Computer Architecture Reading Group Notes

Date: 3/11/04
Discussion Leader: Brandon
Notes: Sewook
Topic: HW/SW task partitioning algorithm

Papers:

Bharat P Dave, Ganesh Lakshminarayana, Niraj K Jha. COSYN: Hardware Software Co-Synthesis for Embedded Systems, 34th DAC Anaheim, 1997.

F Salice, Del Vecchio, L Pomante, W Fornaciari. Partitioning of Embedded Applications onto Heterogeneous Multiprocessor Architectures, Proceedings of the 2003 ACM symposium on Applied Computing.

Administrative
We will resume our discussion group next quarter.
Next topic will be power management in server system.

COSYN: Hardware Software Co-Synthesis for Embedded Systems

Summary:

This paper proposes a task partitioning algorithm for embedded systems, named COSYN. COSYN partitions tasks into clusters based on periodic deadline and find out low cost heterogeneous embedded system architecture in terms of performance, power, and cost. Because of the heuristics to cluster tasks, it finds out feasible solution several orders of magnitude advantage in CPU time over existing algorithm, even though the solution is quite close to optimum solution.

Discussion:

Are the task execution time and other parameters able to change dynamic?
➔ It only handles static feature and so parameters comes form worst-case.
Why is COSYN faster than other previous algorithm?
➔ It is because it uses heuristic to cluster tasks.
Why the CPU time to obtain feasible solution is that important?
➔ The short CPU time due to simple heuristic gives us scalability. If the target design has a lot of tasks such as transport system in the example, previous algorithm is hard to generate an answer with reasonable computation time.
In terms of cost, ASIC is always cheapest.
➔ Yes, it seems that they did not include design cost. However, ASIC is not always cheapest if we think about design reuse, design complexity, time to market, estimated volume of product, and so forth.

Partitioning of Embedded Applications onto Heterogeneous Multiprocessor Architectures

Summary:

This paper also proposes a task partitioning algorithm for the embedded application. It presents four metrics to measure the architectural cost: Affinity, Load, Communication, Physical cost. First, it puts all tasks in one PE, allocates, optimizes and verifies the solution. If the solution is not feasible, increase the number of clusters and iterate again. It uses genetic algorithm to find feasible solution.

Discussion:
What is main difference between COSYN and this algorithm?
> ➔ This algorithm revisits clustering while COSYN does not.
> This algorithm does not deal with power consumption.
> This algorithm uses genetic algorithm to cluster the tasks.

How can we know the parameters for the cost function?
> ➔ Based on System C behavioral description of the system, we can simulate it on the various PE.