Software Productivity for Consumer Appliances

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Abstract

Technological developments, such as miniaturization and convergence have a strong impact on the form, function and content of consumer appliances. The appliance makers are struggling with the consequences, especially with the exponential increasing SW effort. The trends and the impact on consumer appliances are discussed. Then the software effort problem is analyzed and solution directions for the SW productivity problems are explored.

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Convergence

Telecom

Consumer

Computer
Integration and Diversity
Uncertainty (Dot.Com effect)

source: BigChart.com
dd march 19, 2001

AOL
Amazon.com

source: BigChart.com
dd march 19, 2001

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Moore’s law

From: COPA tutorial, Rob van Ommering

1965
1 kB

1979
1990
64 kB

2000
2 MB

Moore's law

2 MB

64 kB

From: COPA tutorial, Rob van Ommering
Problem: increasing SW size, decreasing reliability?

![Graph showing typical amount of errors per product over time from 1990 to 2005. The x-axis represents years (1990, 1995, 2000, 2005), and the y-axis represents man-years per product in a log scale. The graph shows an increasing trend in errors per product over time.]
Manage large PCP teams of > 1000 people

or

Significantly increase SW productivity

from: Ad Huijser
Philips Software Conference 2001
## Partial Solution: Configurable Component Platform

<table>
<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 amp</th>
<th>Bluetooth</th>
<th>TCP/IP</th>
<th>MP3</th>
<th>pSOS</th>
<th>WinCE</th>
<th>1394</th>
<th>GPS</th>
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- ● required
- ○ optional
Exploring problem space and solution ingredients

Problem space

Technology:
- MIPS
- ARM
- Real
- RF
- Bluetooth
- TCP/IP
- MP3
- pSOS
- WinCE
- 1394
- GPS

Solution ingredients
- Composable Architecture
- Family of products
- Configurability
- Programmability, flexibility
- Increase supplier content
- Competitive Performance / cost / power

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version: 0
September 1, 2020
LWAfromStakeholderToQualities
The Holy Grail: Reuse

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version: 0
September 1, 2020
ARtheHolyGrail
"Guiding How” by providing rules for:

1. Functional Decomposition
2. Construction Decomposition
3. Allocation
4. Infrastructure
5. Choice of integrating concepts
Evolution of functionality

- Customer specific
- Domain specific applications
- Domain specific infrastructure
- Generic infrastructure

Year x, Year x+2, Year x+4

Enabling, supporting consolidation standardization
Existing SW stacks

customer specific

domain specific applications

domain specific infrastructure

generic infrastructure

DVP
MHP
STR
TV
VCR
DVD
GSM
3G
wireless LAN
bluetooth

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But there are much more:

- modem cable
- ADSL
- ... 
- firewall
- residential gateway
- homeserver
- audio
- MP3, ...
- CD, SACD, DVD, ...
- radio
- jukebox, HD, ...
- car infotainment
- security
- home control
- webcam
- videocam
- photocam
- games
- mediascreen
- PDA
- webpad
- PC's
- modem cable, ADSL, ...
- games
- mediascreen
- PDA
- webpad
- PC's
Simplistic Architecting: Digital TV

analog TV

Set top box

Digital TV

Digital Video Platform SW

Digital Video Platform SW

TV applications

TV domain HW

Set Top Box Platform

Computing HW

Set Top Box domain HW

Digital TV UI

Set Top Box Platform

3rd party stack(s)

MHP

TV applications

TV domain platform

Set Top Box functions

Computing HW

Digital Video Platform SW

TV domain HW

Set Top Box domain HW

Computing HW

Digital Video Platform SW

TV domain HW

Set Top Box domain HW

Computing HW
Available Code Assets

Digital TV UI

<table>
<thead>
<tr>
<th>TV applications</th>
<th>TV computing Infrastructure</th>
<th>3rd party stack(s)</th>
<th>Set Top Box functions</th>
<th>MHP</th>
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</thead>
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<tr>
<td>TV domain platform</td>
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Digital Video Platform SW

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<thead>
<tr>
<th>TV domain HW</th>
<th>Set Top Box domain HW</th>
<th>Computing HW</th>
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</thead>
</table>

"Legacy" code > 500 Myr
Merge problems

Architectural mismatch:
- wrappers, translators, conflicting controls

Additional code and complexity,
- no added value

Poor performance;
- additional resource usage

Problems ↔ Architecture
- Reuse → non problem

- problems
Ideal homogeneous situation?

long term dream

Reference Architecture + Sample implementation of Framework and Components

OS
FS
MP3
MPEG2

Computing Infrastructure

Domain Infrastructure

language
style

Configuration

Personalization
Theme

Framework

Reference Architecture

Applications
TV record EPG

Services
storage routing

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version: 0
September 1, 2020
SWPhomogeneousDream
Today’s reality?

DVP  MHP  STB  TV  VCR  DVD

huge amount of glue

customer specific

domain specific applications

domain specific infrastructure

generic infrastructure
Achievable solution?

internal efficiency: fine grain components

Enable components "in the large" nuggets

framework specialization guidelines for integrating concept reference decomposition/allocation interface, format, protocol standards prototyping, development environments
Software productivity research goals

- define
- vary
- create
- integrate
- test
- maintain

faster with less effort

methods
tools
integration technology
component technology
SW technology
standardization
partnering strategy

and/or

better faster more functional more reliable safer

by means of

products

products

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