TVM: End to End Deep Learning Compiler Stack

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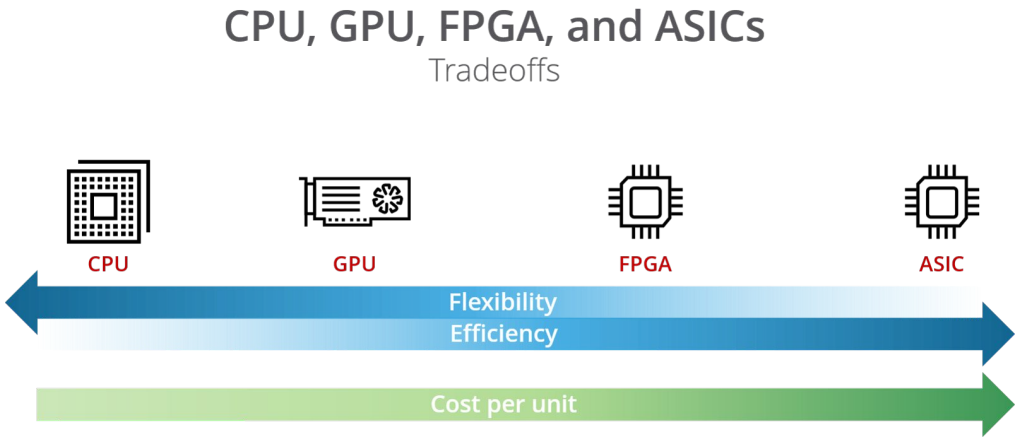
The challenges that deep learning is facing today



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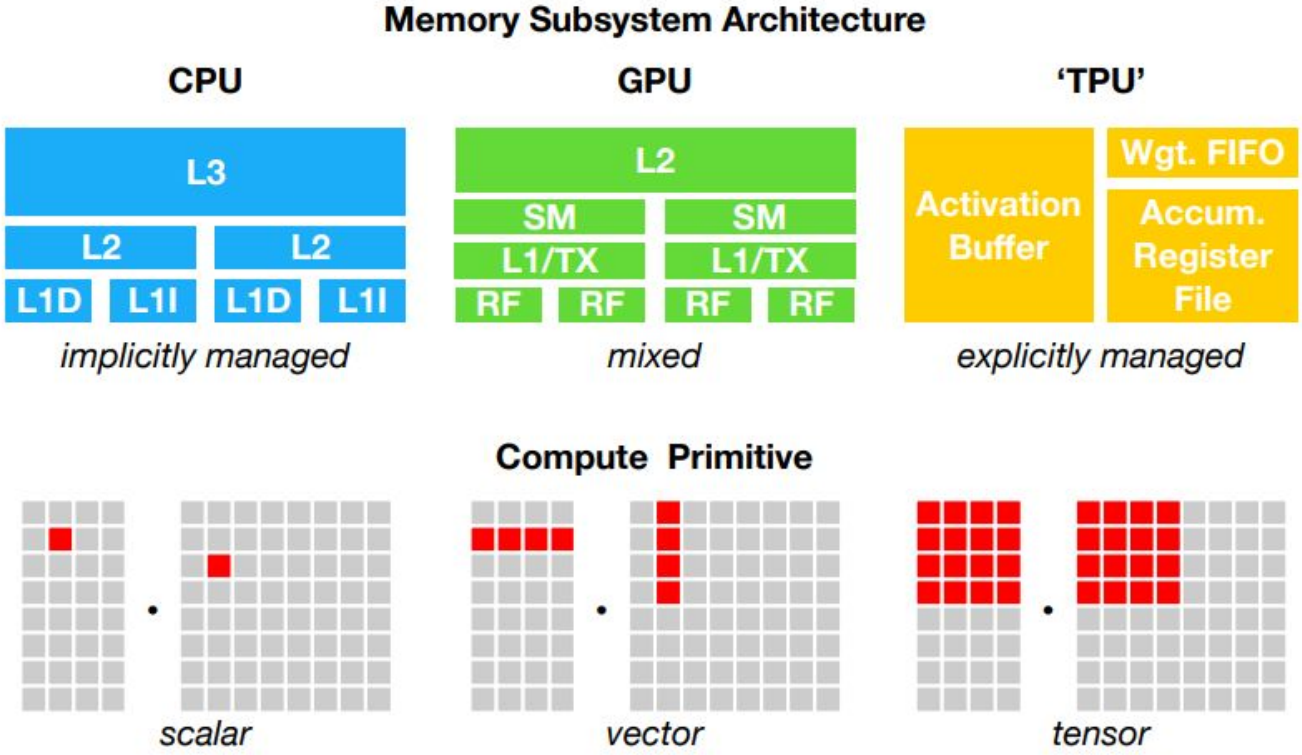
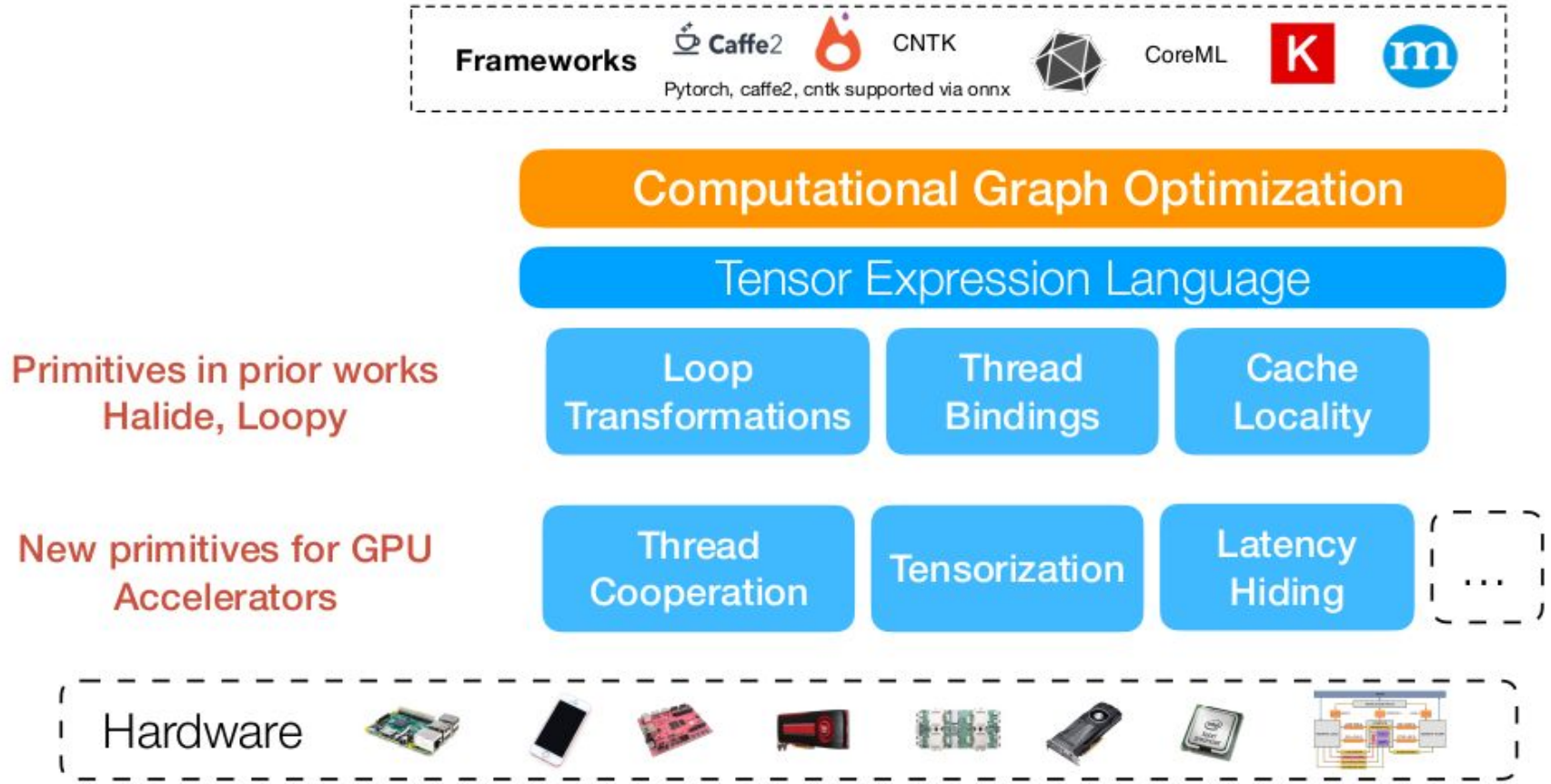


TVM: End to End Optimization Stack

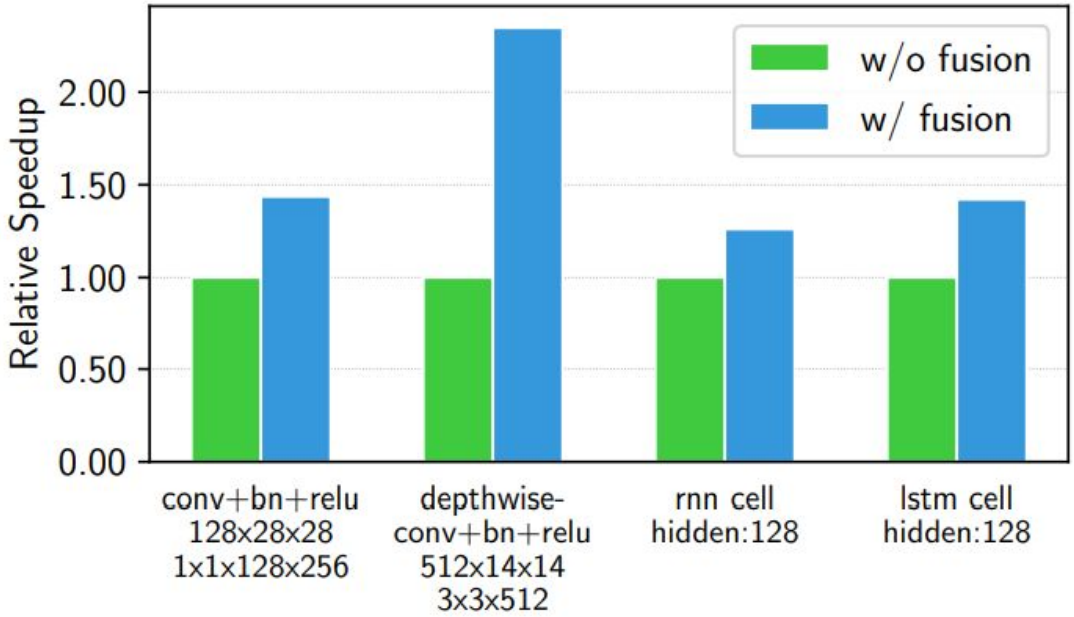


TVM: End to End Optimization Stack

Computational Graph Optimization

- operator fusion
- constant-folding
- static memory planning pass
- data layout transformations

Operator fusion



Performance comparison between fused and non-fused operations. TVM generates both operations. Tested on NVIDIA Titan X

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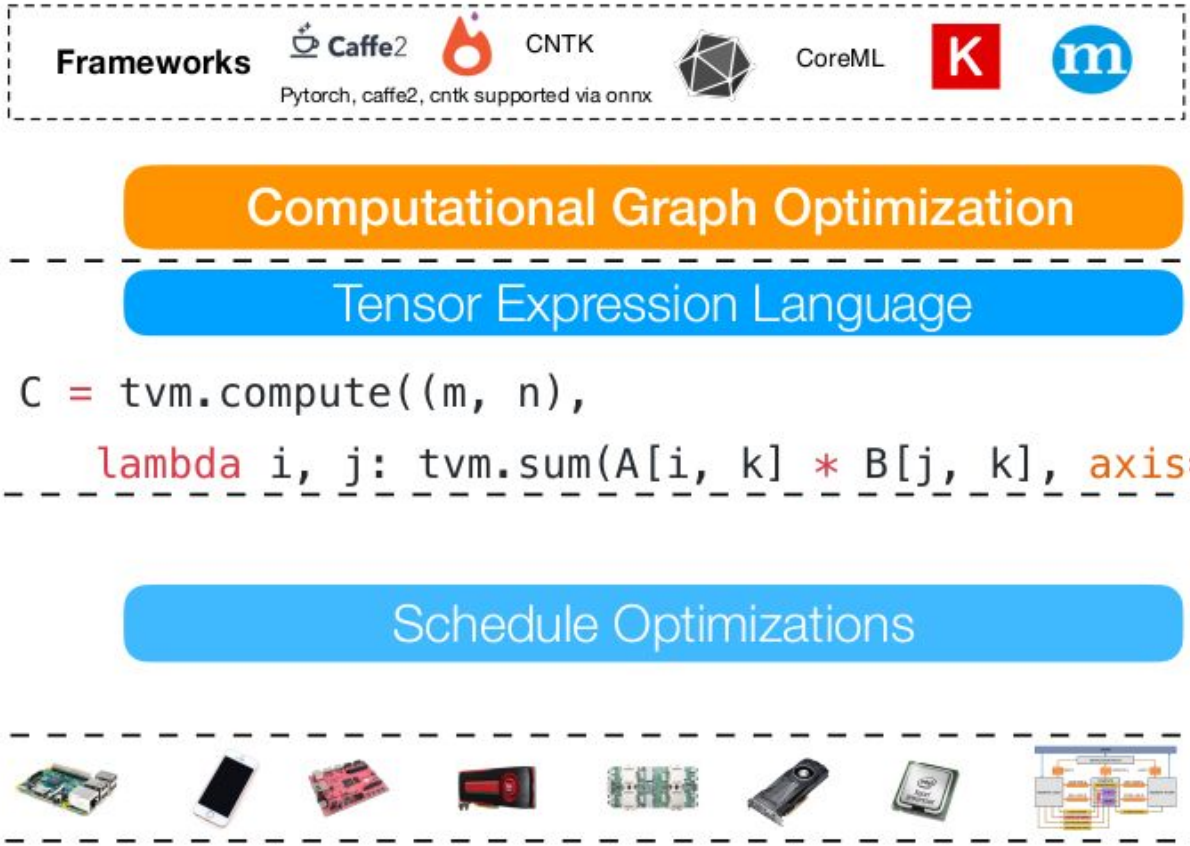


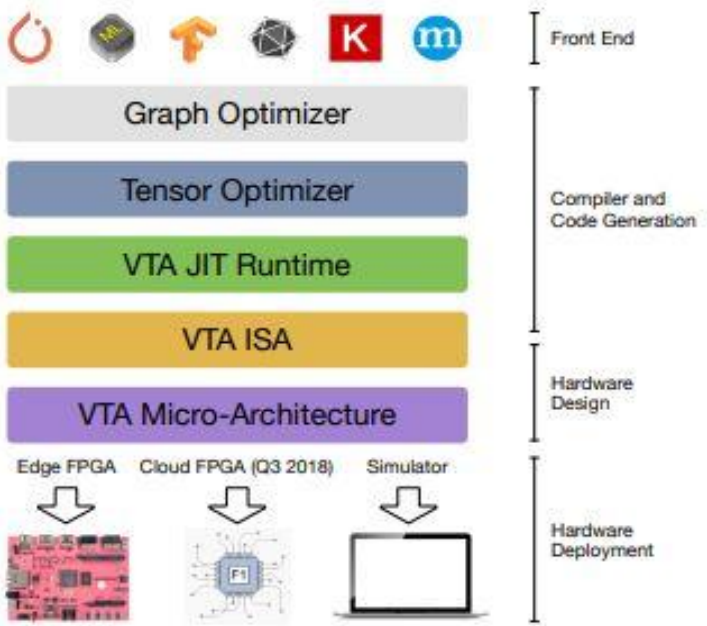
Schedule Optimizations

Schedule primitives used in various hardware backends	CPU Schedule	GPU Schedule	Accel. Schedule
[Halide] Loop Transformations	✓	✓	✓
[Halide] Thread Binding	✓	✓	✓
[Halide] Compute Locality	✓	✓	✓
[TVM] Special Memory Scope		✓	✓
[TVM] Tensorization	✓	✓	✓
[TVM] Latency Hiding			✓

Versatile tensor accelerator (VTA)

- An extension of TVM stack
- Exposes salient features of deep learning accelerators.
- Provides an open deep learning system stack for optimizations.

VTA stack overview



VTA stack overview

1. NNVM (Neural network virtual machine)Intermediate Representation
2. TVM Intermediate Representation
3. VTA JIT Runtime
4. VTA Instruction Set Architecture
    - high-level CISC ISA
    - a low-level, and fixed latency RISC ISA
5. VTA Hardware Micro-Architecture