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Ton Kostelijk, PDSL-E
Overview

• Why a HD / DVD+RW combi? Requirements.
• Ideal system architecture versus available
• Proposal of DXC architecture
• Exposure of unsound trade-off thinking
• Outcome & results
• Conclusion
Why a HD / DVD+RW combi?

DVD-recorder
• playback, record, HQ, permanent storage
• removable disk

HD-recorder
• playback, record, HQ, semi-permanent storage
• time-shift by **simultaneous** playback & record
• non-removable large disk

Combi has it all,
• giving **more freedom** when to watch what and
• **ease of use**: less fiddling with disks.
DXC project

Project Leader: Roel de Bruijne

Chief SW architect: Pavlo Barvinko

Major project issues: (dd Q1 2003)
1. Time-to-market (Q1 2004)
2. Product reliability
Ideal: HD/DVD

Integral application
HD and DVD+RW

Board
Chrysalis

Available: DVD

Board
Chrysalis

HD/DVD

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Dual Xalis Combi proposal

++ Reuse DVD SW as is
++ No interference
++ No performance issues
- Distributed Control, booting, testing, etc.
- Merging of A/V output
- Synchronization of streaming
- BOM
Main opinion against the ideal: *Don’t put two stacks on one processor*

- DVD SW is used to ‘own’ the processor.
- DVD SW is too fragile and monolithic.
- True independence is better, no interference.
- Prevent performance problems.
- Time-to-market is key.
- Reliability is key.
- BOM can be optimized later.

Integration costs reliability and effort
Trade-off thinking:
Better x MUST cost y

Integration
one chrysalis

Reliability
Effort

Oversimplification

Artificial balance paradigm versus multi-dimensions in design space

Qualitative
Two stacks on two processors

Task

OS

CPU

‘RT rpc’

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Two stacks on one processor

Task

OS

CPU

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A closer look at the arguments

- DVD SW is used to ‘own’ the processor.
- DVD SW is too fragile and monolithic.
- True independence is better, no interference.

- SW runs CPU at max 50% load for playback or record.
- SW is 50% 😊, other half:
  - Only PBS is used
  - Already ported ST to X
- Parts of a combi cannot be totally independent.
- Synchronization and merging REQUIRES interference, mainly at streaming (Gen. 2)
Elaborate concrete pros and cons and quantify for Dual or Single Chrysalis

**Pros of single X:**
- Synchronization / merging / control.
- No new board required.
- Much more reuse of DVD SW: boot, factory test, tooling.
- Huge reduction in BOM.

**Concerns**
- Feasibility of combi SX execution architecture.
- Effort estimates
- Risks

**Decision Window**
Dual stack single Xalis Combi

Features

- Continuous HD recording
- Simult. HD Play / record
- Timeshift
- Play DVD[+RW]
- Archive to DVD
- CAM support
- …
Outcome

• Performance / execution arch. feasible,
  – requires mostly non-intrusive changes, e.g., compiler and priority settings, memory arbiter settings, …
  – Changes would also be required for Dual case!

• Total project effort was slightly less, due to
  – synchr./ merging / control greatly simplified.
  – booting, debugging, factory test same as DVD SW
  – no new board design required.

• BOM reduction received a warm welcome, resulting in an increasing amount of orders.
Current status

• Performance improvement:
  – From >100 % to 60 % continuous cpu load for worst case scenario.
  – Total change effort: 1.5 man-year = 2 % of all!

• Changes were integrated in two days.

• Some unexpected problems were encountered, but none were lethal.

• All project deliveries are on time.
Conclusion

• Reusing DVD SW is possible and beneficial.
• In-depth design exploration really pays off, guided by time-boxing to serve planning.
• Execution architecture effort gives large benefits at low cost, and need not be intrusive.
• Trade-off thinking
  – Takes a one-dimensional look at a multi-dimensional solution space.
  – Based on oversimplification and qualitative reasoning, one overlooks much better solutions.
Thanks

- Roel de Bruijne & Pavlo Barvinko
- Vlatko Milosevski
- Bart Franco

- CAEN Chrysalis Driver System team
- DVD+RW 2.1 team
- ...