ALVEARE: a Domain-Specific Framework for Regular Expressions

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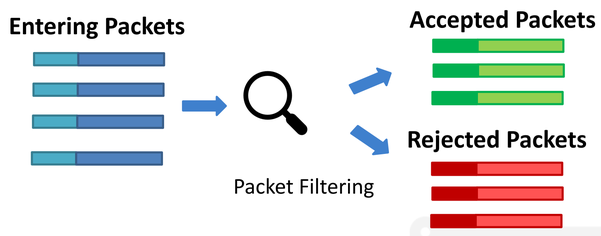
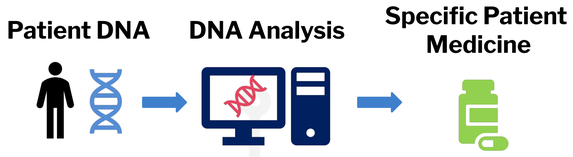
Context Definition

Regular expressions enable effective pattern descriptions in many domains

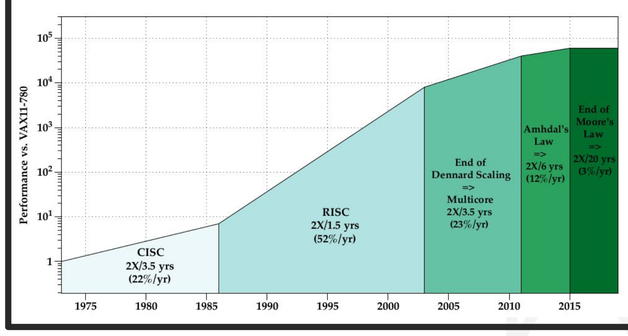
Intrusion Detection Systems



Genetic Marker Research



Current Technology Limitations

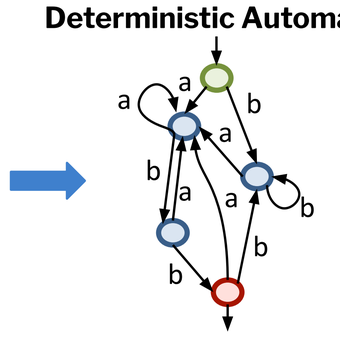


Leveraging **hardware and software integration unlocks new approaches** to solving domain-specific challenges [1], **enabling better efficient pattern matching**

State of the Art

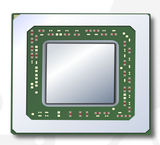
Execution Approach

Regular expression
(a|b)*abb



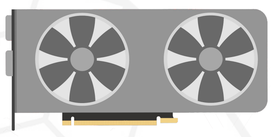
Execution Platforms

CPU



- Google RE2 [2]
- Hyperscan [3]

GPGPU

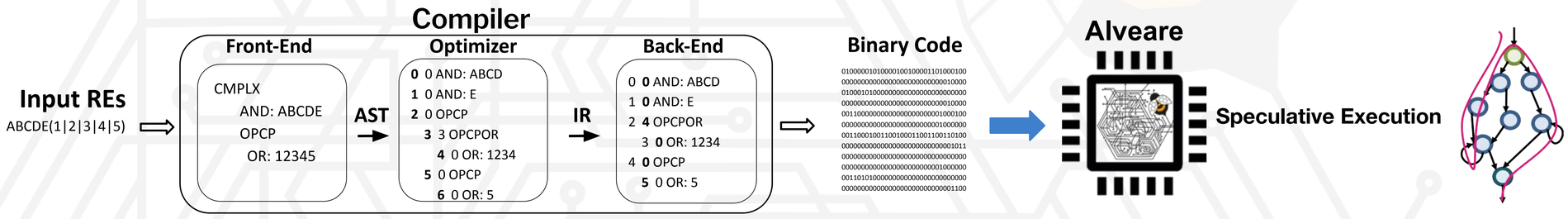


- iNFAnt [4]
- iNFAnt-CG [4]
- OBAT [4]

Hardware Accelerator

- DPU RXP [5]

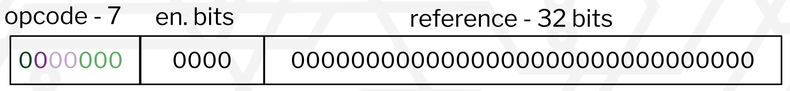
Framework Proof of Concept: RE-as-DSL



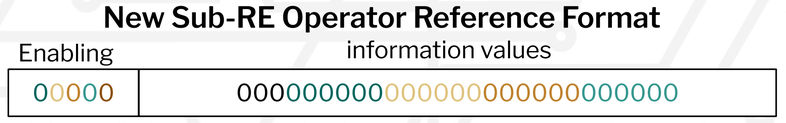
The Proposed RISC RE-tailored Instruction Set Architecture

Class	Operator	Opcode	Description
Control	EoR	*0000000*	End of RE
Base	AND	*0010 - - -*	Char-based And
	OR	*0001 - - -*	Char-based Or
	RANGE	*0011 - - -*	Char-based Range
	NOT	*01 - - - - -*	Match Inversion
Control	(	*1000000*	New Sub-RE
	)	*0 - - - 100*	End of Sub-RE
	QUANT_L	*0 - - - 001*	)+ Lazy Quantifier
	QUANT	*0 - - - 010*	)+ Greedy Quantifier
	|(	*0 - - - 011*	) + OR of Sub-RE

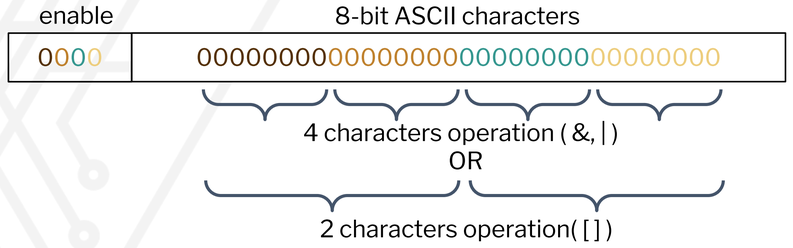
43-bit Instruction Format



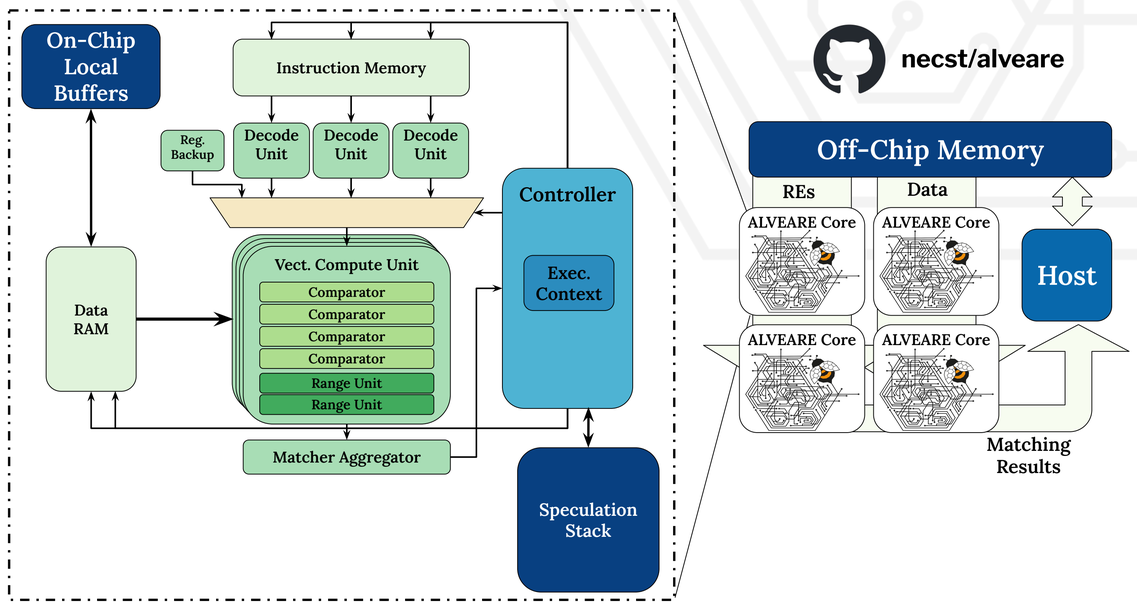
New Sub-RE Operator Reference Format



Base Operators Reference Format



Architectural Organization



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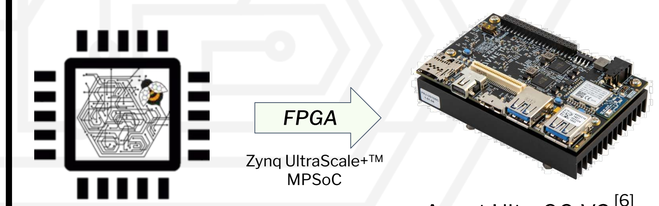
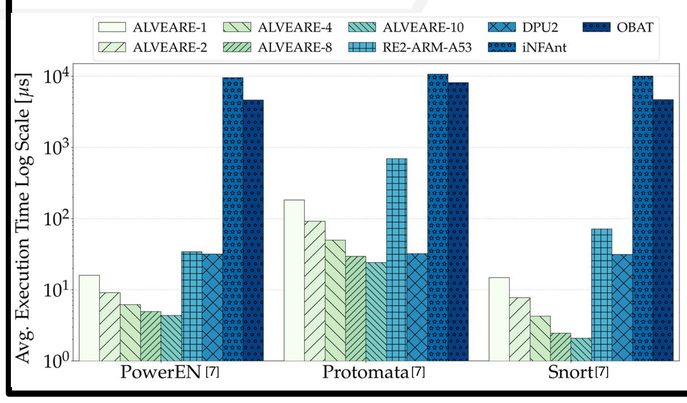
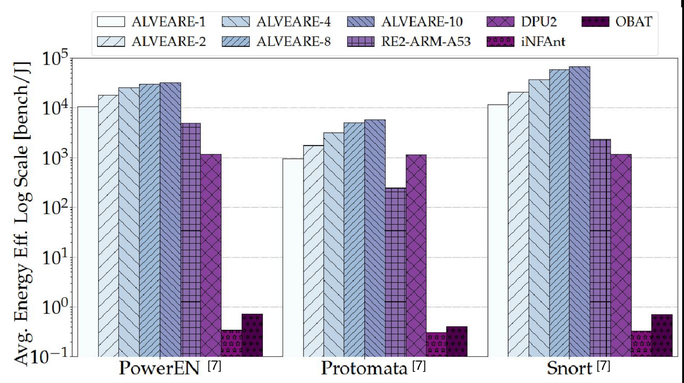
Experimental Results



Microbenchmark RE	Minimal Primitives	Advanced Primitives	Code/Clock Cycles Reduction
[a-zA-Z]	26	1	**26x**
[DBEZX]{7}	28	6	**4.66x**
.{3,6}	1160	2	**580x**
*[^]**	66	2	**33x**





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Acknowledgements

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