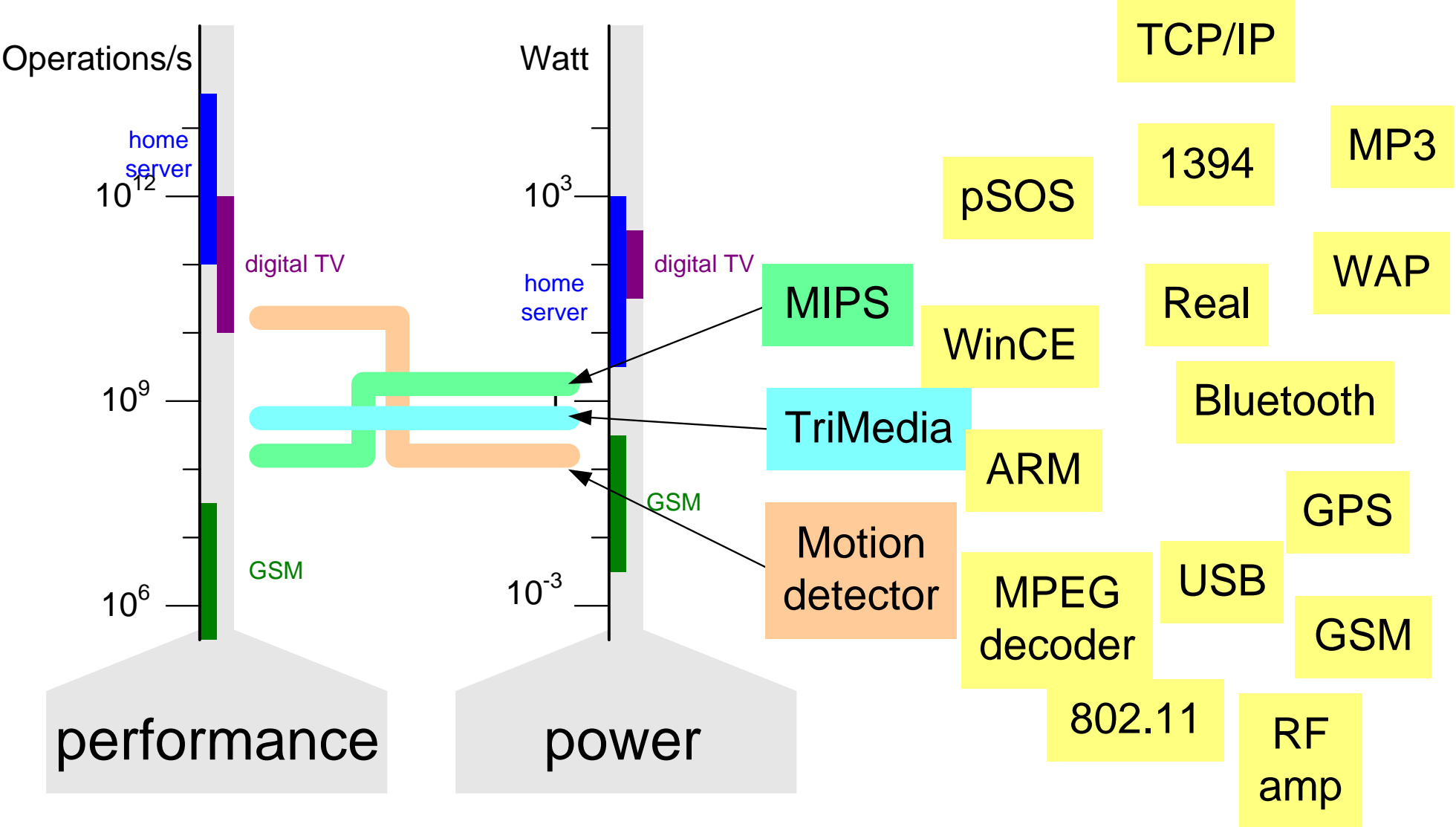
# System Integrator Problem Space - Technology



# System profile



# Semiconductors Technology solutions



# Partial Solution: Configurable Component Platform

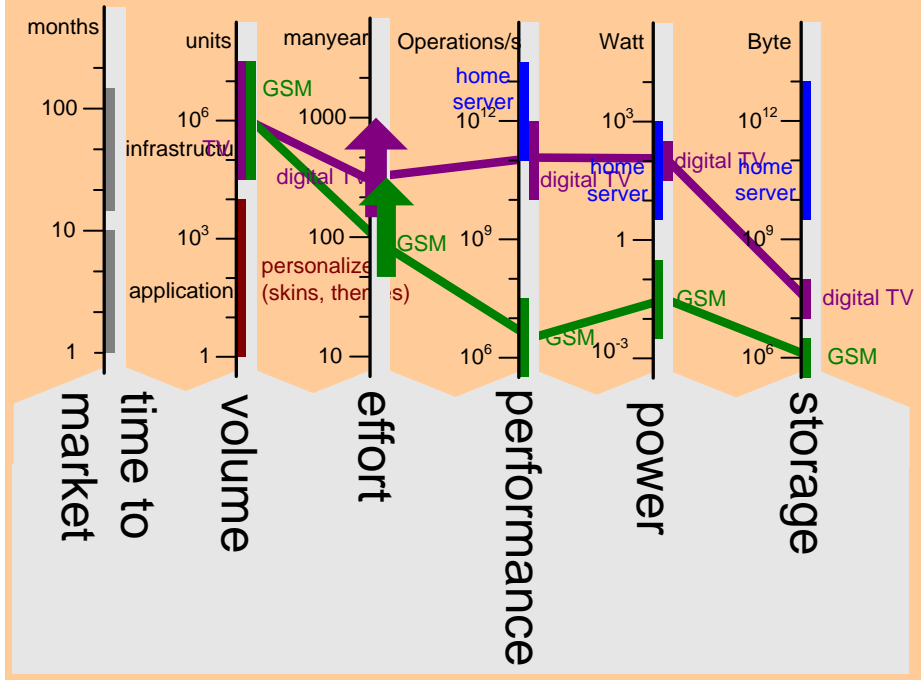
Technologies \ Systems	Technologies														
	MIPS	TriMedia	MPEG decoder	ARM	Real	GSM	RF amp	Bluetooth	TCP/IP	MP3	pSOS	WinCE	1394	GPS	
watch				●	○	○	○	●	○	○	●	○		○	
communicator	○	○	○	●	●	●	●	○	●	○	●	○		○	
digital TV	●	●	●					○	○	○	●	○	●		
set top box	●	●	●					○	●	○	●	○	●		
pda	○	○	○	●	○	○	○	○	●	○		●		○	
camcorder	●	●	●			○	○	○	○	○	●		●	○	

● required

○ optional

# Exploring problem space and solution ingredients

## Problem space



Technologies	MIPS	TriMedia	MPEG decoder	ARM	Real	GSM	RF amp	Bluetooth	TCP/IP	MP3	pSOS	WinCE	1394	GPS
Systems														
watch				●	○	○	○	●	○	○	●	○		○
communicator	○	○	○	●	●	●	●	○	●	○	●	○		○
digital TV	●	●	●					○	○	○	●	○	●	
set top box	●	●	●					○	●	○	●	○	●	
pda	○	○	○	●	○	○	○	○	●	○		●		○
camcorder	●	●	●			○	○	○	○	○	●		●	○

● required  
○ optional

Composable Architecture

Family of products

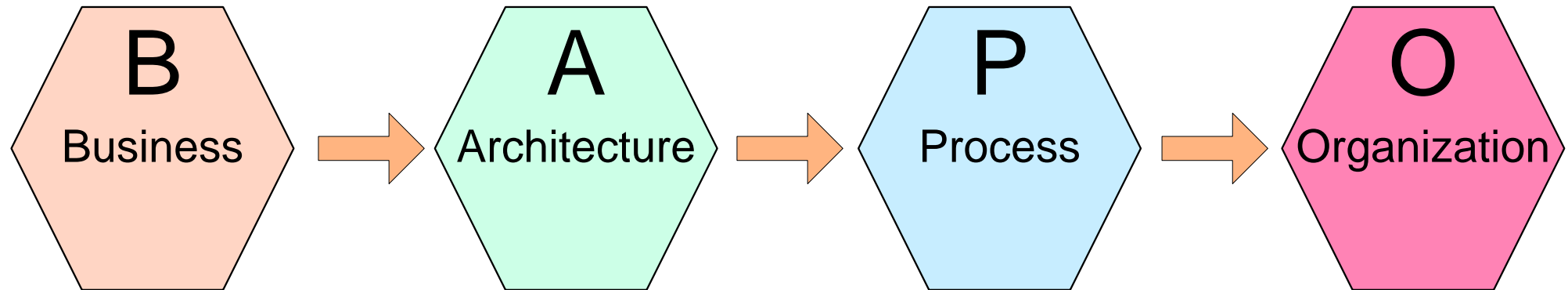
Solution ingredients

Configurability

Programmability, flexibility  
Increase supplier content  
Competitive Performance / cost / power

# More than Architecture

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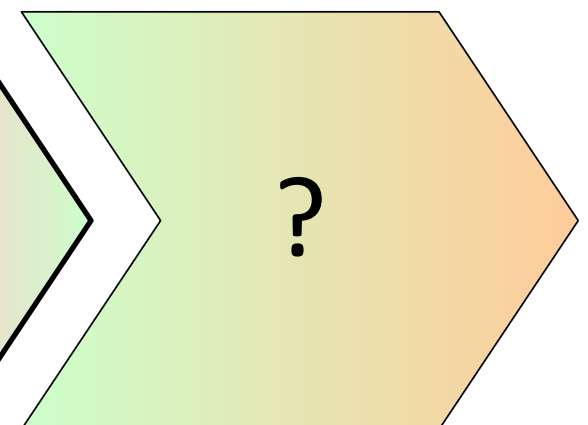
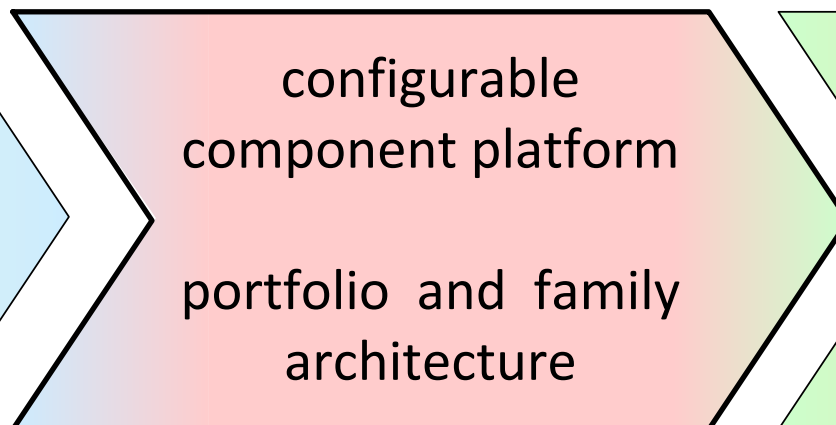
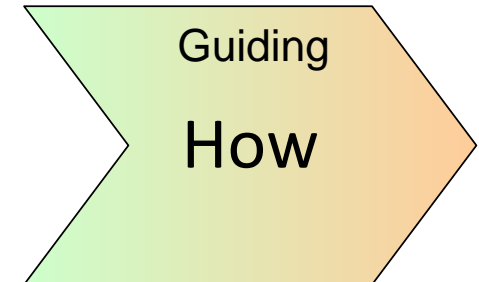
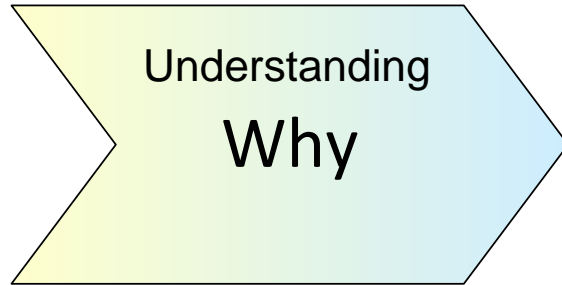


From: COPA tutorial;  
Philips SW conference 2001.

Architecture only works if the complementary viewpoints are addressed consistently

# Conclusions Part 1

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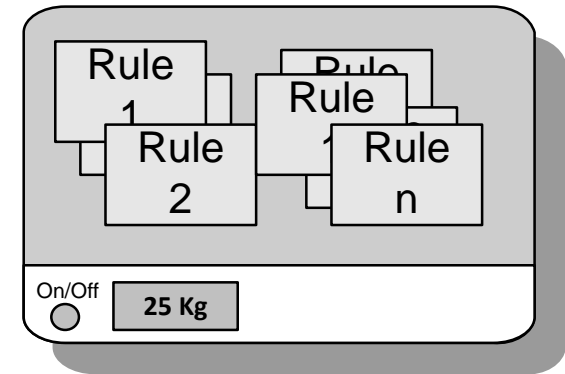
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## Part 2:

Do the things right: light-weight architecture;  
Architectural Chaos or Bureaucratic Control?

# Architecture Weight

$$\text{weight}(\text{architecture}) = \sum_{\text{all rules}} \text{weight}(\text{rule})$$



$\text{weight}(\text{rule}) = f ($ 
 level of **enforcement** ,  
**scope** (impact) ,  
**size** ,  
 level of **coupling** or  
 number of dependencies )

guideline	conditional rule	mandatory rule
component	product	portfolio
single-line	multi-line	multi-page
stand-alone	builds on many rules	
← low ——— weight ——— high →		

# Scope and Impact

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Business or Portfolio

| n  
| m

Product Family

| n  
| m

Product

| n  
| m

Subsystem

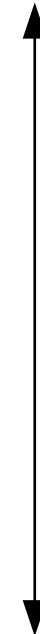
| n  
| m

Component

Heavy-weight

High impact

Large scope

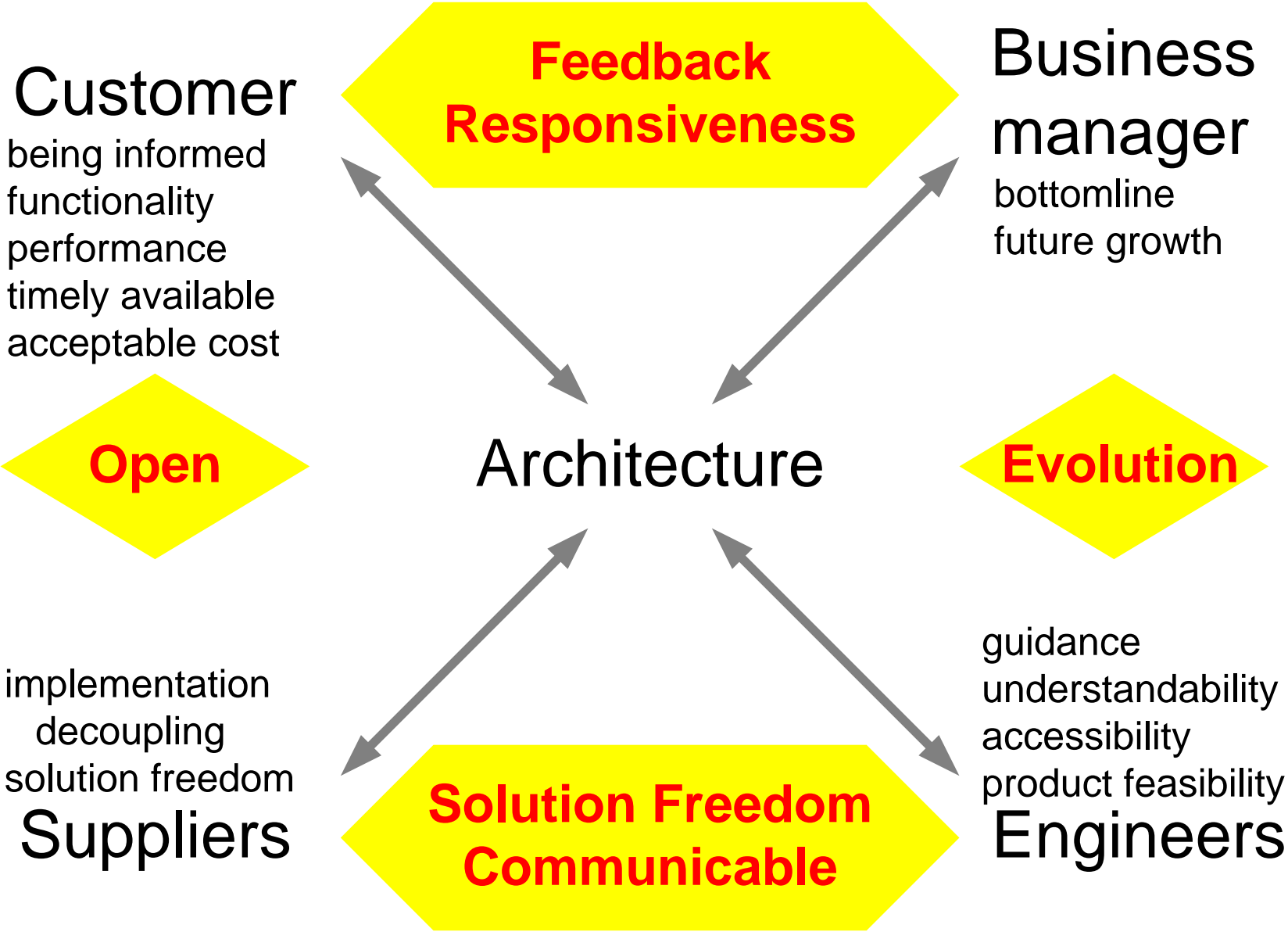


Small scope

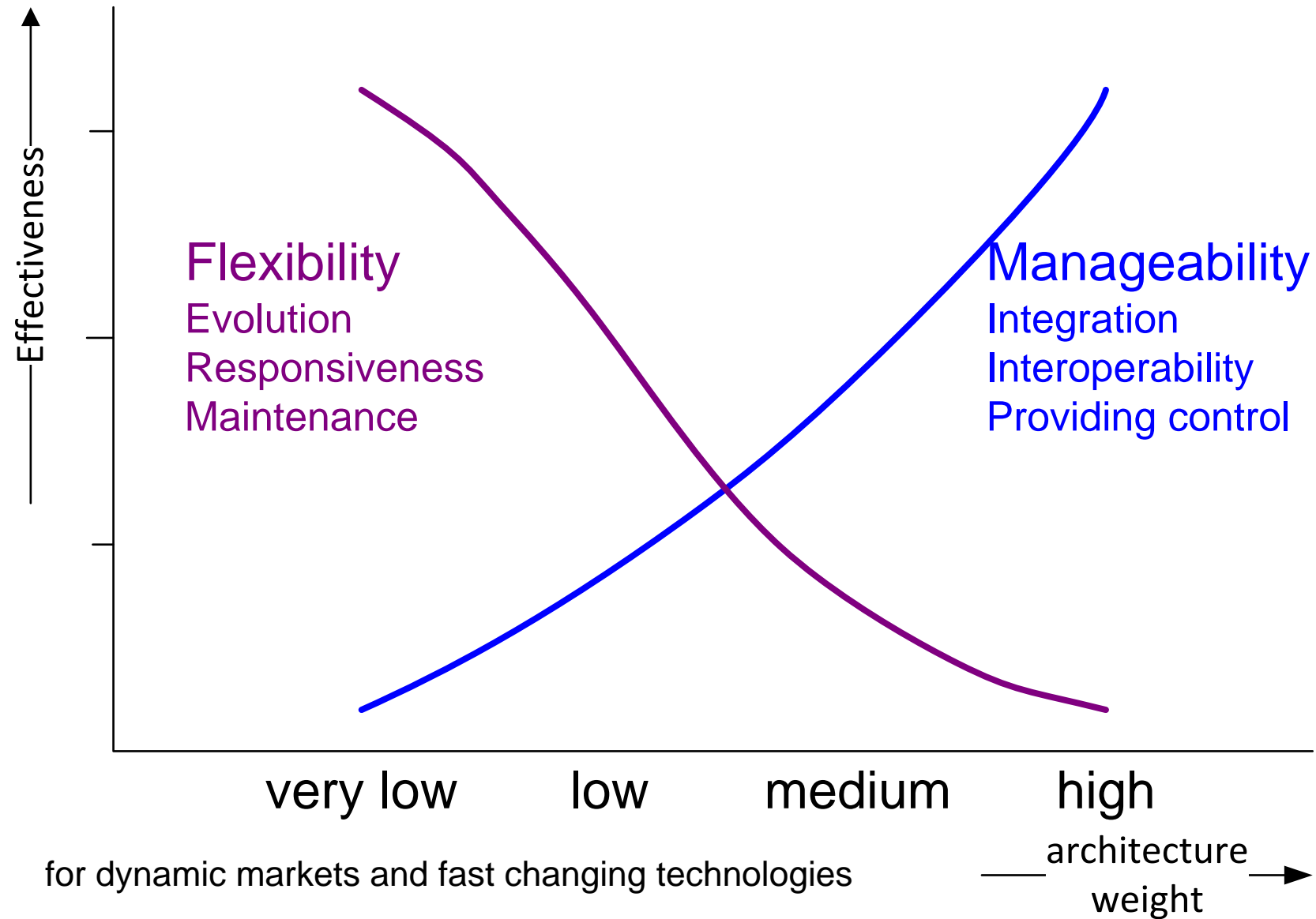
Low impact

Light-weight

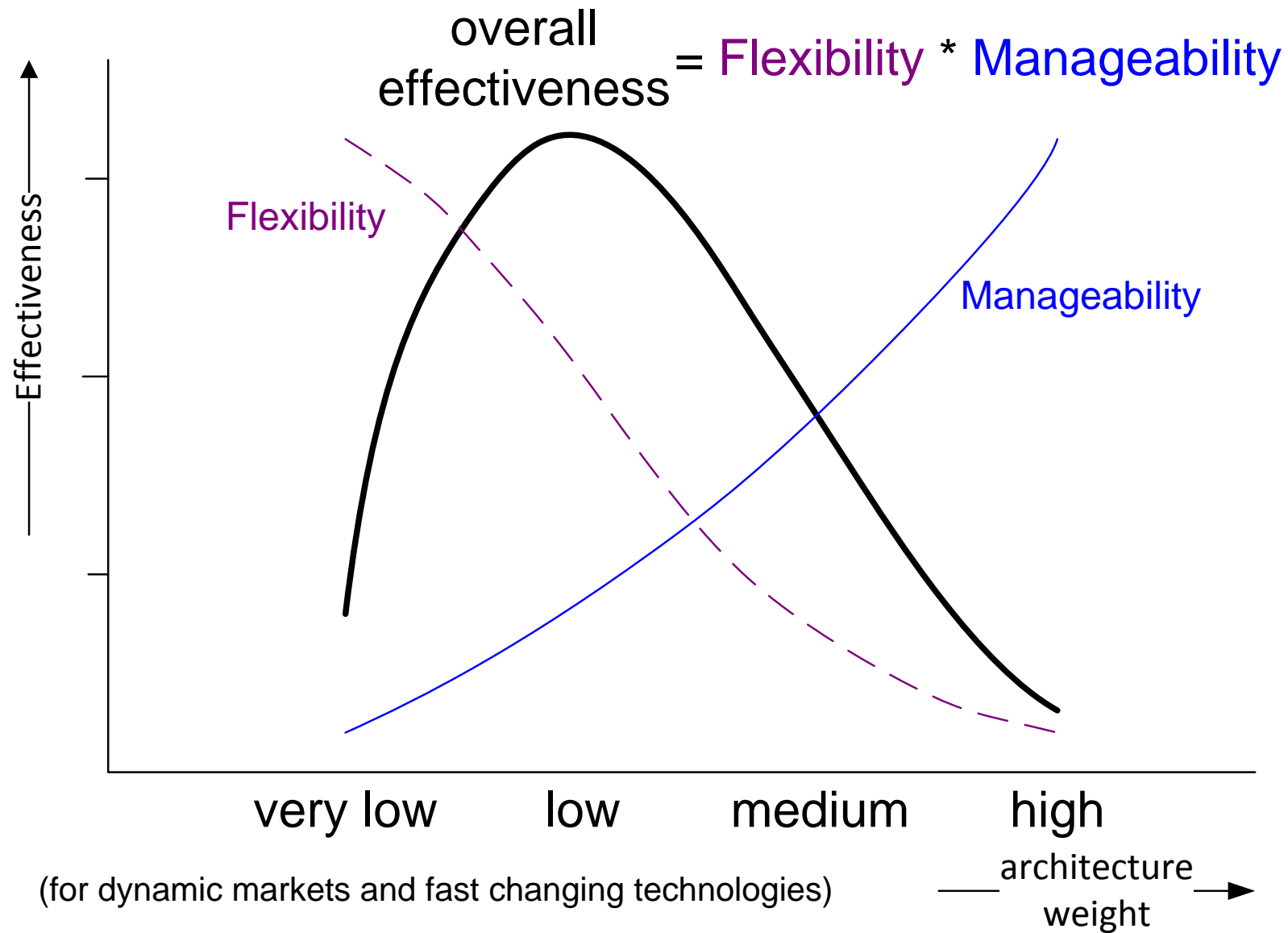
# Criteria for an Architecture



# Weight versus Effectiveness



# Conclusion Part 2



# Light Weight How -To

$$\text{weight}(\text{architecture}) = \sum_{\text{all rules}} \text{weight}(\text{rule})$$

2. Minimize the weight per rule

1. Reduce the rule set to the (business) essential

Understand

- your customer
- your customer's customer etcetera

# Minimize Rule Weight

weight(rule)=

f ( level of **enforcement** ,

**scope** (impact) ,

**size**,

level of **coupling** or  
number of dependencies )

minimize number of mandatory rules

empower, delegate

minimize implementation details  
focus on essential concepts

Apply design principles on architecture  
Multi-view architecting

# Size example: from detail to concept

Every processor will be:

minimize implementation **details**  
focus on essential **concepts**

ARM 922T

ARM 9

ARM  
ISA compatible

able to run VxWorks  
OS compatible

no constraint

heavy

medium

light

by the way, is this rule essential?

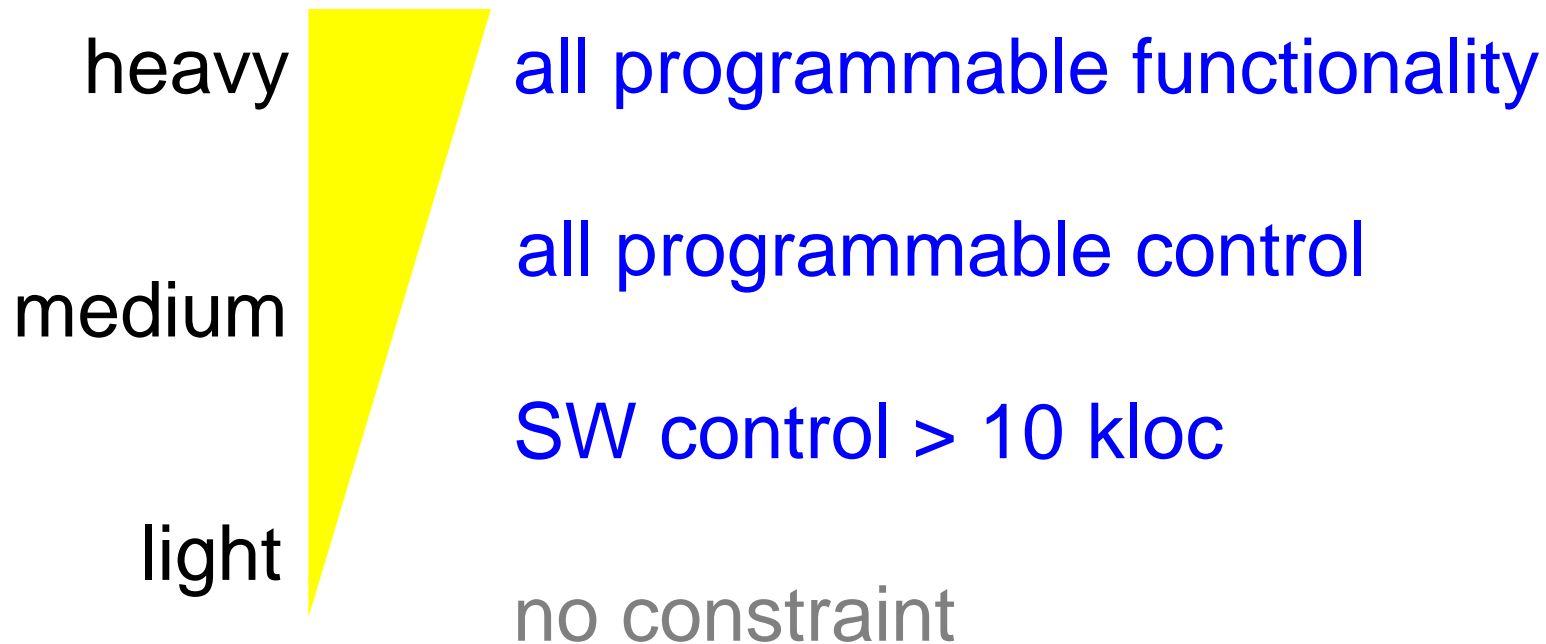
1. Reduce the rule set to the  
(business) essential

# Scope example

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**scope** (impact) , empower, delegate

use ARM ISA compatible processor for:



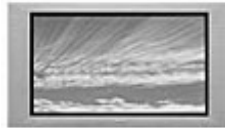
# Example product scope of rules

ARM !



GSM phone

ARM ?



flat display

ARM ?



car

ARM ??



pen



Communicator



television



watch



pda

and what about OS:

PalmOS, Symbian, WindowsCE, Linux, VxWorks, dedicated kernel, ...

and what about programming language, storage, network, power, protocols, formats, user interface, ...

