What I learned building a parallel processor company from scratch

by Andreas Olofsson (HIPEAC-2017)
Disclaimer

“This presentation summarizes lessons learned at Adapteva from 2008-2016. Statements and opinions are my own and do not represent my current employer.”
Adapteva Intro

- Founded in 2008
- 5 chip tapeouts to date with $7M raised
- #1 in Processor energy efficiency (100 GFLOPS/W at 16nm)
- First company to tape out a 1024 core 64-bit processor
- Only product that scales to 1 Billion cores
- Over 100 academic publications validating approach
- 10,000 customers
The beginning (1973)

• TigerSHARC DSP
• Designed in Israel
• We worked VERY hard
• We spent $100M!

• Lessons:
  • KISS
  • Don't fight technology
Finding your recipe (2006-2007)

- Camera CCD readout ICs
- Invented ISA in 2 weeks
- 3-4 person design team
- ">>" $100M in revenue

Lessons:
- Control architecture
- Keep teams small
- Profit from derivatives
Starting a company (2008)

• Sole founder at 35
• I KNEW my idea would work!
• Self funded with life savings
• Peak optimism/efficiency

• Lessons:
  • Check assumptions
  • Read
  • Find advisers
Creating technology (2008)

- Basic arch complete in May 2008
- All grant proposals rejected
- All publications rejected
- Feedback: impossible, not novel

**Lessons:**
- Publishing is broken!
- Grant system is broken!
- ...or I am broken...
Validating technology (2008)

- Layout completed in Oct 2008
- 1GHz operation and 50 GFLOPS/W
- Gave me courage to ask for $$
- **Lessons:**
  - Trust your instincts
  - Leverage contacts
  - Get to MVP fast!
  - VCs need $$ validation
First prototype (2009)

- Epiphany-I prototype
- 16-cores/65nm/12mm$^2$
- "Solo effort"
- 6 weeks to tapeout

**Lessons:**

- Fight the fear
- Sab Kuch Malega
- Foundry + EDA were key
Team building (2010)

- Hired Roman, Oleg
- Best people I knew
- DV+design compliment
- Arch+DV+Design

**Lessons:**

- Hire people you know
- Hire diversity
- Hire technical first
Build a product (2010)

- Dec 2010 tapeout
- Epiphany-III
- 16 cores, 65nm
- 50,000 built to date

Lessons:
- Get it right
- But never stop refining
- Be flexible and fast
Nirvana (2011)

- Chips arrived may 2011
- Worked perfectly!
- Delivered to Bittware
- I was "done", felt at peace

**Lessons:**
- Get the right partner
- Tech is the easy part!
Epiphany-IV (2011)

- 64-cores/28nm/11mm^2
- 70 GFLOPS/W, world #1
- Also created 1024 core layout
- Lots of tire kickers!

Lessons:

- Create COMPLETE solutions!
- $$ talks, BS walks
- Be opportunistic
Marketing Lessons (2011-2016)

- Lots of press!
- But no market pull...
- **Lessons:**
  - Press \(!=\) traction
  - Semi sold door to door
  - Money talks, BS walks
  - Beware time parasites
Selling Lessons (2011-2016)

• I failed
• Bittware failed
• Super sales guys failed

• Lessons:
  • Beware the sales guy myth
  • Can't force sales
  • Get honest feedback
  • Sell solutions, not components
Kickstarting Parallel Computing (2012)

- Parallella: "The $99 supercomputer"
- 18 CPU cores + FPGA on a credit card and @ 5W
- Democratizes access to parallel computing
- $898K raised on Kickstarter in Oct 2012
- Open source and open access
- Now generally available at Amazon & Digi-Key
- Lesson: Avoid Kickstarter
Technology Lessons (2008-2016)

• Creating an ISA is not hard, but a lot of work
• 2D Meshes are fantastic
• Tiled layout are magical
• Heterogeneous is the present/future
• Parallel architectures are still not mainstream
• Moore’s law still going pretty strong
• Chip design costs wildly exaggerated
## Importance of Reducing Friction

<table>
<thead>
<tr>
<th>Typical Skill</th>
<th>Unicorn</th>
<th>Researcher</th>
<th>Maker</th>
<th>Consumer</th>
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<tr>
<td>Board design</td>
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<td>Software plumbing</td>
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<td>System administration</td>
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<td>No</td>
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<td>Soldering, assembly</td>
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<td>Yes</td>
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<td>Building application</td>
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<td>Yes</td>
<td>Yes</td>
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<td>RTFM</td>
<td>Yes</td>
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<td>Total Reach</td>
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<td>10M</td>
<td>1B</td>
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<td>Effort</td>
<td>Result</td>
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<td>------------------------</td>
<td>--------------------------------------------------</td>
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<td>PAL bounty program</td>
<td>30 functions of dubious quality</td>
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<td>Github OSS efforts</td>
<td>Partial fail, limited contributors</td>
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<td>supercomputer.io</td>
<td>Failed, not enough interest</td>
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<td>Camera bounty</td>
<td>Failed, not completed</td>
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<td>Workshop</td>
<td>1 successful, 1 failed</td>
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<td>University program</td>
<td>Failed</td>
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<td>Conference talks</td>
<td>Failed</td>
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</table>
Partnering (2012-2016)

- Magma (Synopsys) : EDA
- BittWare : channel/customer/investor
- GlobalFoundries: manufacturing
- Ericsson: investment, evaluation
- ARL: software development
- Evilcorp (beware): predatory
Fundraising (2008-2016)

- Total ($7.2M) : $200K, $900K (debt), $1.5M, $3.6M, $1M
- I raised self/grants/kickstarter/angels/ff/VC/corporate
- I Spent 1,000 hours to close deal with 3 major investors!
- All deals closed due to personal relationship
- Don't raise VC money without momentum
- Understand how VCs and corporate investors think
Manufacturing

- Need Tier-1 manufacturing partners to compete
- Beware of the valley of death (1,000-->10,000 units)
- Building complex <$100 products in US is not recommended
- Beware EOLs and non-standard parts!
- Only use standard parts available at Digikey
- Always negotiate pricing directly with manufacturer
- Getting above 95% yield requires engineering effort
Epiphany-V Status

• 1024 64bit cores
• 16nm, 117mm^2
• 4.5B transistors
• 64 MB SRAM
• 1024 GPIO signals
• One full-time designer
• Extended ISA for deep learning, comms, crypto
• Dies are back, silicon bringup starting March 2017
Lesson Summary

- **Team:** Need team lined up from day one
- **Marketing:** Emotional. Sell with pictures and stories.
- **Selling:** Validated market pull. Be persistent and patient
- **Fundraising:** Avoid if possible
- **Pricing:** Use low/high pricing model
- **Manufacturing:** One wrong partner can kill your company
- **Product:** Create solutions
- **Software:** Hardware without software is useless