Resource Allocation for Hardware Implementations of Map

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Martha A. Kim Stephen A. Edwards

Columbia University

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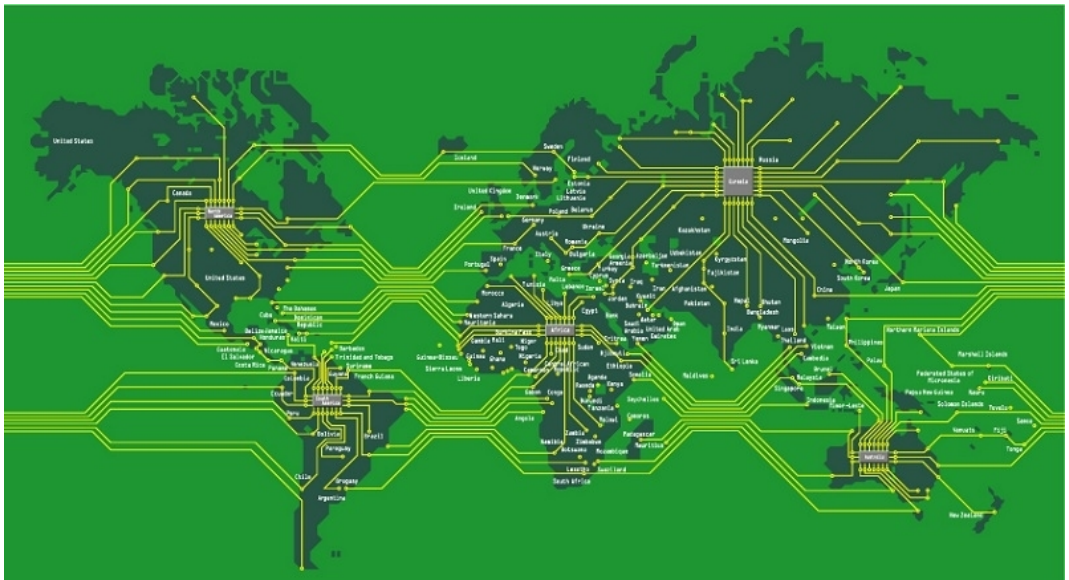
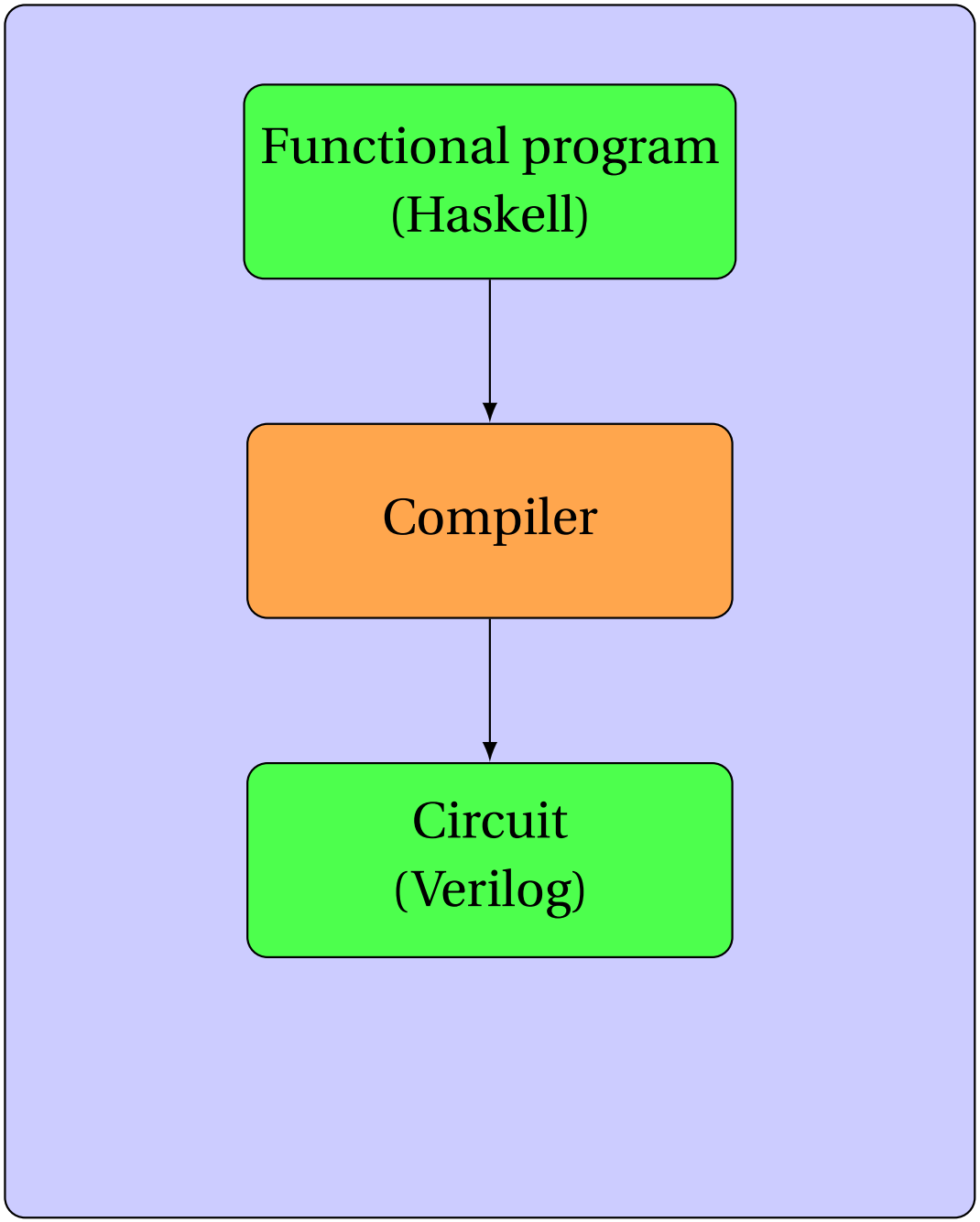


Functional Programs to Functional Hardware



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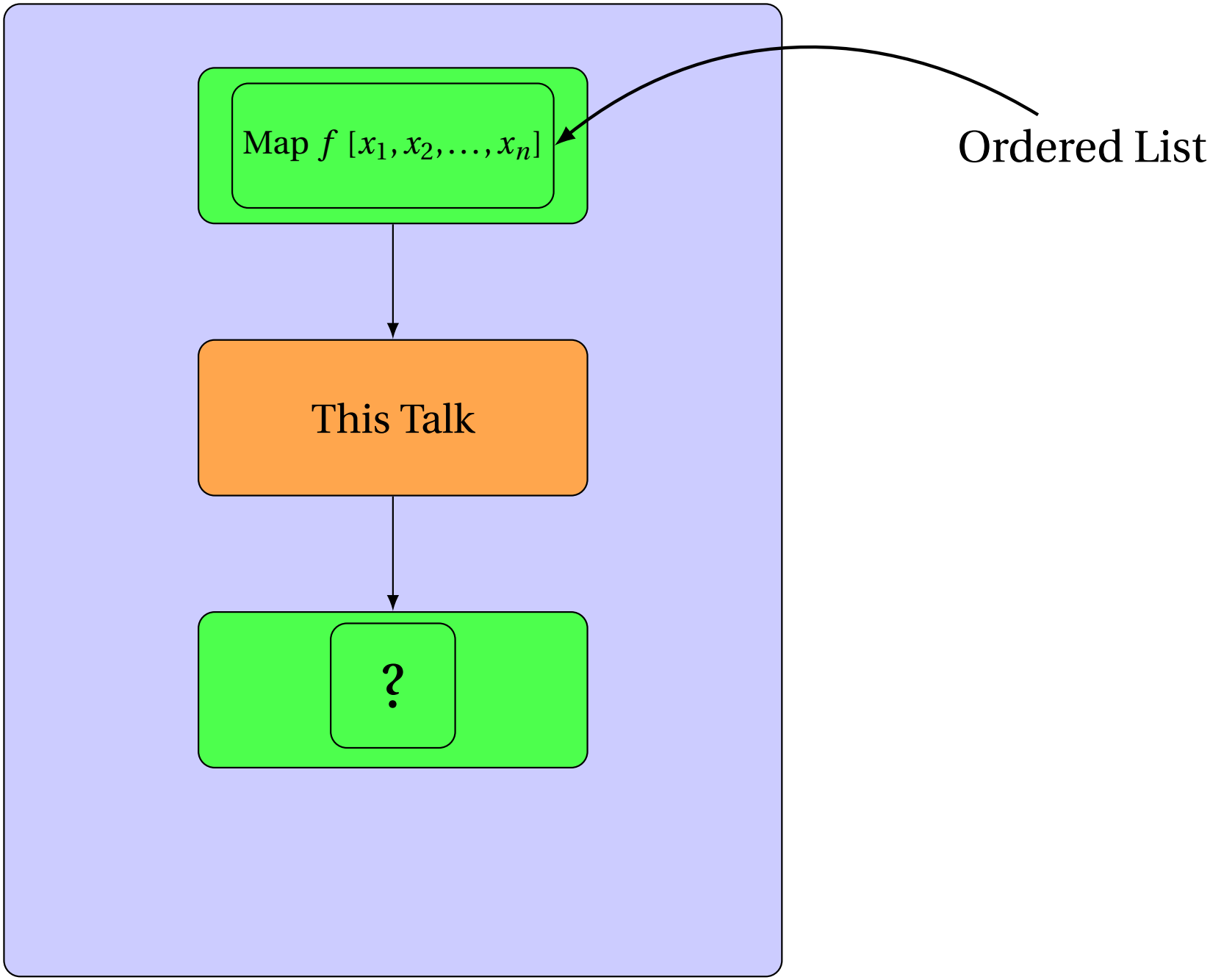
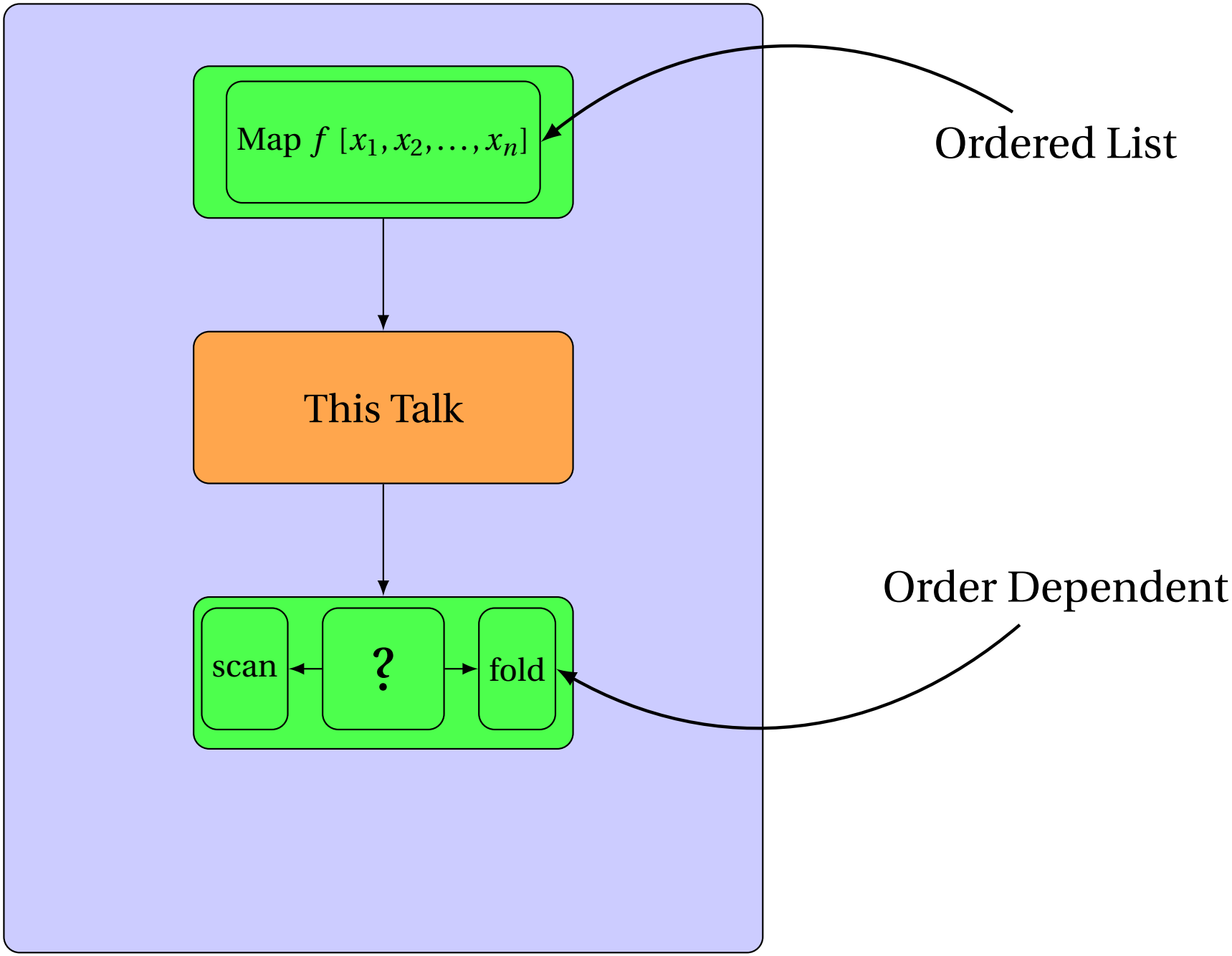
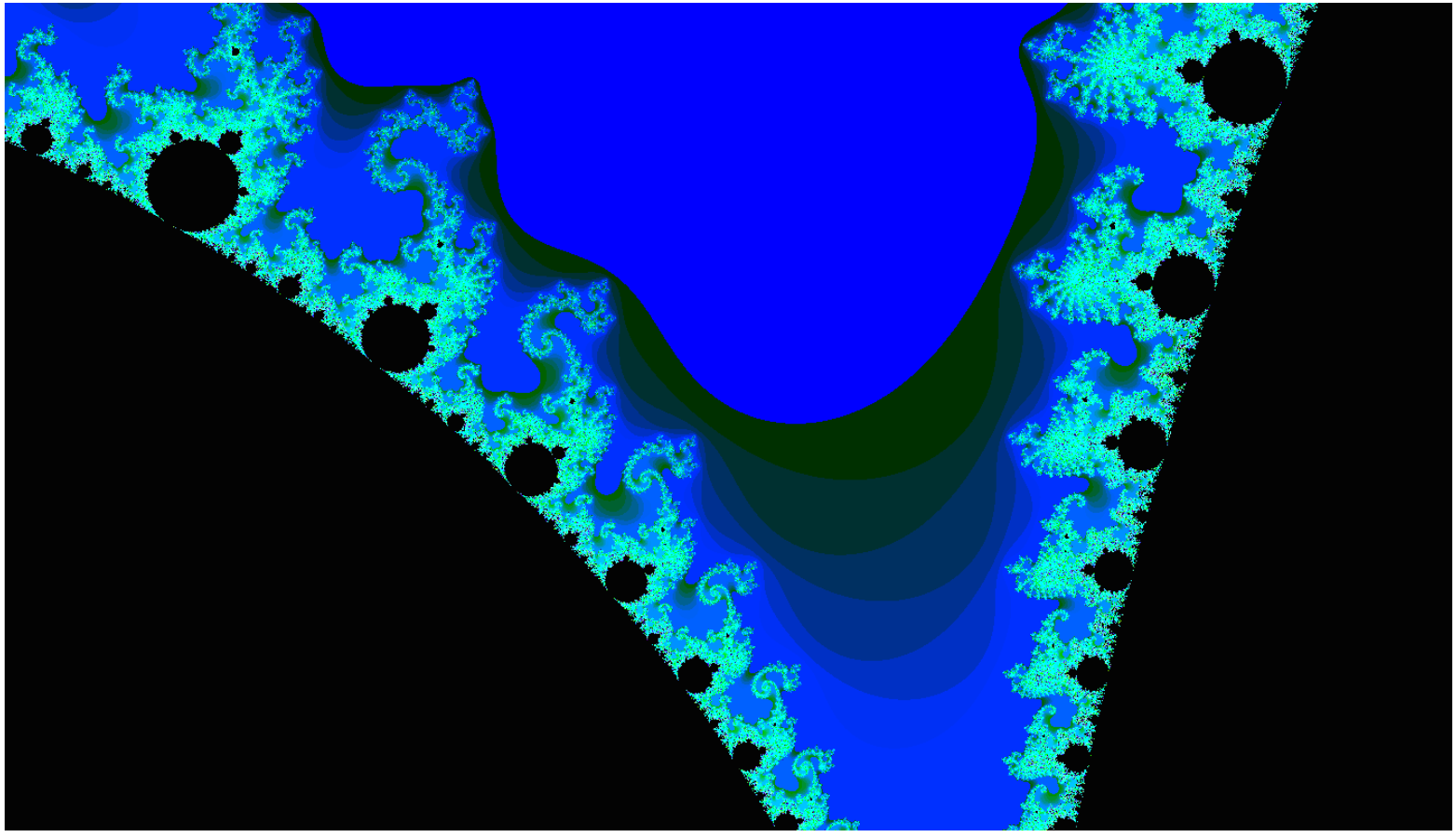


Functional Programs to Functional Hardware



Functional Map vs. MapReduce



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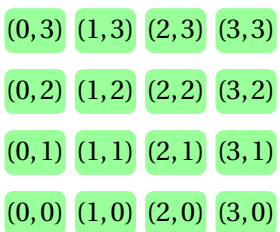

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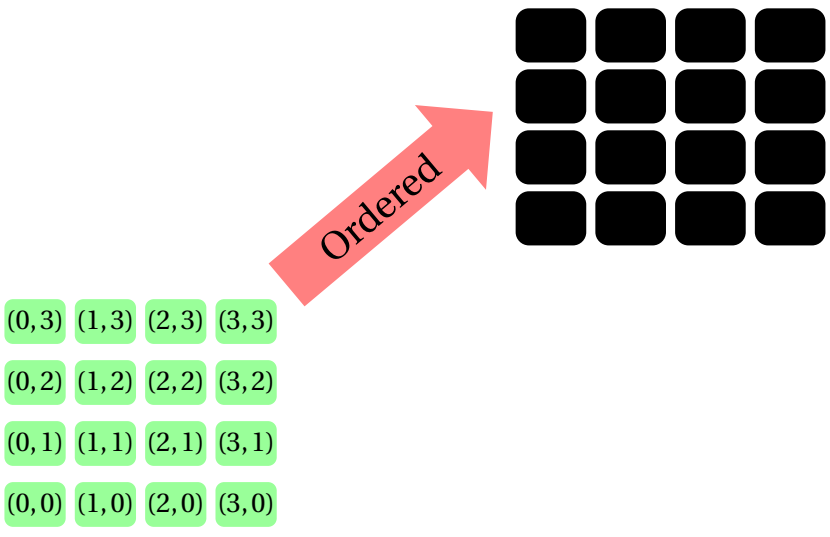

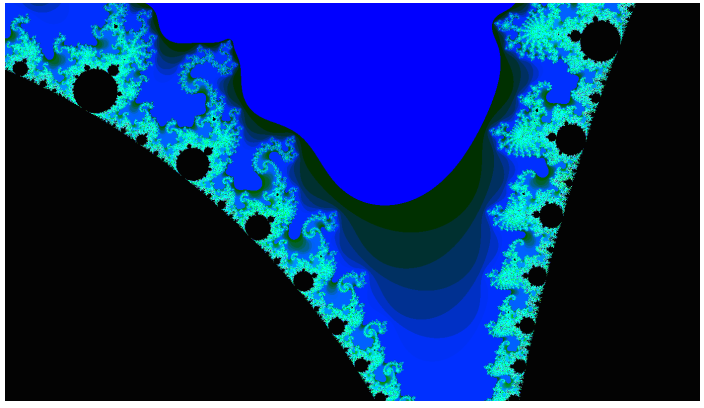

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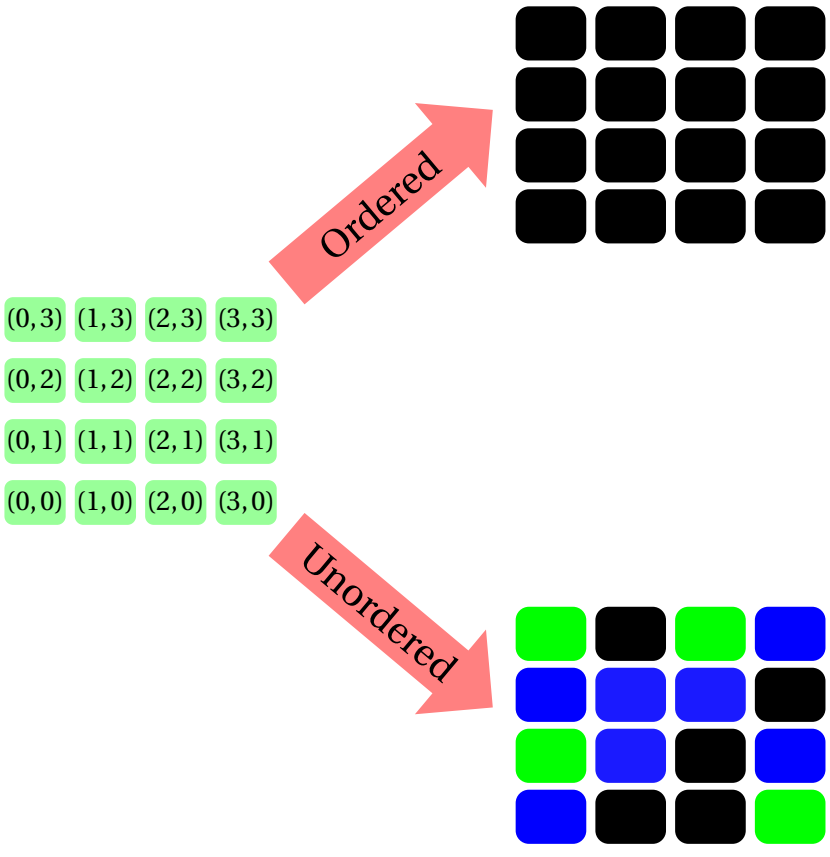

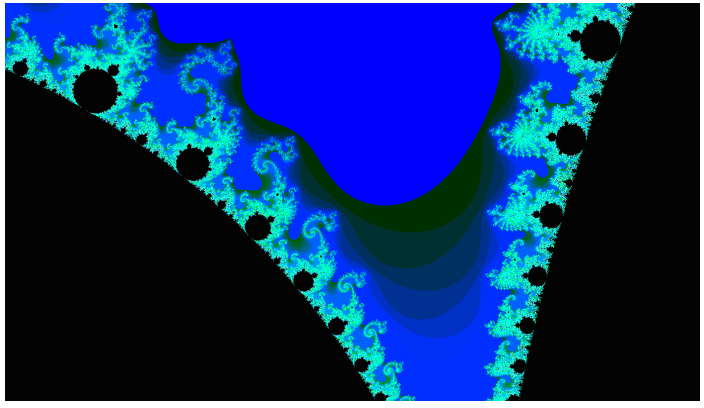

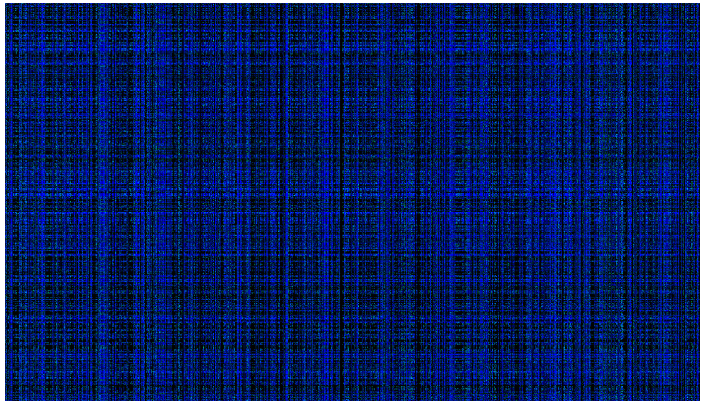

Structure of a Hardware Implementation

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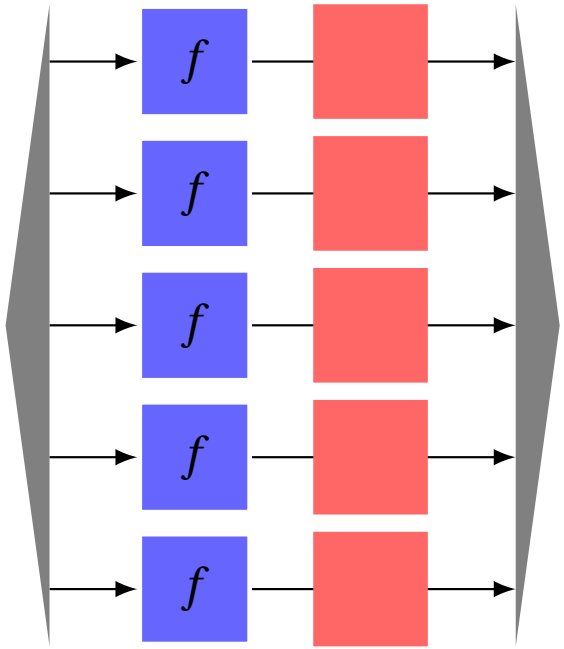

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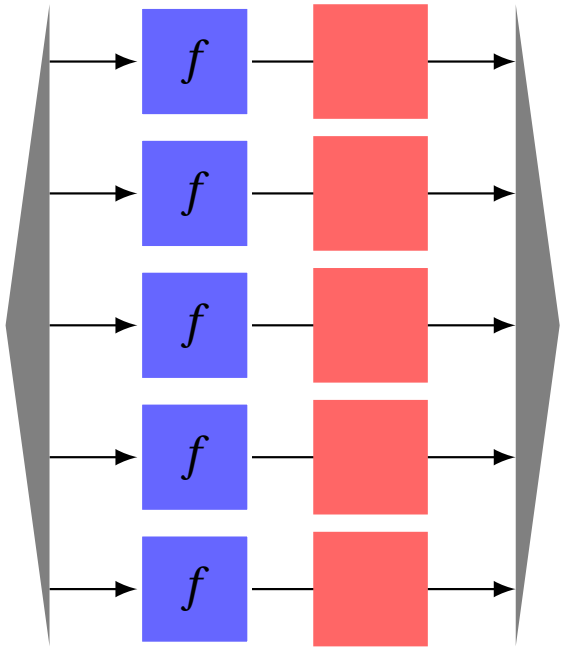

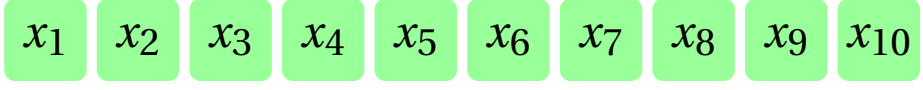

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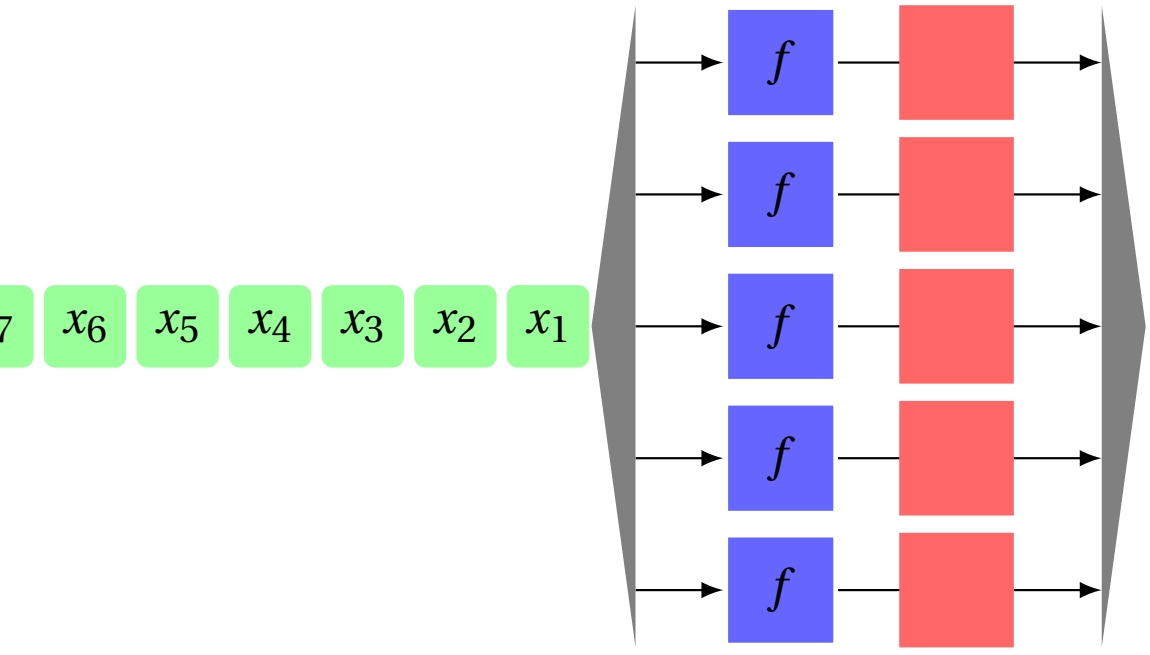

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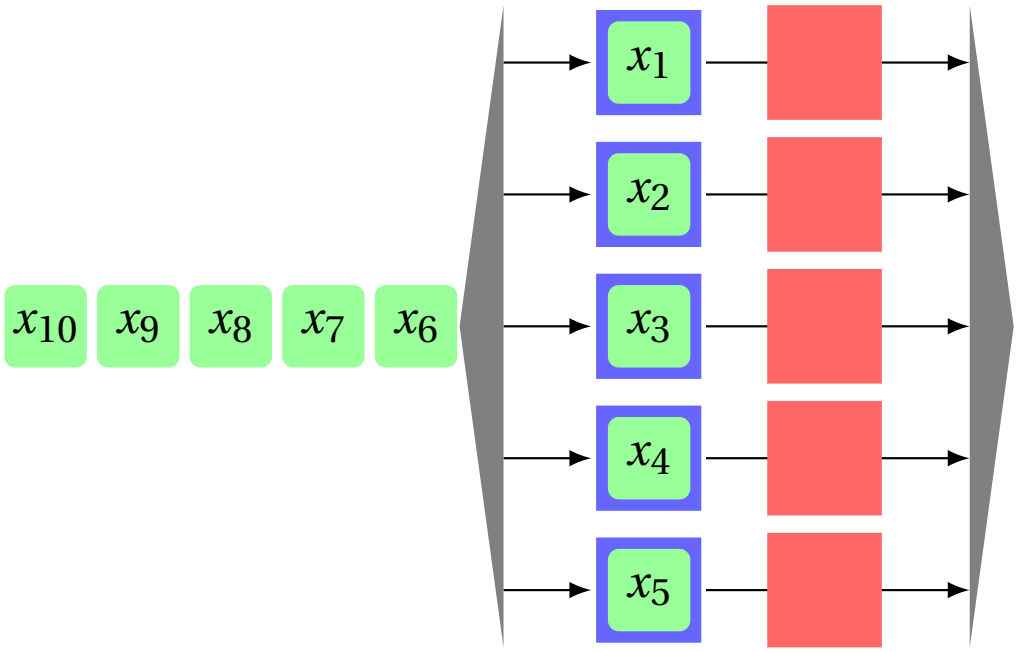

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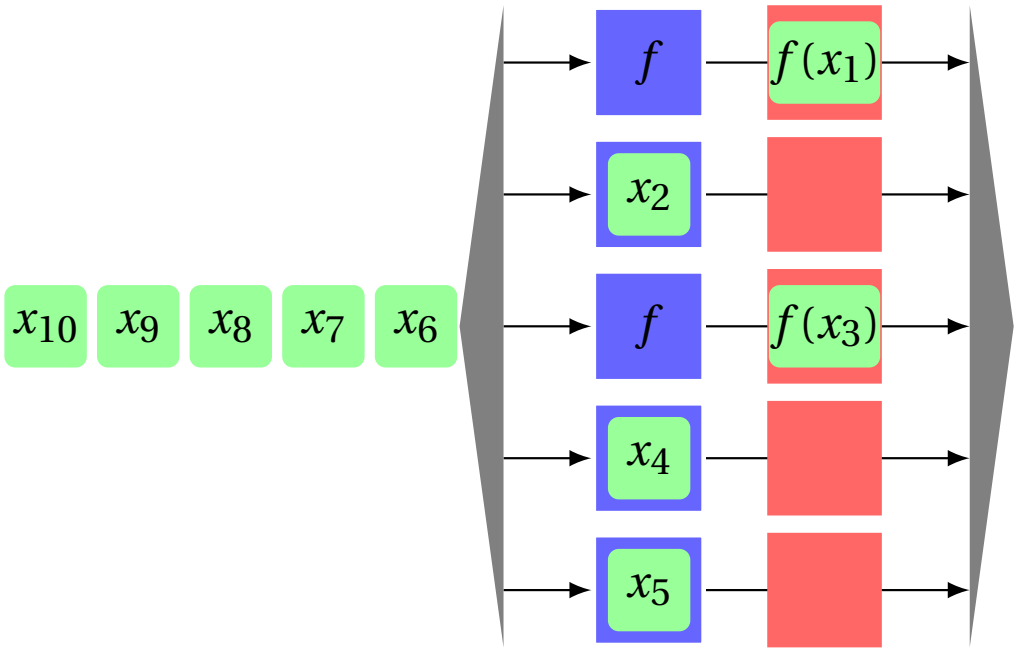

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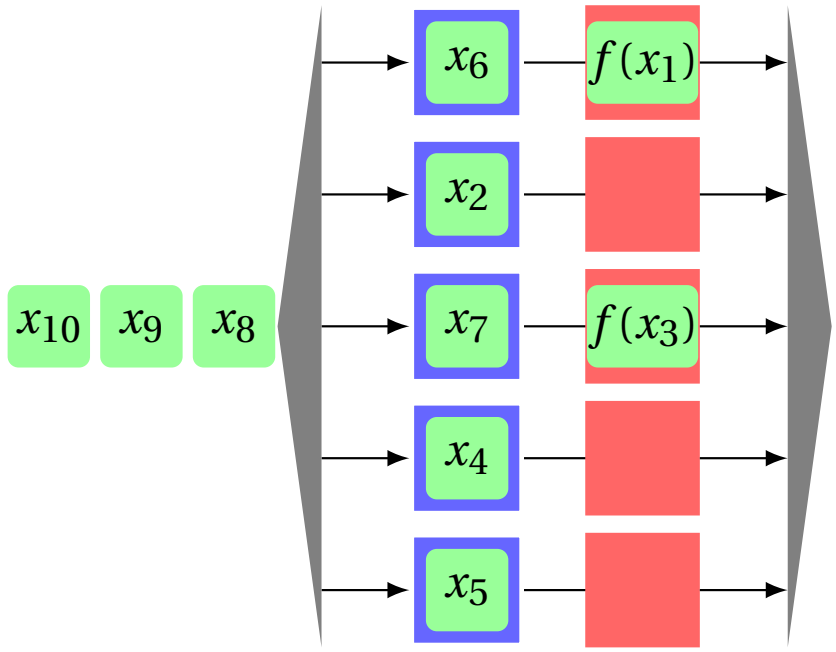

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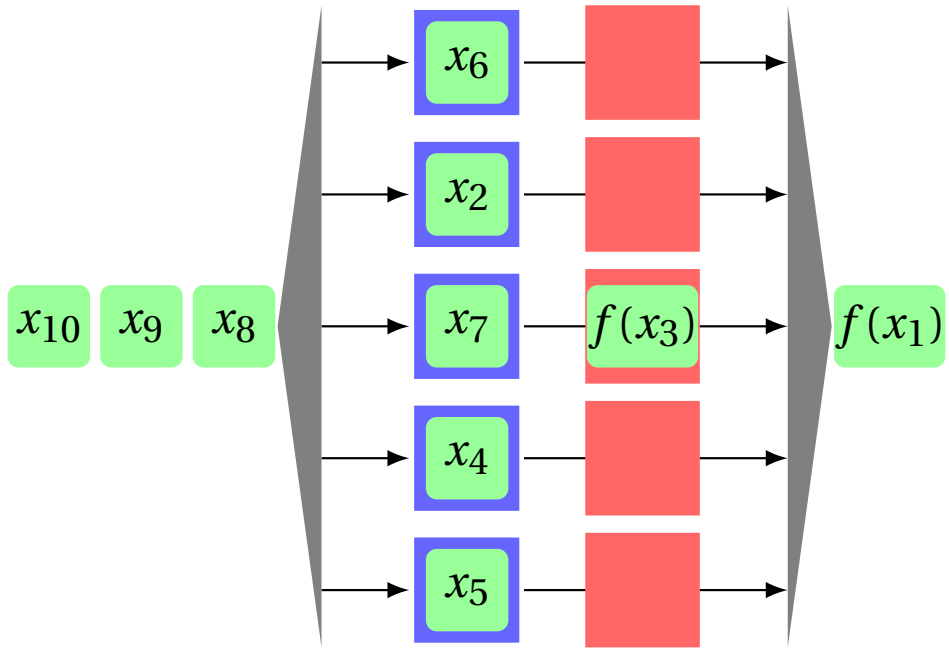

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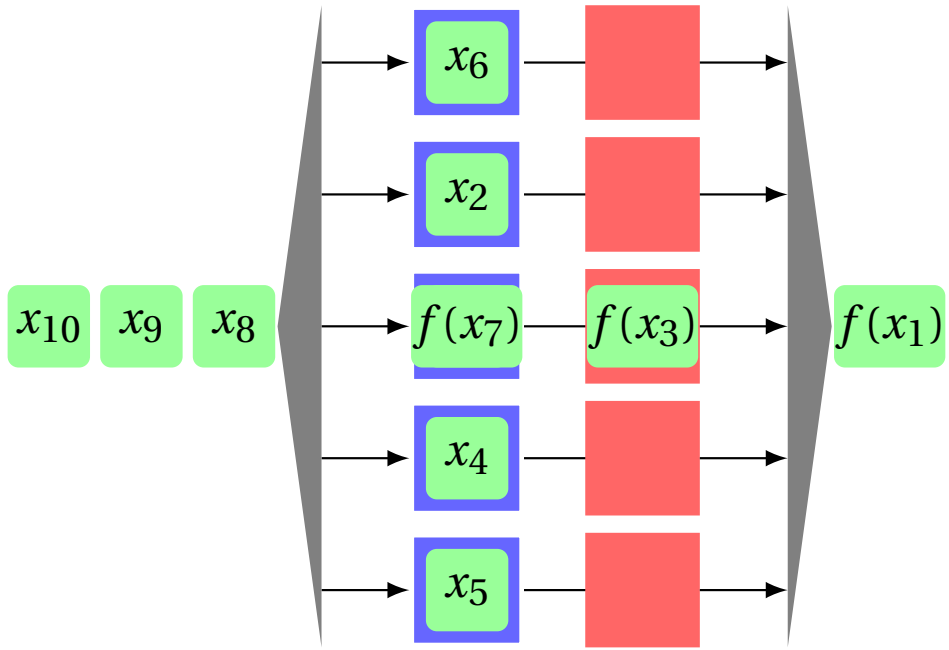

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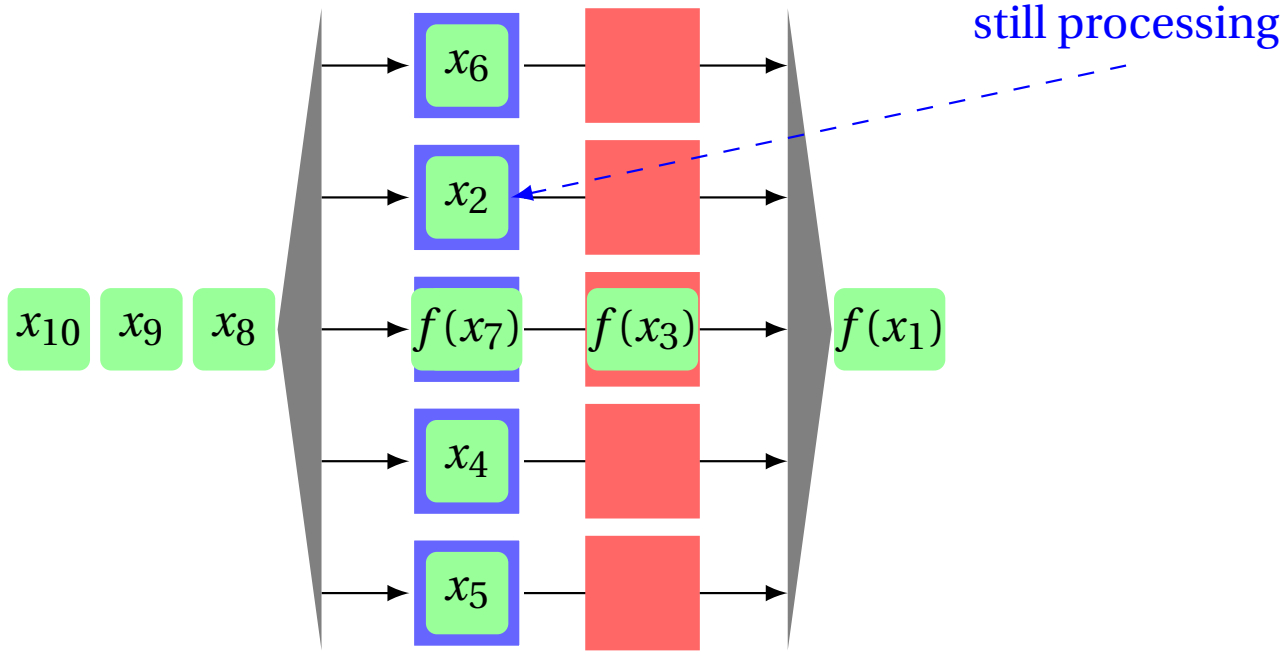

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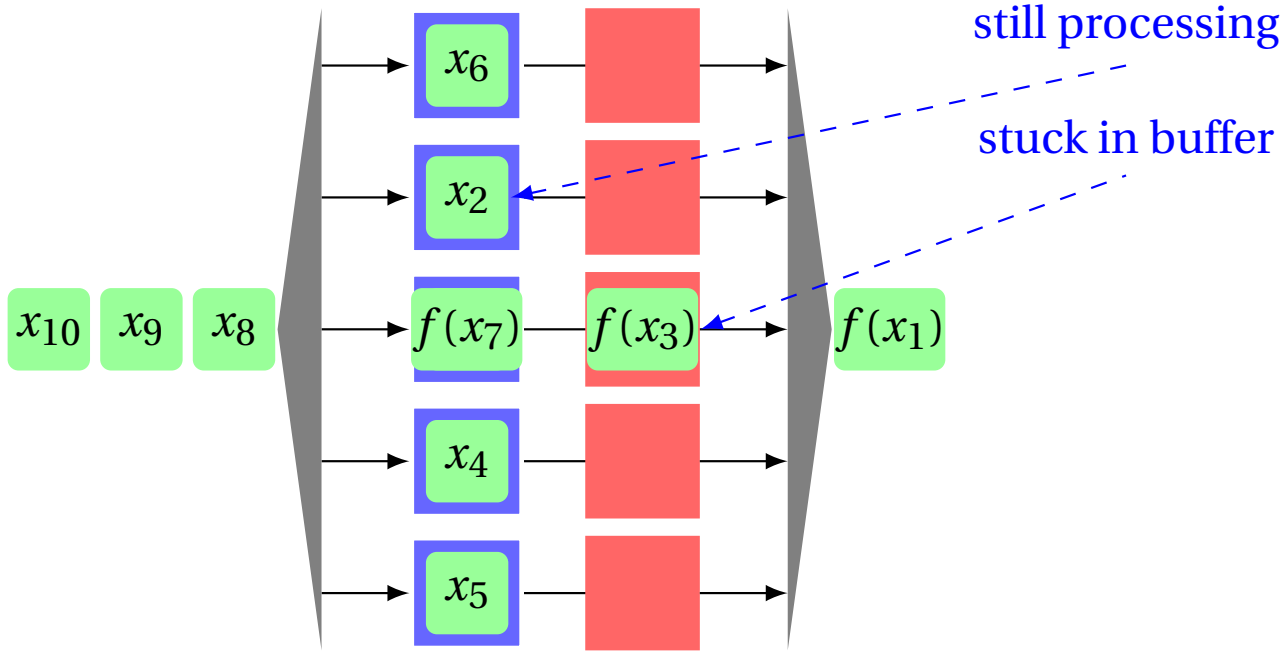

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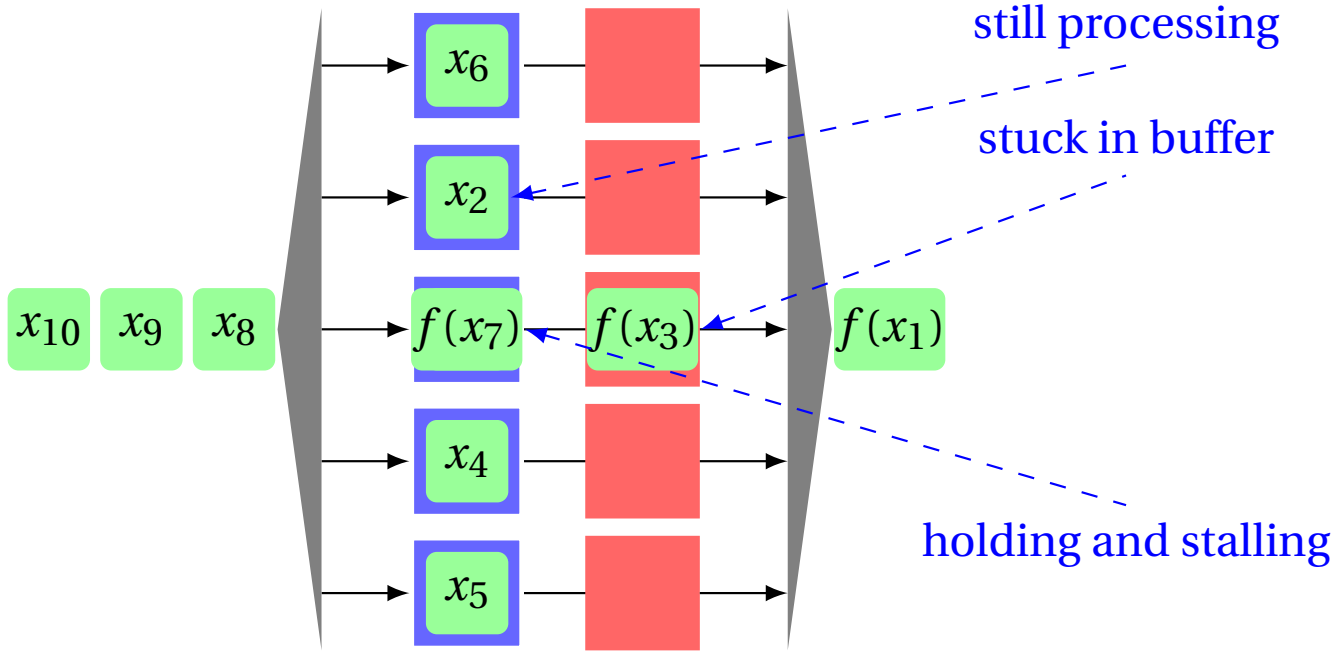

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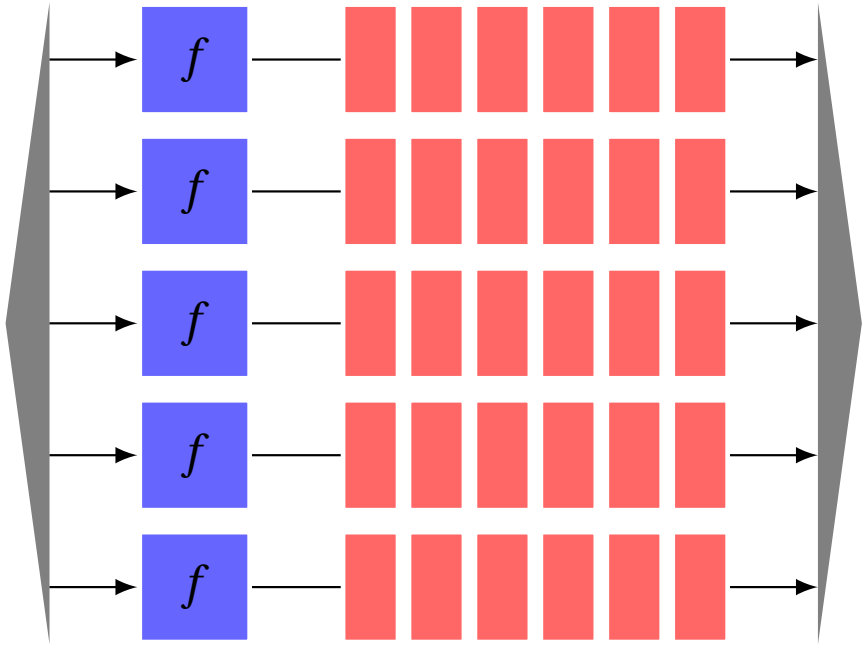

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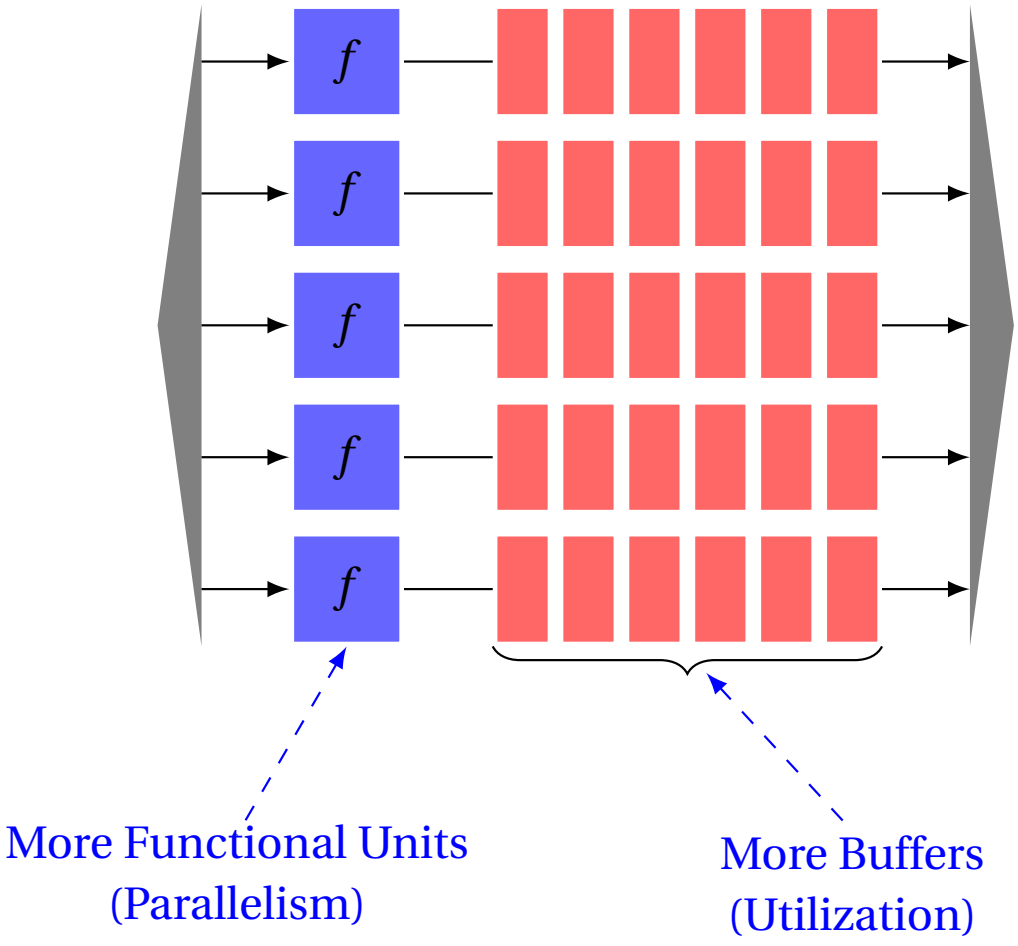
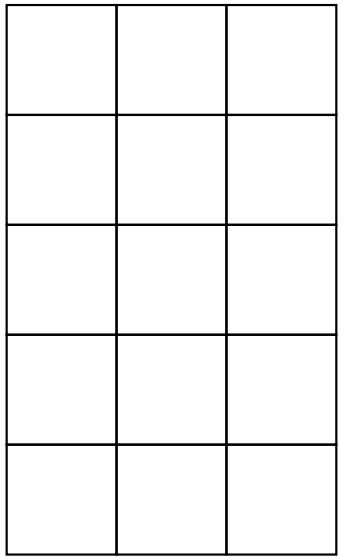
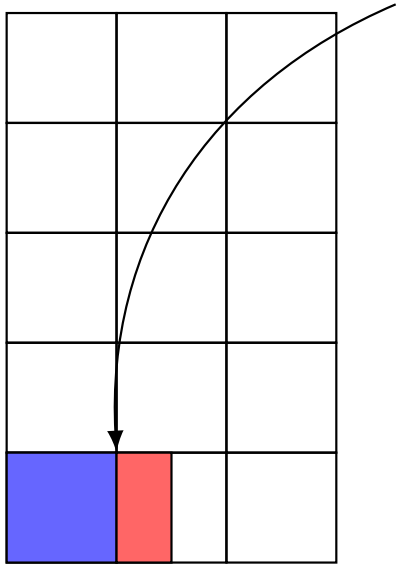


Multiple Possible Configurations...Which to Choose?



Area = 15

Multiple Possible Configurations…Which to Choose?



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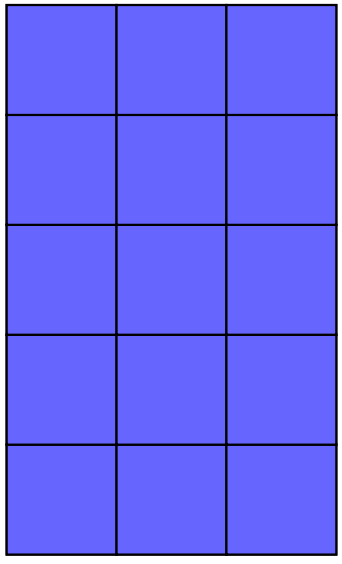

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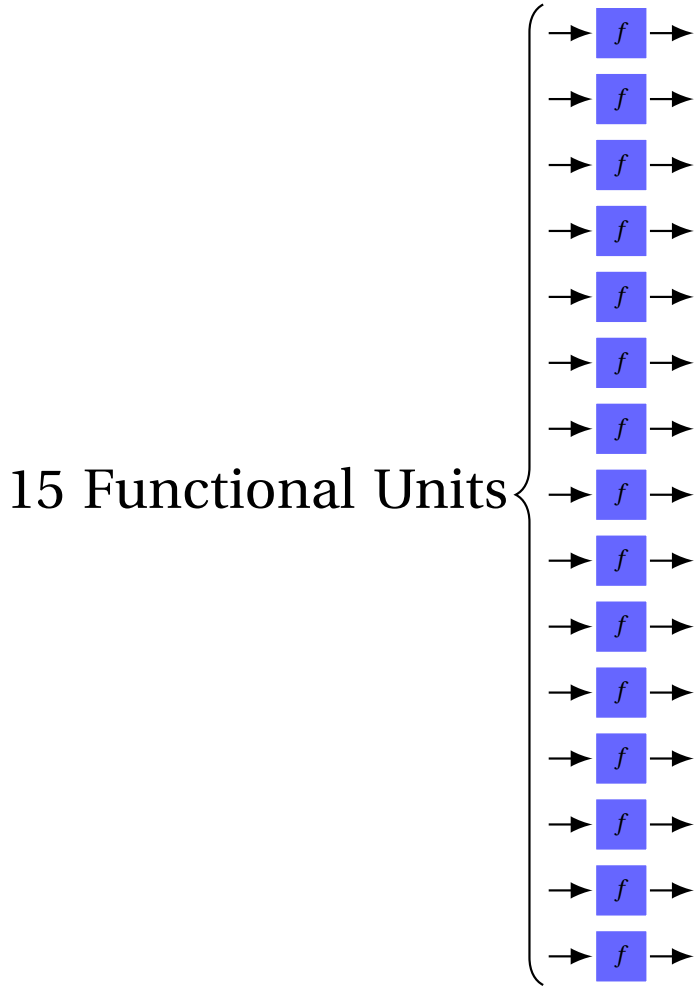

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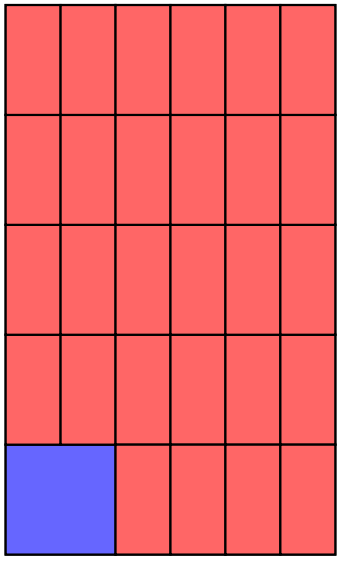

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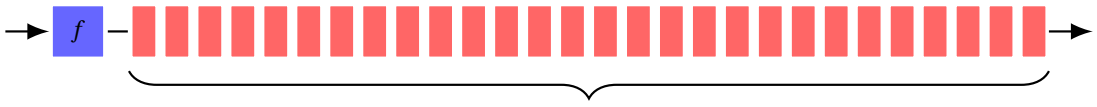

28 Buffers

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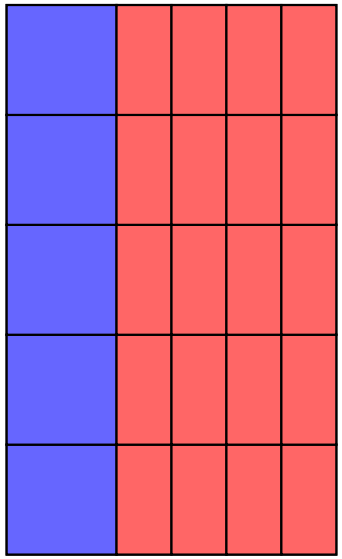

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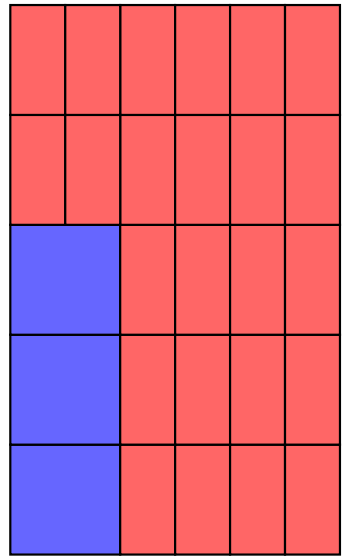
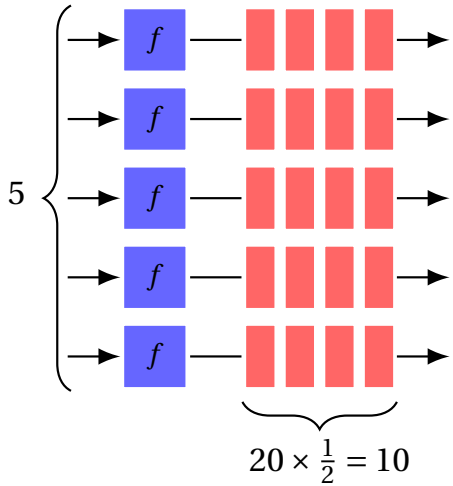
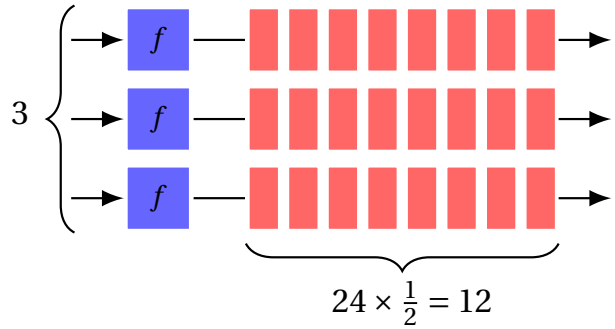
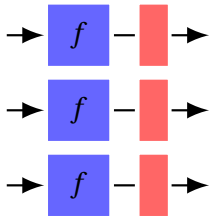






Workload Structure



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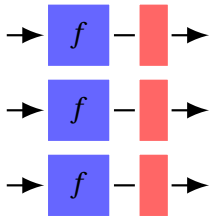
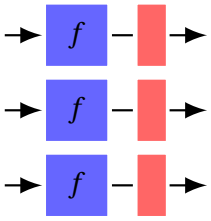


Best-case

Workload Structure



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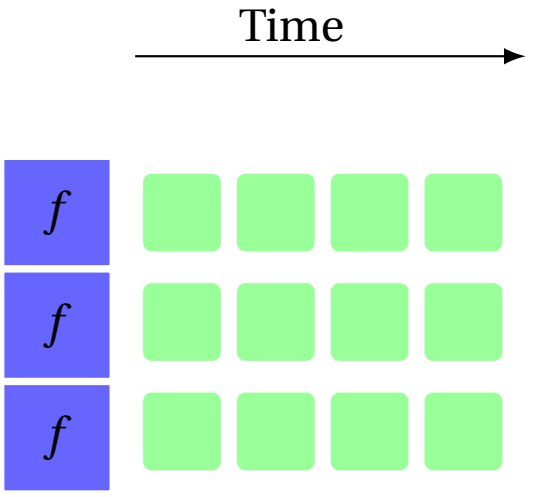

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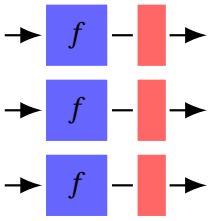
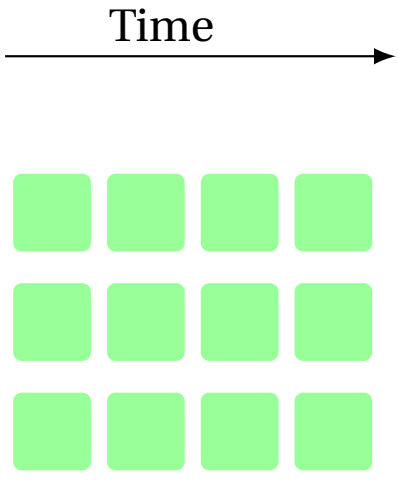


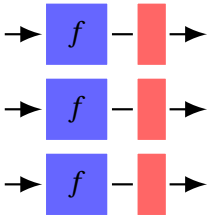


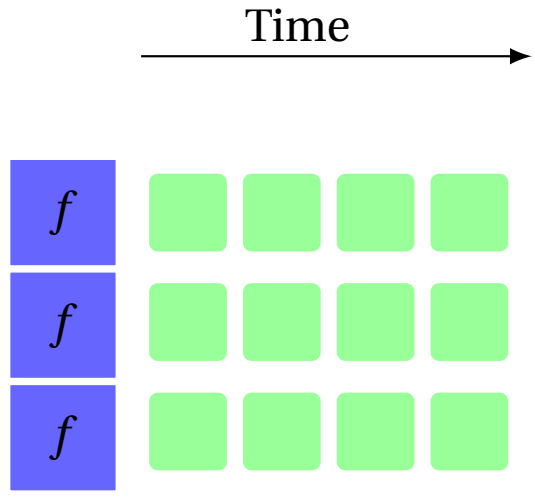
Best-case

Average-case

?

Workload Structure





Best-case

Average-case

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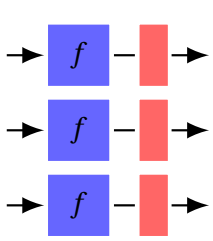
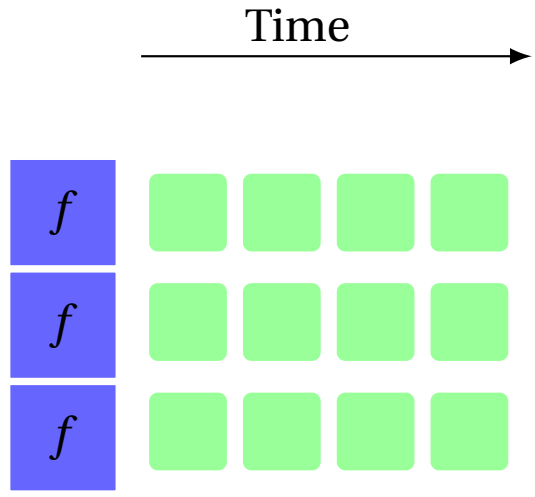
Worst-case

Workload Structure





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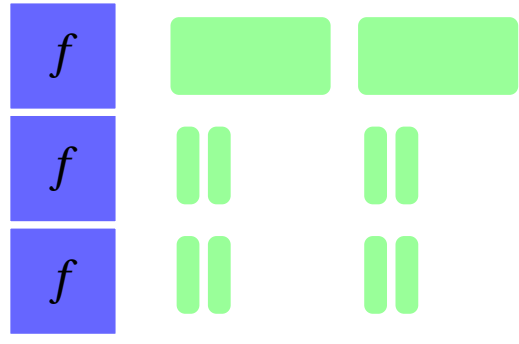

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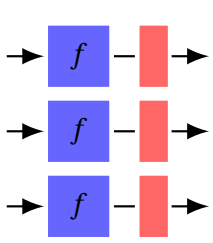

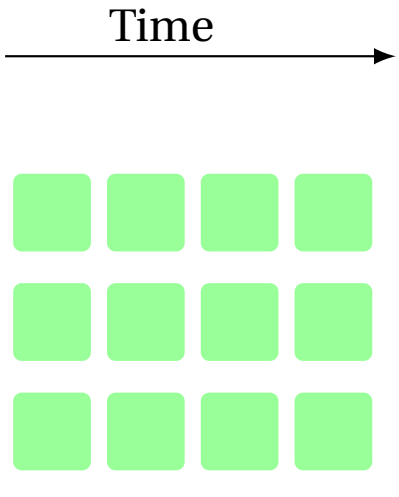

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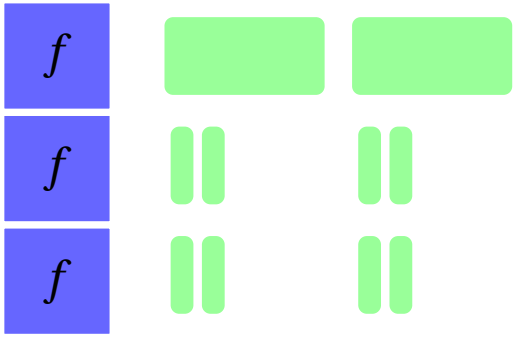
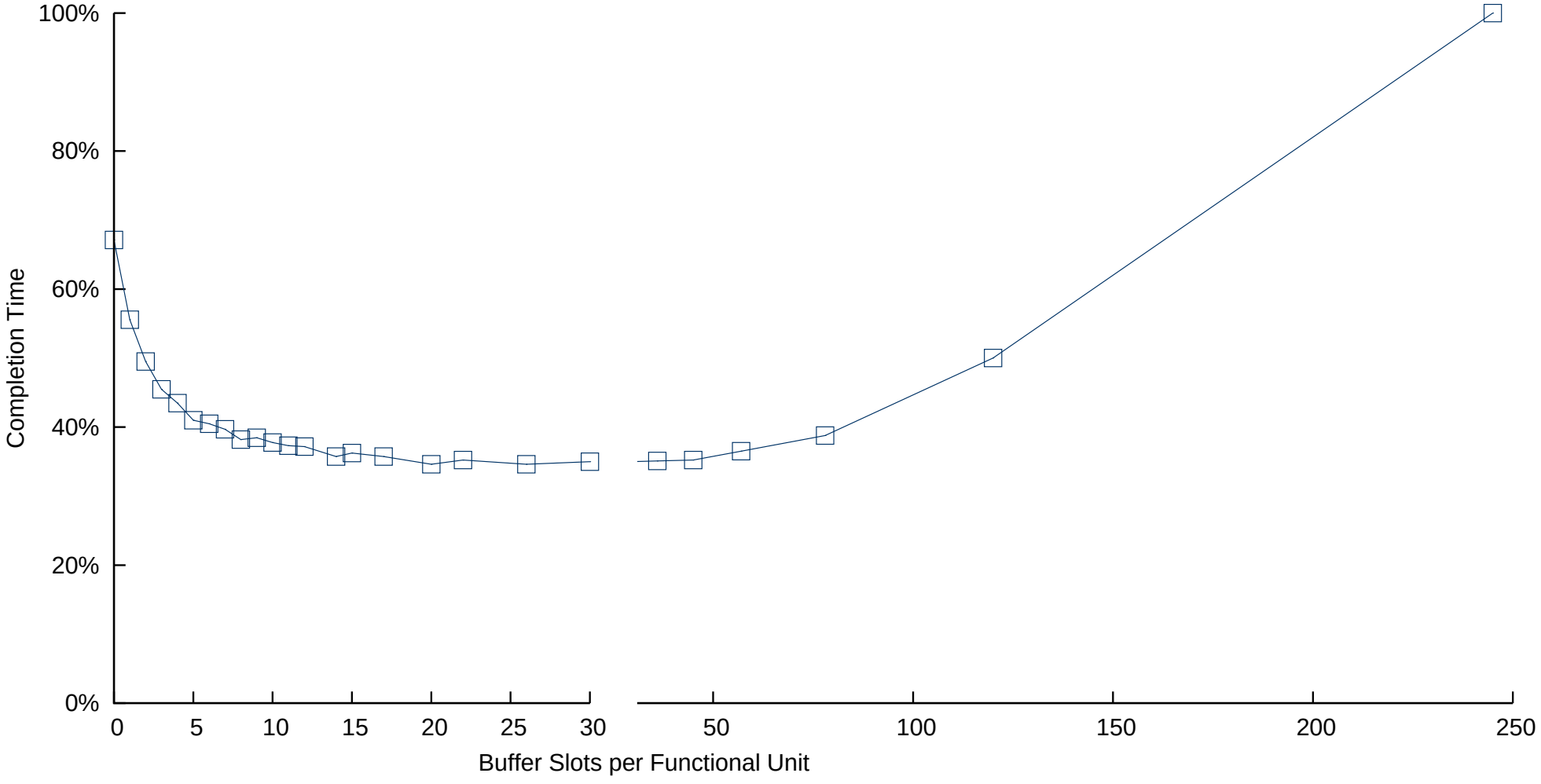


Optimal Resource Allocation

Simulator Results



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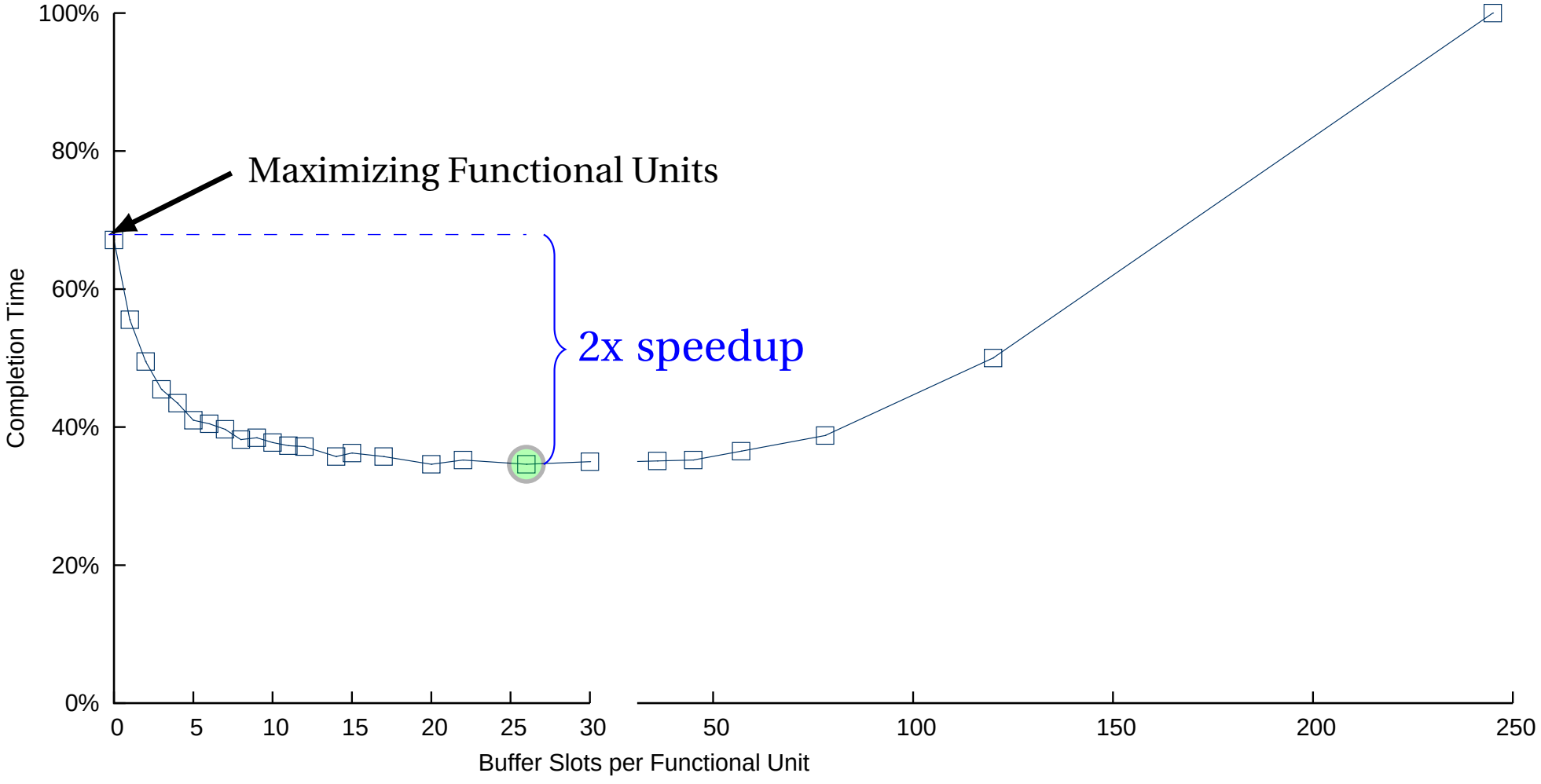

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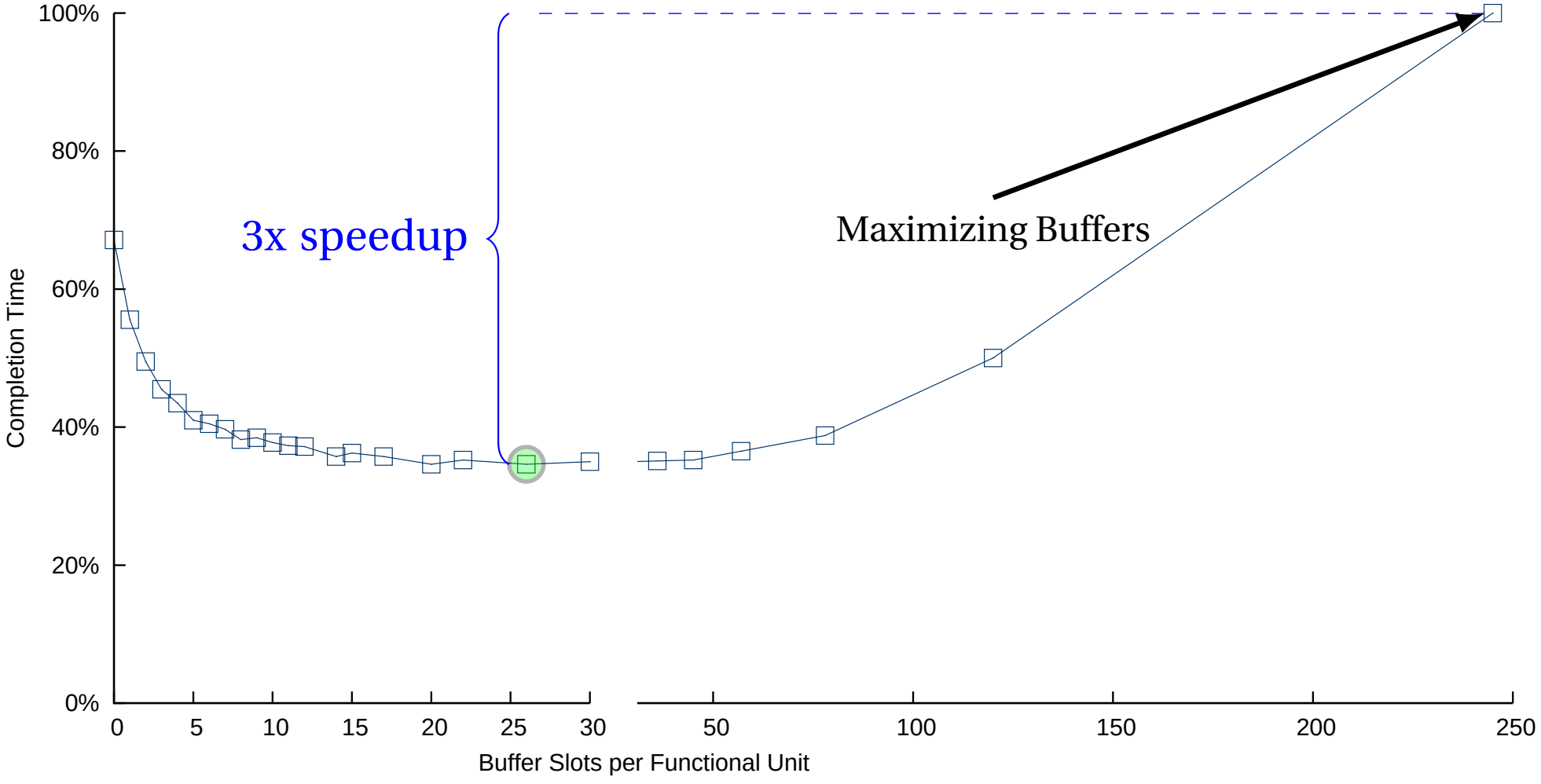

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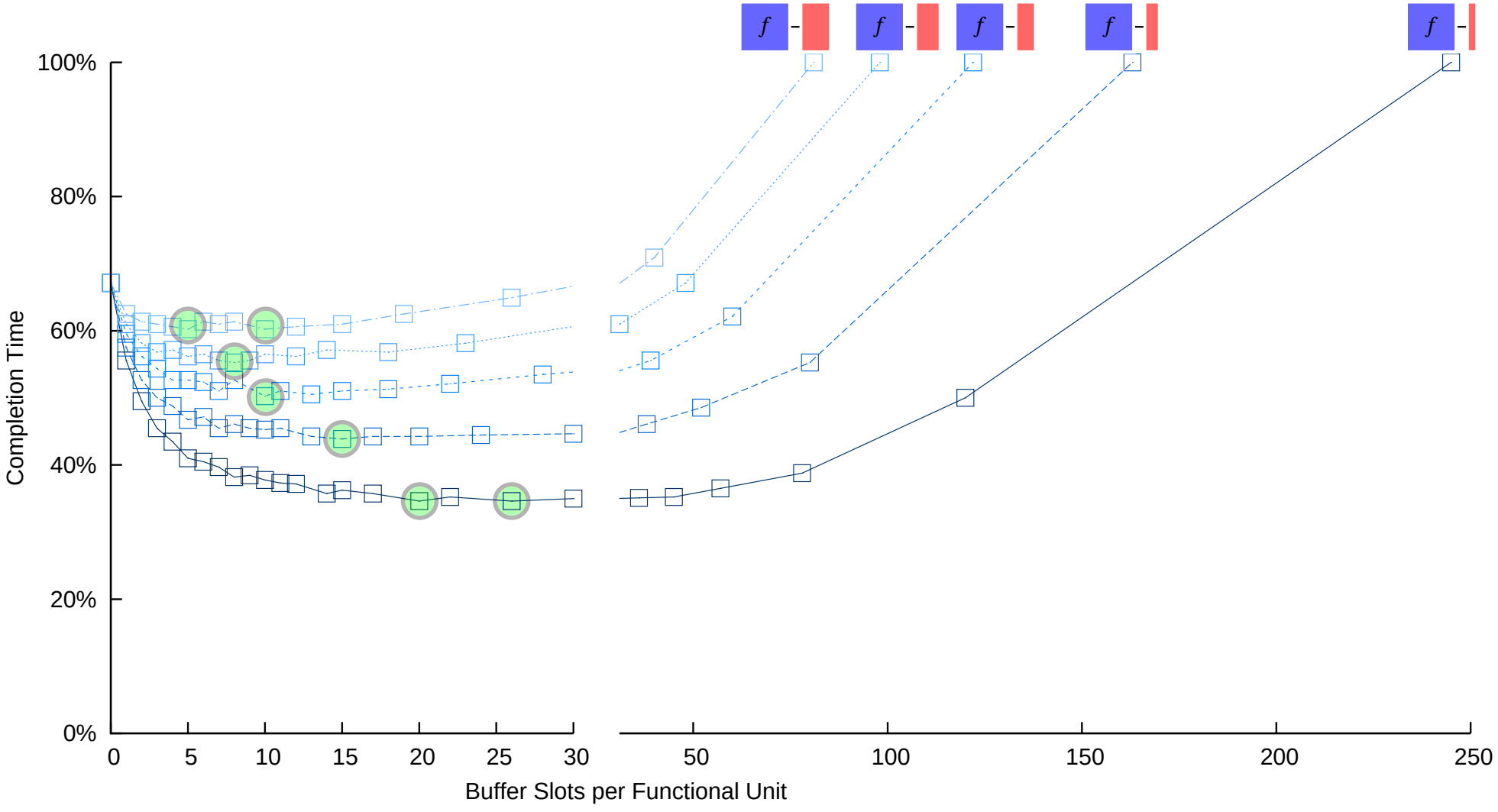

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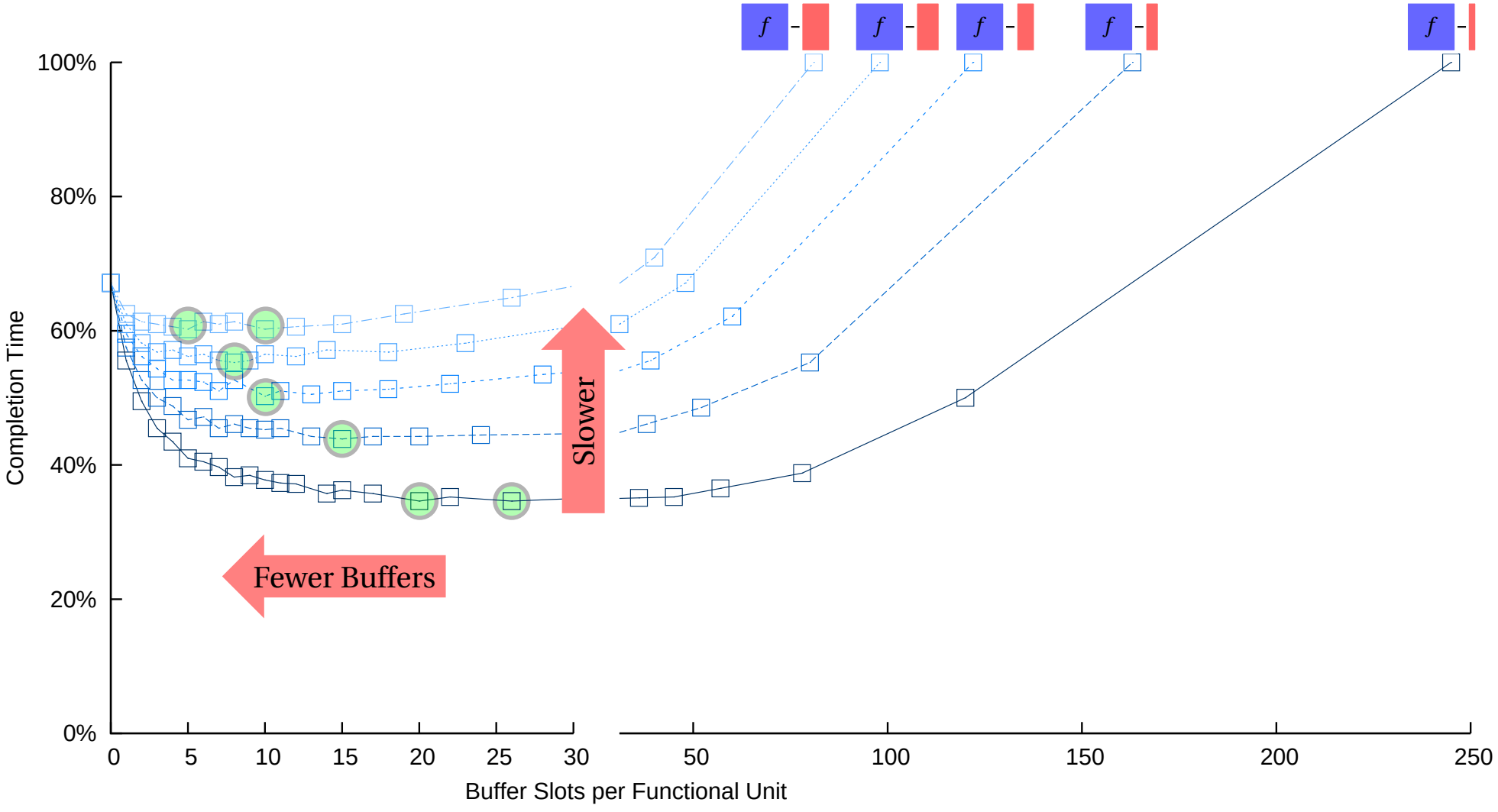
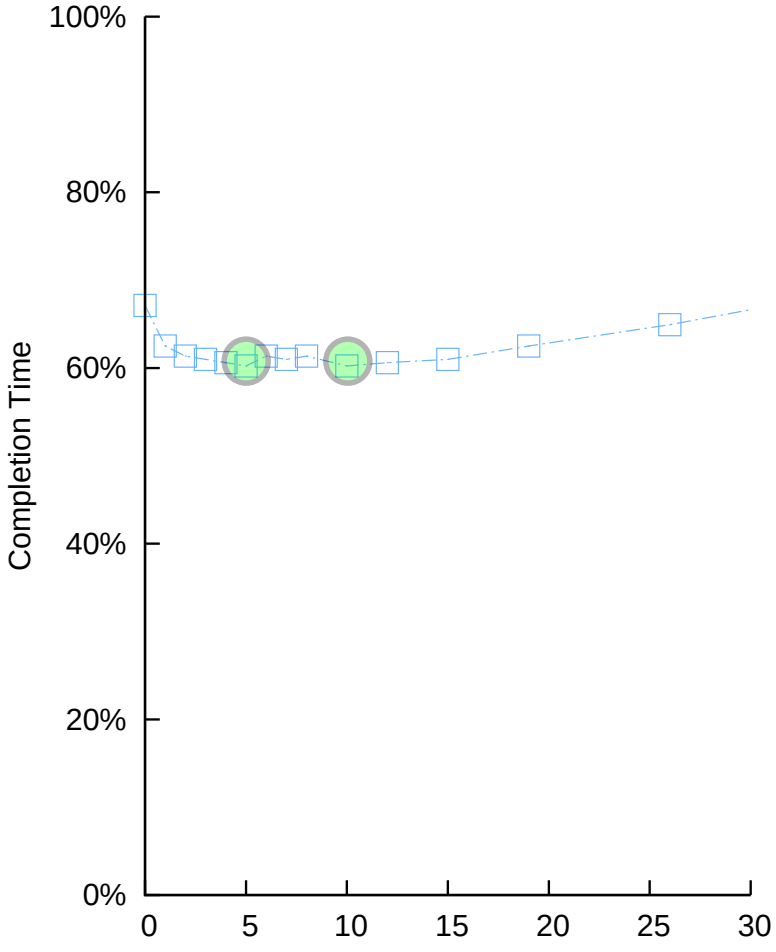


Why Are There Multiple Optima?



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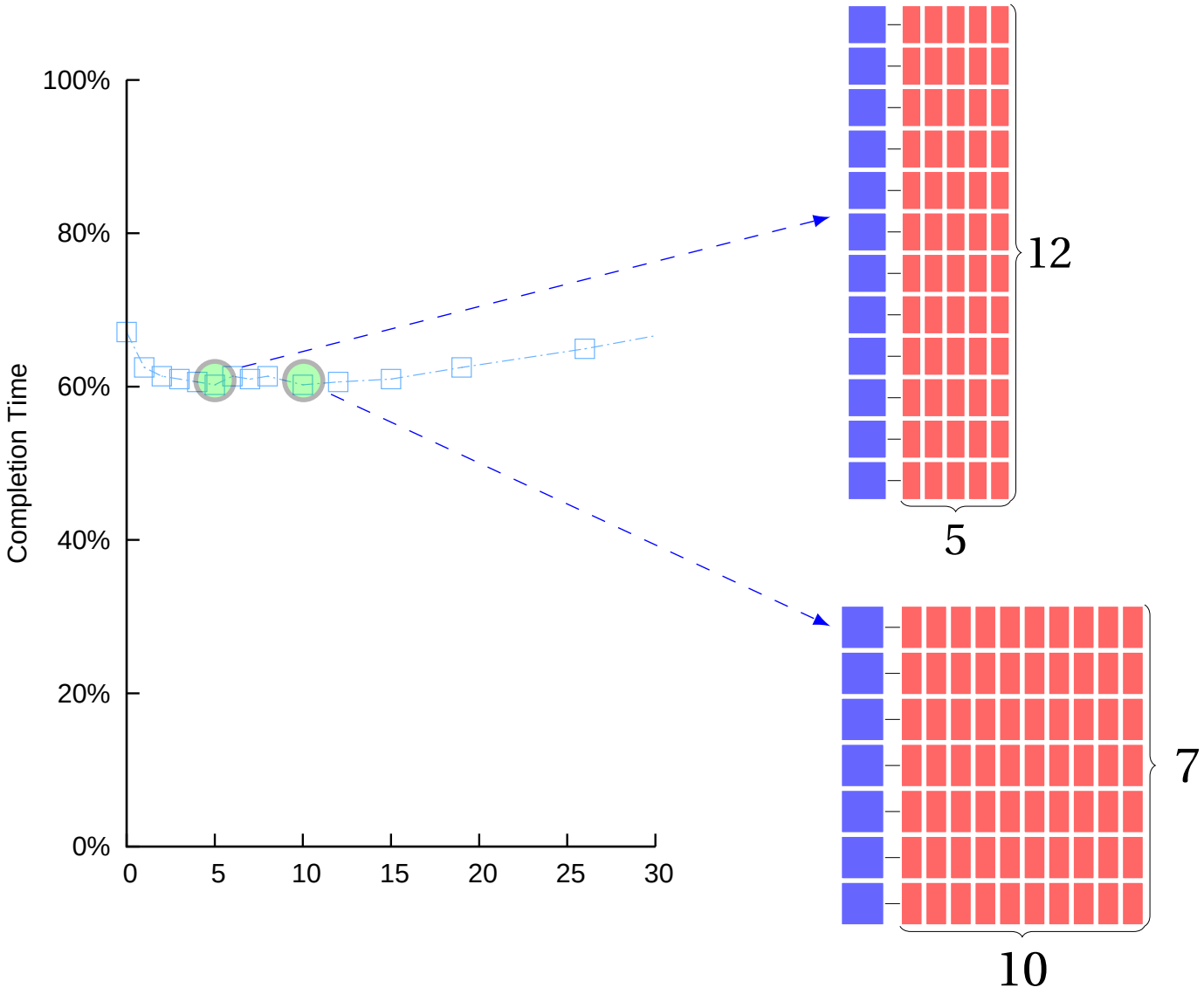

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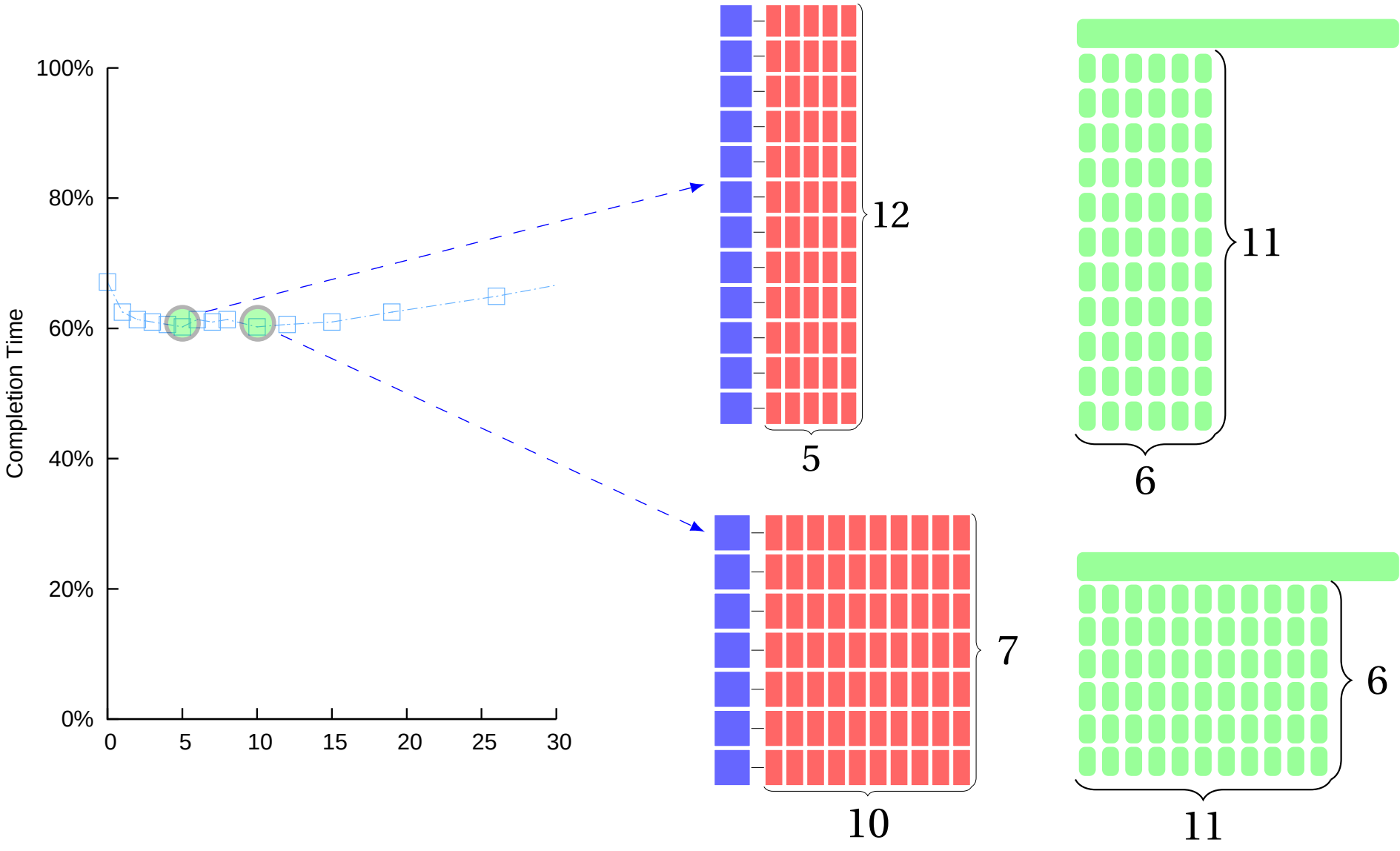
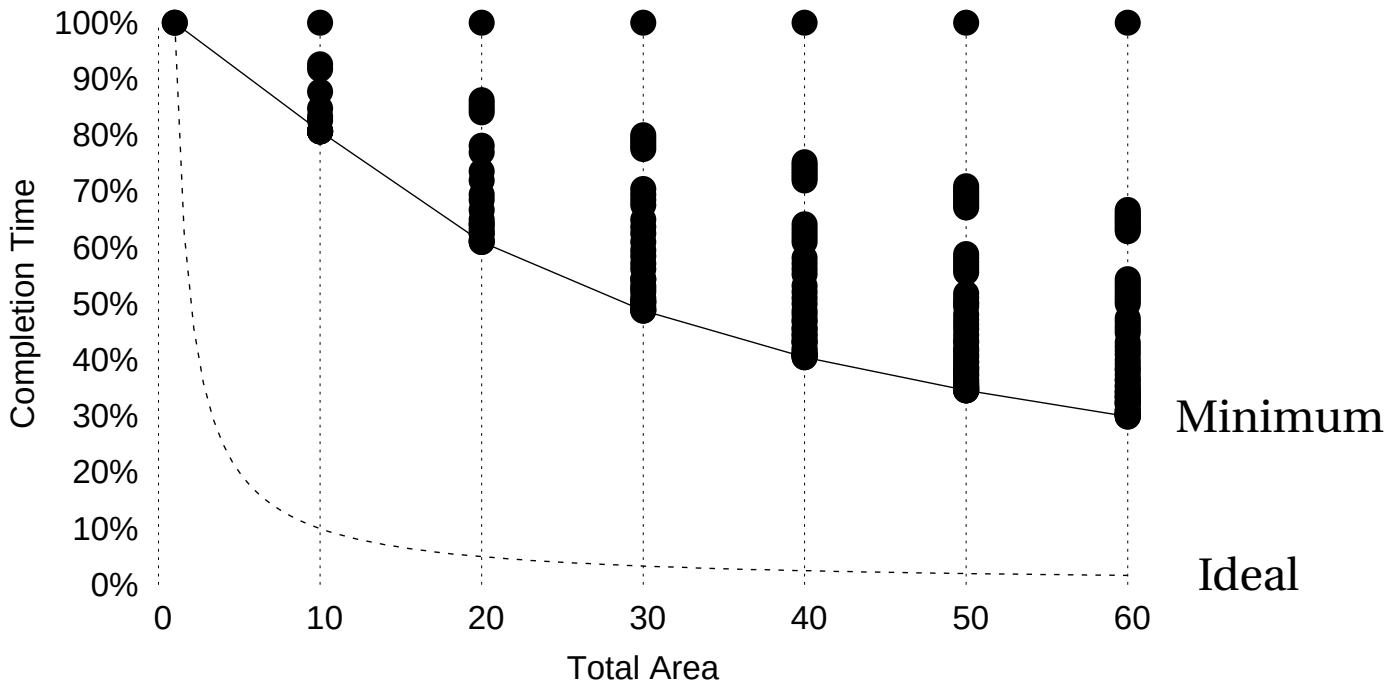


Performance Scales with Area



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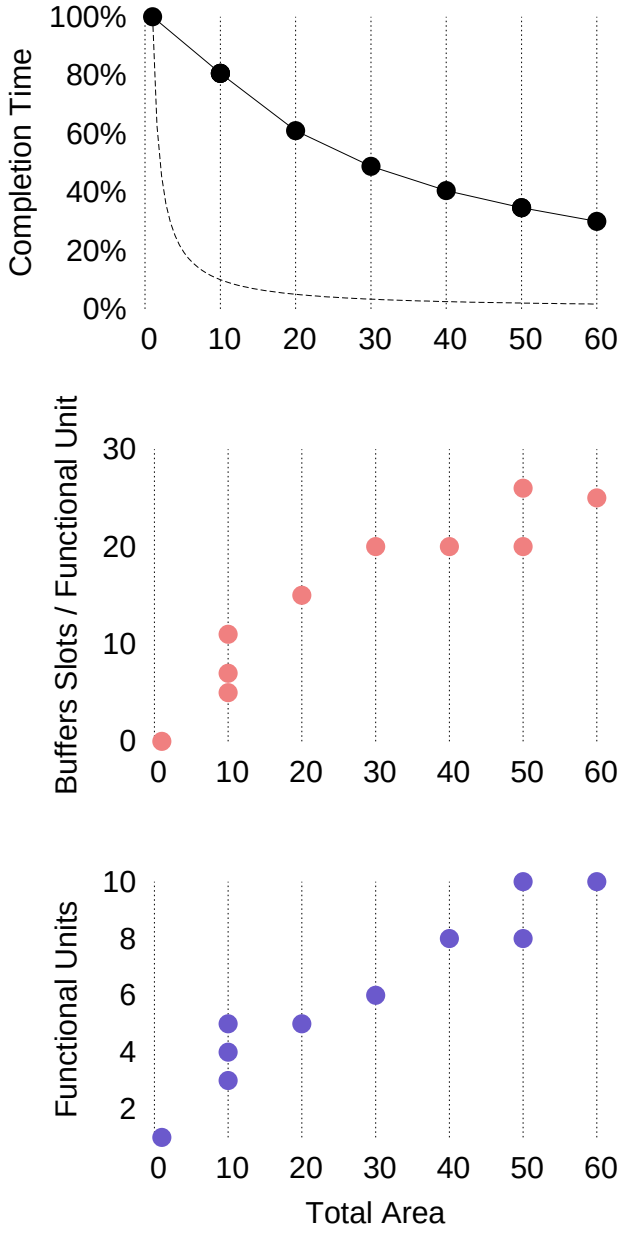

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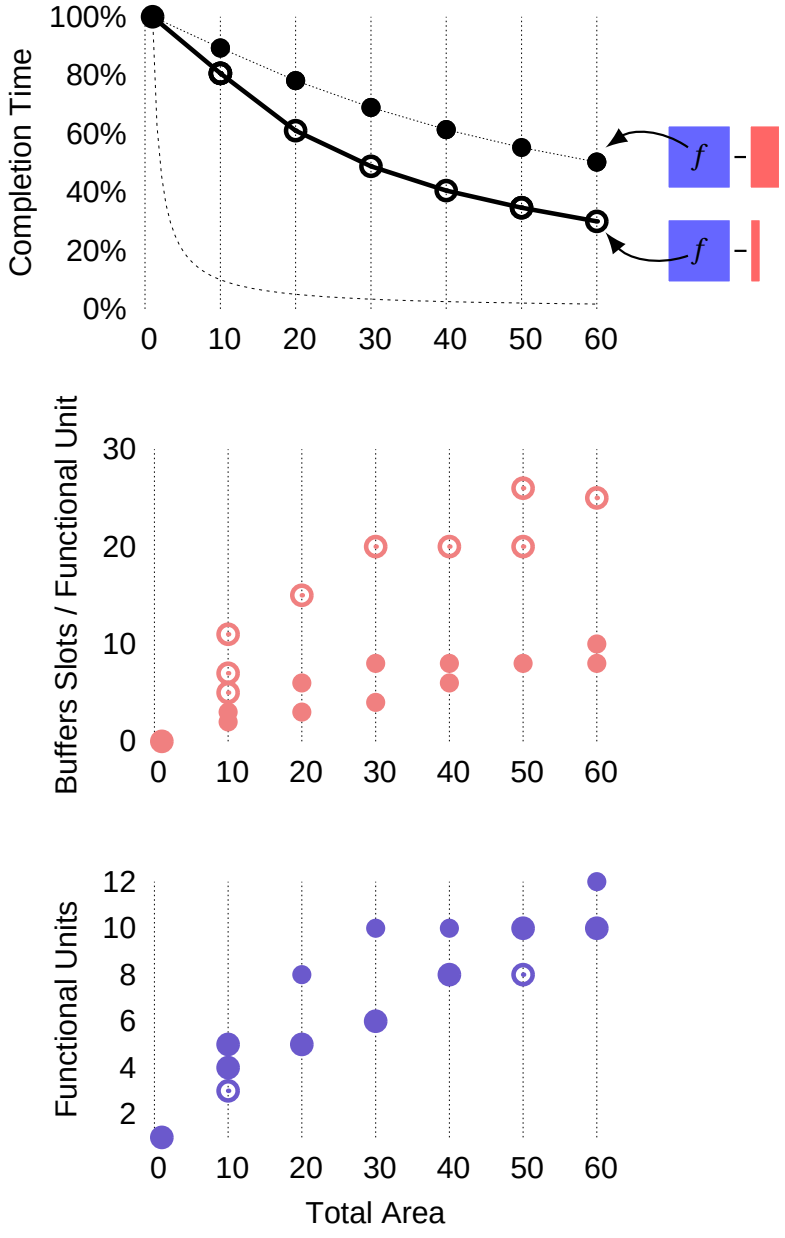
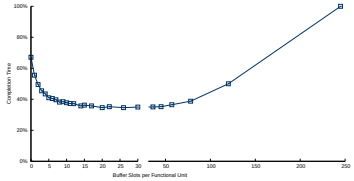
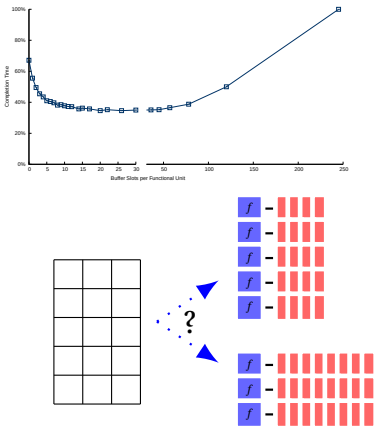


Conclusions



Area allocation is important…

Conclusions



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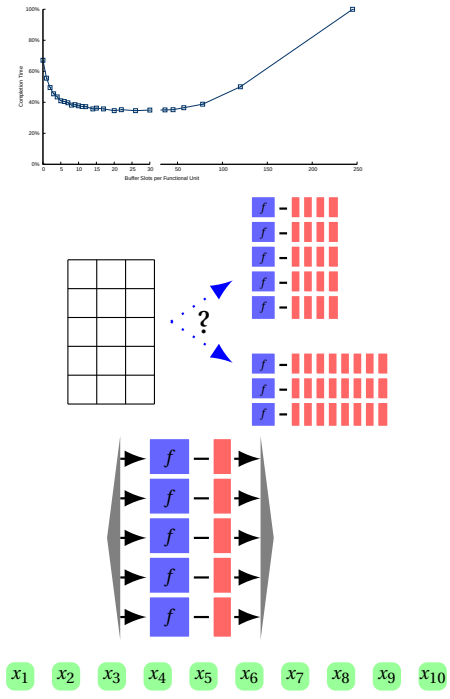
...and non-obvious

Conclusions



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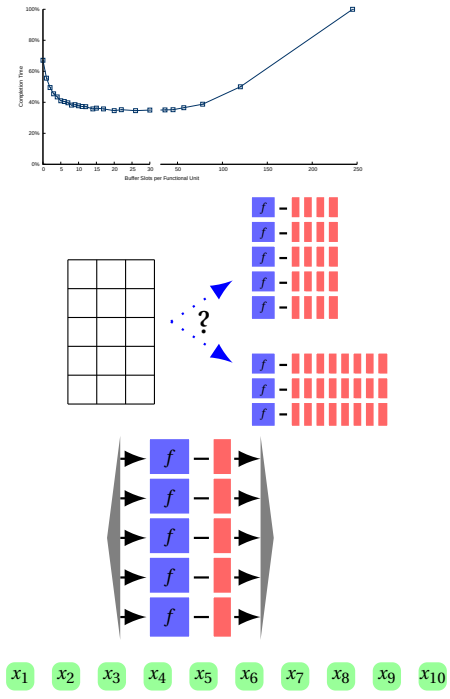
Model helps explore design space

Conclusions



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Synthesize Efficient Hardware Implementation of Map

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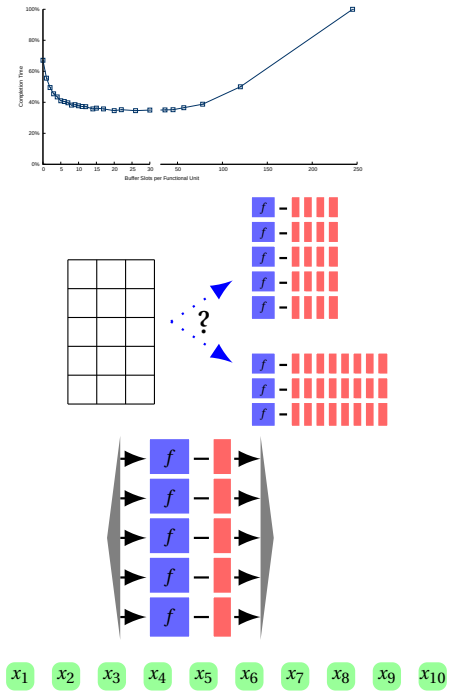

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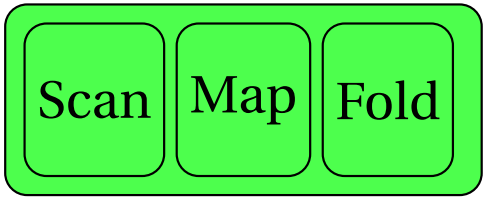

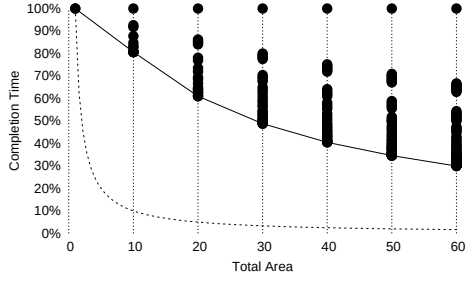

Enhance our abstraction