Why the Best Days of Open Hardware are Yet to Come

bunnie

chumby industries, PTE LTD (General Manager)
bunnie studios LLC (Owner)
In the Beginning...
Model 5X5 Series  
(Chassis No. RC-406)  
Five-Tube, Single-Band, AC-DC Multiplex Superheterodyne Receiver  
Model PLF-10  
Power Line Filter Coupling Unit  

Electrical and Mechanical Specifications  

General Description  

Set-up Procedure for Remote Control  

Alignment Procedure  

Power Line Filter Coupling Unit  

Replacement Parts  

Note on precision furnaced parts, which are marked identified and may be matched from matched units.  

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Addendum to the
Apple II Reference Manual

The main logic circuit of the Apple II is shown below. It is a
floating-point processor that runs at 4 MHz.

You can learn more about the Apple II from the Apple II
手册. It will be available soon.

Please refer to the number 820-94 for more information.

Sep 15, 2011 -
But Today...

Congratulations, you and your Mac Pro were made for each other.

**Notice:** Always replace the side panel after installing components. Your Mac Pro doesn't operate properly without the side panel in place.
What Happened?
What Happened?

Did hardware become too hard and complex?
No!

- Actually, hardware is far too “easy” to improve
The Unrelenting Treadmill of Moore's Law

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Hardware’s Classic Problem: “Sit and Wait” >> Innovate
The Product Cycle

- **Innovate**
  - S: days to weeks
  - H: weeks to months

- **Adopt**
  - S: weeks to months
  - H: months to years

- **Distribute**
  - S: seconds to minutes
  - H: months

Total cycle time:
- Software: weeks-months
- Hardware: months-years

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Moore’s Law Favors Big Business

• “Product pipelines”
  – 2-3 generations in simultaneous development

• “Massive distribution”
  – Infrastructure to build, deploy millions per month

• “Secrecy”
  – Secrecy delays competition by a few months
  – With tech doubling every 18 mos, that’s a big advantage
This Too Shall Pass.
Clock Scaling Ended Around 2003

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Moore’s Law is Slowing Down

- Density doubling rate is now “officially” every 24 months
- Certain fundamental transistor parameters have hit a wall already – $V_{th}$, $V_{ddmin}$, gate oxide thickness
- Where does it end?
  - Sometime between 2020-2030, gate length = 5nm
What Does this Mean For You?

- Someday:
  - Your computer won’t get any faster next year.
  - Your phone won’t get any smaller next year.
  - Your flash drive won’t store any more data next year.
This is Good News For Us.
Moore’s Law Revisited
Moore’s Law Revisited (Log Scale)
Implications

- The life cycle of hardware is a better fit for smaller organizations
- A higher value on optimization, craftsmanship
- More stable, common platforms
Things to Look Forward To

- Arduino-like devices as powerful as your smartphone*
- Competitive DIY chassis for notebooks, tablets
- FPGAs that perform comparably to CPUs
- A rise in “repair culture”
Example Indicator

- Shanzhai mobile phone culture in China
  - “Trailing edge” technology satisfies a large market segment
  - Small shops are very competitive and profitable
  - Lots of re-use and re-processing of parts
Conclusion

- “Exponentials are never forever”
- With every passing year, the standards and customs our open hardware community makes become more “sticky”

- The best years of Open Hardware are yet to come!
Thanks!

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