

TinyPC: Enabling Low-Cost Internet Access in Developing Regions¹

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Introduction



Technology can impact everyone

- Health, education, government, commerce

"First World" technology is a bad fit

- New research agenda



Our focus

- "Wiring" the "Jungle" OR
- Internet for the "other" billion

- Not targeting literacy problems

Introduction



\$100 Laptop, Simputer ...



TinyPC



Embedded World

Motivation

David Culler, [ArchRock's Primer Pack/IP](#), IPSN'07



IPv6-based Low-power
Wireless Personal Area Networks

Adam Dunkels, [8-bit TCP/IP Stack](#), MobiSys'03



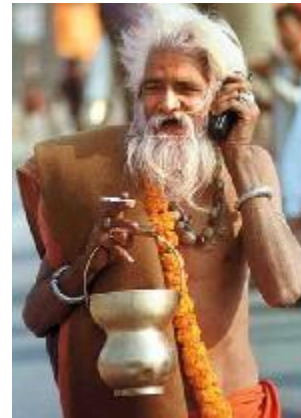
Image Courtesy: Moteiv

Motivation

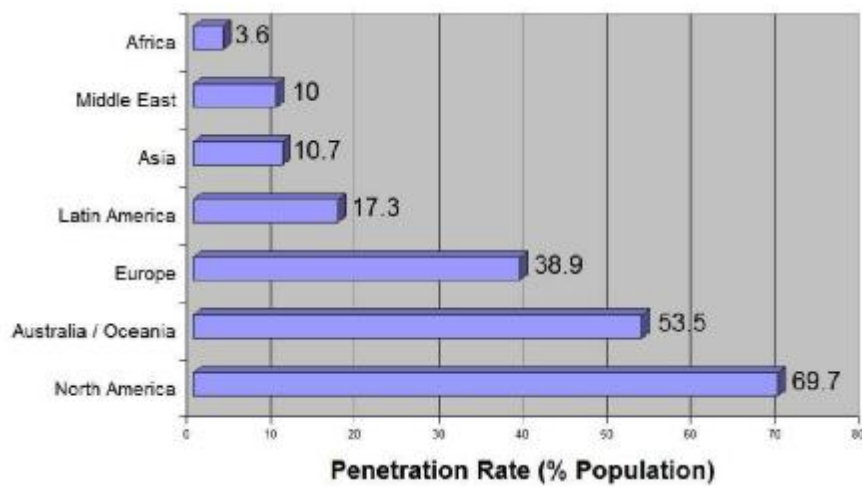
Limited access to information (libraries, books)

High demand (billions of potential users)

Extremely low Internet penetration



Motivation



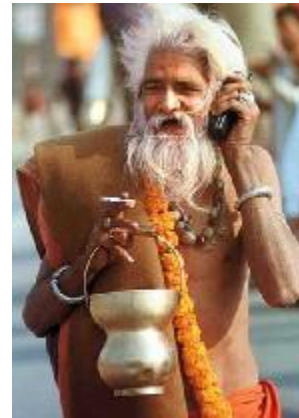
Motivation

Limited access to information (libraries, books)

High demand (billions of potential users)

Extremely low Internet penetration

Previous attempts were commercial failures
(Computador Popular, Simputer)



\$200+ is NOT low cost !!!

Design Goals

Leverage Local Resources
 Simplicity **Low Cost**
 Internet Access
 Wireless Connectivity



Mobile Phones

Fundamental (human) limits:

- size of screen (output)
- size of keyboard (input)



Image Courtesy: Apple

Mobile Phones

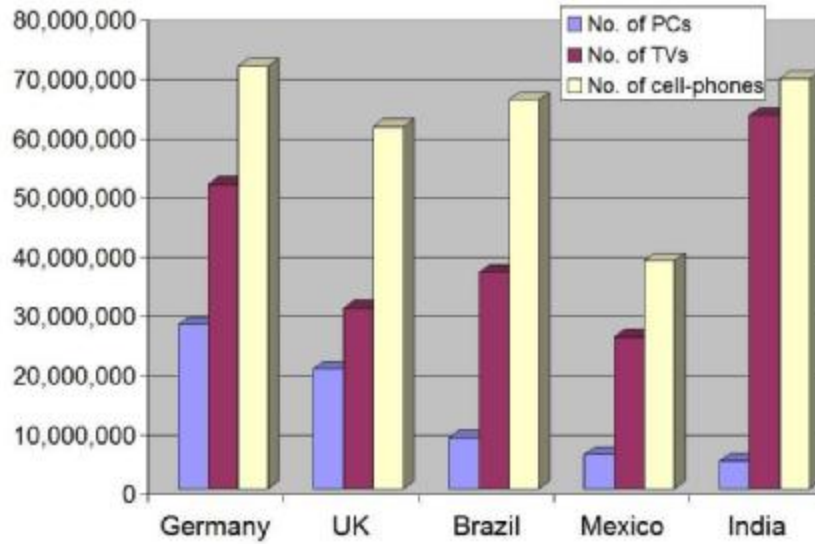


Too Expensive!!!!

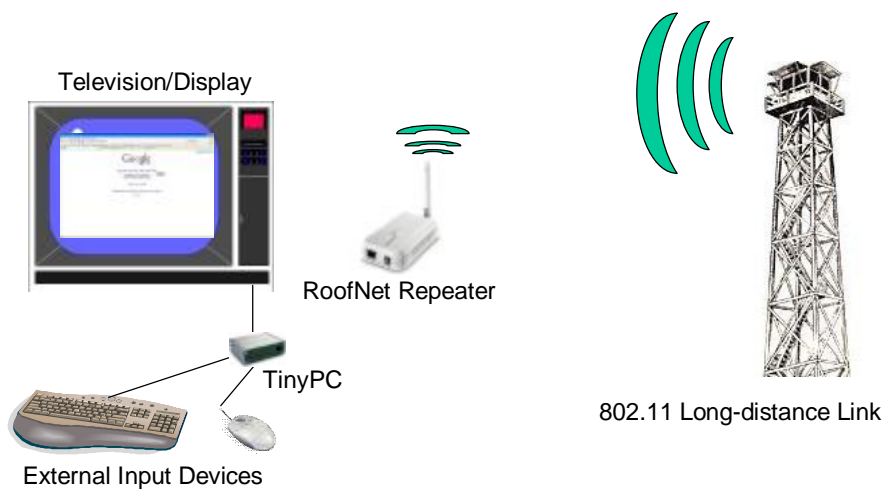


Ref: S. Keshav. "Why cell phones will dominate the future internet". *ACM SIGCOMM CCR* 2005.

(TVs + cell-phones) vs PCs



Big Picture



TinyPC Hardware

Computing

- Intel Xscale 312-520 MHz

Memory & Storage

- 16 MB DRAM,
- 2 MB FLASH,
- 1 GB USB (integrated)

Display

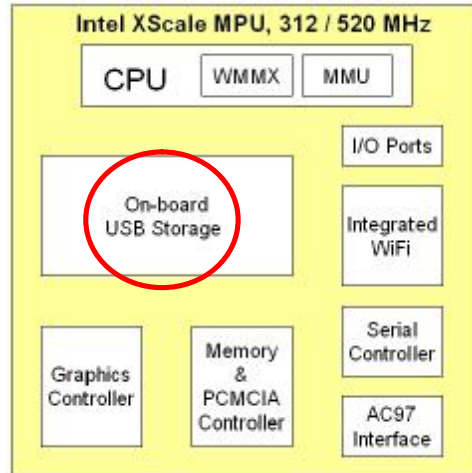
- TV or External Display

Networking

- 802.11 b/g (integrated)

Target Price

- \$50 or less



Simplified Block Diagram of TinyPC

Networking

Delay Tolerant Networking

- intermittent connectivity

802.11 Long-Distance

- rural access

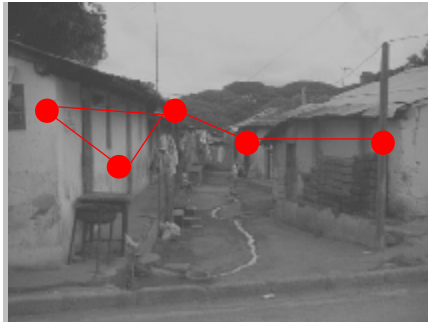
MIT RoofNet

- last mile



Image Courtesy: TIER @ Berkeley

Networking



Meraki Mini \$49



Meraki Outdoor \$99

Images Courtesy: Meraki

Comparison – MIT \$100 Laptop

- \$100
- Aimed at children & education
- New display technologies
- Power supply



Image Courtesy: OLPC

Comparison – Simputer

- \$240 - \$440
- PDA-like display
- Touch-screen



Image Courtesy: Amida Simputer

Comparison – Rural Kiosks

- Personal or family use
vs.
Shared computing
- Complimentary concepts



Image Courtesy: Comat

Comparison – Computador

- \$300
- Never came to market
- No hard drive



Open Questions

- Social issues
- Sustainable development
- TV as display
- Other open research problems



Conclusions

Help bridge the digital divide

Low-cost, practical

Not a short-term solution

"Fancy cell-phones" vs. TinyPC



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Fred Jiang (UC Berkeley)



If you think I am crazy ...



Further Information

Muneeb Ali

<http://muneeb.org>

Thank You !



Comparison Table

Item	Year	Memory	Processor	Storage	Network	Display	Price Target/Actual
Computer	2001	64 MB RAM	AMD 644	Flash 32M B	Cablest,	Monitor	\$300 (Target)
Poplar Sampler	2005	32 MB DRAM	Intel StrongARM	Flash 325MB, upto 1285MB	Internal Modem, IR, and WLL	Built in LCD	\$275 \$410 (Actual)
MIT 510C Loglog	2002	256 Mbit DRAM	AMD LX-700, 433 Mhz	Flash 324 Mbit	802.11b/g	Built-in TFT	\$110 (Target)
ToyPC	2007	16 MB DRAM	Intel Xscale, 312-620 MHz	2 MB FLASH, 1 GB JFFS	802.11b/g	TV or External Display	\$60 (Target)