

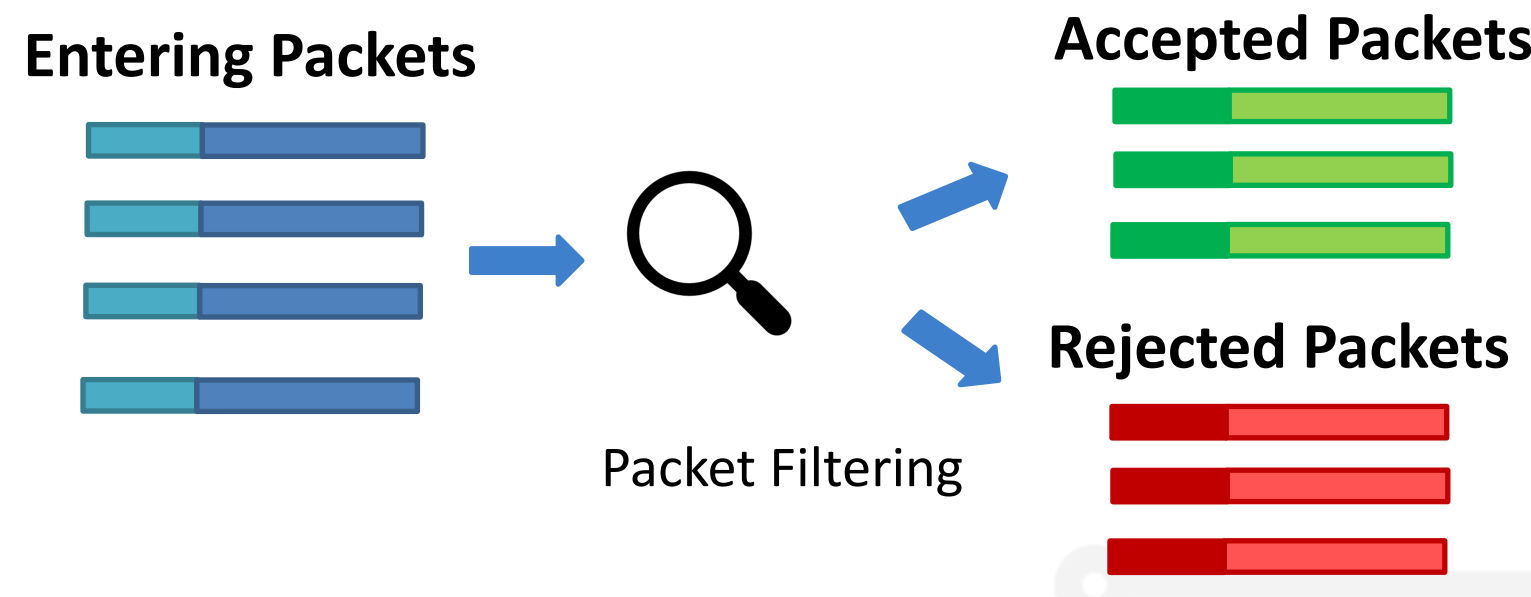
# ALVEARE: a Domain-Specific Framework for Regular Expressions

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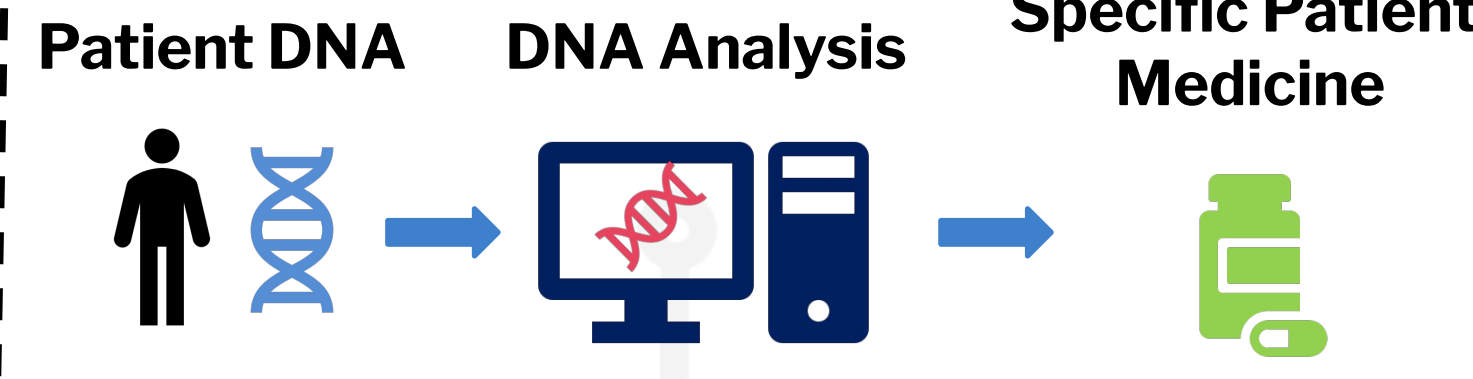
## Context Definition

Regular expressions enable effective pattern descriptions in many domains

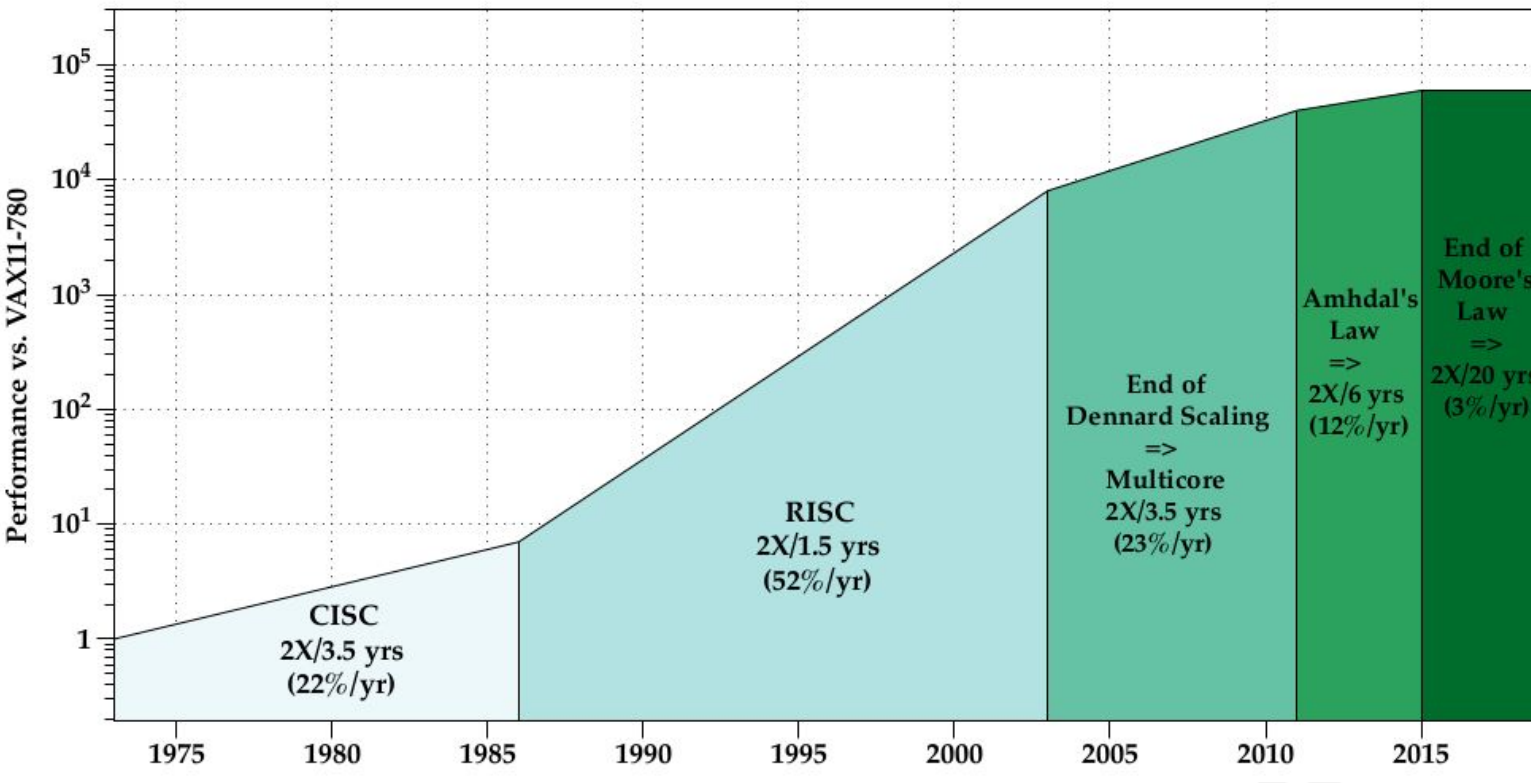
### Intrusion Detection Systems



### Genetic Marker Research



## Current Technology Limitations



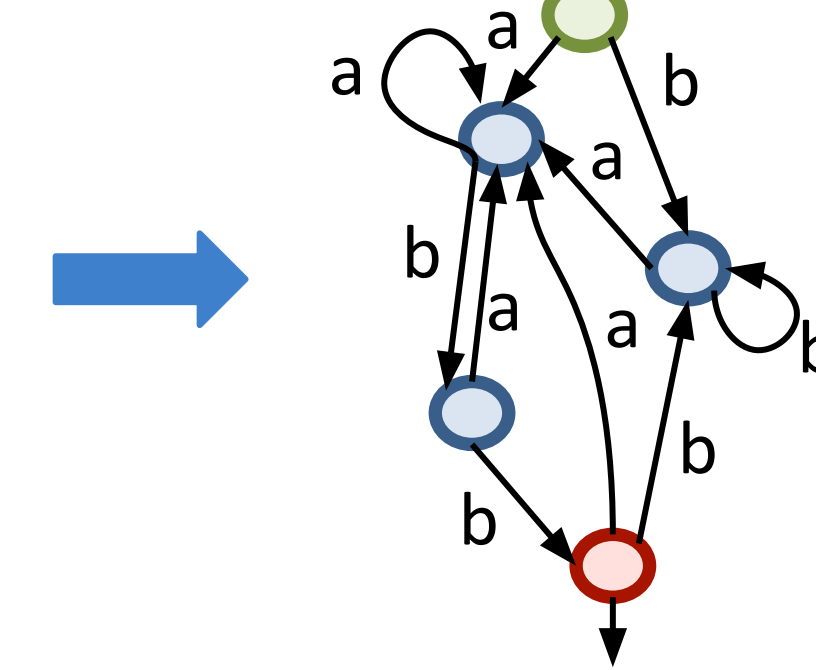
Leveraging **hardware and software integration** unlocks new approaches to solving domain-specific challenges [1], enabling better efficient pattern matching

## State of the Art

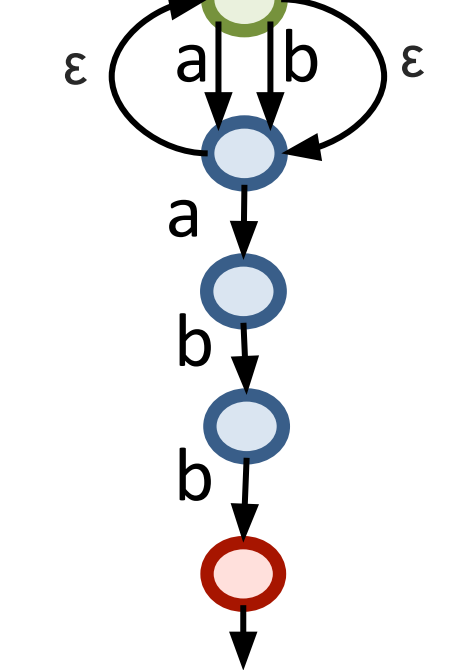
### Execution Approach

Deterministic Automata Non-Deterministic Automata

Regular expression  
(a|b)\*abb

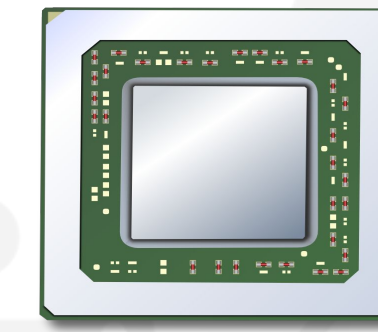


VS / Mixed



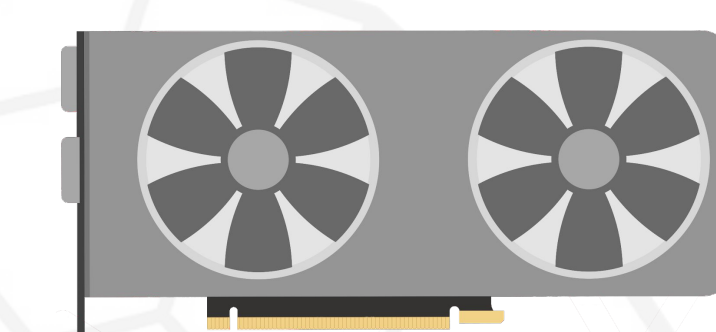
### Execution Platforms

#### CPU



- Google RE2 [2]
- Hyperscan [3]

#### GPGPU



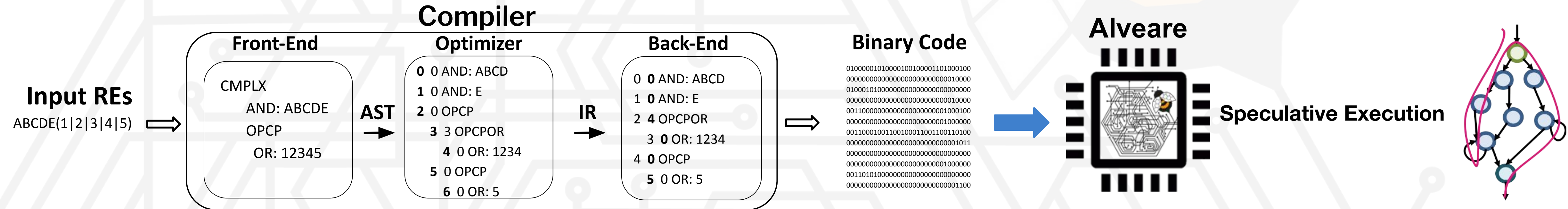
- iNFAnt [4]
- iNFAnt-CG [4]
- OBAT [4]

#### Hardware Accelerator



- DPU RXP [5]

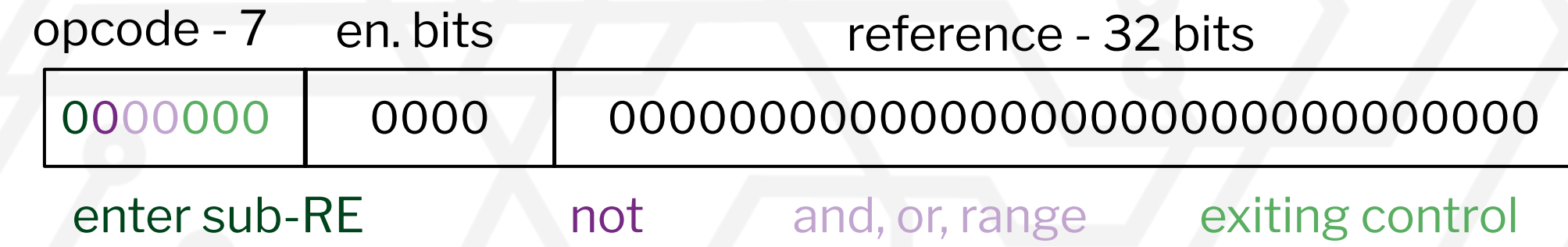
## Framework Proof of Concept: RE-as-DSL



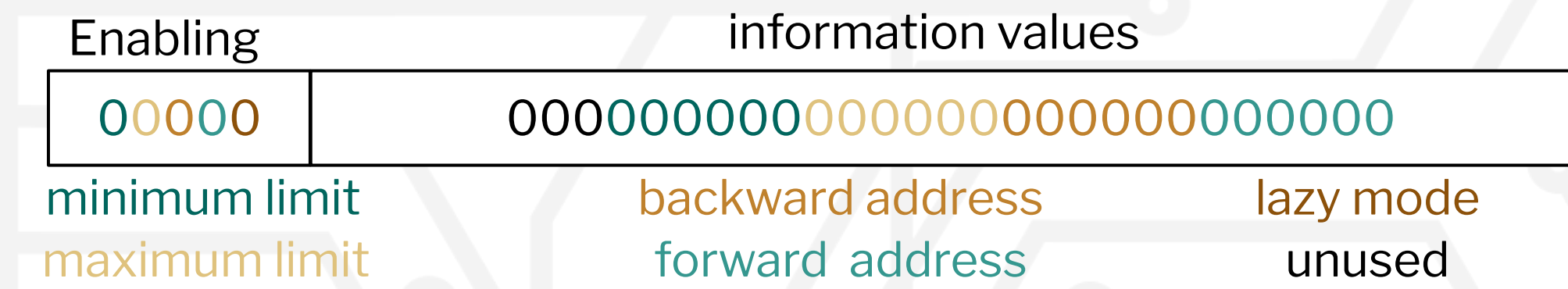
## The Proposed RISC RE-tailored Instruction Set Architecture

Class	Operator	Opcode	Description
Control	EoR	000000	End of RE
Base	AND	0010---	Char-based And
	OR	0001---	Char-based Or
	RANGE	0011---	Char-based Range
	NOT	01-----	Match Inversion
Control	(	100000	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

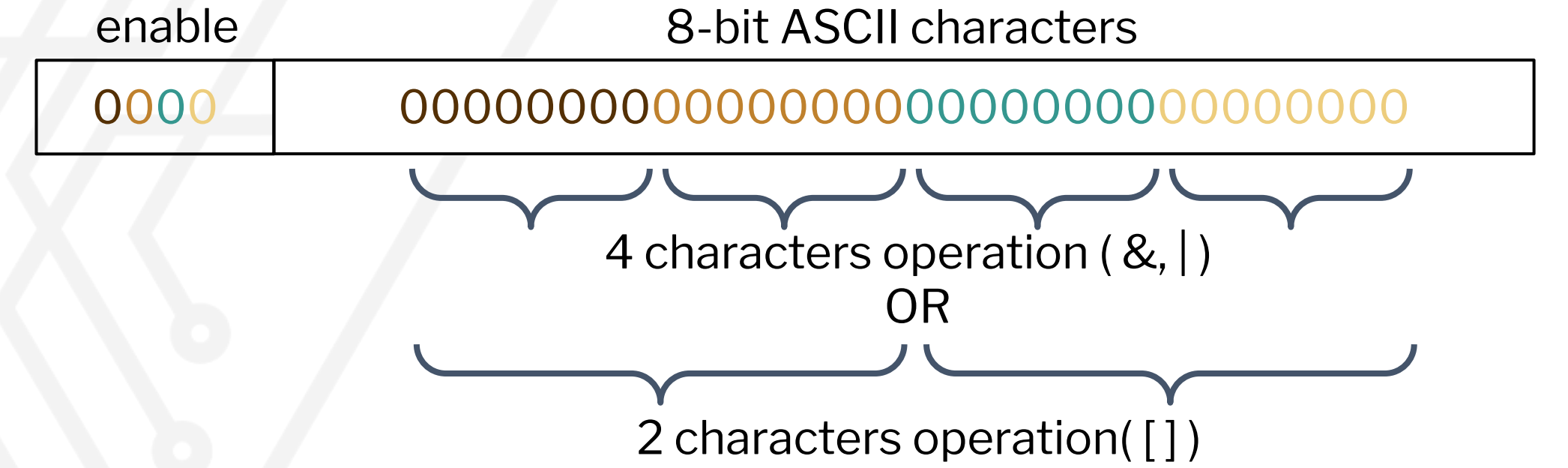
### 43-bit Instruction Format



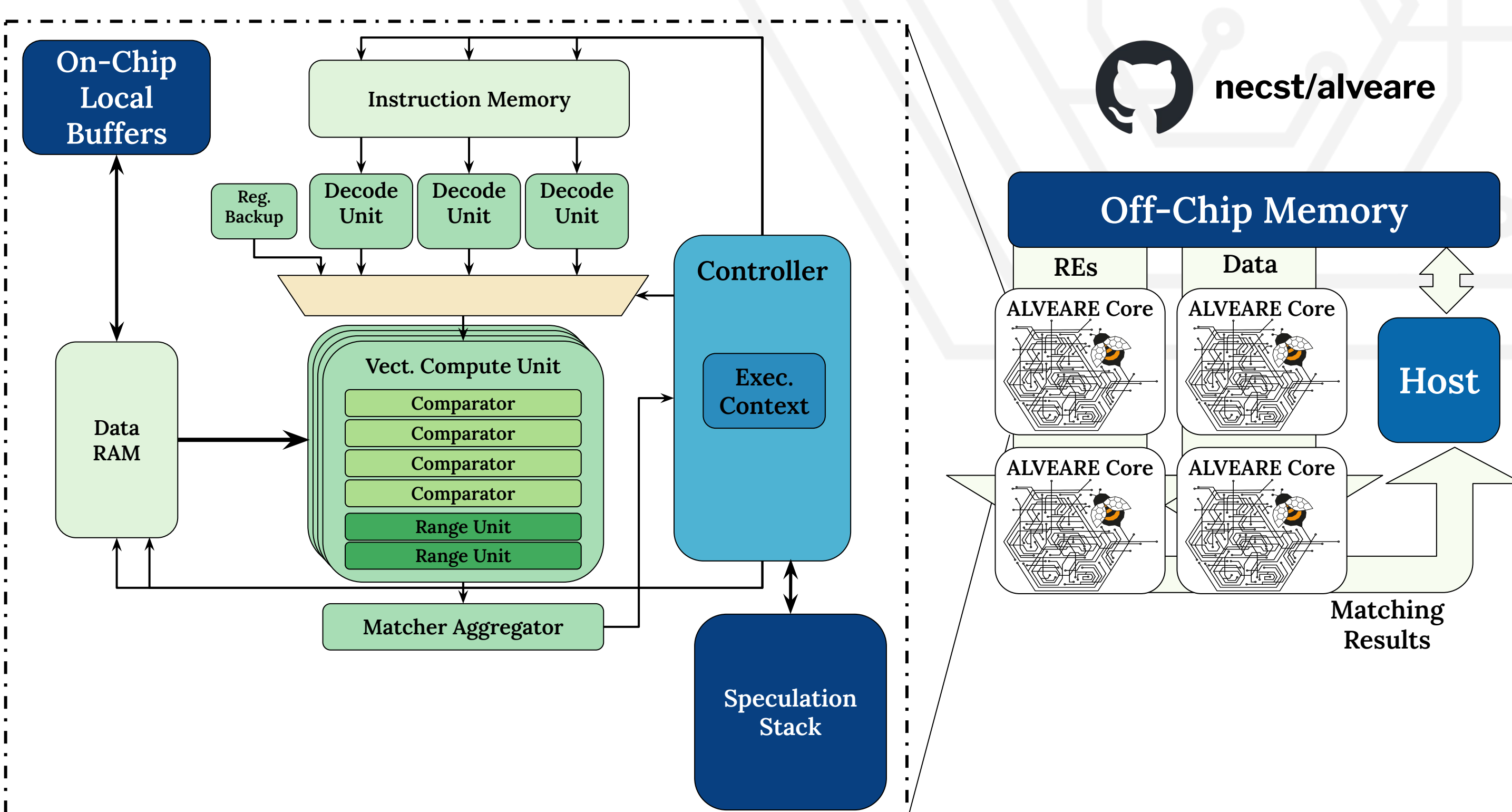
### New Sub-RE Operator Reference Format



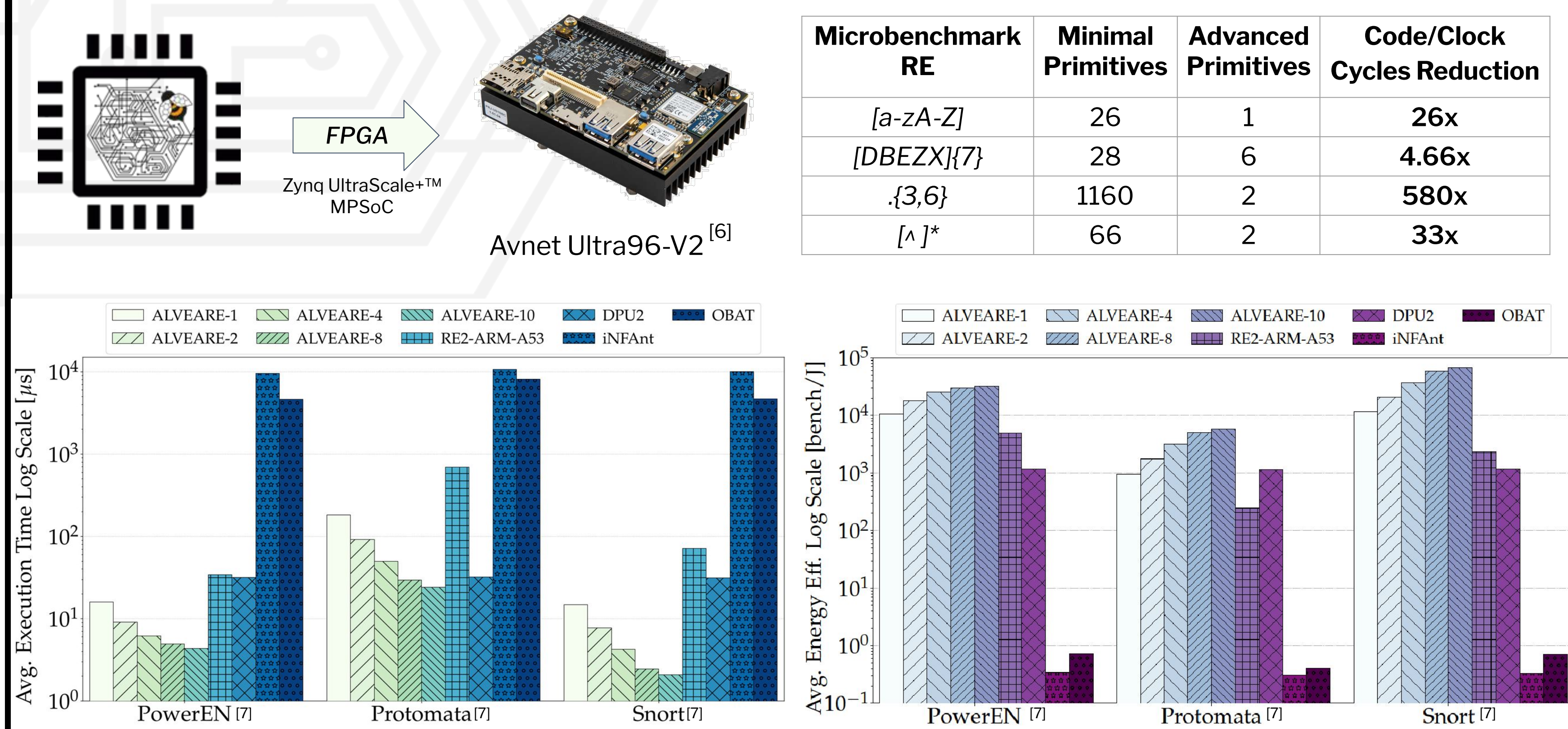
### Base Operators Reference Format



## Architectural Organization



## Experimental Results



## References

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- [2] Google. 2020. Google re2. <https://github.com/google/re2>.
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- [4] Liu, Hongyuan, et al. "Why gpus are slow at executing NFAs and how to make them faster." Proceedings of the Twenty-Fifth International Conference on Architectural Support for Programming Languages and Operating Systems. 2020.
- [5] Burstein, Idan. "Nvidia Data Center Processing Unit (DPU) Architecture." 2021 IEEE Hot Chips 33 Symposium (HCS). IEEE, 2021.
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## Acknowledgements

We thank the AMD University program, NVIDIA Academic HW Grant Program, Oracle Cloud Infrastructure and Oracle for Research for the Research support, the anonymous reviewers, and L. Cicolini, E. D'Arnese, E. Del Sozzo, G. Sorrentino, and G. Antichi for precious feedback. The Avnet Ultra96-V2 and BlueField 2 board images are property of the respective companies.