OLPC System Architecture

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One Laptop Per Child
October 4, 2006

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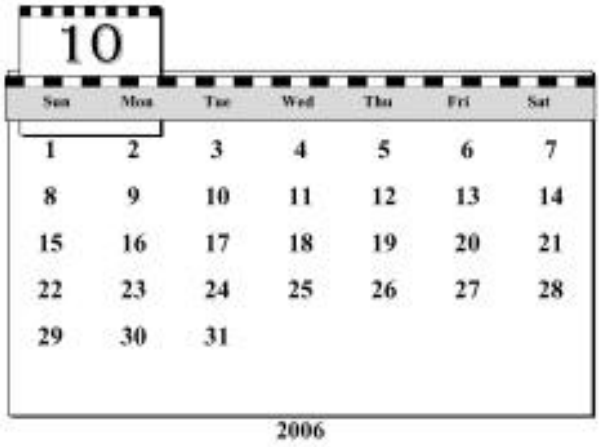
Agenda

- Introduction
- Core Architecture
- Mechanical Design
- Power System Design
- ASIC Architecture
- Power Management
- Software
- Summary / Q&A



Introduction

- **One Laptop Per Child**
  - ***A non-profit corporation***
  - ***Creating very inexpensive laptops for kids***
  - ***Focused on education***
- **OLPC is sponsored by:**
  - ***AMD, Brightstar, eBay, Google, Marvell, News Corp, Nortel, Quanta, Red Hat, SES Astra, etc.***
- **We sell to governments**
  - ***Governments must donate laptops to kids***
- **Initial launch countries**
  - ***Brazil, Nigeria, Thailand…***

Our World

Challenges

- **Infrastructure**
  - ***Power***
  - ***Connectivity***
- **Political uncertainty**
- **Physical environment**
- **Effective distribution**
- **Inefficient software**
- **Cost**

Cost Reduction

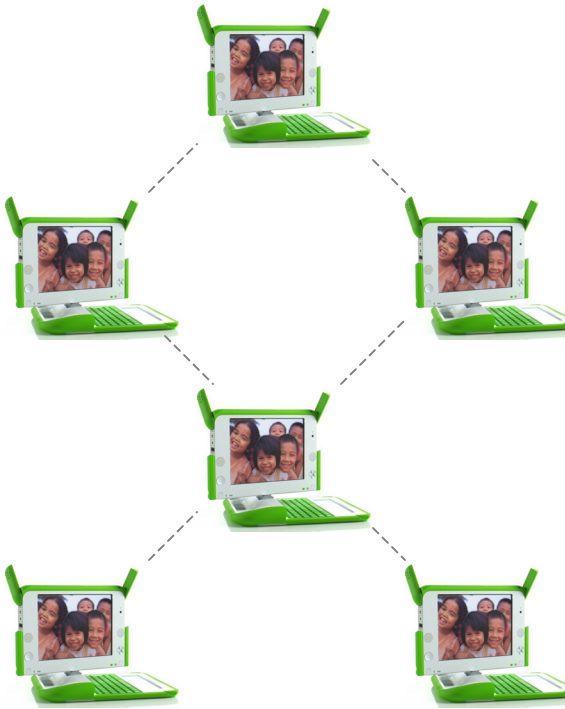
- **Architected for low cost**
  - ***Custom ICs***
  - ***Consumer Electronics interfaces***
- **Large volume is key**
  - ***Common configuration crucial***
- **Direct distribution**
- **Open source software**
- **Optimized software**
- **Power management!**

Core Architecture

- AMD Geode GX2-500 CPU
- On-chip LCD interface
- 128MB DDR SD-RAM
- 1MB SPI Serial Flash
- USB 2.0 ports (3)
- SD Card slot
- Integrated wireless
- Audio and video support
- 512MB LPC NAND Flash Storage
  - *Compressed JFFS2 filesystem: ~1 GB*

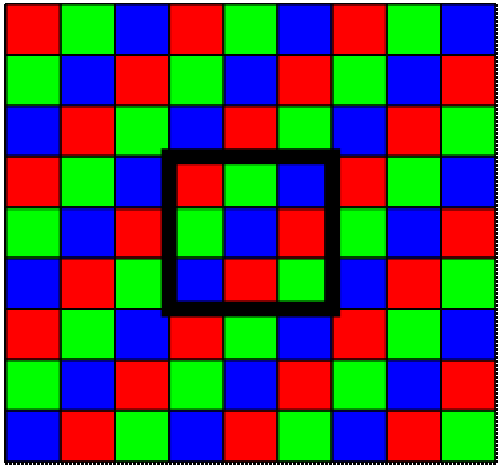
Wireless Mesh

- 802.11G-based ▸ IEEE 802.11S
- Extended antennas: +3 dB gain
- On-chip ARM9 CPU + 96K RAM
- Autonomous mesh router
- Complete infrastructure
  - *School Server w/DVB-S Receiver*
  - *Solar-powered Access Points*
  - *Segmentation: spatial & frequency domain*
- 24 hour/day wireless router



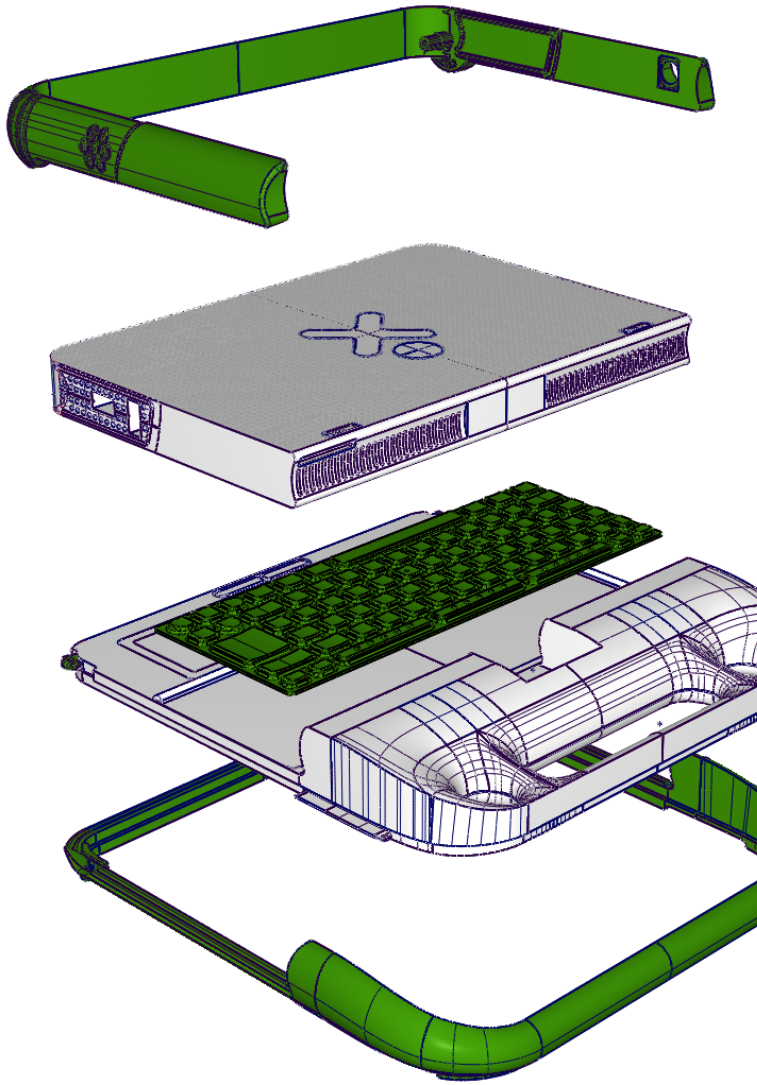
LCD Display

- Custom 7.5” TFT LCD
- 1200x900 Resolution: 200 DPI
- Dual-mode capability
  - *Reflective Monochrome*
  - *Transmissive Color*
- Unique pixel structure
- Cost effective
- Ultra low power consumption



Mechanical Design

- **Safety first!**
  - ***No hazardous substances***
  - ***Rounded, kid-friendly design***
- **Moisture/dust/dirt resistant**
- **Extra rigid shell**
- **Internal “mainframe”**
- **3D connector reinforcement**
- **Replaceable bumpers**
- **Shock-mounted LCD**
- **Transformer hinge**



ONE LAPTOP PER CHILD

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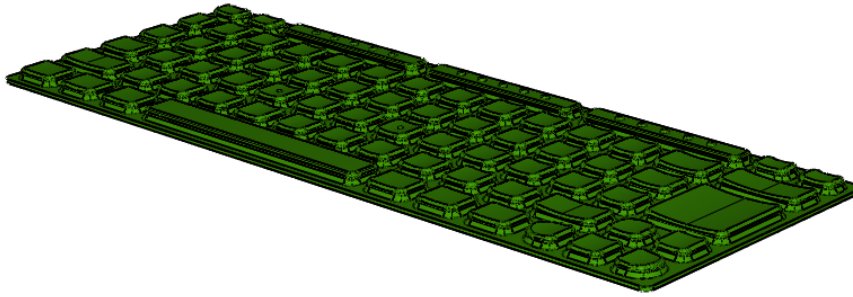
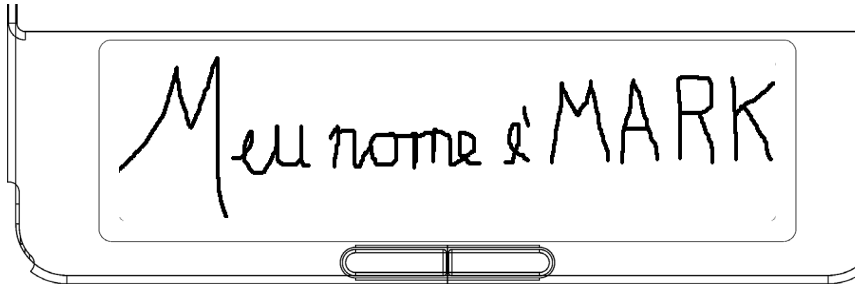
Input Devices

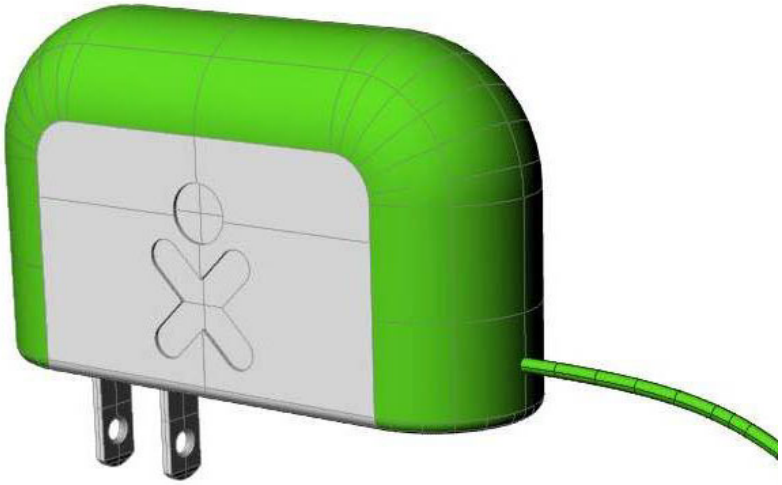
- Game Pad/Controller
- Sealed Keyboard
  - *Keyboard light*
- Dual-Mode Touchpad
  - *Capacitive input via fingers*
  - *Resistive input via stylus/stick*
- Internal microphone
  - *Sensor mode for learning*
- VGA Camera
  - *Still, Video, Sensor modes*

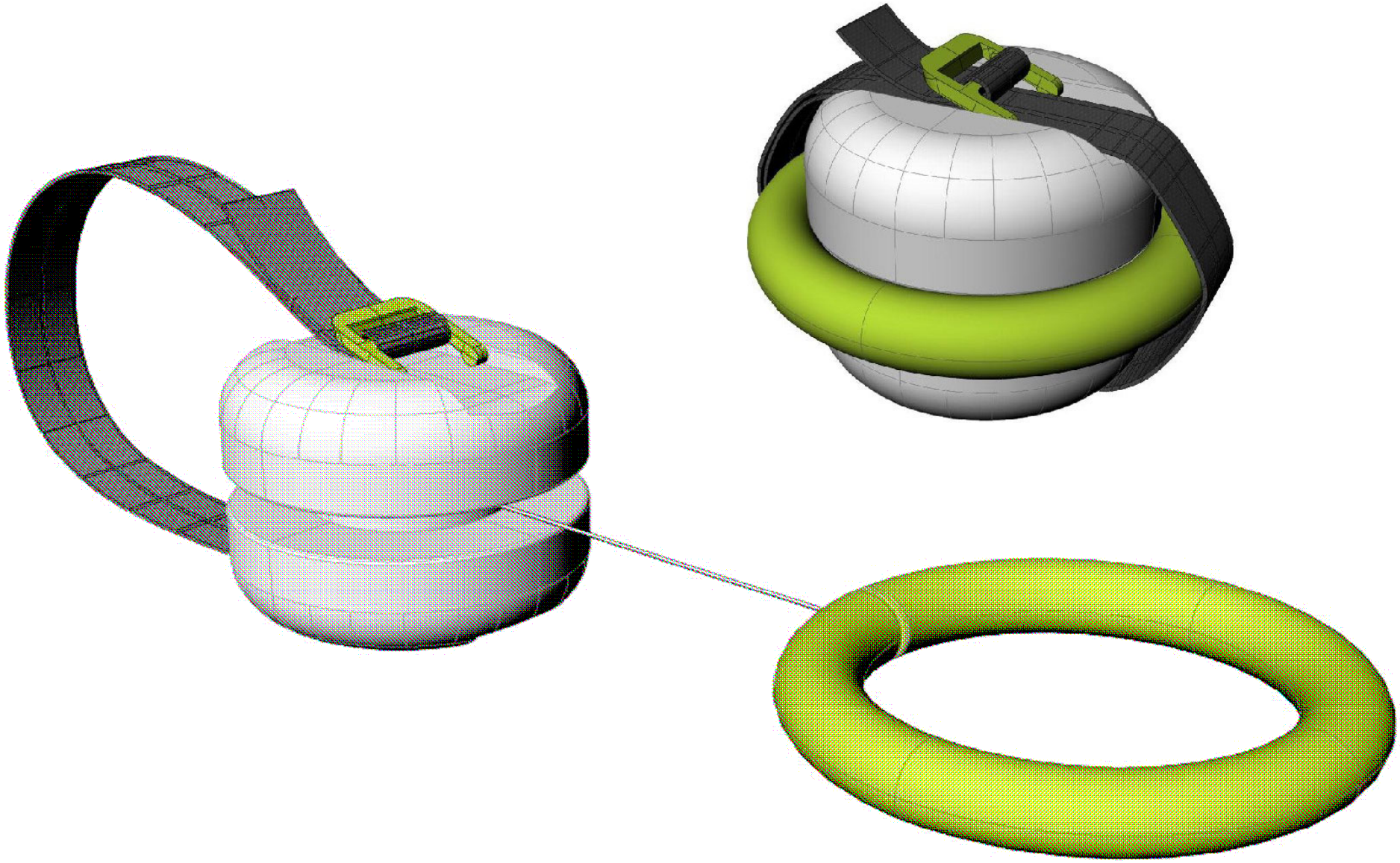




Power System Design

- **Power is unreliable, poor quality**
  - ***Wide-ranging DC input: 10-24V***
  - ***Overrange/polarity/surge protection***
- **Safety First!**
  - ***NiMH Battery***
- **2,000 battery cycles**
- **Gang charger**
- **Human power input**



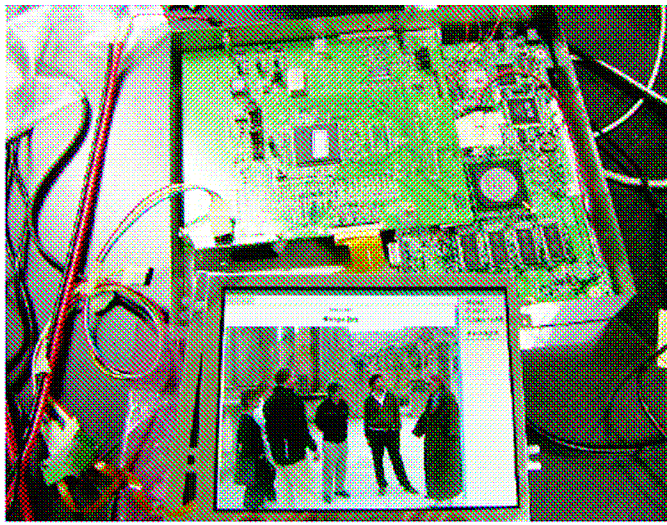


CAFÉ ASIC

- **Challenge:**
  - ***Seek faster storage interface***
  - ***Countries desire storage expansion***
  - ***Camera for new user interface***
- **CAFÉ – Camera And Flash Énabler**
  - ***Bus-mastering PCI interface***
  - ***NAND Flash controller: Storage interface***
  - ***Secure Digital (SD) Slot: Expansion***
  - ***Camera Interface***

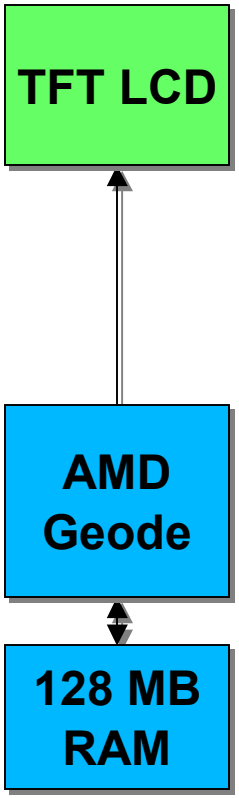
DCON ASIC

- **Challenge:**
  - ***LCD pixel structure impacts system software***
  - ***Power consumption too high***
- **DCON - Display CONtroller**
  - ***DETTL Interface***
  - ***Panel Compatibility***
  - ***Mono/Color Mode Support***
  - ***Antialiasing***
  - ***Self-refresh capability***

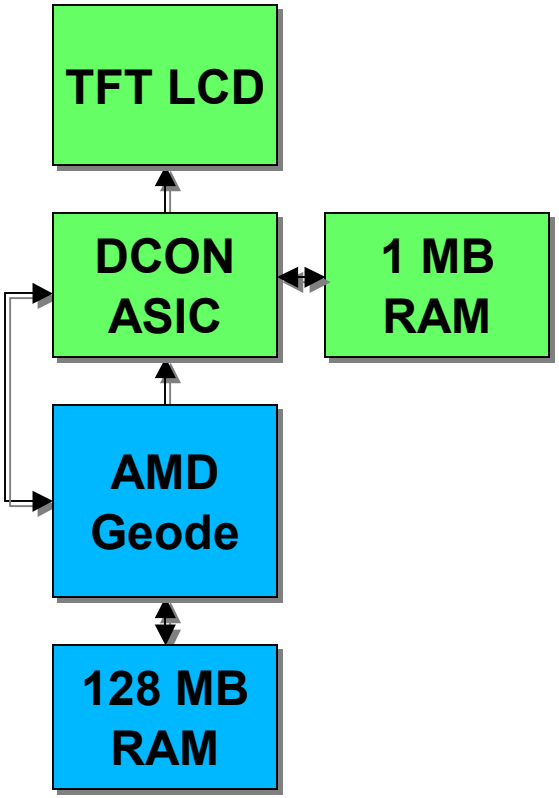


DCON Architecture

Conventional System



OLPC System



Power Management

- **TANSTAAFL… NOT!**
- **OLPC's Top Priority**
- **Suspend to RAM**
  - ***CPU shuts down, RAM contents preserved***
  - ***Conventional notebooks: ~10 seconds***
  - ***OLPC: < 100 mS***
- **DCON: Screen stays active**
  - ***System appears to be running***
- **User activity: instant wakeup**
- **Target power consumption: 2.0 Watts avg.**

System Software

- **Fighting software bloat**
  - ***Focus on improved efficiency***
  - ***Reduced CPU and memory requirements***
- **System security**
  - ***Tempting hacker target***
  - ***Theft resistance***
- **Secured LinuxBIOS**
- **Simple Linux Bootloader**
- **Linux Operating System**
- **“Sugar” User Environment**

Software Applications

- Journal
- Web browser
- WIKI / WP
- eBook
- Chat
- VoIP
- Email
- Logo
- Etoys
- Video support
- Music manager
- Audio support
- Multimedia
- Search

Thank You!

Questions?