

# Searching the World Wide Web in Low Connectivity Communities

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Libby Levison

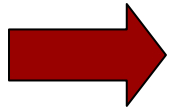
Massachusetts Institute of Technology



# Web search

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- Alternative information sources exist
- Web search replaces other info sources
- Existing telecomms infrastructure



Optimized for fast delivery

# Search: low-connectivity communities

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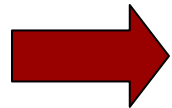
- Few sources of information
- Web could provide information access
- But - little infrastructure:
  - Telephone
  - Electric

# Costs

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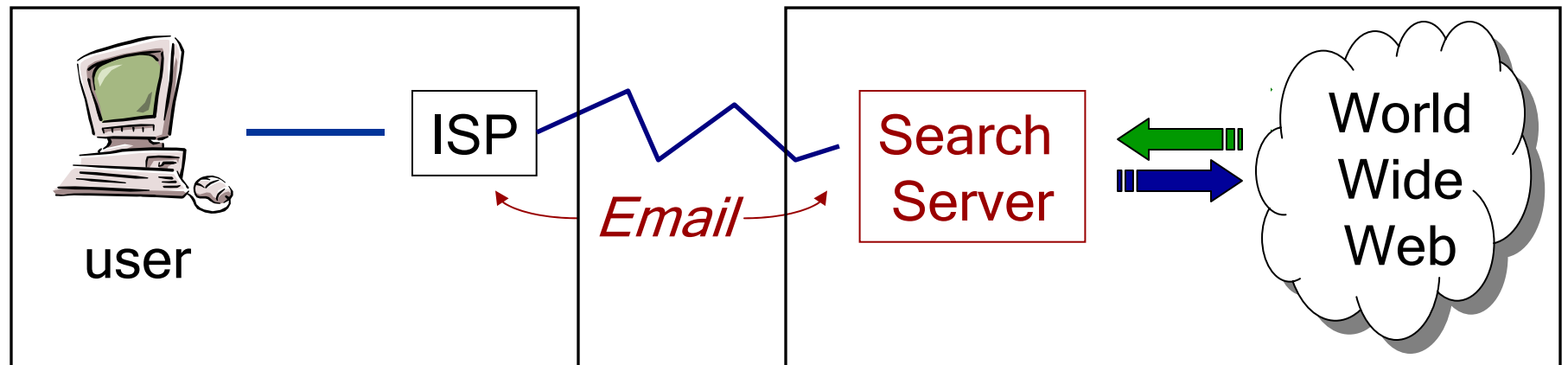
High-bandwidth search in low-connectivity settings

- Cost of infrastructure
- ISP access fees
- Telephone fees



Is the goal still fast delivery?

# Proposal: email-based search



- User searches on local machine
- If information not found,  
email query to Server on Internet.
- Server performs search, returns results
- Results downloaded from ISP
- User reads results off-line

# The TEK Search Engine

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**T = K**

**time equals knowledge**

# Talk Outline

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- Introduction
- **TEK Implementation**
- Rationale
- TEK for the Global Community
- Discussion

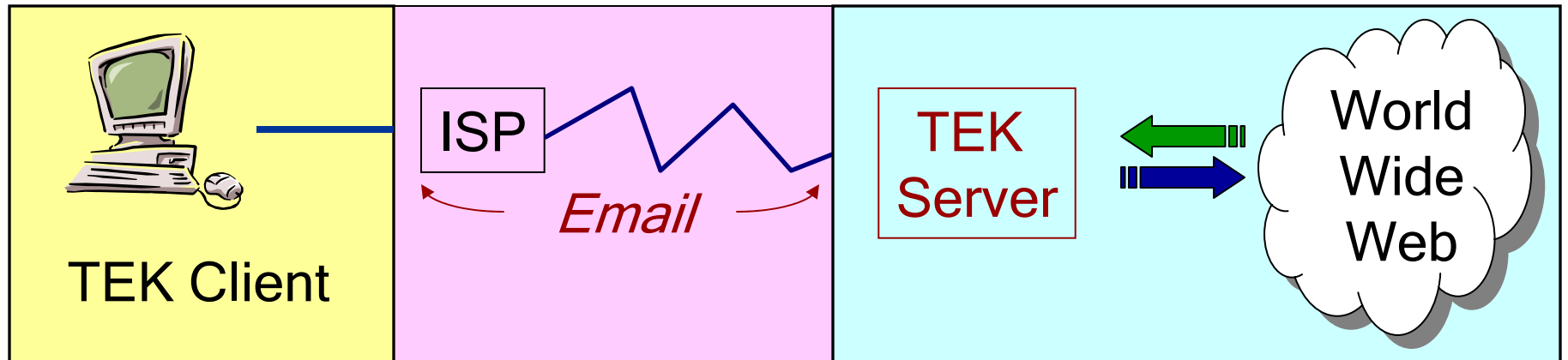
# TEK Design Goals

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- Reduce dependence on telecomms
  - Low & intermittent connectivity
  - Low-bandwidth
- Reduce number of Internet searches
- Similar to existing search engines
- User friendly



# TEK: Time Equals Knowledge

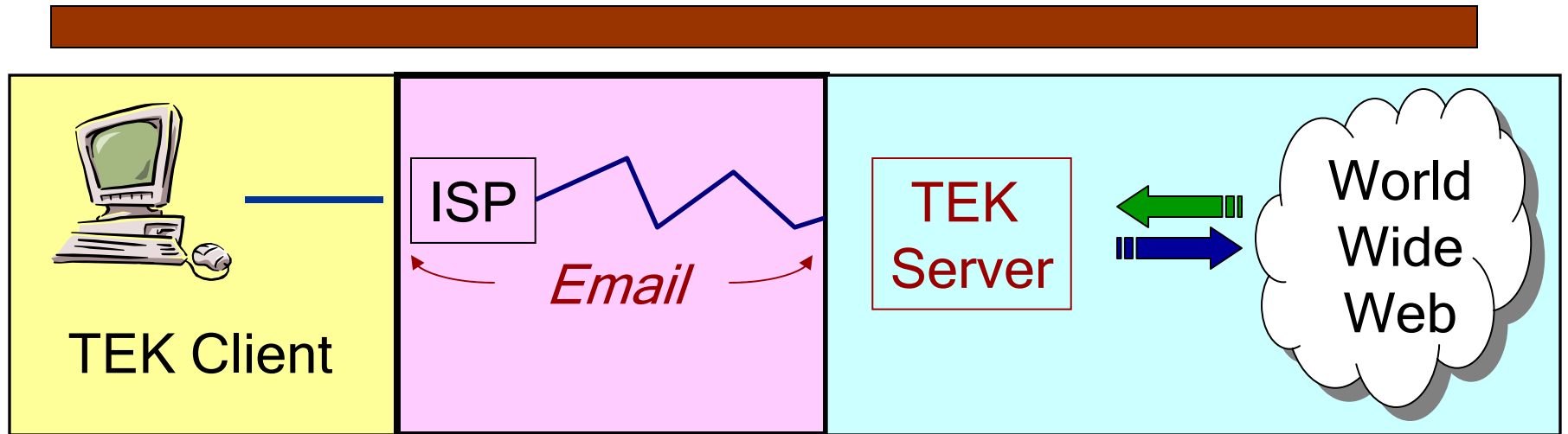


Decouple search from Internet access:

1. TEK Client: user interface
2. Email protocol: transfers info via email
3. TEK Server: finds, returns results

Demo

# TEK Protocol



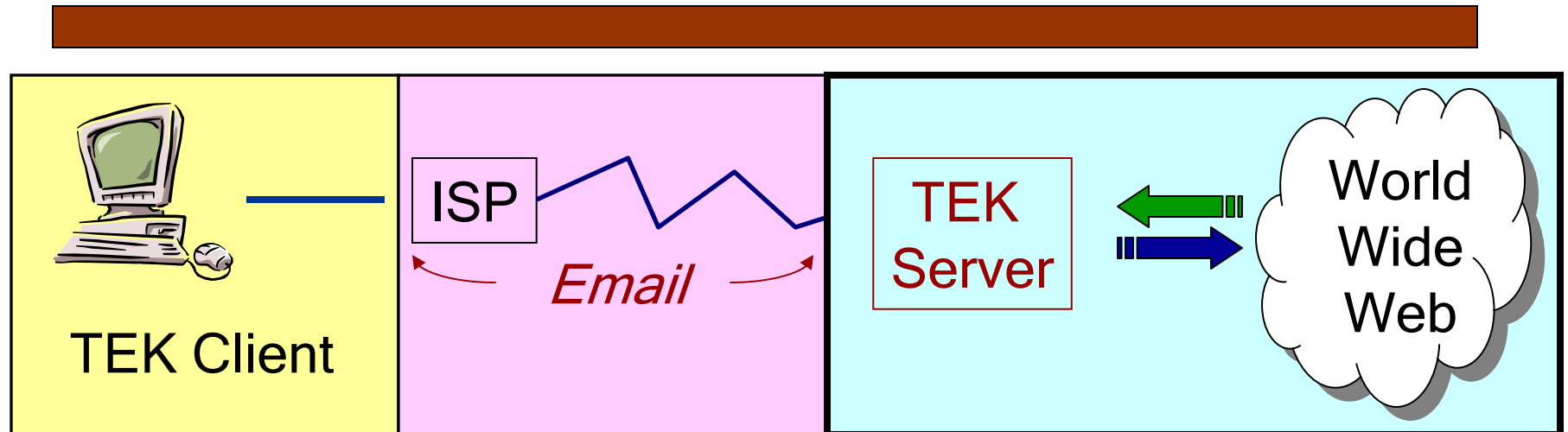
- Email *not* reliable: messages get lost
- TEK Protocol tracks all messages

# TEK Protocol

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- Runs on both TEK Client and TEK Server
- Request-reply model
- If no reply, automatic retransmission
- Other functions:
  - Client Registration
  - Administration messages

# TEK Server



- Receives information request
  - General search, page fetch
- Finds & returns information
- Provides front page navigation tool

# TEK Server

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Goals: 1. Reduce bandwidth  
2. Send best content

- Remove duplicate pages
- Remove extraneous code
- Select authority pages over hubs

# TEK Server: Track Client state

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- Record all client search requests
- Record all URLs sent to client
- Checks all candidate URLs,  
does not send previously sent URLs

# TEK: Summary

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- Low-connectivity
- Low-bandwidth
- User friendly
- Similar to existing search engines
- Manageable amount of information



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# Rationale I: Decreased Cost

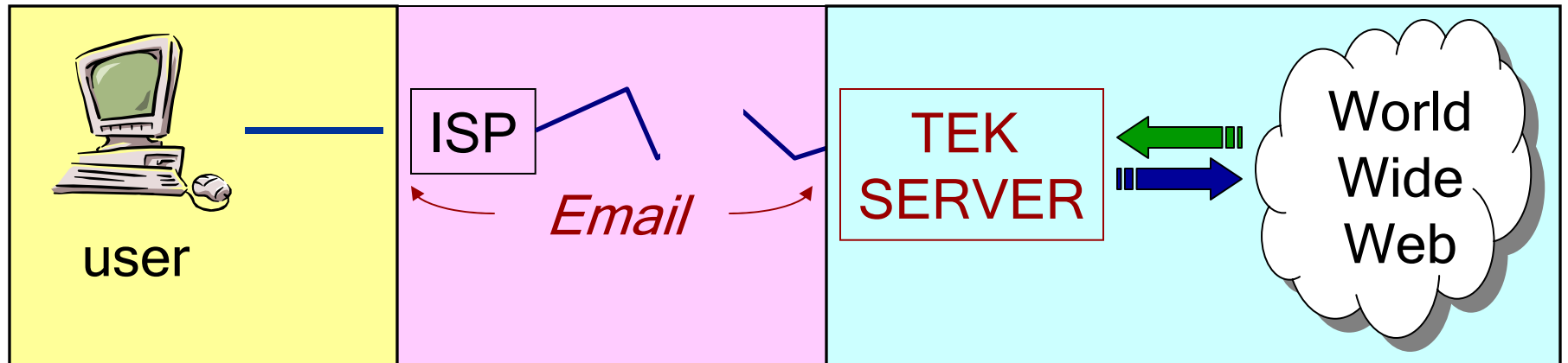
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- Connection time is shorter
- Email-only accounts less expensive
- Call ISP at will:
  - Calls cheaper, lines less-noisy, off peak
- Local web cache prevents some searches

# Email and Internet rates

	Email only (month)	Internet (month)	
Armenia Arminico	\$8.50	\$42	Night discount: 50%
Malawi E & O	\$15	\$30	
Sri Lanka LankaNet	\$11	\$15	Extra hours: \$1.32 peak \$0.88 off peak

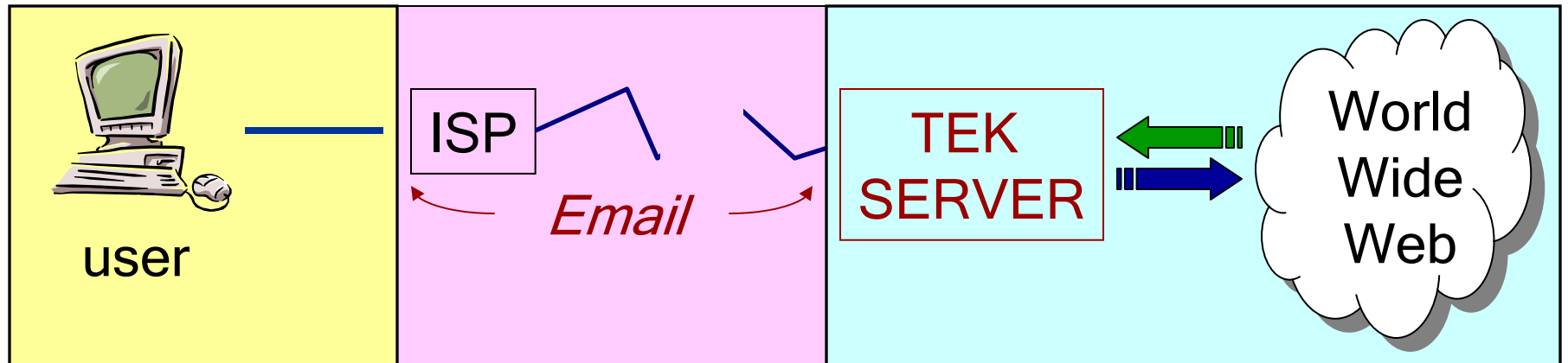
# Rationale II: Improved Reliability



Email as communication medium:

- Never need continuous path from client to server

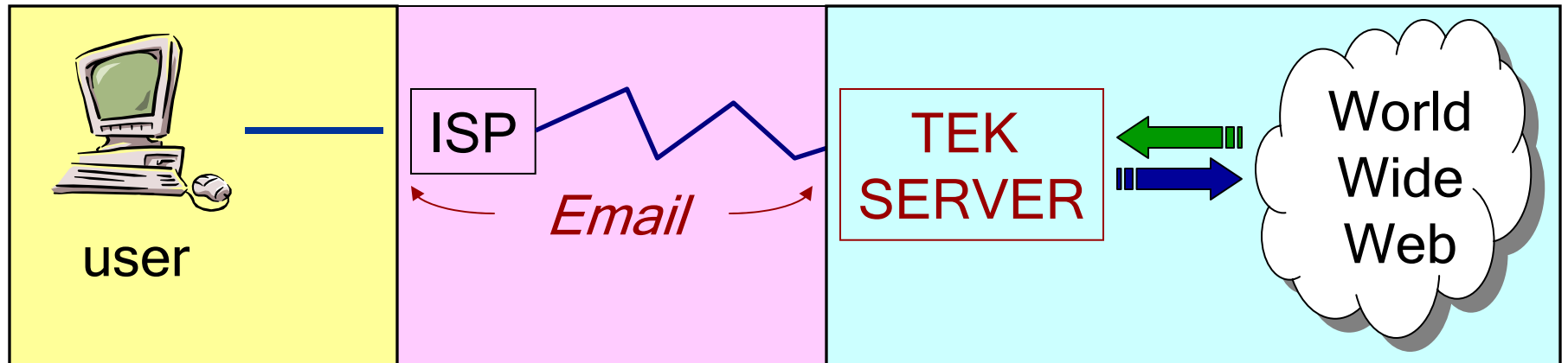
# Rationale II: Improved Reliability



Email as communication medium:

- Never need continuous path from client to server
- Reduce dependence on global network

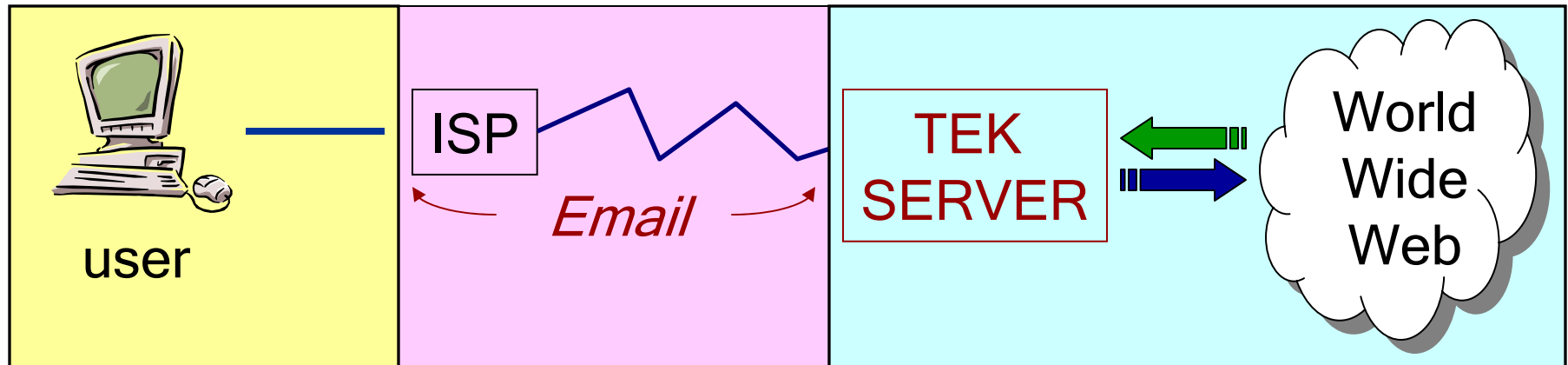
# Rationale II: Improved Reliability



Email as communication medium:

- Never need continuous path from client to server
- Reduce dependence on global network
- Store and forward

# Rationale II: Improved Reliability



Email as communication medium:

- Never need continuous path from client to server
- Reduce dependence on global network
- Store and forward
- Asynchronous

# Rationale III: Improved Convenience

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- View results offline : quick, reliable
  - Build local URL library
  - More people can use computer
- Send email during off peak hours
- Filtered results returned by TEK Server
- Manageable amount of information



# Talk Outline

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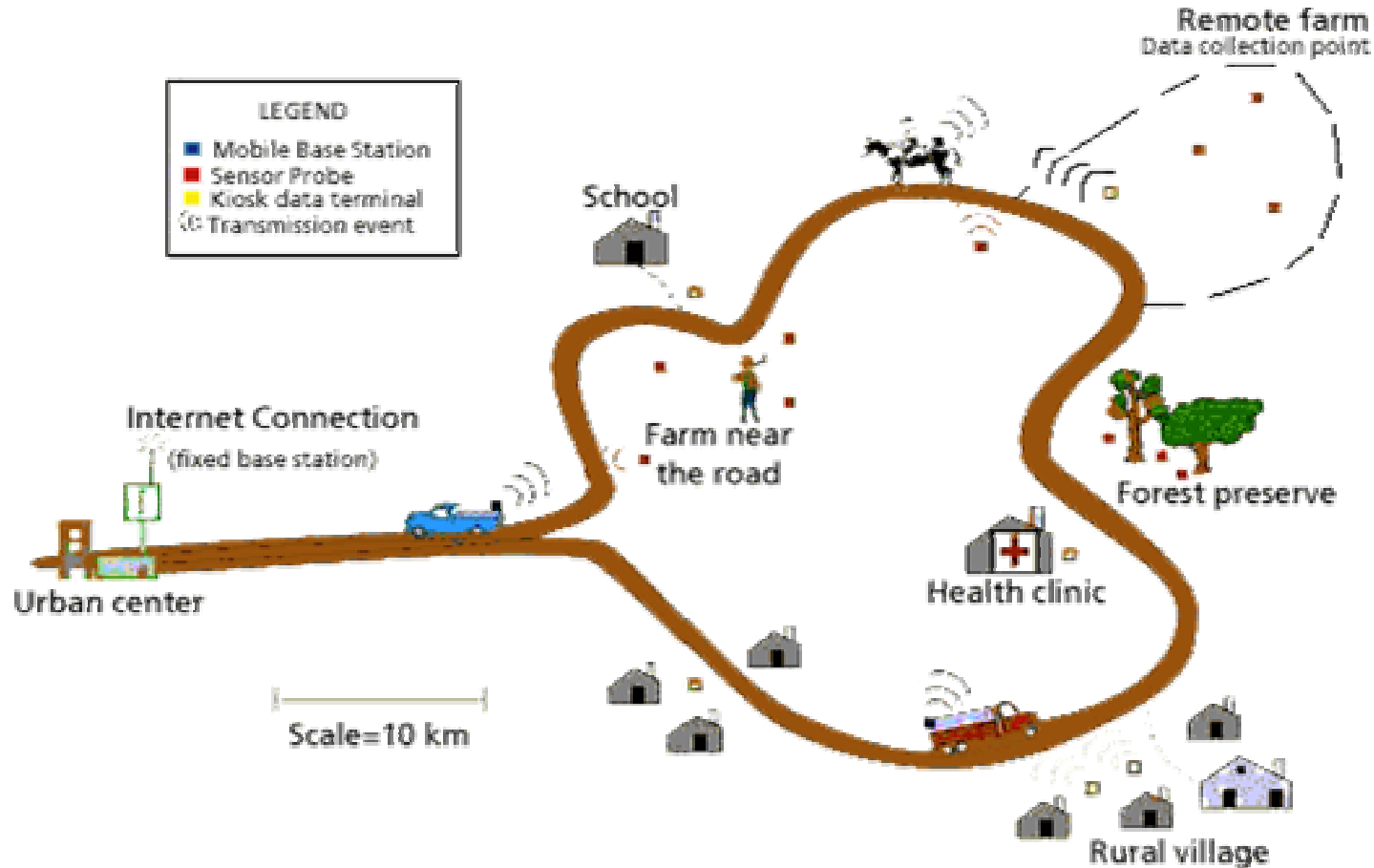
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# TEK for the Global Community

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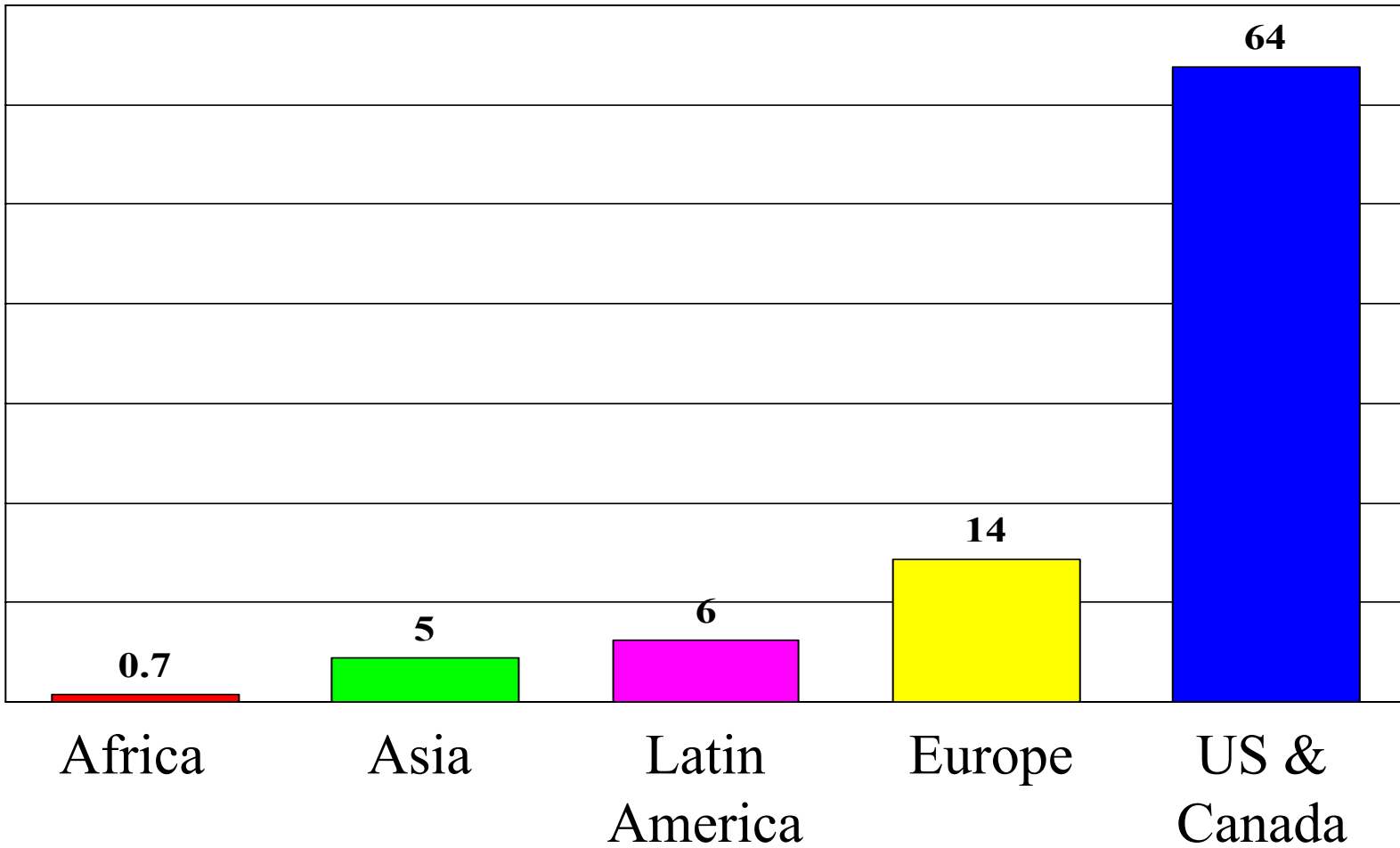
- Extends Web search to email-only users
- Extend still farther:
  - collect outgoing emails on diskette,
  - take diskette to Internet

# Applications: DakNet



Fletcher & Hasson, 2002

# Percentage population online



2001 data

# Appropriate Information Technology

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- “Technology that fits”
- Need to understand:
  - What technology is possible
  - What technology, infrastructure exist
  - Cultural context
- Numerous technical challenges,  
if we can find them

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# Open Issues

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- TEK: Web search only
  - Access must be bi-directional
- Different cultural information needs
- Summarization
- Send graphics on request

# Summary

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- TEK: email-based Search engine
  - More affordable
  - More reliable
  - More convenient
- Extends access to Web search
- TEK: Appropriate Info Technology
- Alpha deployment this summer



# TEK Participants

- William Thies
- Janelle Prevost
- Tazeen Mahtab
- Genevieve Cuevas
- Saad Shakhshir
- Bihn Vo
- Alexandro Artola
- Yuliya Litvak
- Sheldon Chan
- Sid Henderson
- Mark Halsey
- Damon Berry
- Libby Levison
- Saman Amarasinghe



