Update on Ara

14/12/2022

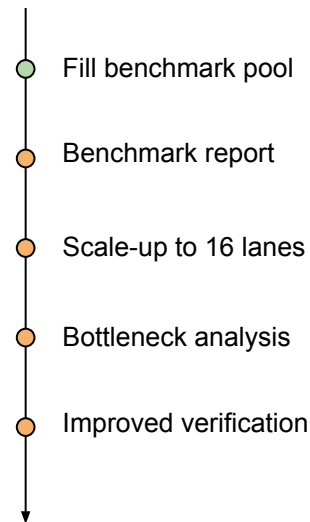**Matteo Perotti**

Matheus Cavalcante

Professor Luca Benini

Integrated Systems Laboratory
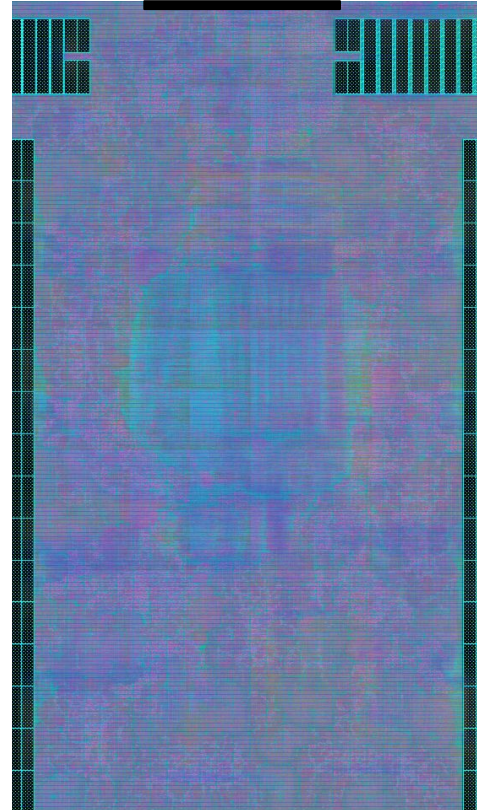
ETH Zürich

Summary

- **Software**
    - Power Analysis Env
    - SpyGlass Flow

- **Hardware (RTL + Backend)**
    - 8-lanes
    - 16-lanes pipelined SLDU
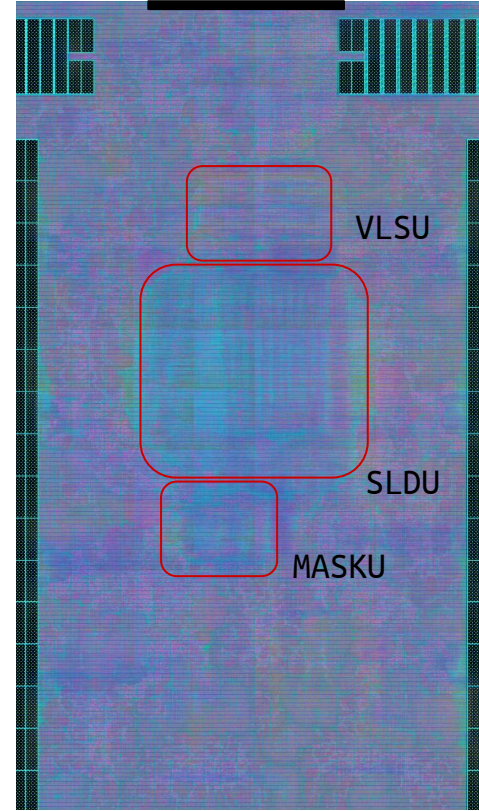   - Barber-Pole
    - New instructions

Fill benchmark pool

Benchmark report

Scale-up to 16 lanes

Bottleneck analysis

Improved verification

Scale-up

- **8 lanes**

  - Area
    - Die Area: ~1.75 mm2
    - Cell Area: ~1.30 mm2
    - +10% cell area w.r.t. Ara V1

Scale-up

- **8 lanes**

  - Area
    - Die Area: ~1.75 mm2
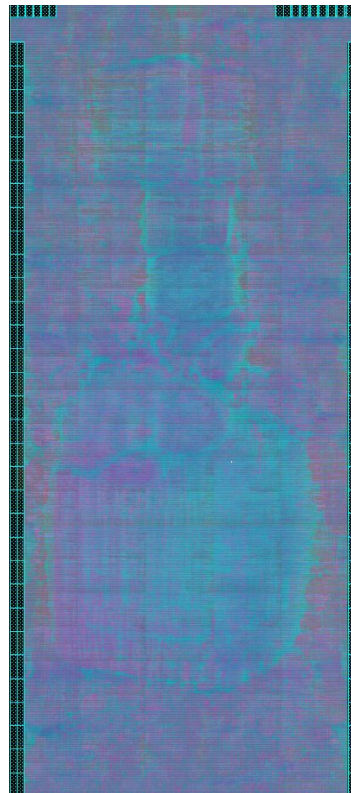   - Cell Area: ~1.30 mm2
    - +10% cell area w.r.t. Ara V1

Scale-up

- **8 lanes**

  - Area
    - Die Area: ~1.75 mm2
    - Cell Area: ~1.30 mm2
    - +10% cell area w.r.t. Ara V1

  - Frequency
    - SS Freq: 935 MHz
    - TT Freq: 1.3 GHz
    - +10% TT Freq w.r.t. Ara V1
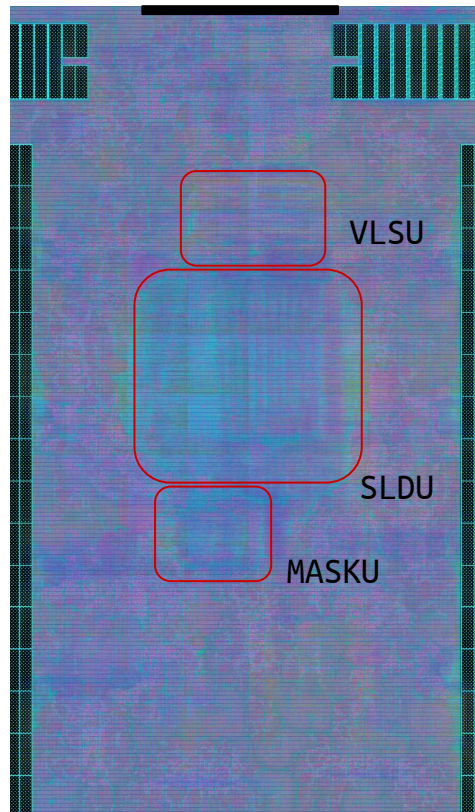
Scale-up

- **16 lanes (pipelined sldu)**

    - Area
        - Die Area: ~4.34 mm2
        - Cell Area: ~3.02 mm2
        - +40% cell area w.r.t. Ara V1

Scale-up

- **16 lanes (pipelined sldu)**

  - Area
    - Die Area: ~4.34 mm2
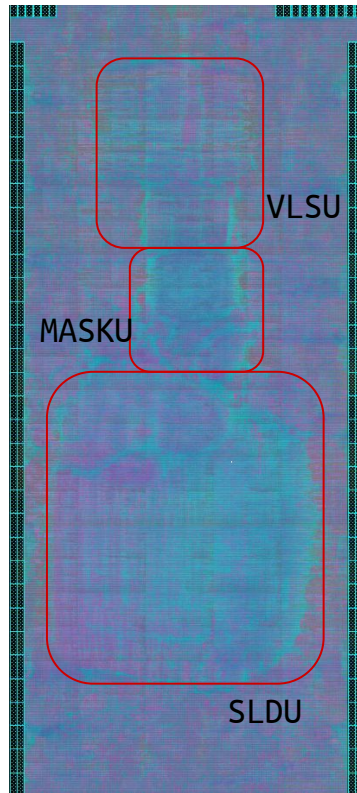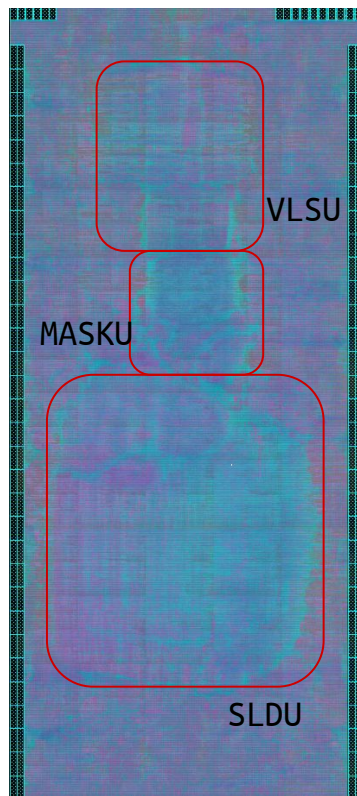   - Cell Area: ~3.02 mm2
    - +40% cell area w.r.t. Ara V1

Scale-up

- **16 lanes (pipelined sldu)**

  - Area
    - Die Area: ~4.34 mm2
    - Cell Area: ~3.02 mm2
    - +40% cell area w.r.t. Ara V1

  - Frequency (ignoring in/out paths)
    - SS Freq: 720 MHz
    - TT Freq: 1 GHz
    - -4% TT Freq w.r.t. Ara V1

PRs - Compliance

- **New instructions**

  - **Mask**
    - vcpop, vfirst, vmsbf, vmsof, vmsif, viota, vid

  - **Fixed-Point**
    - vssra, vssrl, vnclip, vnclipu, vsmul, vaadd, vaaddu, vsadd, vsaddu, vssub, vssubu, vasub, vasubu

PRs - Compliance

WIP

⇅ **[HW] Add support for vector permute instructions** ✓
#180 opened 2 days ago by M-Ijaz-10x ◯ 3 tasks done

➤ Vector complex shuffling
✓ vfrsqrt7
✓ vfrec7
✗ Segment memory ops

Reviewed

⇅ **[HW] Add support for vfrsqrt7 instruction** ✓
#184 opened last month by Shafi10x • Changes requested ◯ 3 tasks done

Reviewed

⇅ **[HW] Add support for vfrec7 instruction** ✓
#191 opened last week by Shafi10x • Changes requested ◯ 3 tasks done

Planned

⇵ **[HW] Seg load** ✗
#136 opened on Aug 24 by OttG • Draft

Further

- **Software**
  - Stall analysis
  - WAW / WAR profiling

- **Hardware (RTL + Backend)**
  - Compliance + Verification
  - Scale up to 16 lanes

Fill benchmark pool

Benchmark report

Scale-up to 16 lanes

Bottleneck analysis

Improved verification