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.
What is Architecture?

Understanding Why
Describing What
Guiding How

Do the right things
Do the things right
Table of Contents

1. Do the right things; The Dynamic Market

2. Do the things right; Light-weight Architecture

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On/Off

25 Kg

This appliance may only be used for non commercial use
accuracy +/- 200 g
Part 1:

Do the right things;
The Dynamic Market
Value chain

Providers
- UPC
- Canal+
- AOL
- AT&T

Retailers
- Fry's
- Dixon

Consumers
- Boonstra
- Peper
- Kok
- Chirac
- Blair
- Pietersen
- Smith
- Jones
- Jansen
- Muller
- Kleisterlee
- Clinton
- Koch
- Leonardo
- de Gruijter
- d'Oliviera

System Integrators
- Sony
- Nokia
- Philips CE-TV
- Philips CE-DN
- Philips CE-PCC
- Loewe
- Philips Components
- Intel
- Microsoft
- Micron
- Philips Semiconductors

Component and Platform Suppliers
- ST
- LG
- TI
- Samsung
- Liberate
- Liberatel
- Samsung
- LG
- ST
- TI
- Philips Semiconductors
- Philips Components
- Microsoft
- Intel
- Micron
- Philips CE-PCC
- Philips CE-DN
- Philips CE-TV
- Loewe
- Sony
- Nokia

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LWAvalueChain
Telecom

Consumer

Computer

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LWAconvergence

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Integration and Diversity

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LWAIntegrationAndDiversity
Uncertainty (Dot.Com effect)

source: BigChart.com
dd march 19, 2001

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Moore's law

1965
1979
2000
1990
1 kB
64 kB
2 MB

From: COPA tutorial, Rob van Ommering

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System Integrator Problem Space - Business

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LWAproblemSpaceBusiness
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LWAProblemSpaceTechnology
System profile

Problem space

- Problem space with various metrics and values:
  - Operations/s: 10 -3
  - Bits: 10^12
  - Watt: 10^9
  - Bytes: 10^12
  - Units: 10^6
  - Months: 100
  - Manyear: 10^3
  - TV: 10^6
  - Personalized skins, themes: 10^9

- Metrics related to technology and performance:
  - Time to market: 1 manyear
  - Volume: 100
  - Effort: 10^6
  - Power: 10^3
  - Storage: 10^6

- Graph showing the relationship between different metrics and values.

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LWAsystemProfile
Semiconductors Technology solutions

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LWAsolutionSpaceTechnology
## Partial Solution: Configurable Component Platform

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<thead>
<tr>
<th>Technologies</th>
<th>MIPS</th>
<th>TriMedia</th>
<th>MPEG decoder</th>
<th>ARM</th>
<th>Real</th>
<th>GSM</th>
<th>RF</th>
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<th>Bluetooth</th>
<th>TCP/IP</th>
<th>MP3</th>
<th>pSOS</th>
<th>WinCE</th>
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- ●: required
- ○: optional
Exploring problem space and solution ingredients

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

Solution ingredients
Configurability

Family of products

Composable Architecture

Technologies

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- required
- optional
Architecture only works if the complementary viewpoints are addressed consistently.
Conclusions Part 1

Understanding

Why

dynamic market convergence integration diversity

Describing

What

configurable component platform portfolio and family architecture

Guiding

How

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LWA2conclusionsPart1
Part 2:

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

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

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

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LWAarchitectureWeight
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LWAArchitectureScope
Criterions for an Architecture

Customer
being informed
functionality
performance
timely available
acceptable cost

Open

Suppliers
implementation
decoupling
solution freedom

Solution Freedom
Communicable

Feedback
Responsiveness

Business
manager
bottomline
future growth

Evolution

guidance
understandability
accessibility
product feasibility

Engineers

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LWAstakeholdersArchitecture
Weight versus Effectiveness

For dynamic markets and fast changing technologies:

- **Flexibility**
  - Evolution
  - Responsiveness
  - Maintenance

- **Manageability**
  - Integration
  - Interoperability
  - Providing control

---

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Conclusion Part 2

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LWAeffectiveness
Light Weight How -To

weight(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) = minimize number of mandatory rules

f ( level of enforcement, empower, delegate minimize implementation details focus on essential concepts

scope (impact),

size,

level of coupling or number of dependencies )

Apply design principles on architecture Multi-view architecting
Size example: from detail to concept

Every processor will be:

- ARM 922T
- ARM 9
- ARM
- ISA compatible
- able to run VxWorks
- OS compatible
- no constraint

minimize implementation details
focus on essential concepts

by the way, is this rule essential?

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

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

use ARM ISA compatible processor for:

- **heavy**
  - all programmable functionality
- **medium**
  - all programmable control
- **light**
  - SW control > 10 kloc
  - no constraint
and what about OS:
- PalmOS, Symbian, WindowsCE, Linux, VxWorks, dedicated kernel, ...

and what about programming language, storage, network, power, protocols, formats, user interface, ...
1. Dynamic Market: Understand Your Customer

2. Optimal architecture: Light weight!