UDC session no.: 4D-18

HIROSAKI UNIV
VLSI PROJECT

Design and Chip Implementation of an Instruction Scheduling Free Ubiquitous Processor

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Motivation

- VLSI trend
  - ✓Not high clock speed but power conscious high performance
  - ✓Parallelism
- H/S collaboration parallelism
  - ✓Hardware parallelism
    - • Multicore
    - • Multiple pipeline
    - • Not only integer but also floating point arithmetics for multimedia computing
  - ✓Software support
    - • Parallelizing compiler
      - ▪TLP/ILP abstraction
      - ▪ Instruction scheduling for arithmetics
        - ▫Performance degradation due to pipelining disturbance

Research objective

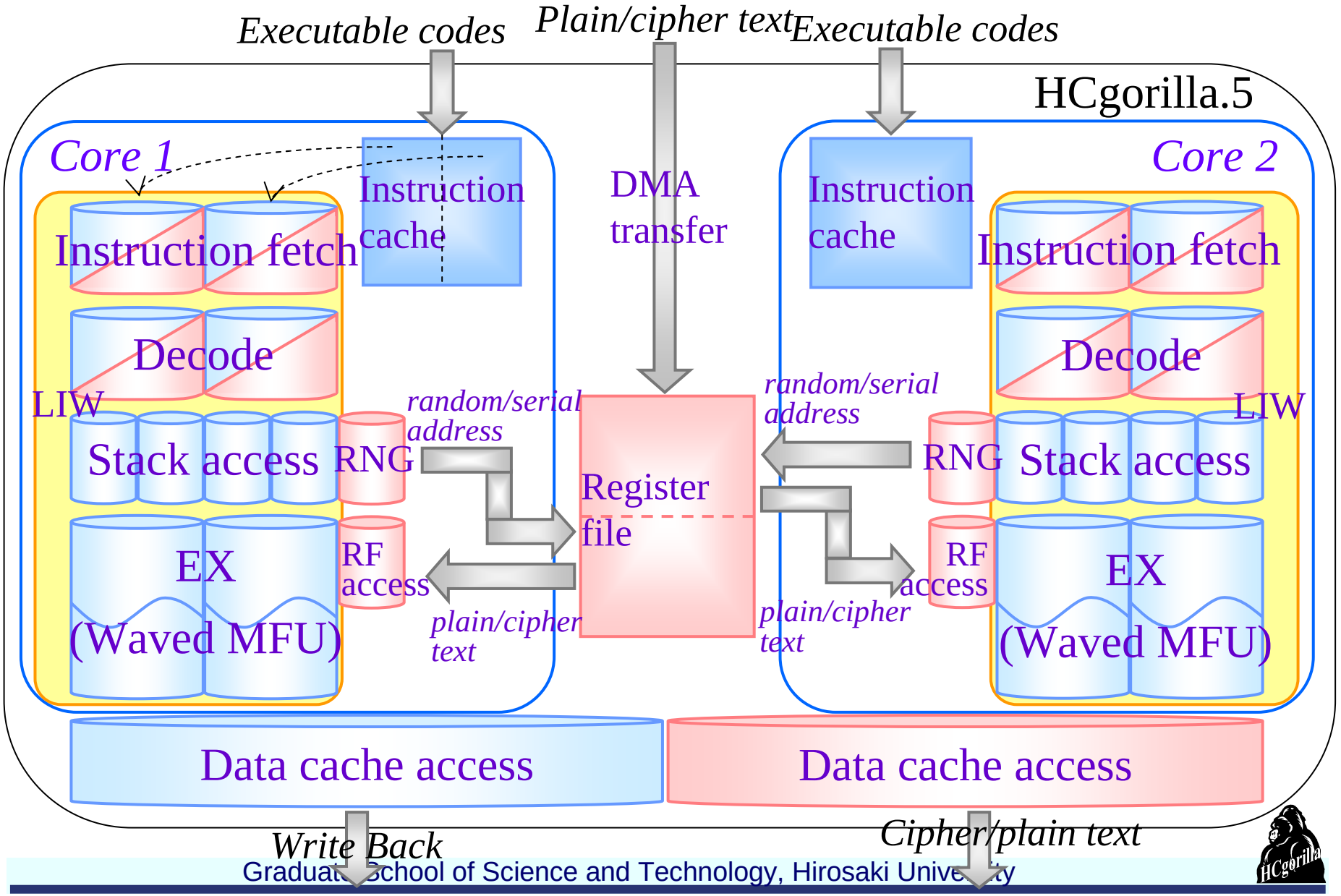
- Compact scheme for arithmetic parallelism
- Instruction scheduling free (out-of order) hardware parallelism
  - ✓Double scheme
    - Merge of scalar units (IU, FPU)
    - Wave-pipelining of the resultant MFU

    ←Power conscious speedup
  - ✓Parallelization of multifunctional media pipes
  - ✓Support the by an LIW compiler for ILP extraction
- HCgorilla chip implementation

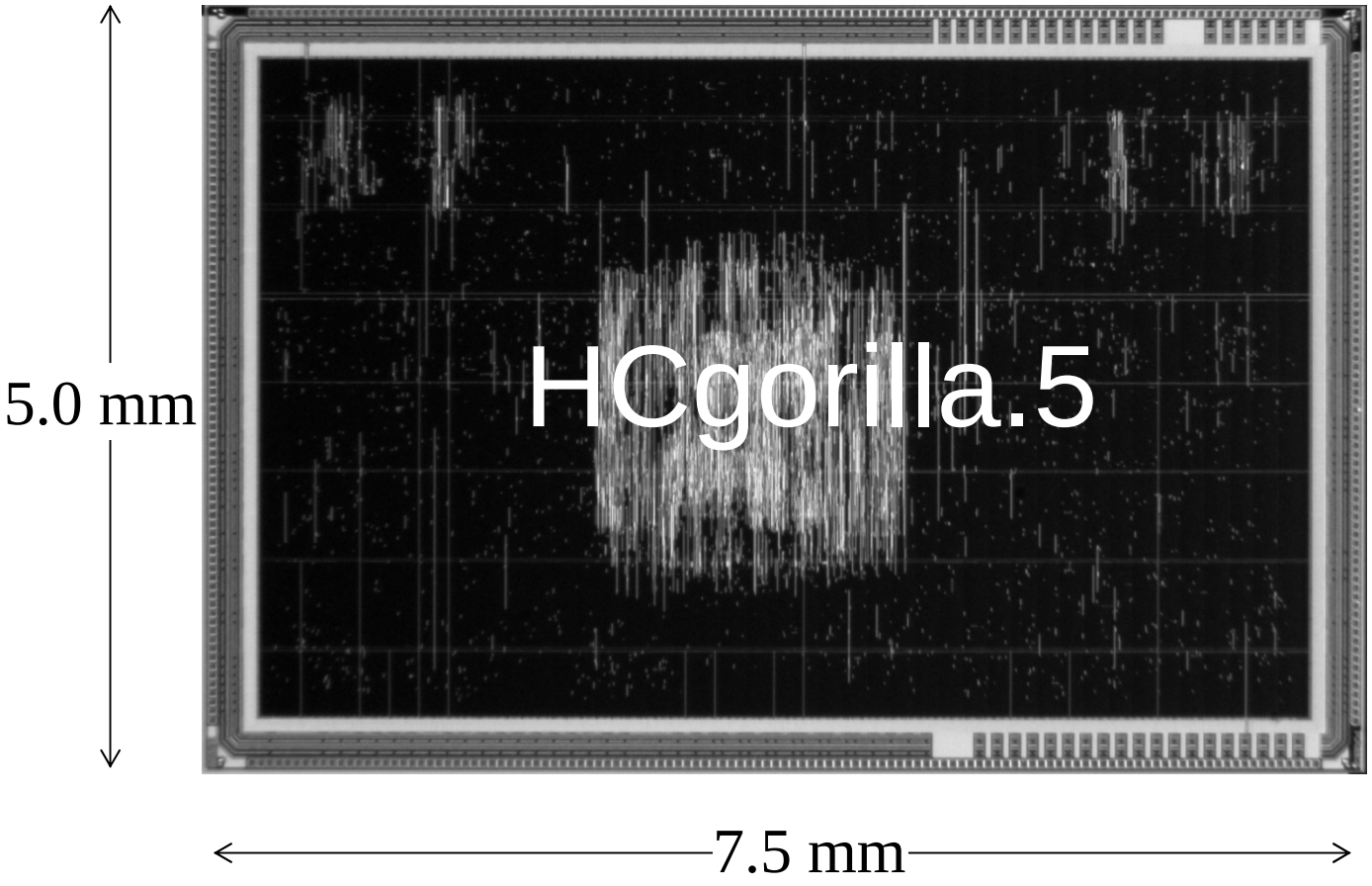
Specifications of HCgorilla family

Chip version					HCgorilla.3	HCgorilla.4	HCgorilla.5
Design Rule					ROHM 0.18 μm CMOS		
Per processor	Chip area				5.0 mm × 7.5 mm		
	Power Supply				1.8 V (I/O 3.3 V)		
	Power consumption				241 mW		274 mW
	Clock frequency				330 MHz	400 MHz	200 MHz
	Instruction cache				2 byte × 32 word × 2		2 byte × 64 word × 2
	Data cache				2 byte × 128 word		2 byte × 128 word × 2
	Stack memory				2 byte × 8 word × 4		2 byte × 16word × 8
	Register file				2 byte × 64 word		2 byte × 128 word
	No. of cores				2		
Per core	Pipeline	Media	Number		2		
			EX	IU	2-wave × 2		2-wave MFU × 2
				FPU	NA	5-clock × 2	
			No. of stacks		1		2
			ILP degree		2		4
			Throughput			0.07-0.09 GIPS	0.13 GIPS
			Java bytecode		61	77	58 (102)
		Cipher	Number		1		
			RNG		4-bit LFSR		6-bit LFSR
			Throughput		0.1-0.2 GOPS		
			SIMD code		2		
Remarks					ASP-DAC 2009	Synthesis	ASP-DAC 2010

Organization of HCgorilla.5



HCgorilla.5



VDEC Annual Report 2009

Running time of an arithmetic test program