Cumulative price-performance advances in technologies are bringing ICT within reach of the global poor.

Emergence of successful business models has spurred commercial interest in these unconventional but large markets.

Many successful pilot applications have demonstrated the positive impact of ICT on global sustainability and quality-of-life.

And many of the very best ICT researchers from throughout the world are passionate about this challenge!
BREWER’S CONJECTURE:

Providing traditional enabling infrastructure, like building out roads, rail, the electrical grid and providing piped water is very expensive and can only really be economically justified for high density, relatively affluent communities.

Network infrastructure, on the other hand, is inexpensive enough to deploy economically to rural areas and can be used to build the economic base that then justifies investing in roads, rail, electricity and water grids later.

Source: Eric Brewer
Open, Standards-Based Global ICT Platform: Infrastructure and Basic Services

- Very Low Cost, Operates Off the Power Grid, Designed for Intermittent Connectivity, Supports Low Literacy and Multiple Languages, Reliable in Extreme Environments, Supports Shared Access, Private and Secure
- Must support telephony (synchronous and asynchronous) & data communication
- Must support sensor networks (potentially millions of sensors/application)

Network access feels just like power grid access in a developed community: You simply "plug in" (wirelessly, of course!)

“People Are the Killer App of the Internet”
Pavel Curtis, Xerox PARC, 1992

- Online Auctions
- Mega-Player Online Games
- Simple Telecommunications
- Education & Training
- Blogs, Friendster, Livejournal, Tribe.net
- Time-Sensitive “Valuable” Data
- SMS to MMS++ to Multimedia Calls
- Distributed Collaborative Environments
- Business Relationships & Negotiation

The power of ideas and opportunities, fueled by local entrepreneurial energy, is the most powerful resource available in this resource-scarce part of our world.
General Three-Tier, Intermittently-Connected Network Architecture

Source: Eric Brewer
A Village Basestation: 2004
Support 100 simultaneous feeds at > 1Mbps each

- 100M logic gate equivalent
- 1 Gbyte Memory
- 200 Gbytes Disk
- Battery
- Silicon Solar Cells (1.5m²)
- Mechanical Structure
- Cost US $750
- Dissipate 250W at full load

A Village Basestation: 2010
Support 200 simultaneous feeds at > 2Mbps each

- 300M logic gate equivalent
- 10 Gbyte Memory
- 10,000 Gbytes Disk
- Battery
- Silicon Solar Cells (1m²)
- Mechanical Structure
- Cost US $500
- Dissipate 150W at full load
Devices

- Develop standard chip family for human application ⇒ $1-7 per chip
  - Processor, memory, radio; network, speech, and display support
- Develop standard chip family for sensor application ⇒ $1-0.01 per chip
  - Processor, radio, power management, network support, integrated GPS option
  - Low-power version < 200 microwatts
- Novel low-cost organic semiconductors for flexible displays and inexpensive circuits
  - 10-50x cheaper, ultimately more robust

Asynchronous Two-Way Communication

- The telephone system was developed when memory and storage was expensive
- Semi-interactive, but potentially much less expensive...
- Savings:
  - No need for dedicated resources
  - Can “store-and-forward” data (like real mail)
  - Can hide problems (e.g. power out) by waiting or redundancy
- Examples: voice messaging, SMS/MMS, correspondence classes, medical diagnosis (non-emergency), coordinating money transfers, e-commerce (e.g. catalogs), e-mail
Light-Weight Audio SMS

The Technology Peace Corps Prototype

- Idea co-developed by Tom Kalil, Rich Newton (Berkeley) & Raj Reddy, Bernadine Diaz (CMU)
- Berkeley prototype evolved from Bridging the Divide 2004, led by Drew Isaacs (MOT)
- 8 teams of 4 students, from Engineering, Haas, SIMS, Economics, Public Health, ERG, City & Regional Planning, ...
- Semester studying how to test a hypothesis, conduct interviews, behave in a foreign culture, etc.
- 1-2 months away over summer; many return trips planned in the fall
Who We Are | History | Faculty Advisors

The Bridging the Divide 2004 Conference and associated fellowships are made possible through the close cooperation of the United Nations Industrial Development Organization (UNIDO) and the University of California, Berkeley (UC Berkeley). This is the first partnership of its kind in North America.

UNIDO is one of the United Nations' largest specialized agencies. Within the United Nations organization, UNIDO has responsibility for promoting industrialization throughout the developing world in cooperation with its 170 member states. UNIDO is headquartered in Vienna, and has field offices in 37 countries.

The UC Berkeley conference organizer is the Management of Technology Program, UC Berkeley's joint graduate program of the Haas School of Business, College of Engineering and School of Information Management and Systems.

Bridging the Divide 2004 would not be possible without the thoughtful help and guidance from the Faculty Advisory Board, consisting of some of the world’s leading scholars on our topics.

Sponsors

- Bridging the Divide - 2004 is made possible by the following Sponsors:
- ChevronTexaco
- IBM
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- Roche
We are working with M. Swaminathan Research Foundation (MSSRF), Aravind Eye Hospital, and the Akshaya (e-gov) project in Kerala.

This summer, we got towers up and set up two links: one from Aravind to one of the MSSRF villages (only 3km) and a 10km link that reconnects that village with the hub.

It had a connection that was broken, but we reused the towers and antennas.

We showed videoconferencing between the hospital and the villages (sufficient for basic telemedicine).

We collected 30 samples of Tamil speech for our speech recognizer.

We set up and left a proxy cache that sits in front of the VSAT (which is the only connection from the villages to the outside Internet).
What is the most effective power architecture for rural users?
Principal Conjectures

There are a million useful things we could work on, but:

- A very low cost and reliable network infrastructure, available to everyone, that supports communication and data, is absolutely necessary (but not sufficient...) if we are to support sustainable economic development in poor, rural areas.

- The most important application to support is communication—‘people are the killer app’—but most likely in a very different modality than what we use here in the developed world today.

- The problem is not simply a technology problem (‘just put up wireless links’)—it is as much a systems architectural problem (e.g. where do you put data storage and why?)

Principal Conjectures

- Like the introduction of the railway system in the US, the introduction of an open, standards-based national and international communication backbone network will enable or enhance many small businesses—many of which we cannot imagine today.

- A sustainable business model for deployment and use is critical to success and must be designed in conjunction with the technology—ideally, the system will be deployable in a locally-owned, ‘viral’ way, based on a reference architecture and a pay-as-you-use-it service model.
ICT for Sustainable Development: Next Steps

Working together, we must establish:

u An active, global research and development community of interested university, industry, NGO, and government participants

u A premier international conference with the highest of academic standards—A World Technology Forum

u An international business plan competition for both developed and developing countries targeted to the developing world

u Develop a research and development roadmap for sustainable development

u A world-class publication accessible inexpensively throughout the world

u An international Engineering “Peace Corps” for students and young professionals to work together to address problems and to learn about the challenges and opportunities in the developing world

Source: Tom Kalil, Richard Newton