

MPEG decoder Case

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Outline

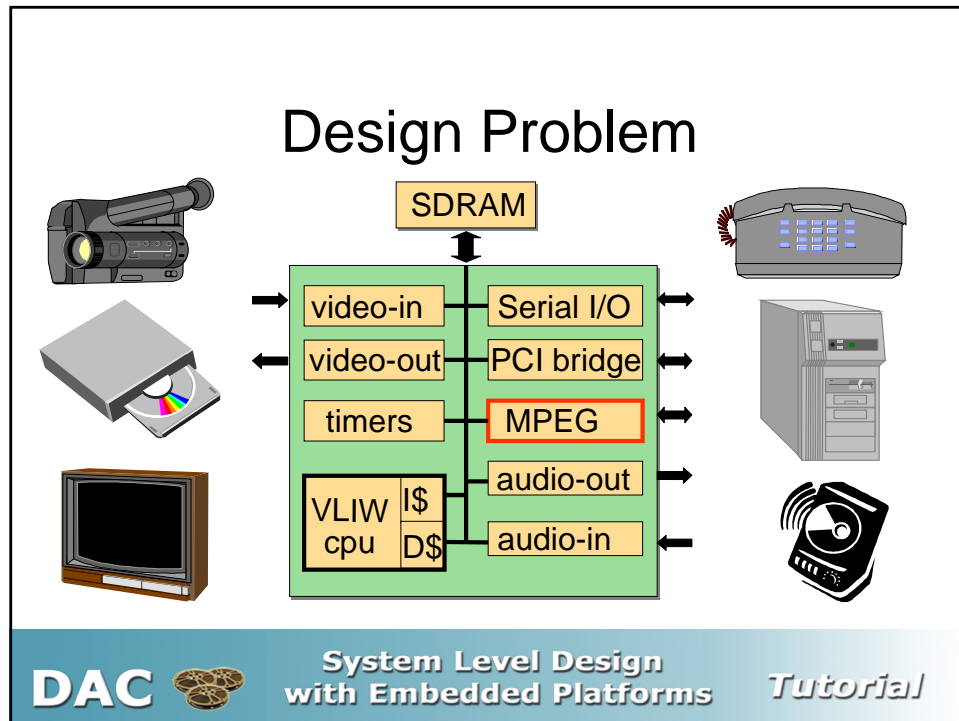
- **Introduction**
- Kahn Process Networks Revisited
- MPEG application
- Mapping
- Design space exploration
- Conclusions

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MPEG2 decoding

Audio and Video,

- Audio completely done in software on VLIW
- Video:
 - describe in Kahn Process Networks
 - Test for compliance with the standards:
 - ranging from H263 to HDTV!
 - Map on software + dedicated hardware



MPEG2 decoding status

IP content in Philips Semiconductors:

Nx2700: single chip HDTV decoder (audio + Video):

- dedicated MPEG2 video decoder
- specialized Video Output
- many other features

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Y chart methodology

In Research:

- Describe the full functionality of the MPEG2 video decoding.
- Mapping and performance analysis

Compare with the Semiconductors results ->

Sanity check on the methodology

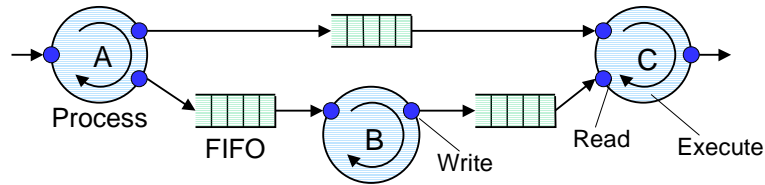
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Application Modeling: Yapi



Y-api:

An C++ api for Kahn Process Networks:

Expose parallelism and communication

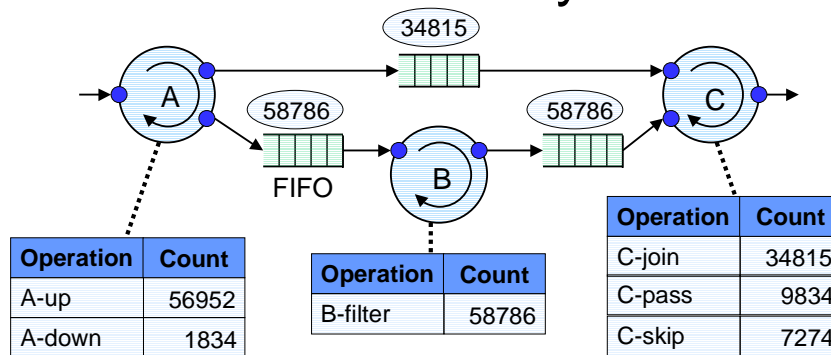
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Workload analysis



Computation and Communication workload

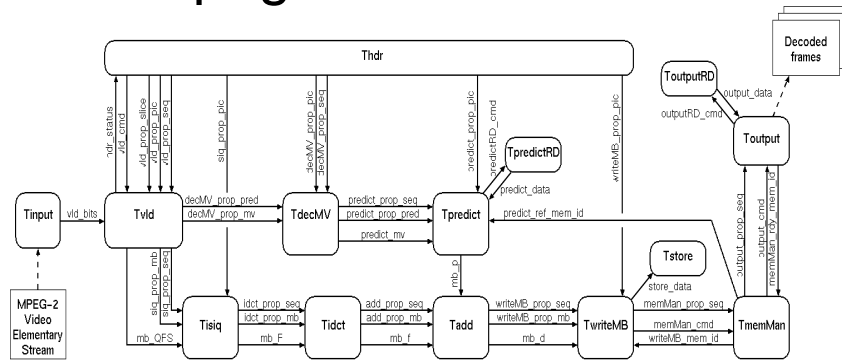
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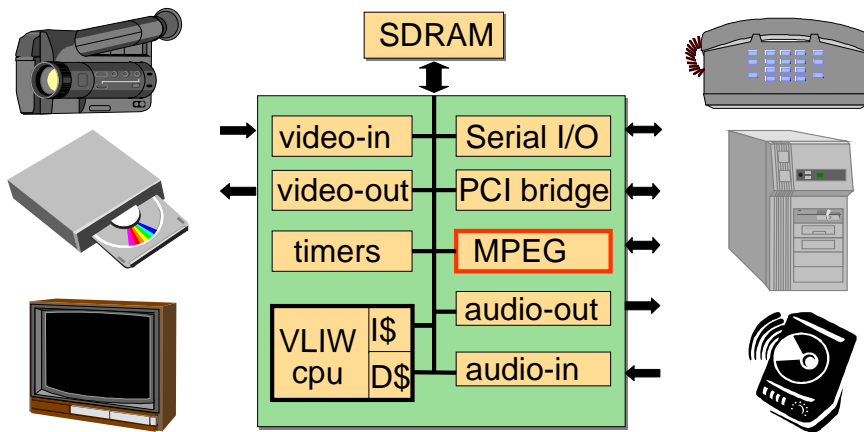
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Mpeg2 video decoder

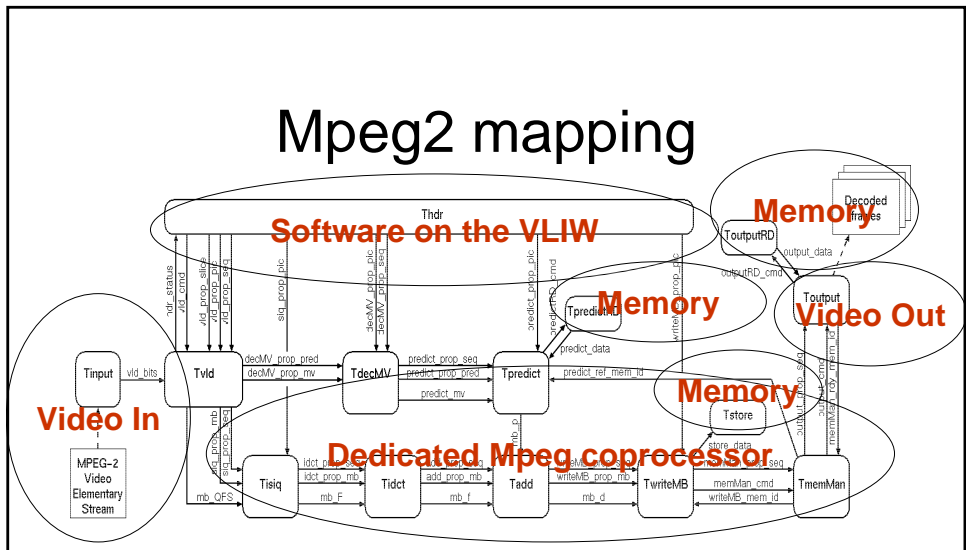


Model of MPEG2 video decoder in Yapi

Design Problem



Mpeg2 mapping



Dedicated Mpeg coprocessor: pipe with fifo buffers and blocking semantics

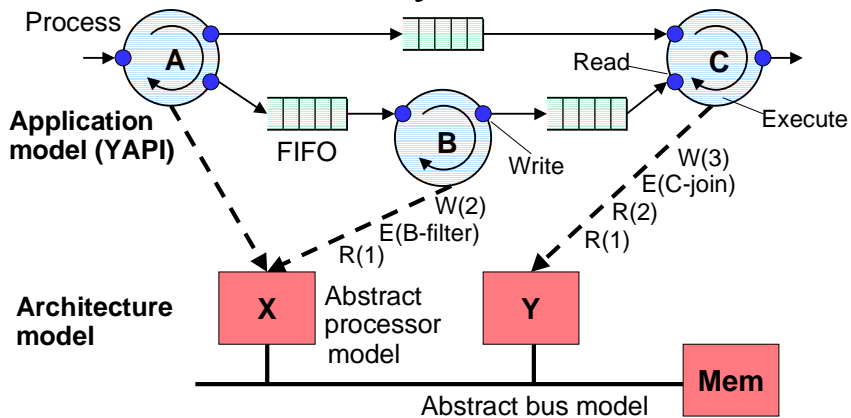
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Mapping and performance analysis



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MPEG2 mapping

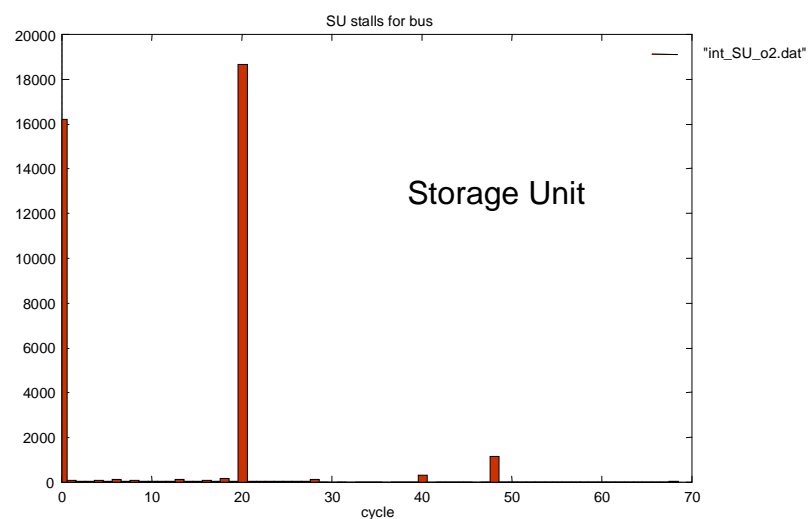
Data dependant: different video streams:

- Computation on the VLIW and coprocessors
- Communication on the bus and internally in the Mpeg2 decoder

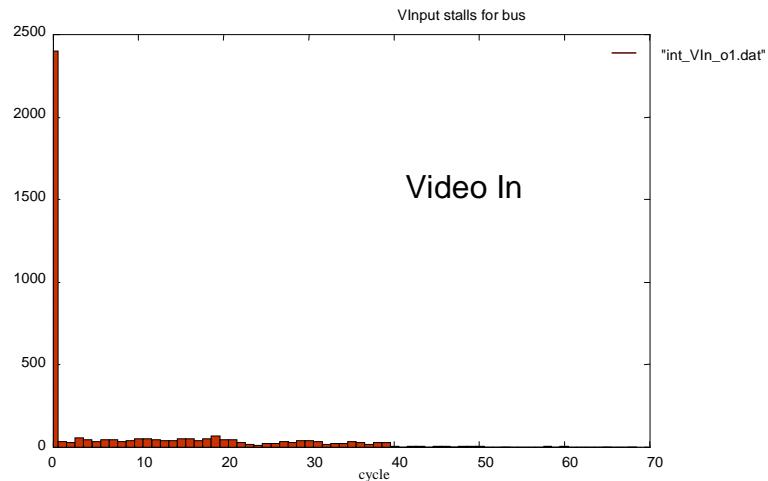
Exploration Questions:

Bus load, burst size of the communication, latency of the memory interface

Exploration results: bus waits



Exploration results: bus waits



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Lessons learned

- Y chart is a valuable guiding principle
- Quantifying design choices is key
- Match of Model of Computation and Model of Architecture
- Tools required: Mapping, Simulation and Design Space Exploration support
- **Raise the level of abstraction for exploration**

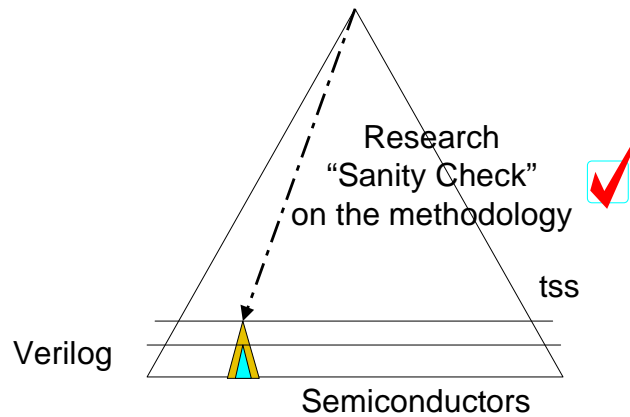
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Conclusion



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References

- Pieter van der Wolf, Paul Lieverse, Mudit Goel, David La Hei, and Kees Vissers, "An MPEG-2 Decoder Case Study as a Driver for a System Level Design Methodology" In: Proc. 7th Int. Workshop on Hardware/Software Codesign (CODES'99), Rome, Italy, May 3-5 1999.
- E.A. de Kock, G. Essink, W.J.M. Smits, P. van der Wolf, J.-Y. Brunel, W.M. Kruijtzter, P. Lieverse, K.A. Vissers. "YAPI: Application Modeling for Signal Processing Systems" In: Proc. 37th DAC, Los Angeles, June 2000.
- [Http://ptolemy.eecs.berkeley.edu/~vissers](http://ptolemy.eecs.berkeley.edu/~vissers)

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