CROWDSOURCING CODE TUNING WITH PeachPy.io

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INTRODUCTION

High-performance scientific libraries include a large portion of optimized assembly code. Maintaining processor-specific optimized assembly and keeping it up-to-date requires rare low-level optimization skills. In practice, a very small pool of potential contributors is further reduced by the lack of access to target hardware, and complicated software configurations required for scientific projects.

We develop infrastructure to increase productivity of performance tuning experts:

- PeachPy, a Python-based DSL for assembly metaprogramming. PeachPy automates boring and error-prone parts of assembly programming, such as register allocation and adaptation of code to different ABIs.
- WebPeachPy, a Python interpreter with PeachPy that runs inside a Web browser.
- WebRunner, a REST server that safely loads and executes compiled assembly kernels.
- PeachPy.io, an in-browser IDE for assembly code tuning and analysis.

PeachPy Example: SGEMM

```python
ym_c = [[YMMRegister() for m in range(mr // 8)] for m in range(mr // 8)]
ym_b = [YMMRegister() for m in range(mr // 8)]

VZEROALL()

with Loop() as loop:
    for m in range(0r // 0):
        if function.target.has_ssse3:
            PABSW(dst1, src1)
            PABSW(dst2, src2)
        elif dst1 == src1:
            PMAXSW(dst2, tmp2)
            PMAXSW(dst1, tmp1)
            PSUBW(tmp2, dst2)
            PSUBW(tmp1, dst1)
            PXOR(tmp2, tmp2)
            PXOR(tmp1, tmp1)
        else:
            PABSW(dst1, src1)
            PABSW(dst2, src2)
            PSUBW(dst1, src1)
            PSUBW(dst2, src2)
            PXOR(dst1, dst1)
            PXOR(dst2, dst2)

VZEROALL()

YMADD2DSP(ym_a, ym_c)
YMADD2DSP(ym_b, ym_c)
```

PeachPy Example: x264 Macro

```python
def absw2(dst1, dst2, src1, src2):
    if function.target.has_ssse3:
        PABSW(dst1, src1)
        PABSW(dst2, src2)
    elif dst1 == src1:
        PMAXSW(dst2, tmp2)
        PMAXSW(dst1, tmp1)
        PSUBW(tmp2, dst2)
        PSUBW(tmp1, dst1)
        PXOR(tmp2, tmp2)
        PXOR(tmp1, tmp1)
    else:
        PABSW(dst1, src1)
        PABSW(dst2, src2)
        PSUBW(dst1, src1)
        PSUBW(dst2, src2)
        PXOR(dst1, dst1)
        PXOR(dst2, dst2)
```

PeachPy.io Infrastructure

- **WebRunner**
  - HTTP Server
  - ELF Loader
  - seccomp-bpf sandbox
  - perf_event data
- **WebPeachPy**
  - Web Browser
  - AJAX Request
  - Python code editor

PeachPy.io Code Editor

- **WebRunner Specification**
- **PeachPy.io Code Analysis**

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