

Searching the World Wide Web in Low Connectivity Communities

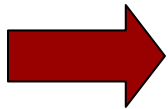
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Massachusetts Institute of Technology



Web search

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



Optimized for fast delivery

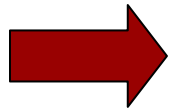
Search: low-connectivity communities

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

Costs

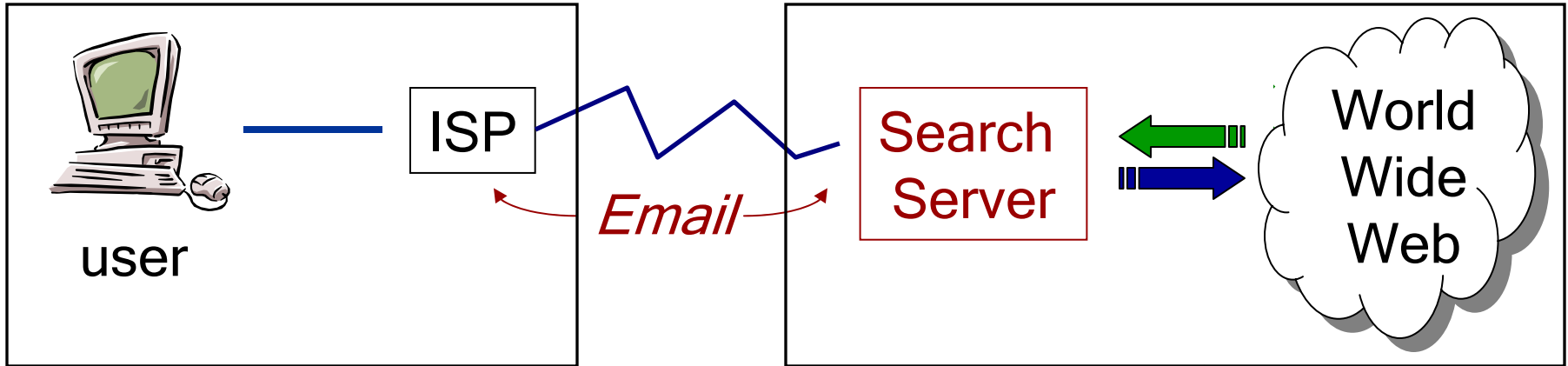
High-bandwidth search in low-connectivity settings

- 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

T = K

time equals knowledge

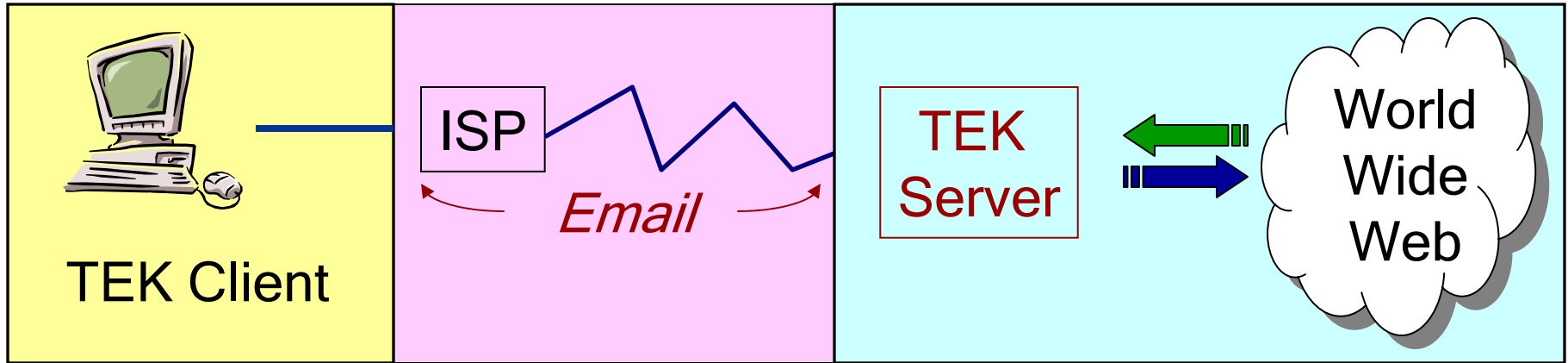
Talk Outline

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

TEK Design Goals

- 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

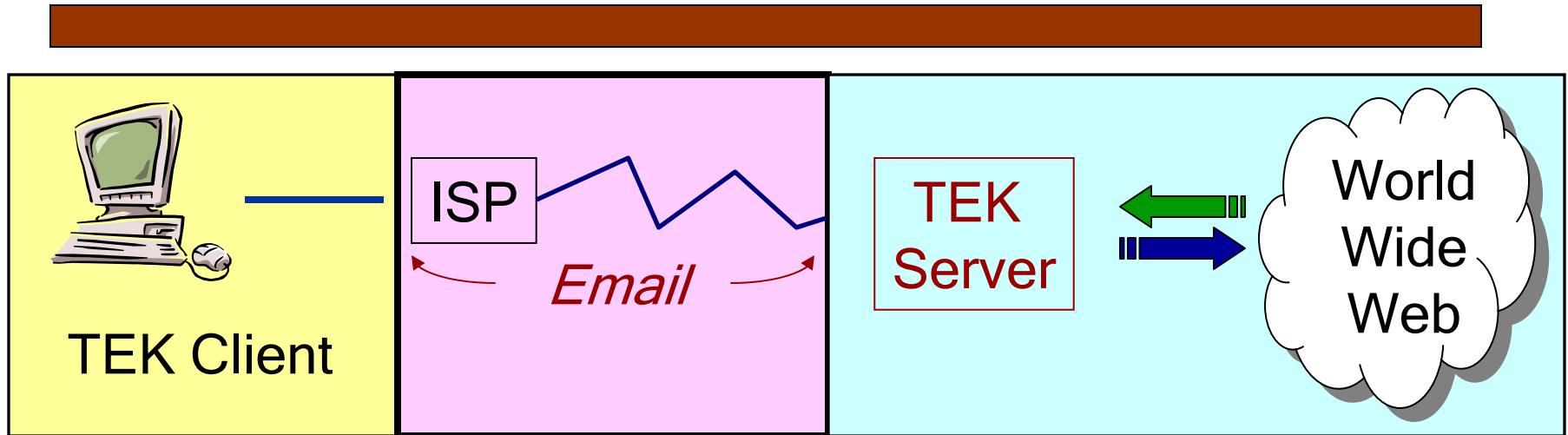


Decouple search from Internet access:

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

Demo

TEK Protocol

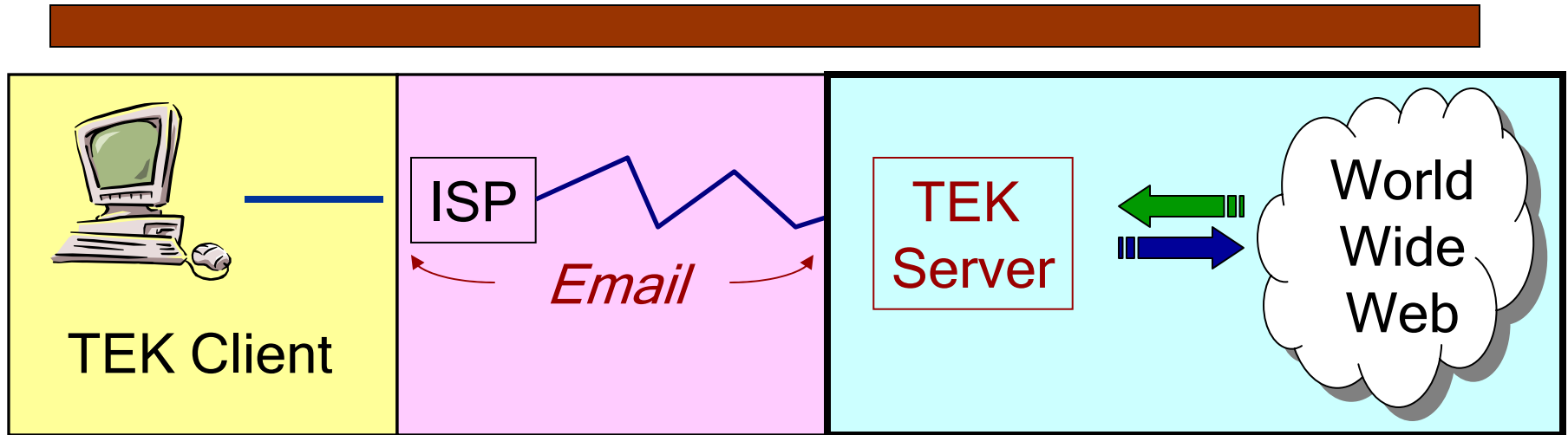


- Email *not* reliable: messages get lost
- TEK Protocol tracks all messages

TEK Protocol

- 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

Goals: 1. Reduce bandwidth
2. Send best content

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

TEK Server: Track Client state

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

TEK: Summary

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

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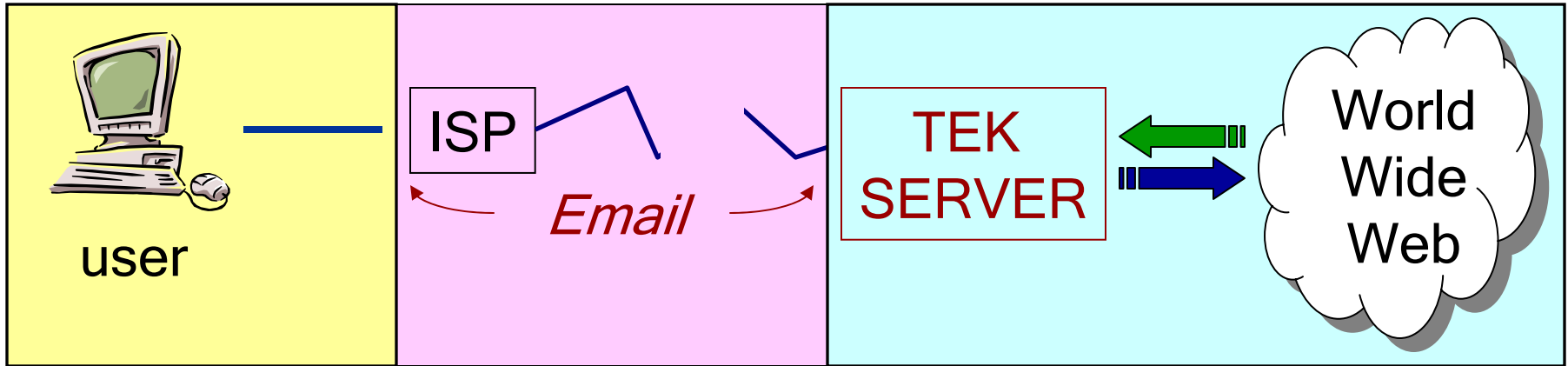
Rationale I: Decreased Cost

- 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

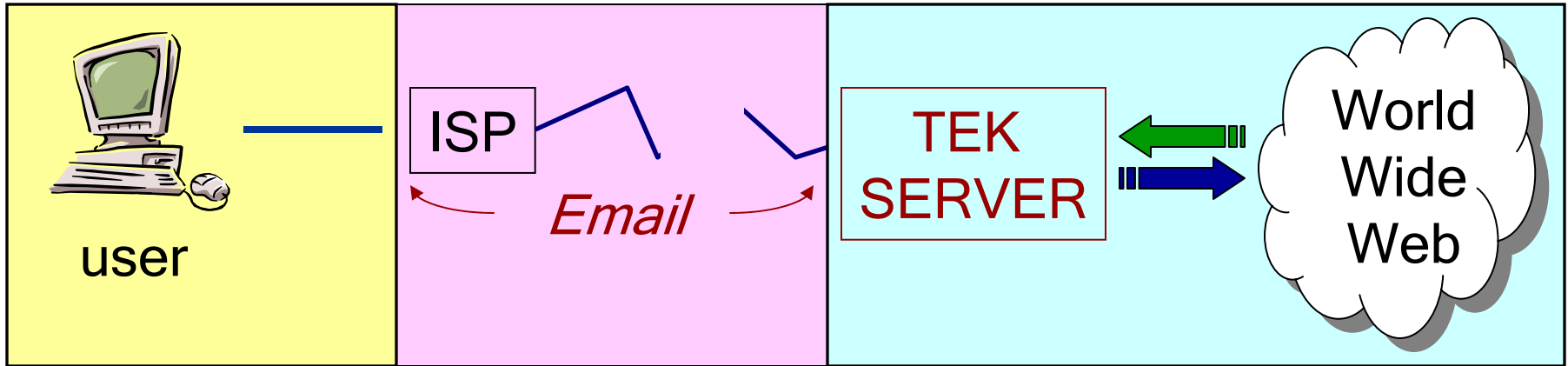
Rationale II: Improved Reliability



Email as communication medium:

- Never need continuous path from client to server

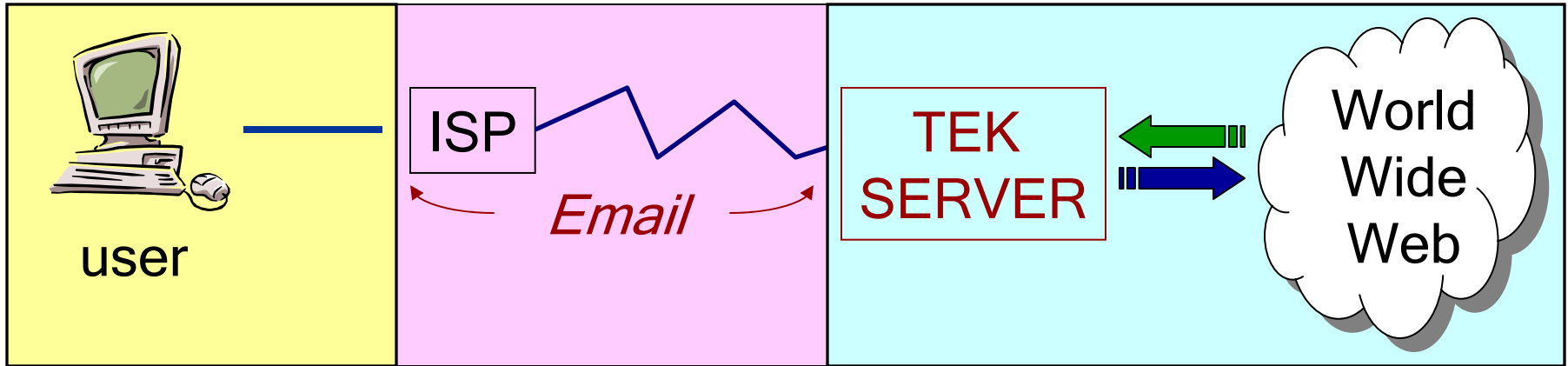
Rationale II: Improved Reliability



Email as communication medium:

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

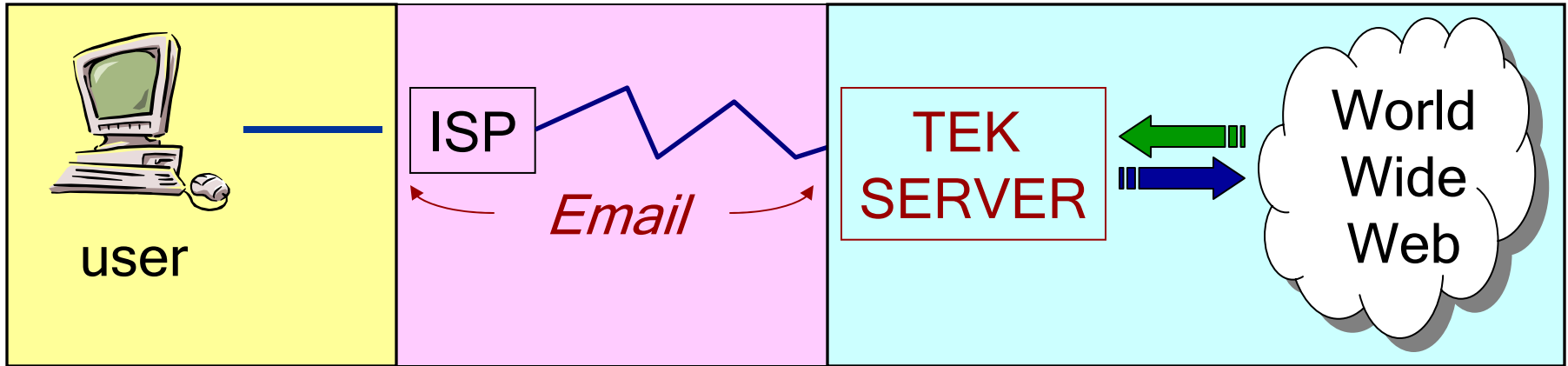
Rationale II: Improved Reliability



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

- 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

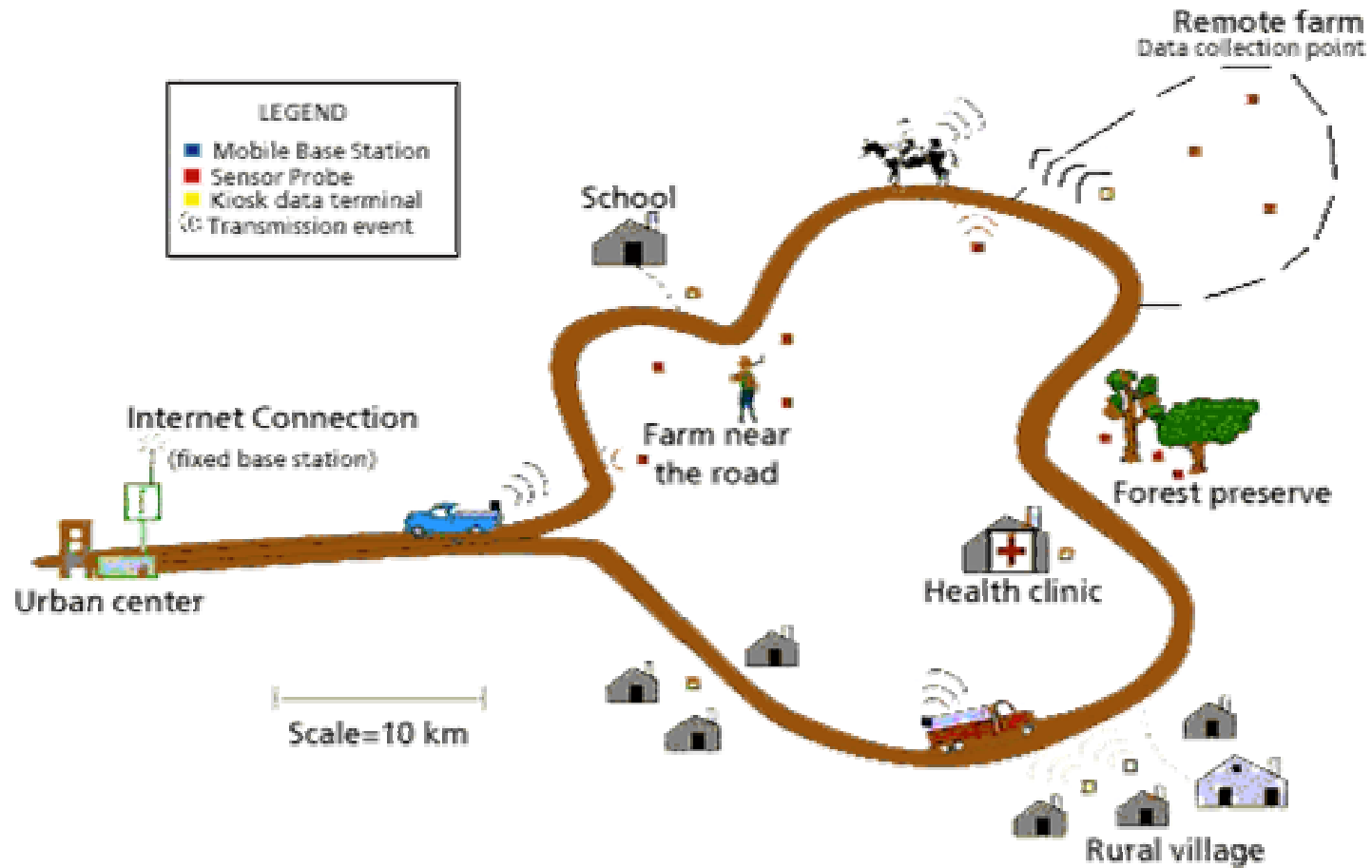
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TEK for the Global Community

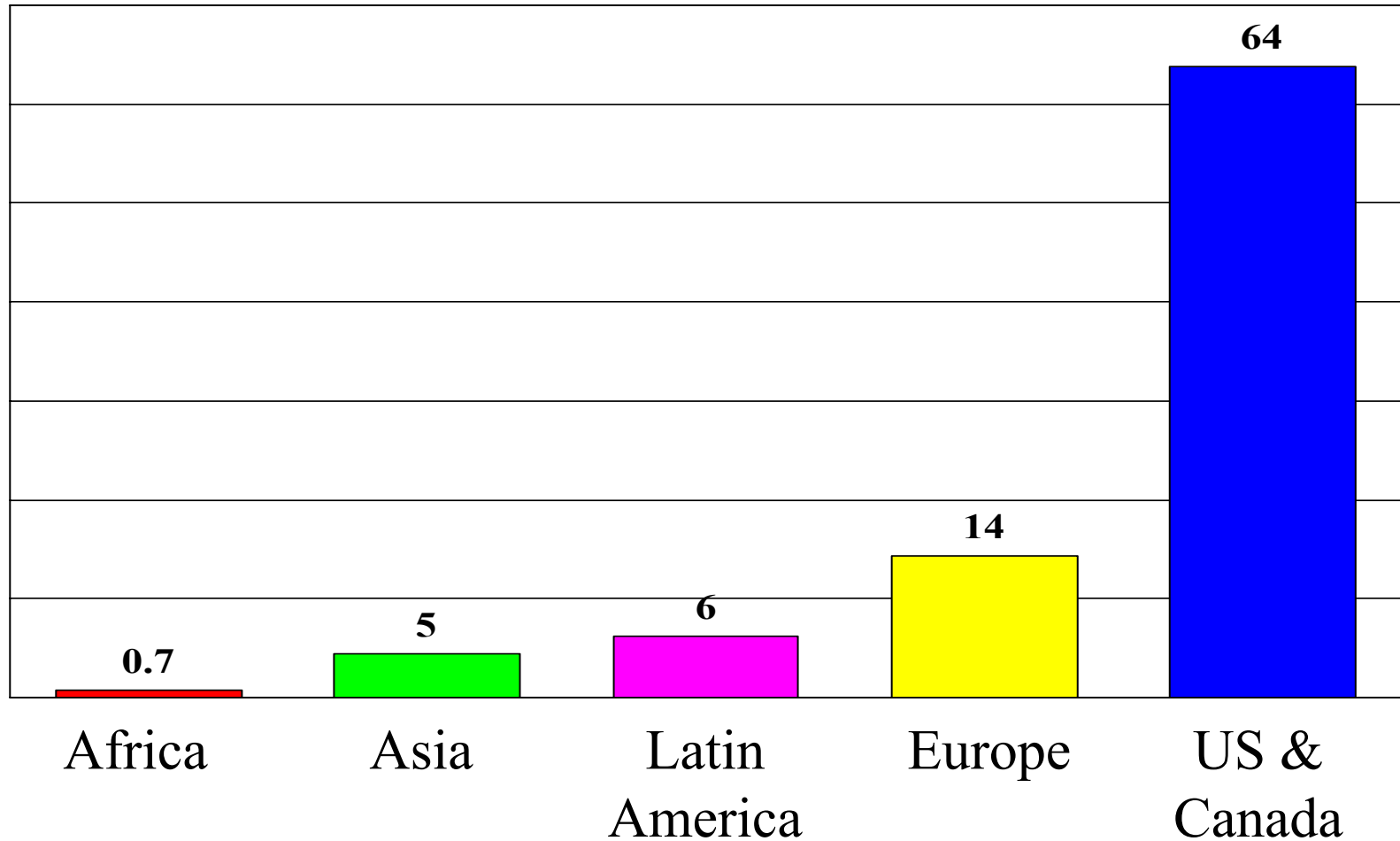
- Extends Web search to email-only users
- Extend still farther:
collect outgoing emails on diskette,
take diskette to Internet

Applications: DakNet



Fletcher & Hasson, 2002

Percentage population online



2001 data

Appropriate Information Technology

- “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

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

Summary

- 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
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