Bahurupi: A Polymorphic Heterogeneous Multi-core Architecture

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Introduction:

The distinction between high-performance embedded architecture & general-purpose computing architecture is rapidly disappearing

What do we except from a smartphone?

Features:

- A polymorphic heterogeneous multi-core architecture
- Can be tailored according to the workload by software
- Fabricated as a homogeneous multi-core system containing multiple identical, simple cores.
- Main Novelty: its ability to morph itself into a heterogeneous multi-core architecture at runtime under software directives.

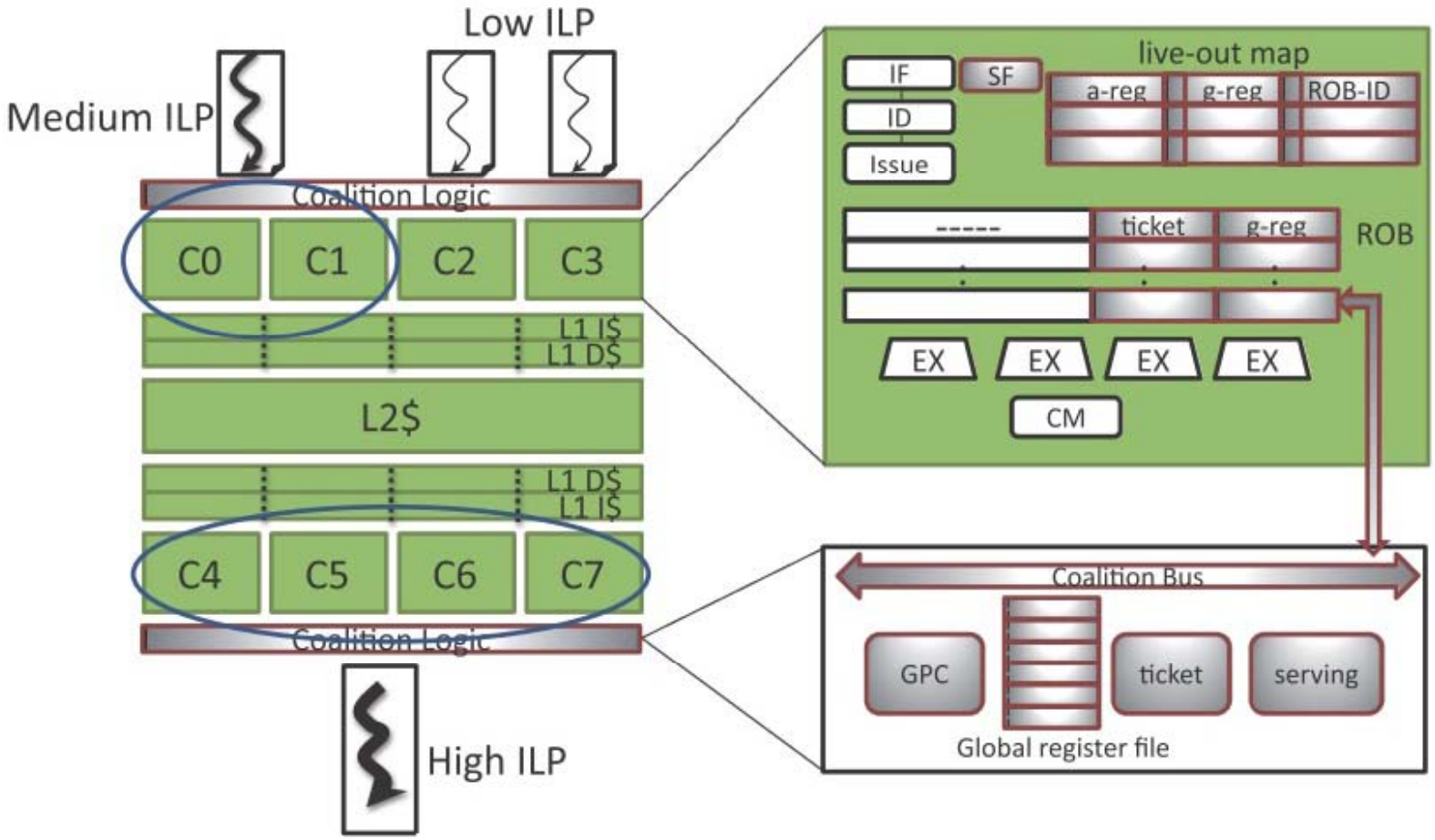
Advantage:

Solving the conflicting requirements of TLP & ILP applications

And

Achieves the seamless transition between ILP & TLP.

A high-level overview of Bahurupi architecture



Bahurupi Execution Model

Bahurupi recofigurable multi-core architecture allowas cores to form coalition

What is a coalition?

A group of cores working together to speedup the execution of a serial stream of instructions

A core fetches & executes one basic block of instruction at a time.

The Goal is:

To execute the basic block in parallel on the cores that form coalition

To achieve the execution model of Bahurupi

- Resolve registers AND memory dependencies
- To ensure the cores fetch, rename and commit the basic blocks in program order

The main speedup of Bahurupi comes from the out-of-order parallel execution of instructions from different basic blocks on different cores

Sentinel instruction:

Compiler detects live-in & live-out registers to correspond to each basic block

Next step: to communicate the live-in & live-out information to the hardware architecture

So introduce a new instruction called: Sentinel

To encode this information

The sentinel instruction format

Bahurupi Execution Model requires:

a) in-order fetching of the sentinel instruction
b) In-order commit of the instruction across the cores

Architectural Details:

1. live-in register renaming
2. live-out register renaming
3. Branch Misprediction & Exceptions
4. Memory Heirachy
5. Compiler Supports

Conclusion:

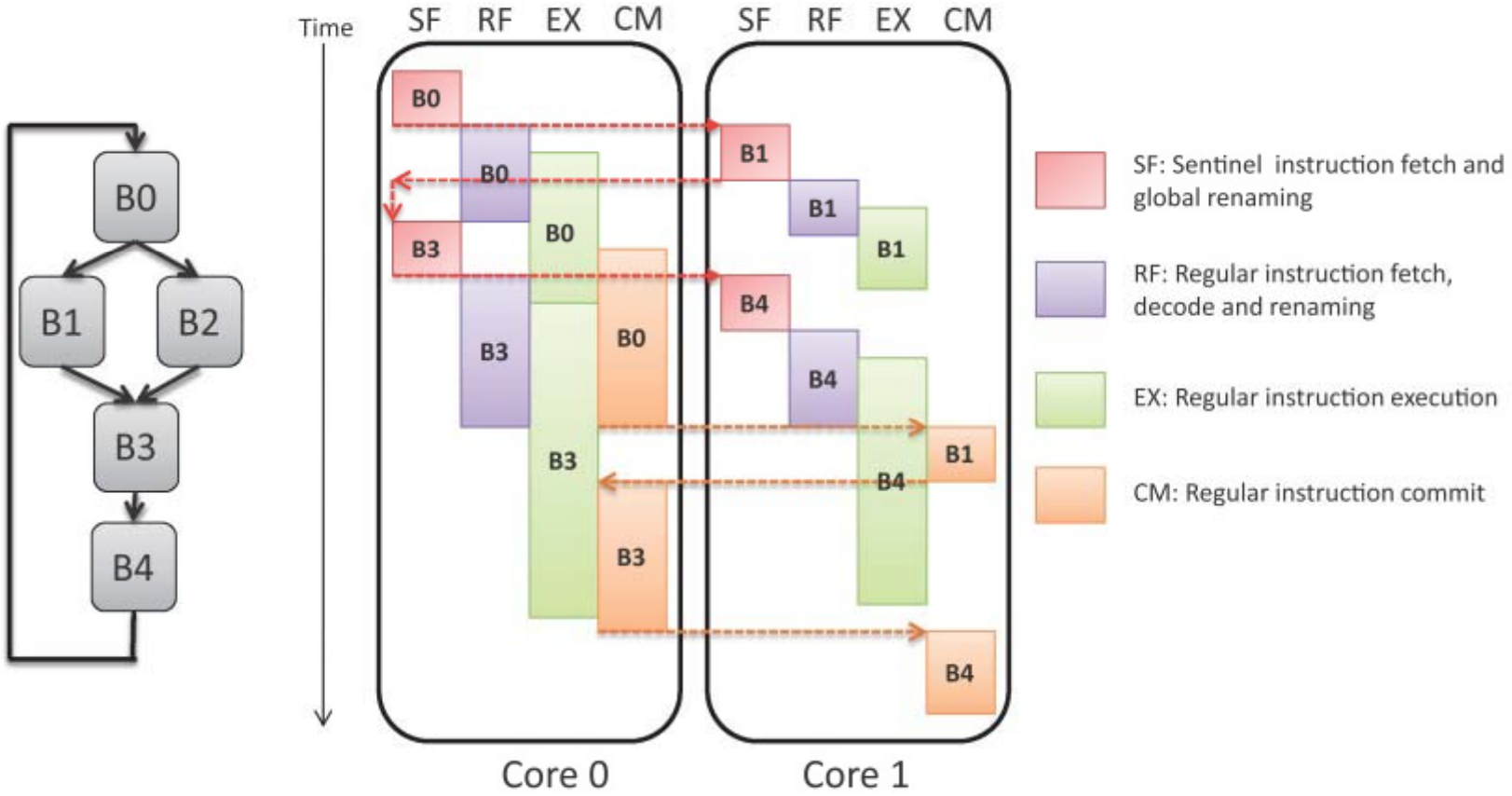
Bahurupi : a reconfigurable multi-core architecture

Bahurupi: can dynamically merge the base 2-way out-of-order execution engine

Bahurupi: a hardware-software cooperative solution

Thanks for you attention

Bahurupi distributed execution model



(a) Control flow graph (CFG) of a program, and (b) Execution of the CFG on 2-core Bahurupi architecture.