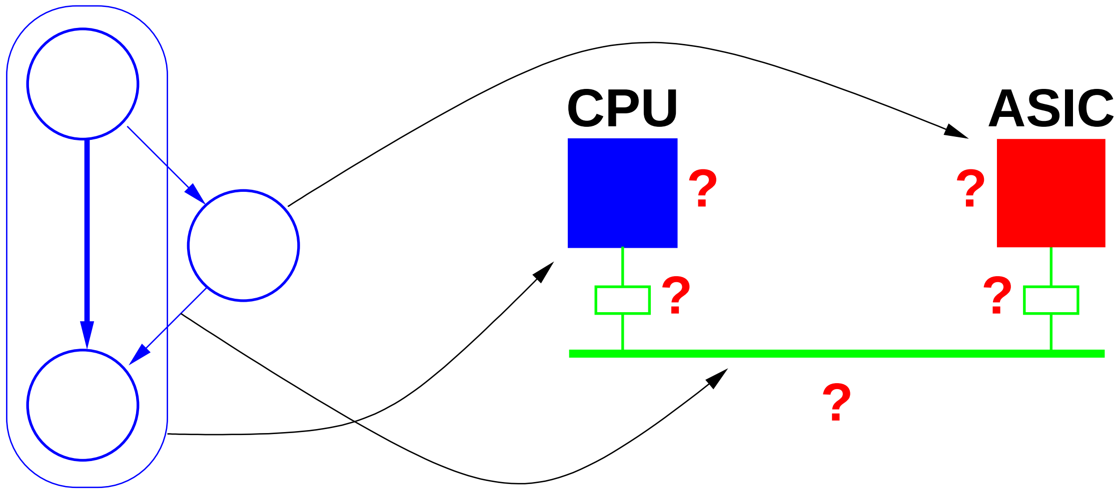
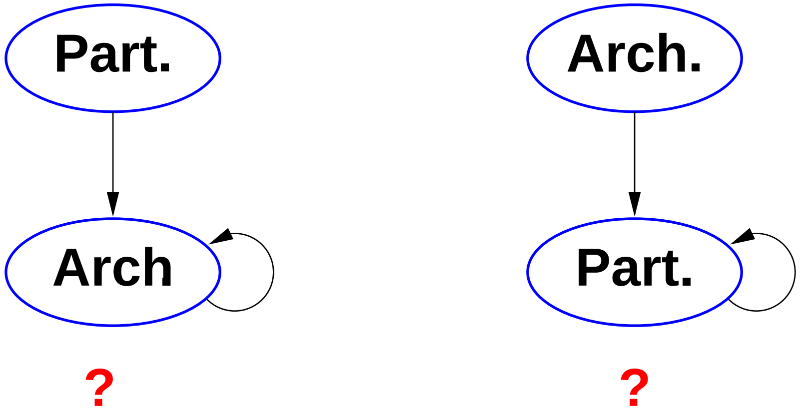
Integrating Communication Protocol Selection with Partitioning in Hardware/Software Co-design

Peter V. Knudsen and Jan Madsen

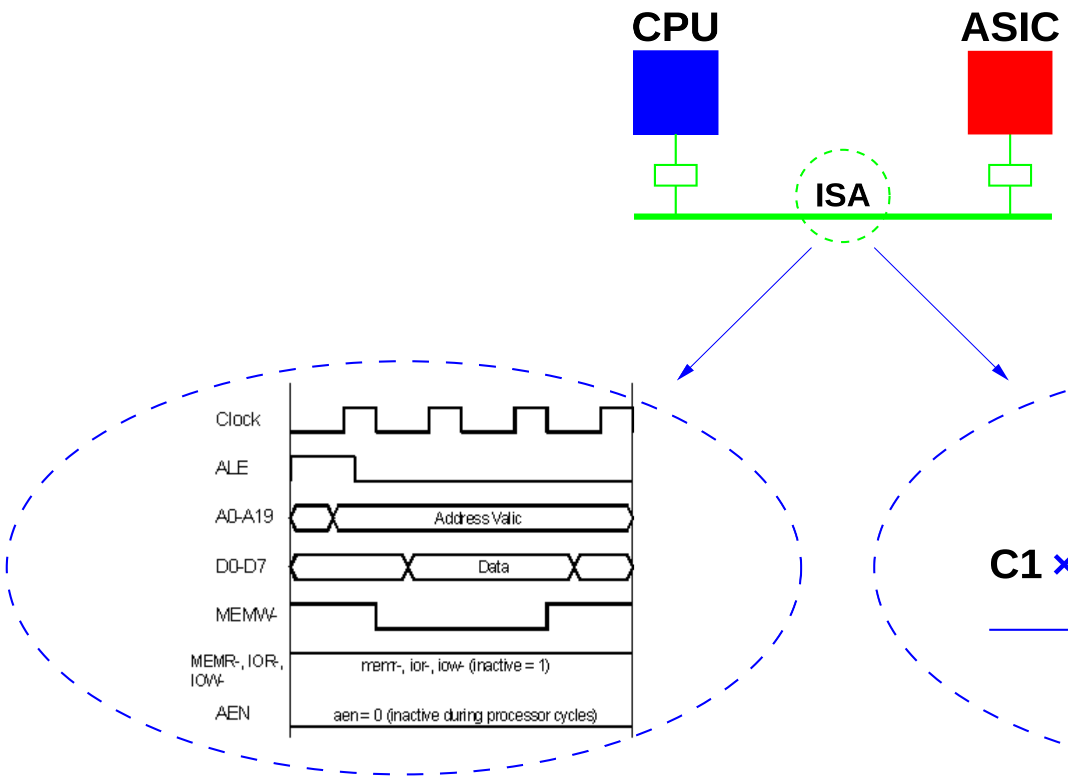
Computer Systems section
Department of Information Technology
Technical University of Denmark

Problem





Simulation vs. estimation



$$Tcomm = \frac{C1 \times NumData \times \frac{W\_P}{W\_C} + C2}{F\_C}$$

The communication model

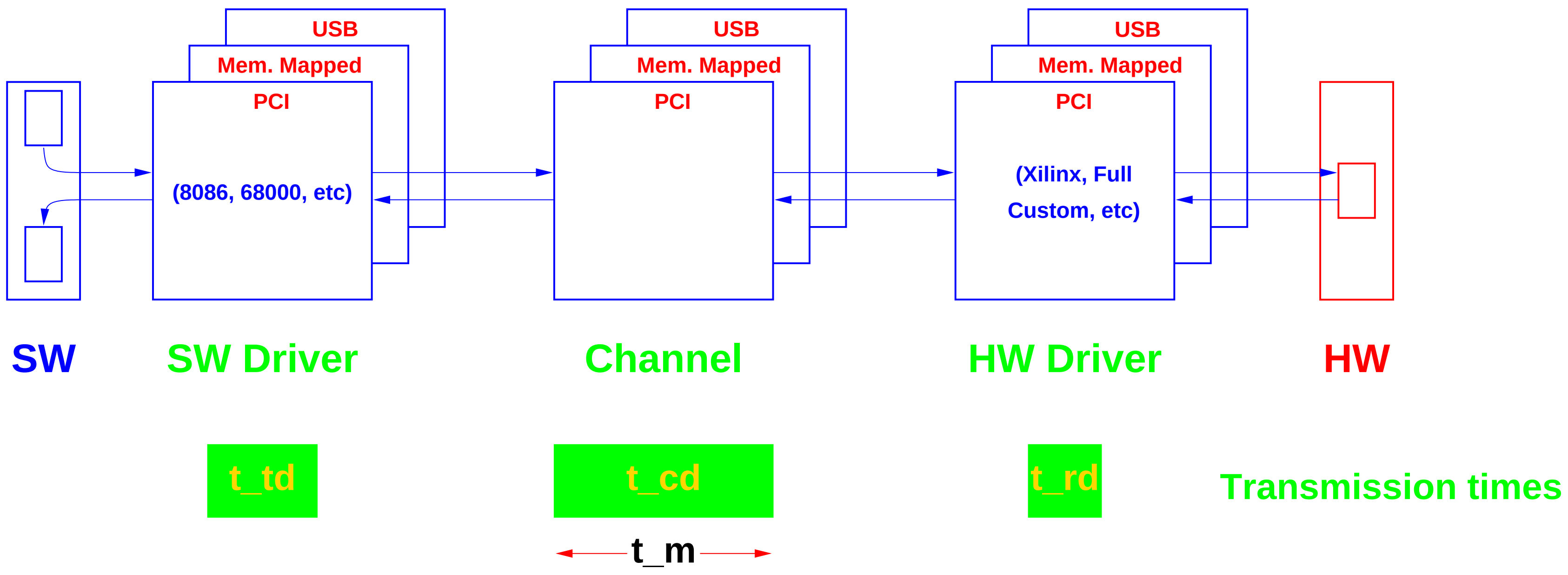
1. A general high level model of communication protocols

2. Incorporates characteristics of the HW/SW drivers

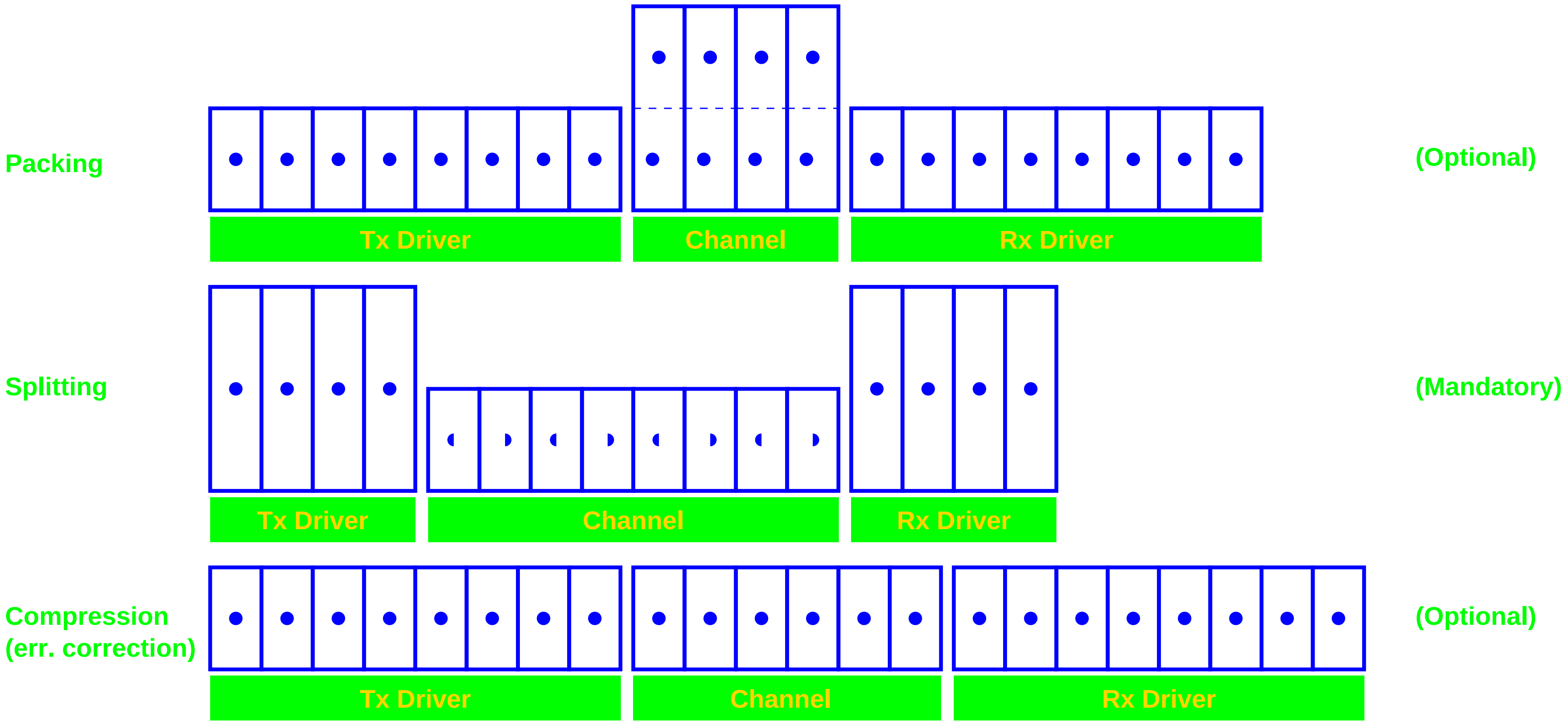
3. Includes fast performance/area/price estimators

4. Is integrated with partitioning in a co-synthesis system as to allow for fast evaluation of design tradeoffs

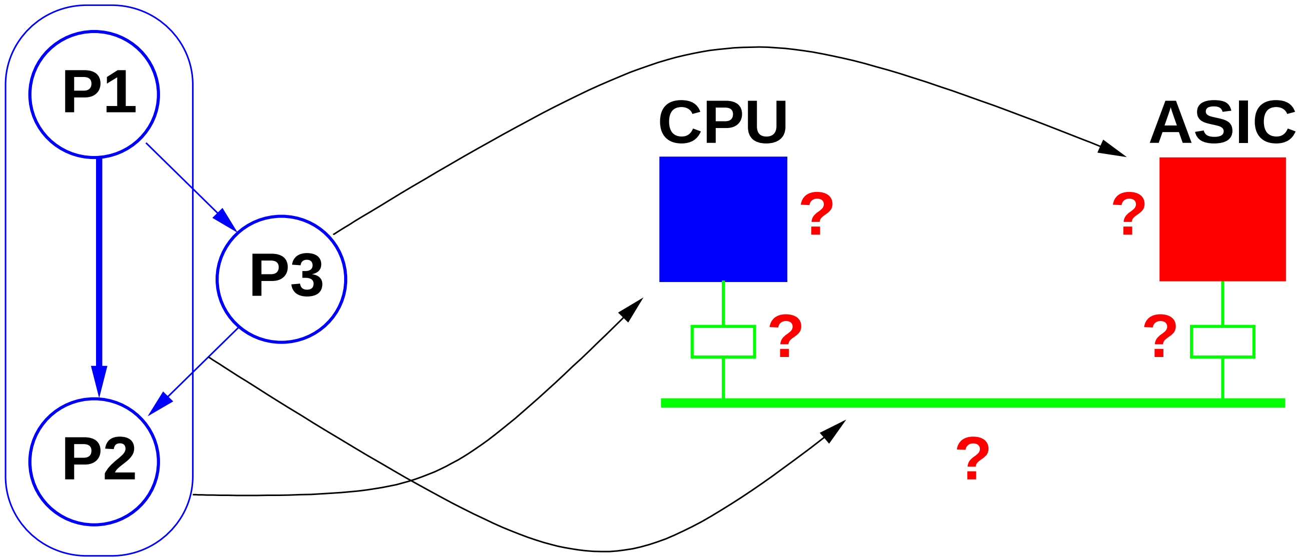
Structure of the communication model



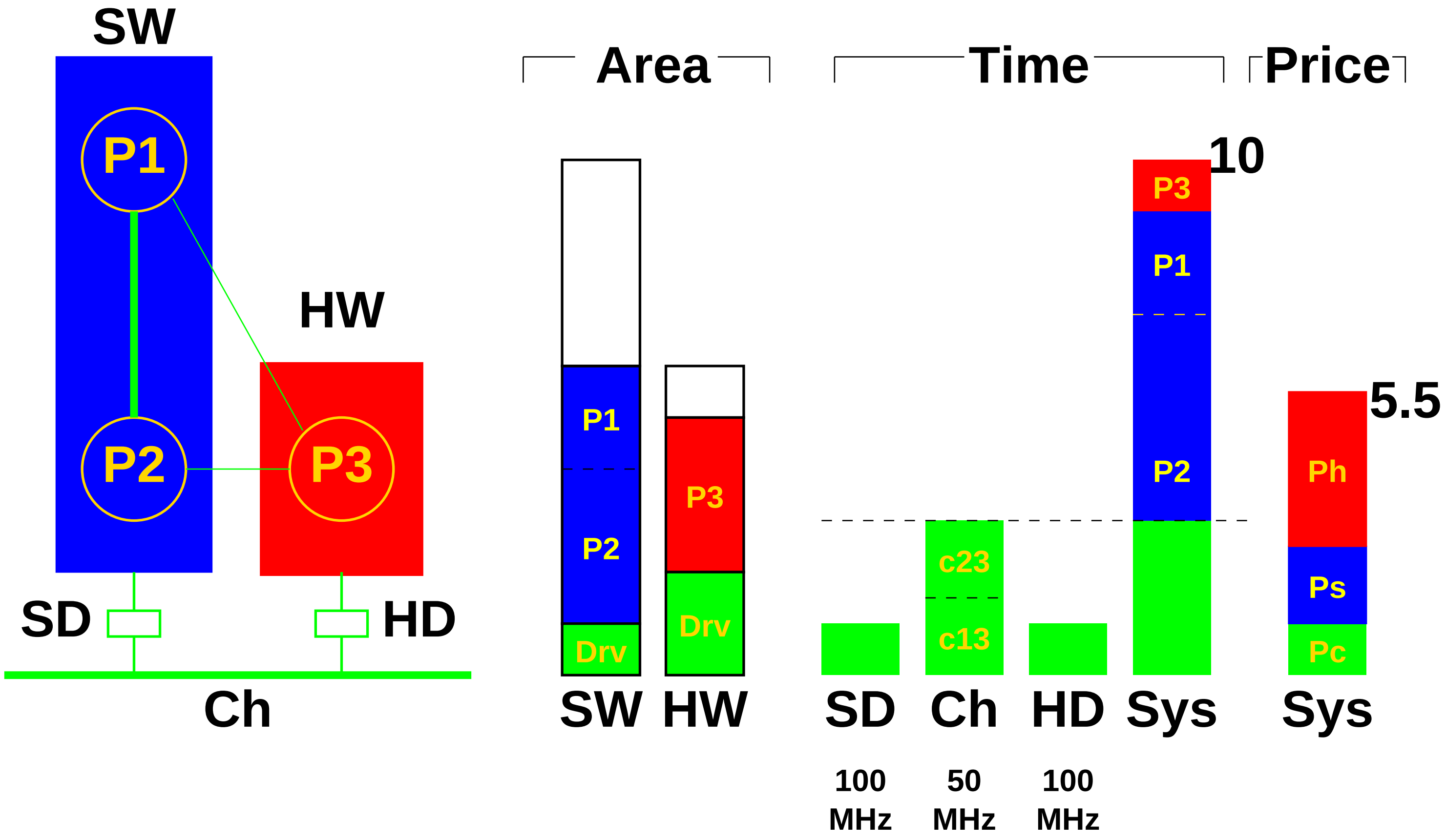
Communication alternatives



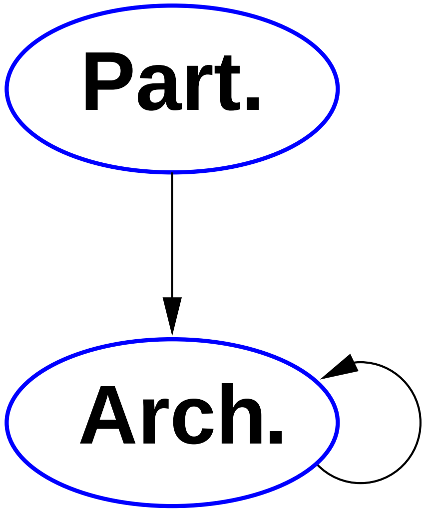
Partitioning vs. protocol exploration



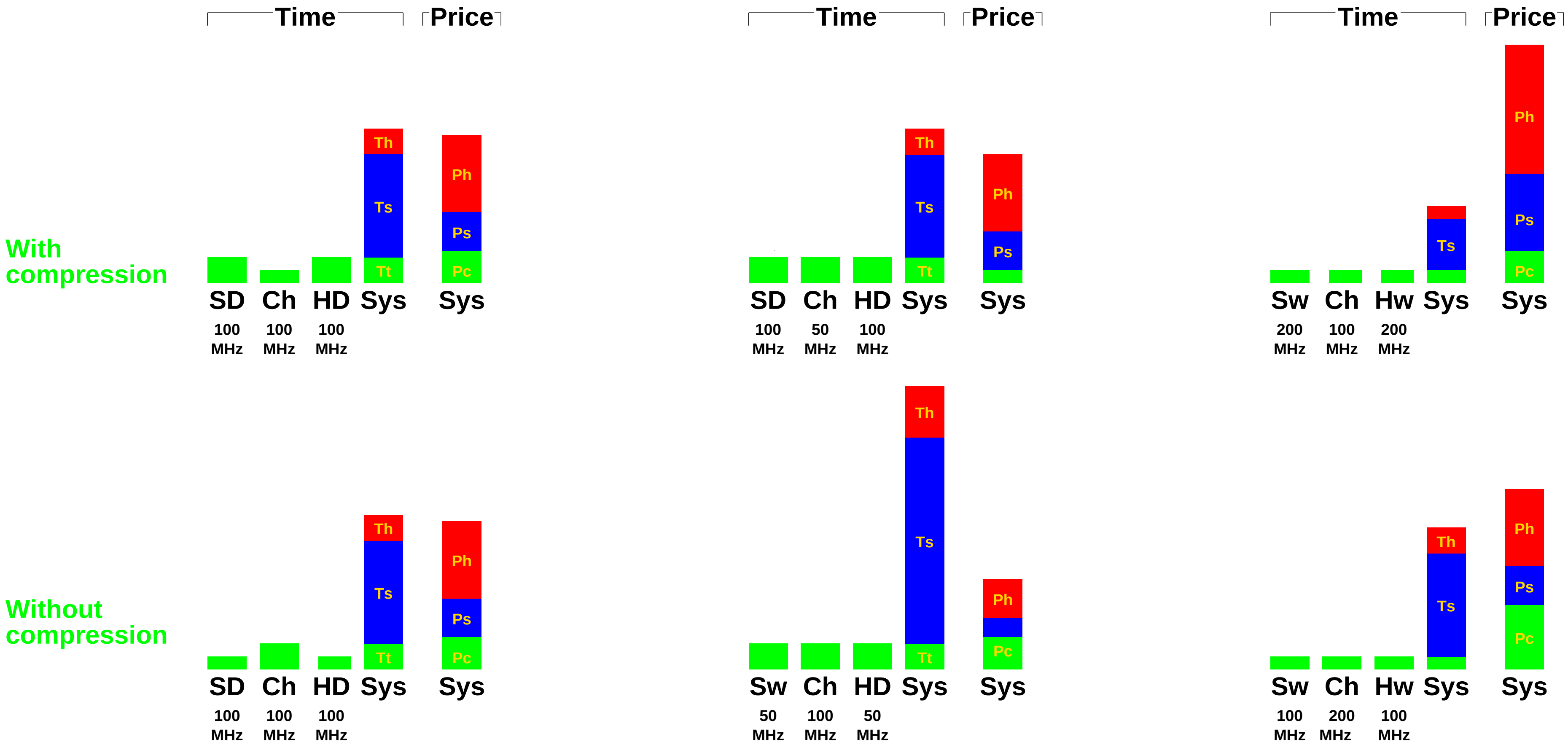
Characterization of a design space point



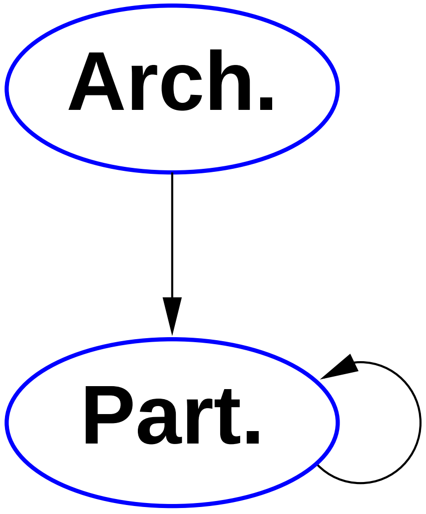
1) Partitioning, then architecture tuning



Driver processing & component speed tradeoffs



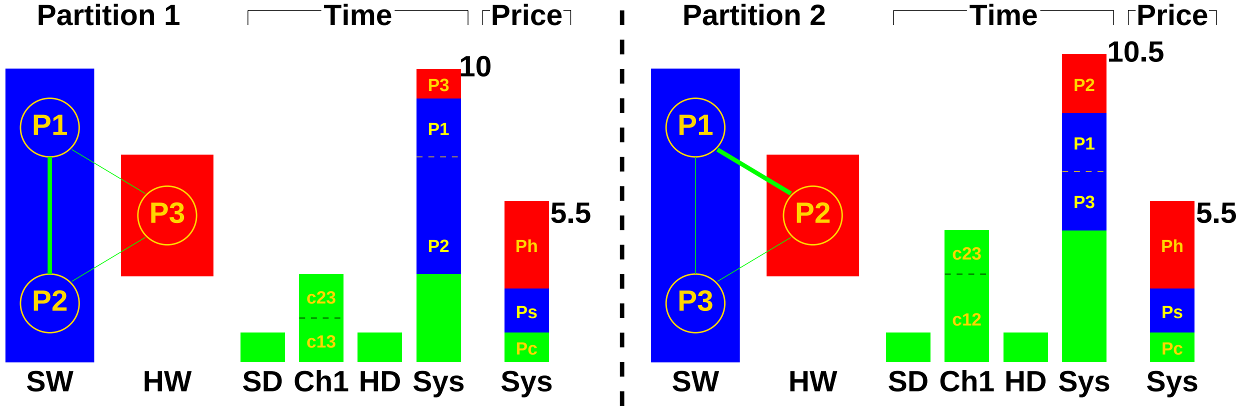
2) Architecture selection, then partitioning



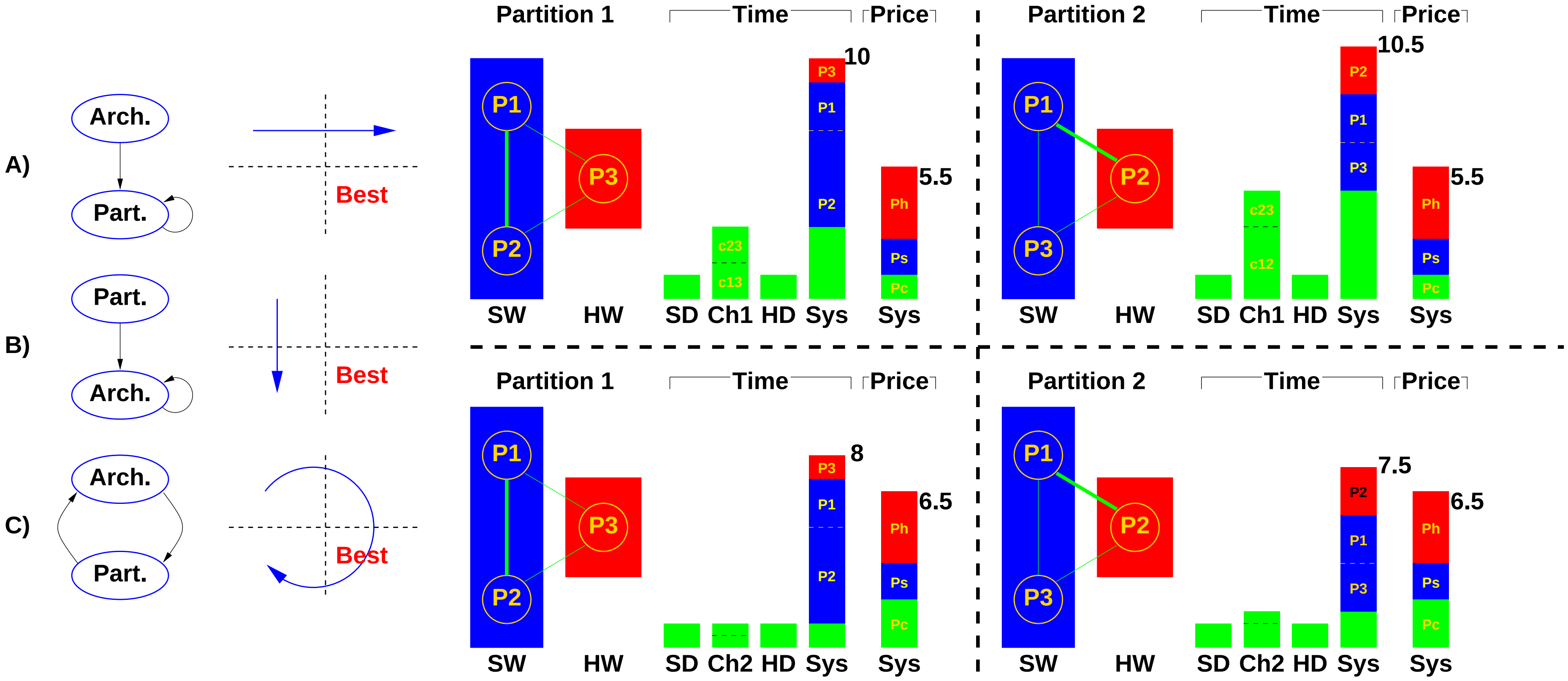
Speedup / communication overhead tradeoffs

Finding the best partition

for a fixed architecture

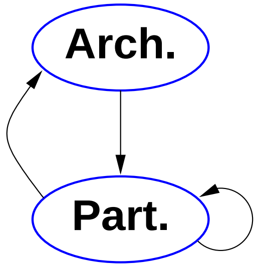


Integration between protocol selection and partitioning



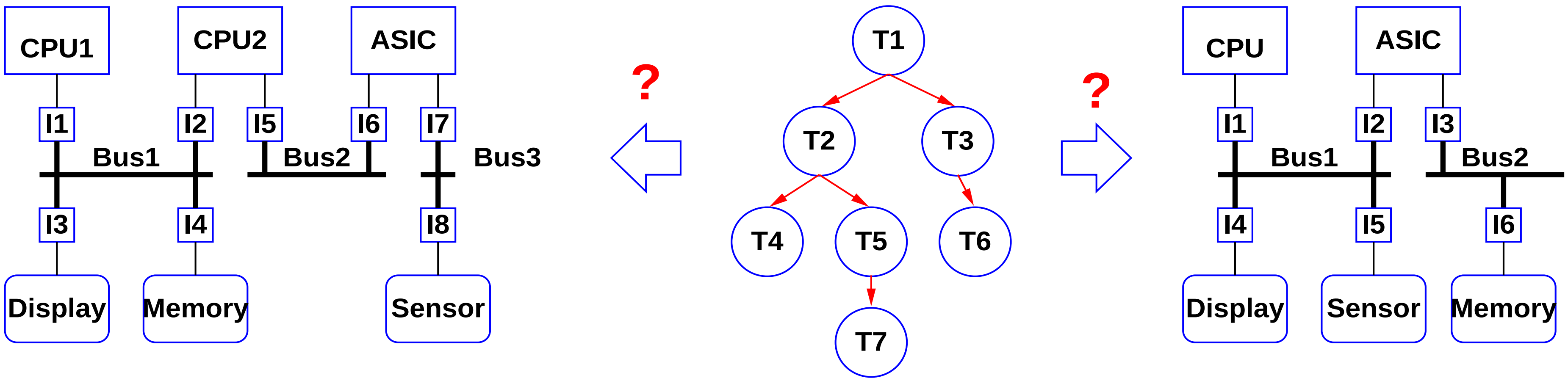
New communication tradeoff parameters in LYCOS (italic)

Design flow:



Specification	Software	Hardware	Channel	Algorithms
Granularity	Code size	Area		Fast - less accurate
	Price	Price		Slow - more accurate
		Datapath alloc.		
	Frequency	*Frequency*	*Frequency*	
	Driver	*Driver*	*Burst mode/size*	
	-processing	*-processing*		
	-code size	*-area*		
	-price	*-price*		

Even more needed for general problem



Conclusion

- Fast communication estimation necessary in design exploration phase

- Model must handle driver processing alternatives such as packing, compression and splitting and component characteristics such as operating frequencies, areas, power consumption, etc.

- Communication estimation has been *integrated* with partitioning in the LYCOS co-synthesis system as to allow for fast design space exploration.