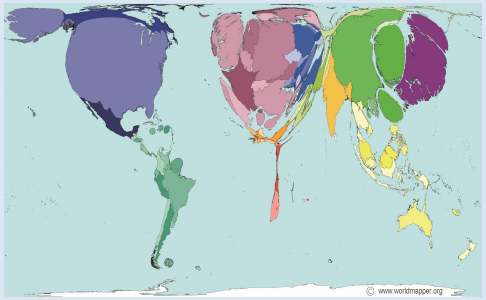
Network Solutions for Challenged Environments

Mobility @ Michigan
http://mobility.eecs.umich.edu/

Meanwhile in Madagascar



WorldMapper.org, Internet Users, 2002

Developing countries have poor network access
- Simple tasks unpleasant
- Rich media prohibitively difficult

Bandwidth and cost, orders of magnitude difference

Most common way to connect: shared dialup
- 10-15 Kbps on a good day
- Loooong waits

What gives?

Ignore half the possible audience?
- Not if we can help it!

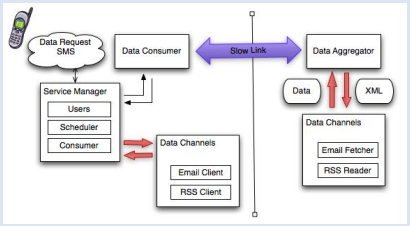
What can we work with?
- Cell phones are widely available
- Storage is more abundant than bandwidth
- Capacity differs in time, across nodes
- People are predictable

Personal CDN

Several attempts to ease poor connectivity
- P2P caching, data staging etc.
- All rely on commonality of requests
- Person 'A' requests, person 'B' Benefits

Unfortunate for personal data

Our system supports
- A hinting mechanism
- Resource scheduling
- A simple plug-in architecture for channels



Deployment

Implemented and deployed
- Addis Ababa, Ethiopia

Several data channels

Order of magnitude time savings

Moving forward:
- Automatic hints
- Context of data use
- Useful for mobile devices

Bulk Data

Makes up significant part of data transfers

Picasa Windows Live amazon web services

How to send data in challenged networks?

Two related approaches
- Ad hoc networks
  - Good at using mobility
  - Ignore link diversity
- Delay tolerant networks
  - Good at handling diversity
  - Restrict mobility, no division of labor

No incremental and ready to deploy solution

Incremental and Hybrid

Combine all available resources

Started with a large scale human mobility study
- 100,000+ users tracked
- Efficient, decentralized model

Weak connectivity
- Network feedback
- Maintaining up to date routes

Good connectivity, when available:
- Route shortcuts
- Last mile delivery

We get significant time savings, better delivery