# FPGAs, GPUs and the PS2 – A Single programming Methodology

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## MOTIVATION

- **To program for varied architectures**
  - Single implementation
  - Target different architectures
- **Compare performance**
  - Architectures vary in performance on a task
  - Choose the optimum architecture to use
- **Provide base on which to optimise**
  - Simple base
  - Extend description for additional performance
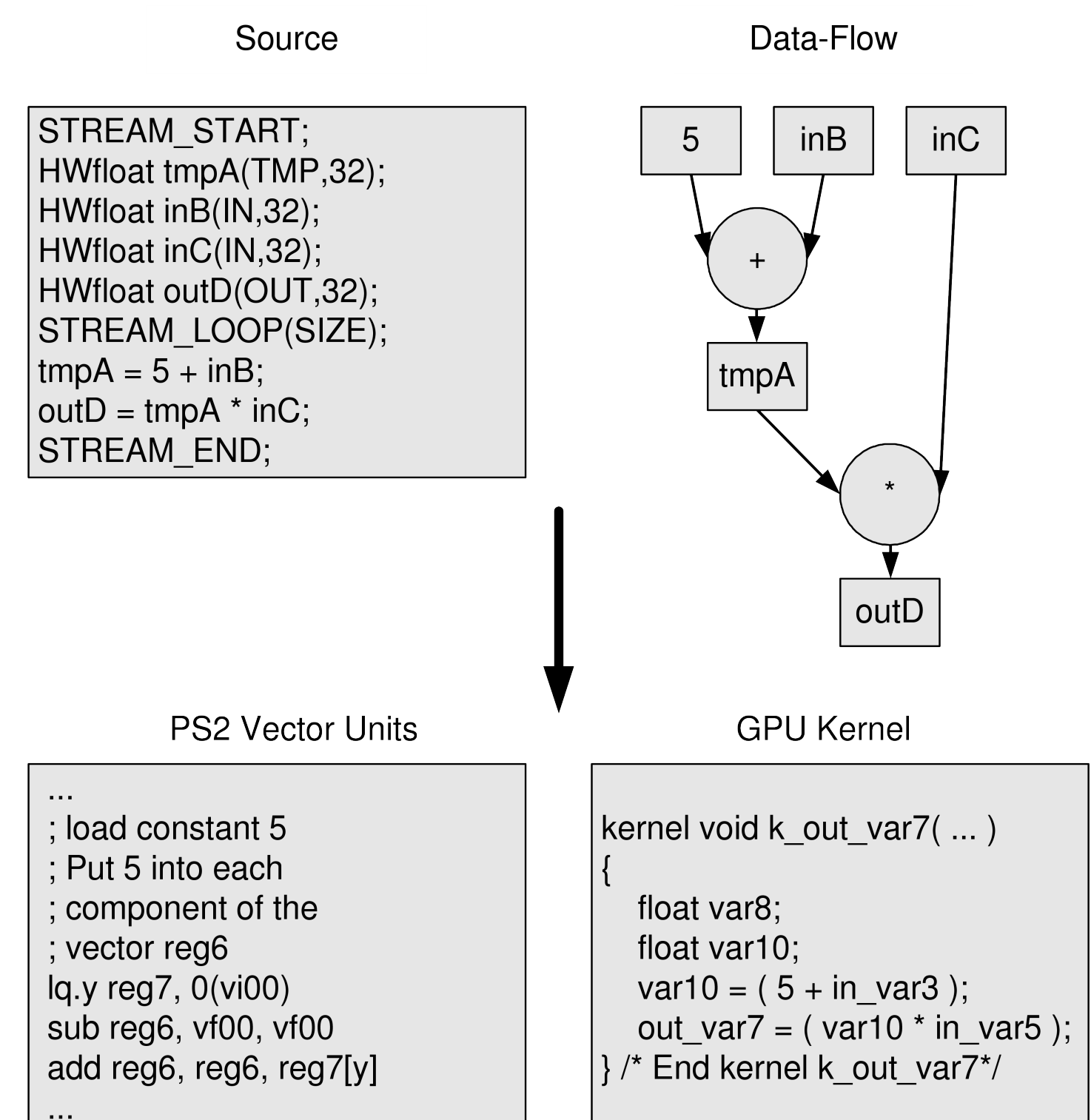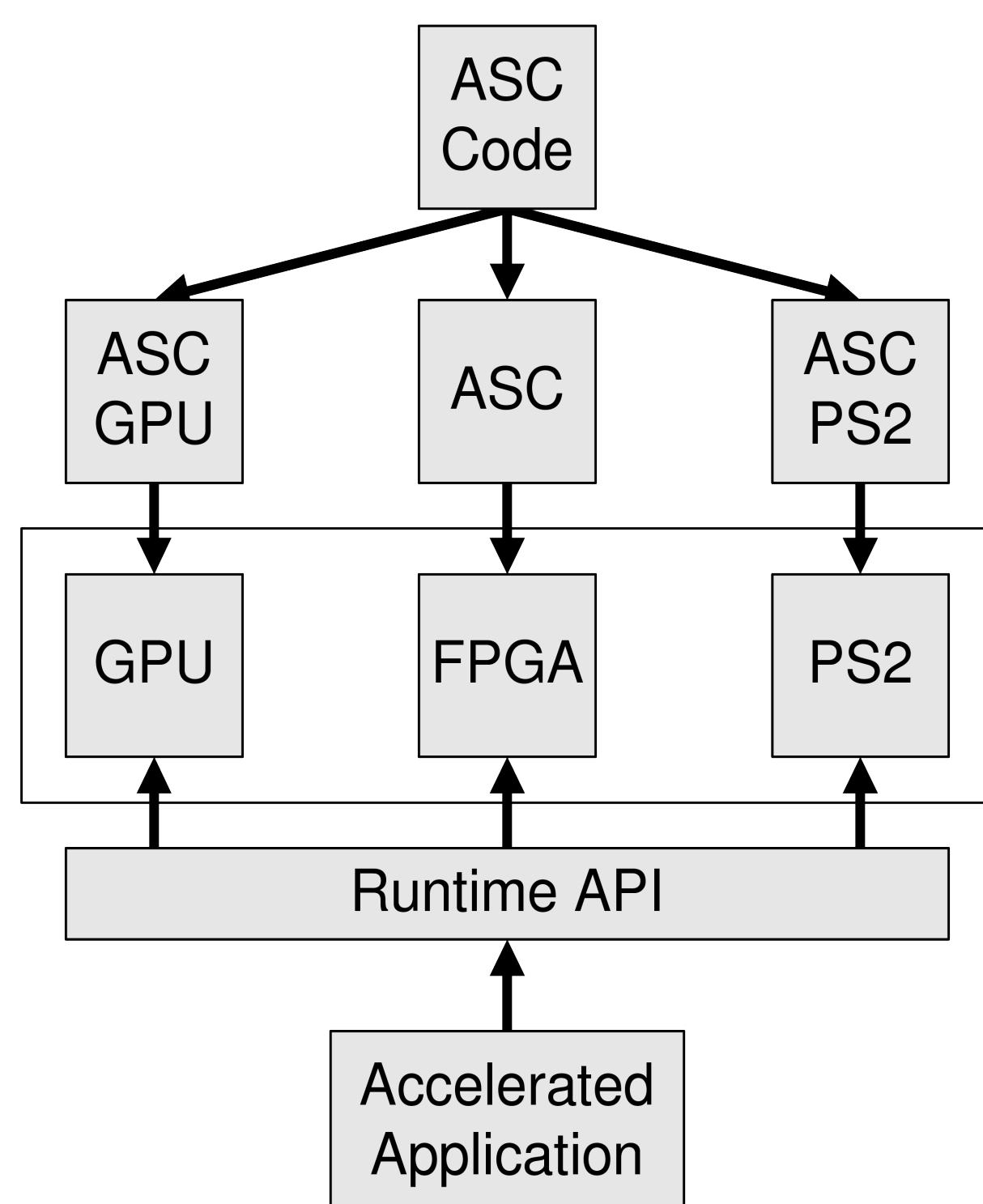  - Extensions are made easier

## APPLICATIONS

- Montecarlo Simulation
- FAST Fourier Transform
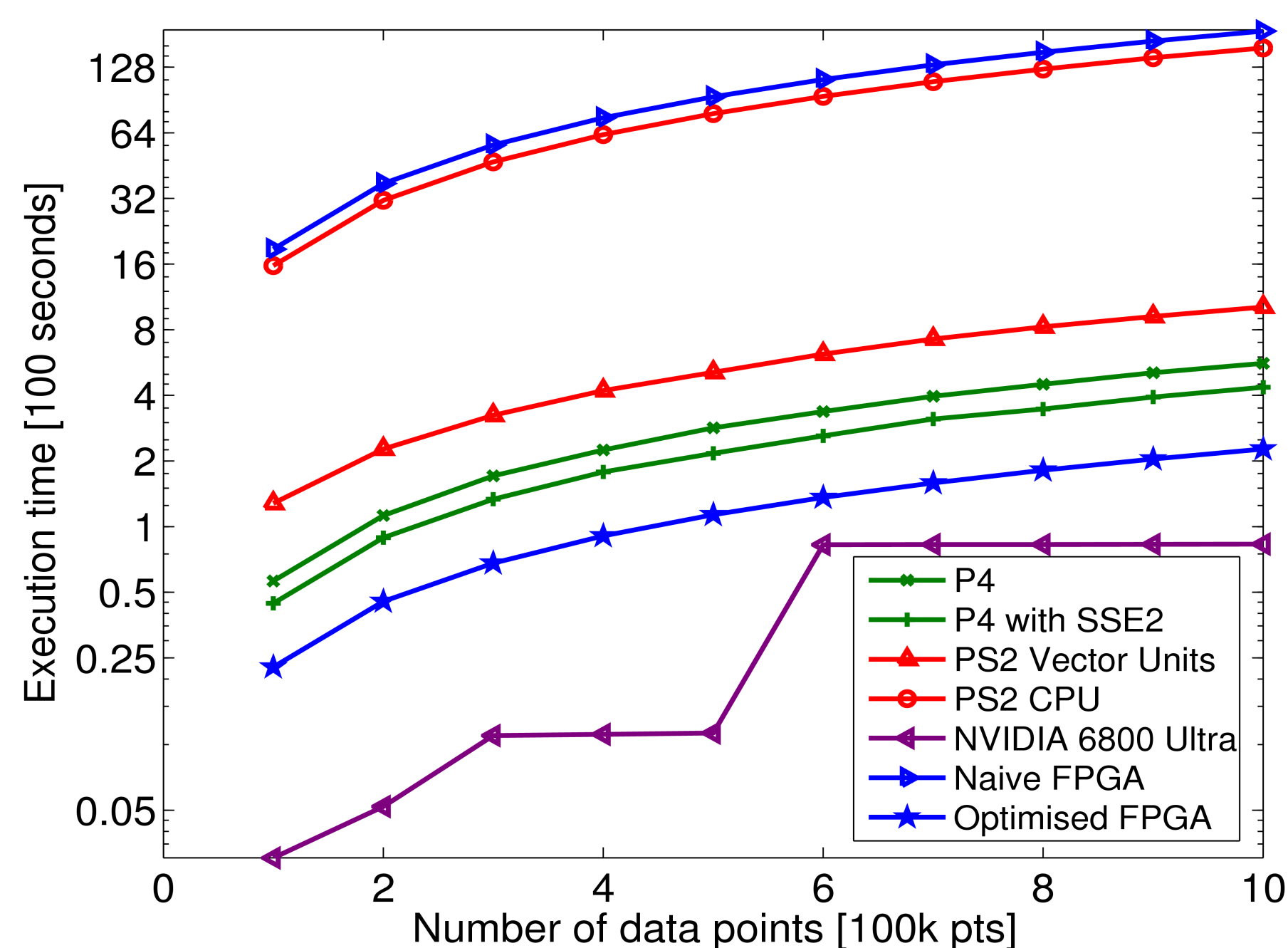
## IMPLEMENTATION

- Single precision floating point
- Simple FPGA optimisations where sensible
- Comparisons with P4

## OUR APPROACH

- **Single source description**
  - Code for A Stream Compiler (ASC)
  - C++ programming model
  - Generates stream architectures for FPGAs
- **Multiple targets**
  - FPGA
  - GPUs
  - Sony Playstation 2 vector units



Source

```
STREAM_START;
HWfloat tmpA(TMP,32);
HWfloat inB(IN,32);
HWfloat inC(IN,32);
HWfloat outD(OUT,32);
STREAM_LOOP(SIZE);
tmpA = 5 + inB;
outD = tmpA * inC;
STREAM_END;
```

Data-Flow



PS2 Vector Units

```
...
; load constant 5
; Put 5 into each
; component of the
; vector reg6
lq.y reg7, 0(vi00)
sub reg6, vf00, vf00
add reg6, reg6, reg7[y]
...
```

GPU Kernel

```
kernel void k_out_var7( ... )
{
    float var8;
    float var10;
    var10 = ( 5 + in_var3 );
    out_var7 = ( var10 * in_var5 );
} /* End kernel k_out_var7*/
```



Montecarlo simulation execution time

FFT execution time

[1] O. Mencer *ASC, a stream compiler for computing with FPGAs,* IEEE Transactions on CAD, 2006

[2] I. Buck et al. *Brook for GPUs: Stream computing on graphics hardware.* Proc. SIGGRAPH, ACM 2004.