One Laptop Per Child

BSDCan

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"It's an education project, not a laptop project."
- Nicholas Negroponte

Why?

High-quality education is key to growing a healthy society.

An inexpensive laptop computer for every child in the world is a good way of doing it.
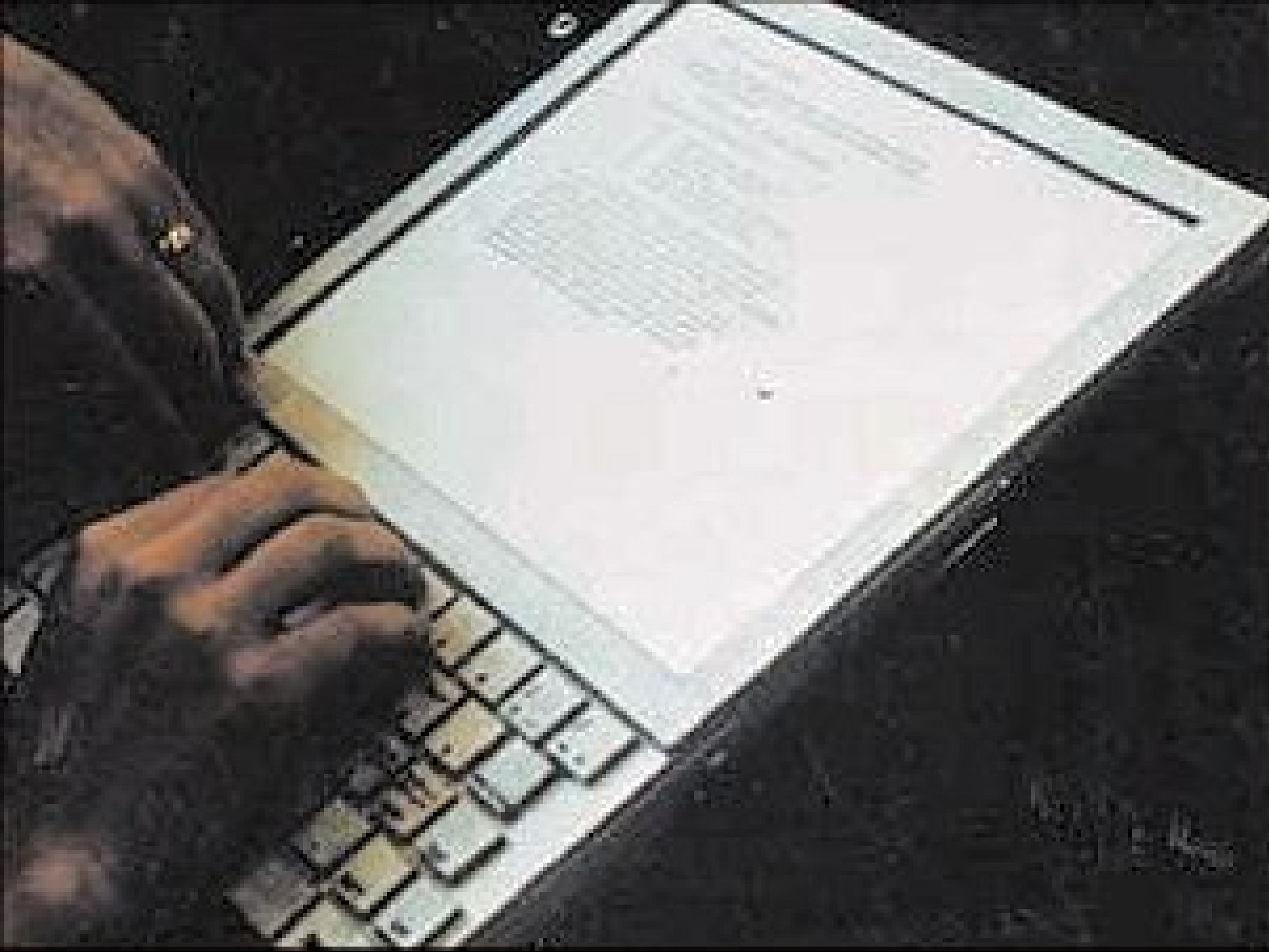
Children learn by doing.

Collaboration is paramount.

It needs to be malleable; not like the immutable systems that we have been trained to "consume" in the Western world.

It must depend on as little infrastructure as possible.

Goals

- high-quality education for everyone is essential for a healthy society

- a **inexpensive** laptop for every child in the world

- learning by doing ("constructionism")

- malleable

- infrastructure not always available

- child-to-child collaboration and communication

Learning Learning

- children learn by doing
- constructionism (a variant of constructivism)
- "'Edutainment'? No thanks. I prefer Playful Learning."
- use the laptop as a tool to **create** things, not for doing "busy work"
- ideas pioneered by folks like Seymour Papert and Alan Kay

Multi-Tiered Content Creation is Bad

- computers should not merely be "delivery systems" for the "content providers"

- more balanced creation to consumption ratio

- kids shouldn't be forced to use watered-down tools

Appropriate to Appropriate

- all OLPC code is Free Software

- transparency is empowering

- much of the user environment and activity code is Python, thus making it editable without use of compilers or toolchains, right there on the laptop

Collaboration

- all Activities shareable on the mesh
- live sharing (think Writely)
- instantly get voice, video, and text chat

Economics

- "Scale vs Pilot"

- millions of machines, not thousands

- when you make that many devices, you can have custom pieces made (ASICs, etc.)

Hardware

- 466 MHz AMD Geode LX-700

- 256 MiB of RAM

- 1 GiB of Flash NVRAM (compressed to give about ~2 GiB with jffs2)

- speciality LCD display

- speciality "CaFE" ASIC, for better NAND access, plus 'bonus' camera and SD
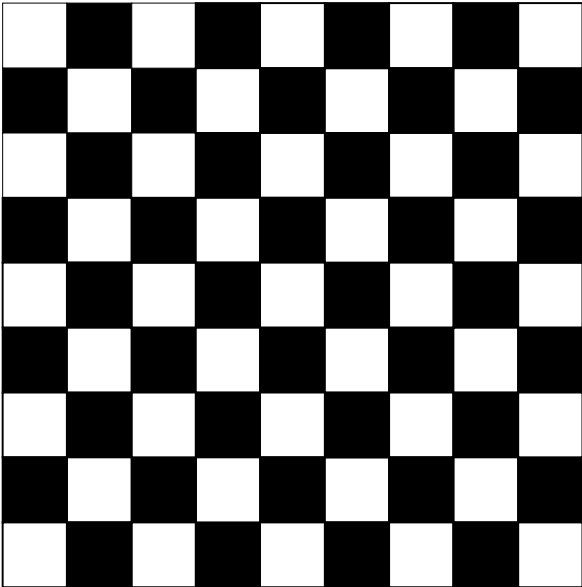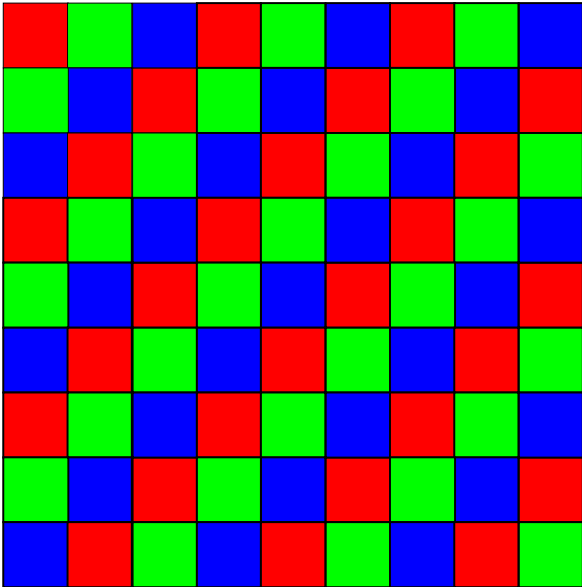
- no moving parts!
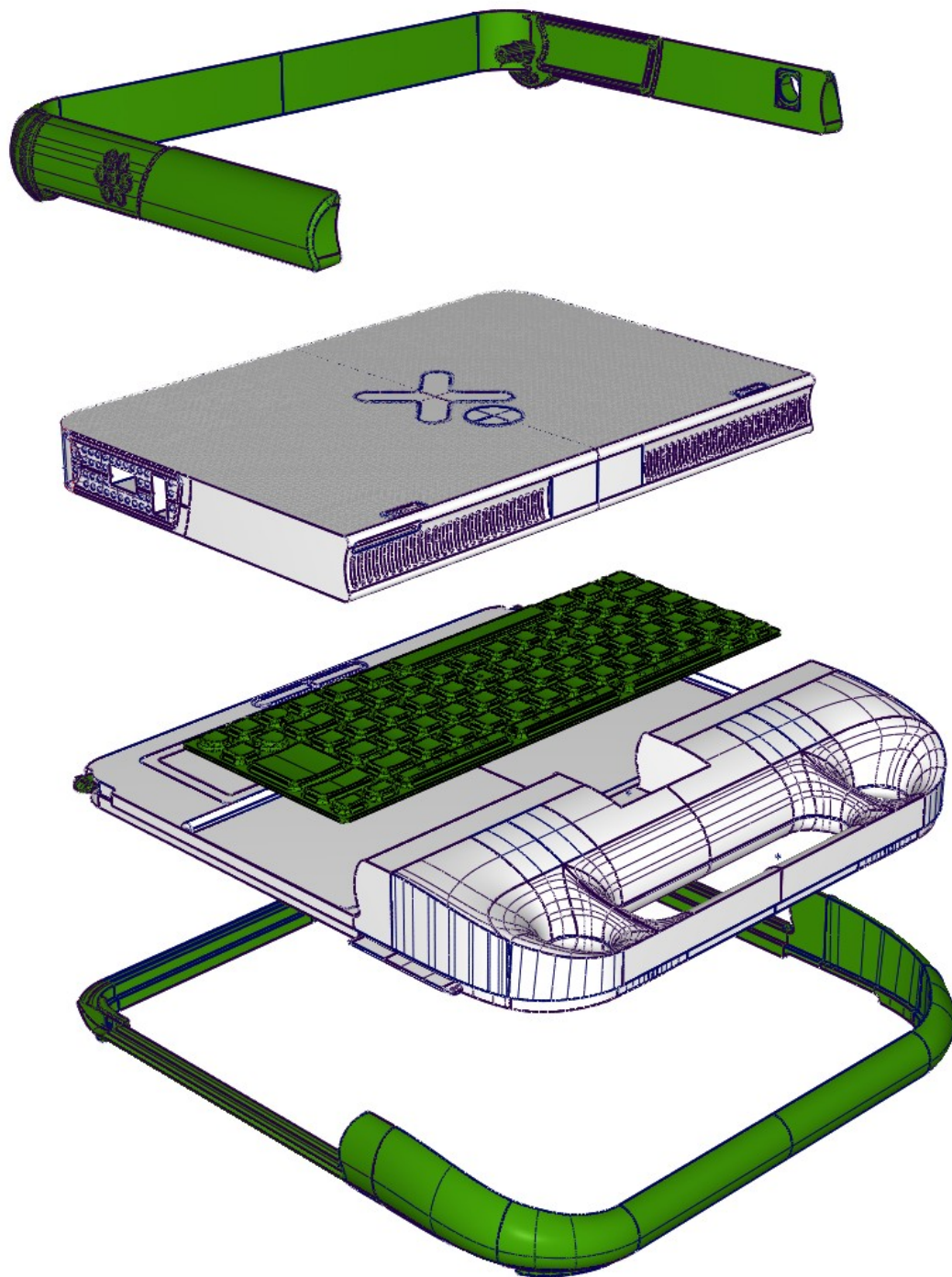
LCD display

- much less expensive than conventional LCDs ($35 target)

- hybrid reflective and transmissive modes

- **outdoors**!

- 1200x900 addressable resolution, 200 DPI

- colour mode effective 800x600, full 1200x900 (200 dpi) in monochrome mode

- LED backlight rather than mercury lamp

Reflective Monochrome   Transmissive Colour

Power Requirements

- grid infrastructure often not available in developing nations

- human power

- traditional laptop uses more than 25 watts

- OLPC needs to be less than 2.5 watts (a whole order of magnitude!)

Where's the crank?!

- crank now an optional separate module
- some locales might not require the crank
- onboard crank tends to torque laptop too much
- more versatile, things like "gang charging" or a PV array on the roof of a schoolhouse are now possible
- Kofi Annan broke it

Crank

- either FreePlay or similar

- not actually a crank, because cranks only use weak arm muscles

- either pull cord (shoulder) or pedal (legs)

- small child can only produce about 5 to 10 watts

- 10:1 minimum usage to cranking ratio

Power Management

- laptop enters suspend-to-RAM state during periods of inactivity

- very aggressive

- DCON chip contains small piece of RAM that (more or less) fits the entire framebuffer, so CPU can be suspended with display still on

- always maintaining mesh network for others, even while suspended

Environmental Impact

- ROHS compliant

- no mercury in display

- will not poison water table when discarded

Can't find a network? Make one instead!

- IEEE 802.11**s** extensions to standard 802.11g
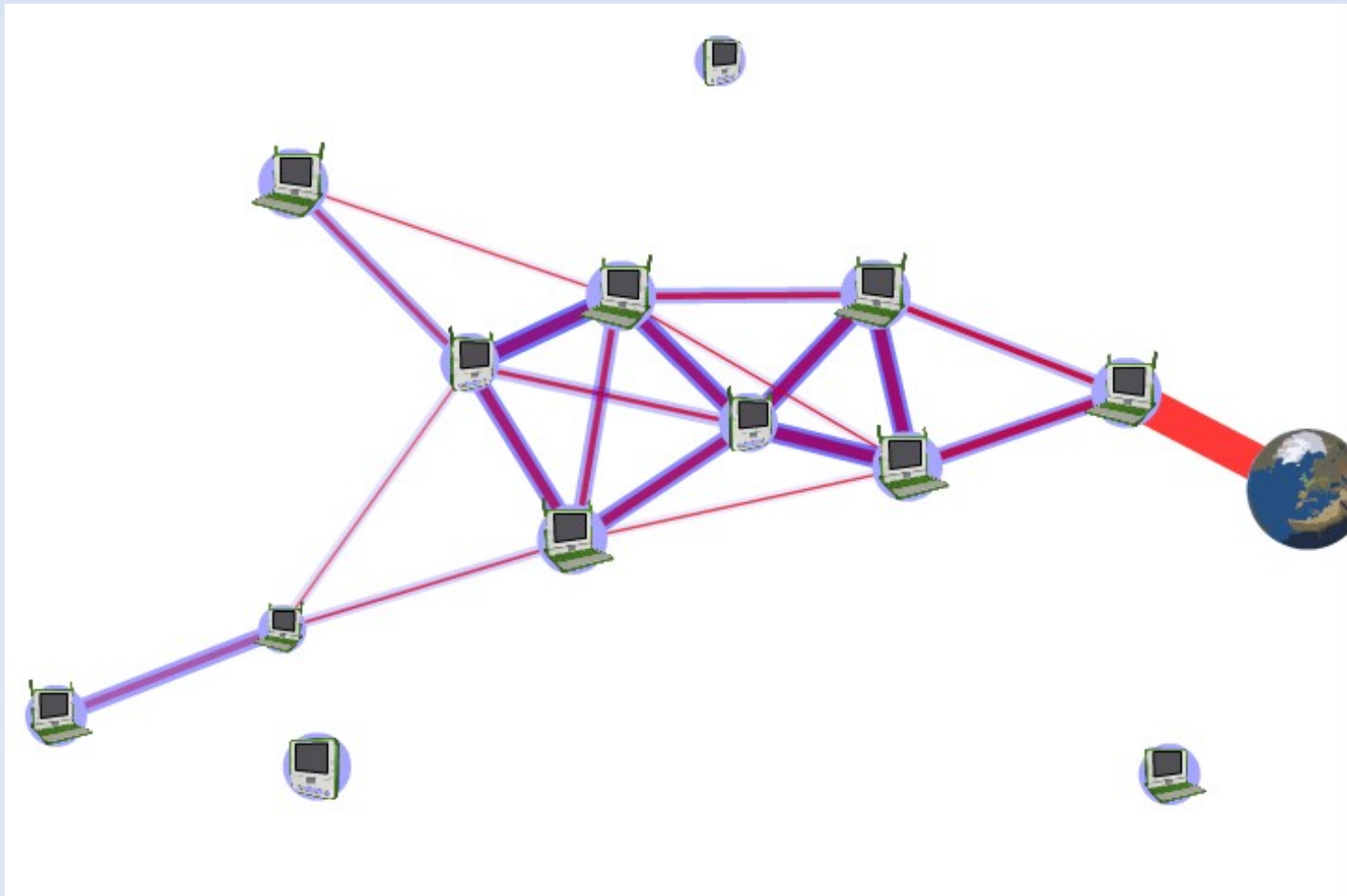
Threats

- Gee, a whole bunch of always-on Internet-connected laptops in the hands of small children?

- mmm, botnets and spam pharms just waiting to happen

- thieves and black market

- corruption and graft

- however, security system must impose on personal freedom as little as possible

Hardware Security

- laptop taken away from its home network ceases to function after set amount of time

- "trusted" firmware and boot path makes it very difficult to defeat without opening laptop and reflashing ROMs

- "modchip" theoretically possible, but unfeasible for common thieves

- identifiable colours

Software Security: "Bitfrost"

- traditional "programs run as me" security model no good

- activities run with minimal rights

- very granular rights system, including CPU scheduling!

- no passwords

- all activities run in linux-vserver sandbox, an in-kernel thin 'virtualisation':
  no CPU overhead, ~32 KiB per process overhead

Software

- entirely Free Software
- OpenFirmware
- Linux 2.6.2x
- Xorg
- Gecko 1.9
- OLPC-specific Sugar user environment

Sugar

- applications are "Activities"
- shell written in Python
- discards "desktop metaphor" in favour of "zoom metaphor"
- Python requires no "toolchains".
- Python is "semantic"; there is no intermediary compiled "presentation" format.

Activities

- collaborative

- discrete "bundles" that are easily shareable with others

- can't join an activity on the mesh because you haven't got it? It will be downloaded from the group automatically.

- Written in Python

- Speciality widget classes in Sugar that derive from Hippo and GTK+

Communication Manager

- Collabora Inc.
- provides the low level constructs for implementing collaboration in Activities
- integrated with Telepathy
- servers are an optimisation only (XMPP)
- runs as dbus service
- handles pipe reliability
- really is a series of tubes

Activities

- Write
- Draw
- TamTam
- Develop
- eToys
- Web
- News Reader
- Block Party

Develop activity

- a Python "IDE"

- both live collaboration and...

- ... distributed version control

- code localisation (maybe)
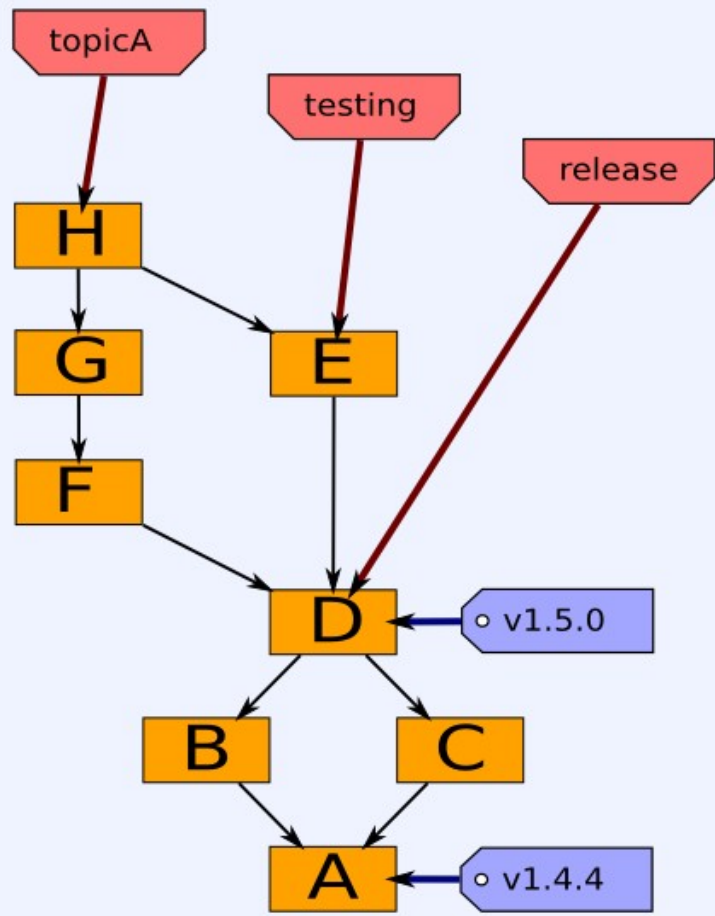
Summary

- laptop computer for children in developing nations

- inexpensive, safe, reliable

- creation as important as consumption

- Free Software

- malleable system; kids can play and change things

Questions?

Bibliography

- OLPC wiki (http://wiki.laptop.org/)
- "Edutainment? No thanks, I prefer Playful Learning", Mitchel Resnick
- "Making Sausage: How the OLPC machine was designed", Jim Gettys