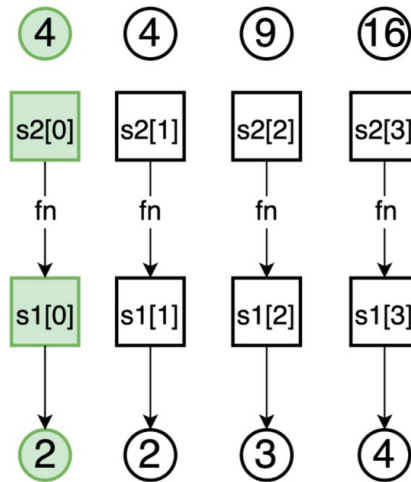
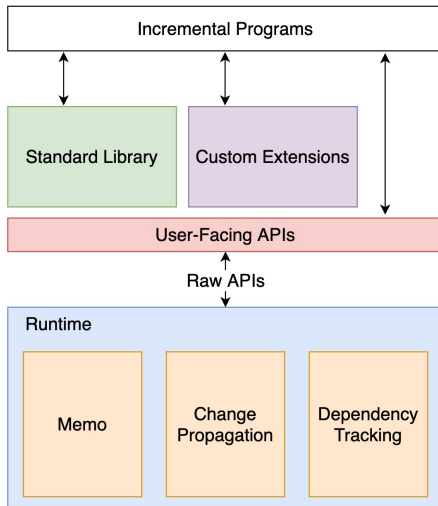


INCR - A New C++ Library

for High Performance Incremental Computation

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```

1 s1 = [1,2,3,4]
2 f = [](x) {x * x}
3 s2 = Transform(s1, f)
4 s1.update(0, 2)
5 s2.force()

```

Project Objectives:

Many computationally intensive applications, such as simulation and modelling software, algorithmic trading systems, and machine learning systems, need to react to changing input data and produce real-time updates to their outputs. Incremental computing is one promising technique to develop such reactive programs. Incremental computations react to input changes by only recomputing outputs that depend on the changed inputs. However, there is a lack of performant and generic libraries that make writing and reasoning about programs with incremental computations simple and accurate. Therefore, this project aimed to develop “INCR”, an open-source, high-performance, and general-purpose library written in C++ for building incremental programs.

It is shown in empirical results that the INCR library has uniformly better performance and guaranteed correctness, and sometimes achieves many orders of magnitude speedups over from-scratch computations.

Program	Input size	Naive (μ s)	Eager w/t memo	Lazy w/t memo	Lazy w/ memo
Transform	10	3.4	0.022	0.016	0.017
	50	14.3	0.031	0.022	0.026
	100	27.8	0.035	0.028	0.031
	500	178.7	0.130	1.01	1.12
	5000	9556.2	0.88	1.75	2.35
Filter	10	3.3	0.029	0.016	0.016
	50	16.9	0.029	0.025	0.027
	100	29.0	0.031	0.029	0.033
	500	174.5	0.112	0.95	1.11
	5000	9792.5	0.79	1.95	2.12

