Information and Communications Technology for Development: Digital Divide

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Purpose of the Lectures

- We'd like to identify some guiding principles for working in ICT4D
  - Concepts and distinctions to use in carrying out research
  - Useful modes for thinking about case studies
- We'll be presenting some of them
- You should try to identify others.

Outline

Digital Divide

How to bridge the Digital Divide

Conclusion (Software Engineering ☺)

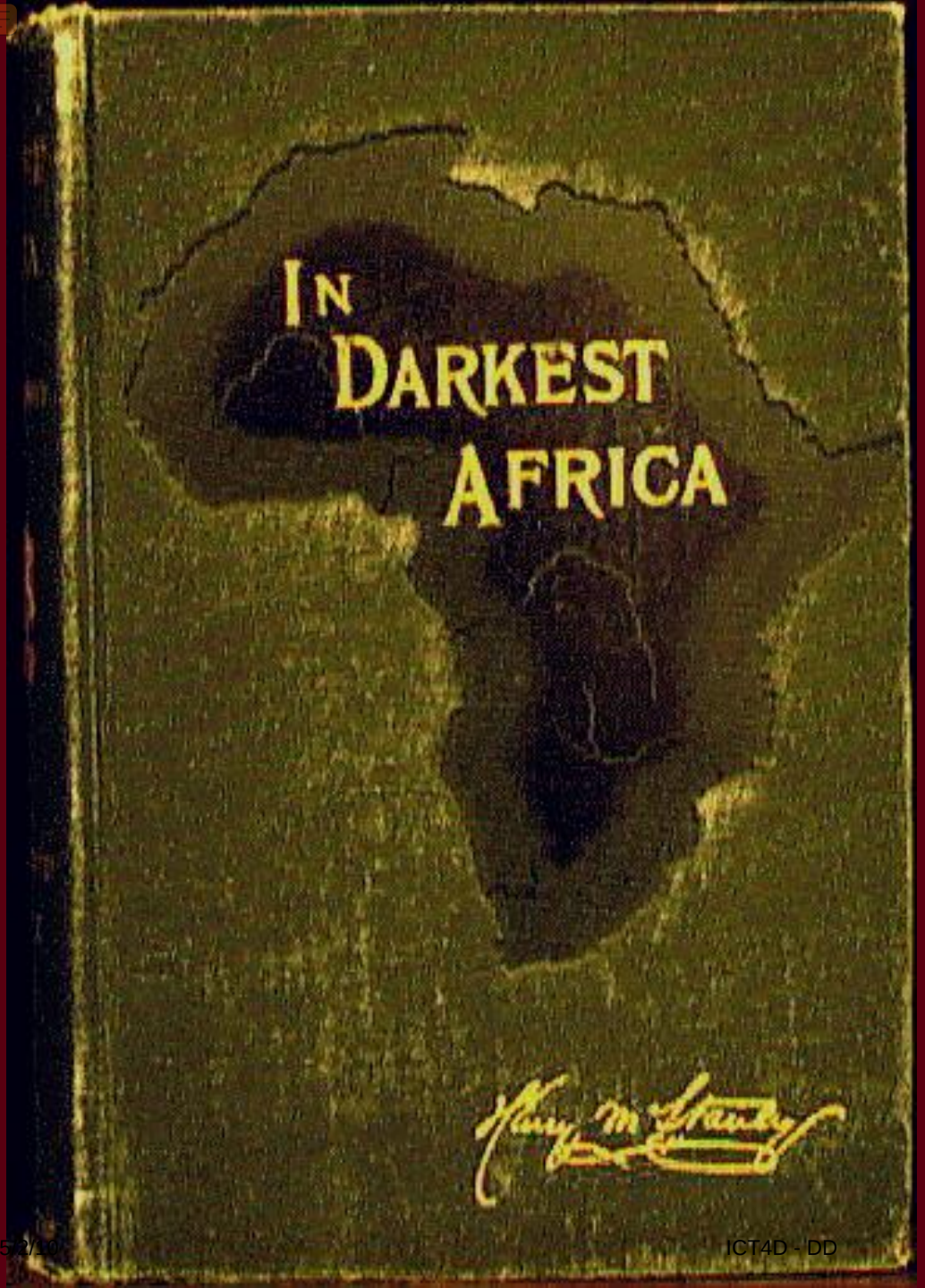
Potential

Characteristic of a *Developing Country* is the need for better and more equitable access to resources

Define an *Information Society* as the desired outcome of the information revolution sparked by ICT

Knowledge resources can potentially be distributed to the *have-nots* without taking away from the *haves*.

ICT can be used in a developing country to extend the distribution of scarce knowledge resources.



The privilege of historic backwardness – and such a privilege exists – permits, or rather compels, the adoption of whatever is ready in advance of any specified date, skipping a whole series of intermediate stages.
Leon Trotsky, 1932–3

Who Chooses the Goals?

Building an Information Society demands the formulation of clear goals for society

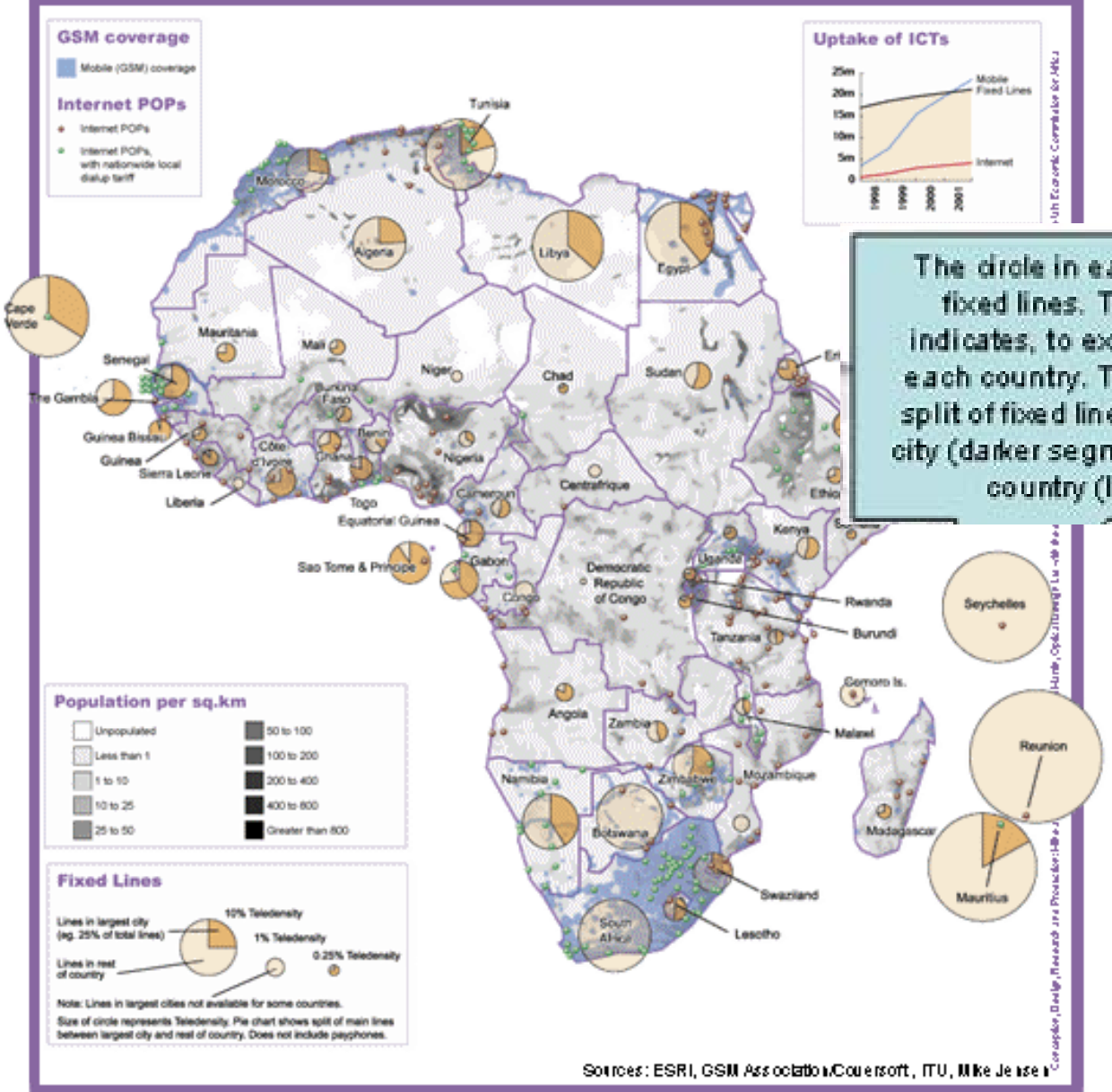
- Technology cannot be appropriately applied if what is appropriate is not known
- But whatever those societal goals, we can assume that ICT can provide a cost effective way of reaching *some* of those goals.

What is the Digital Divide?

The disparities in the penetration of the Information Society

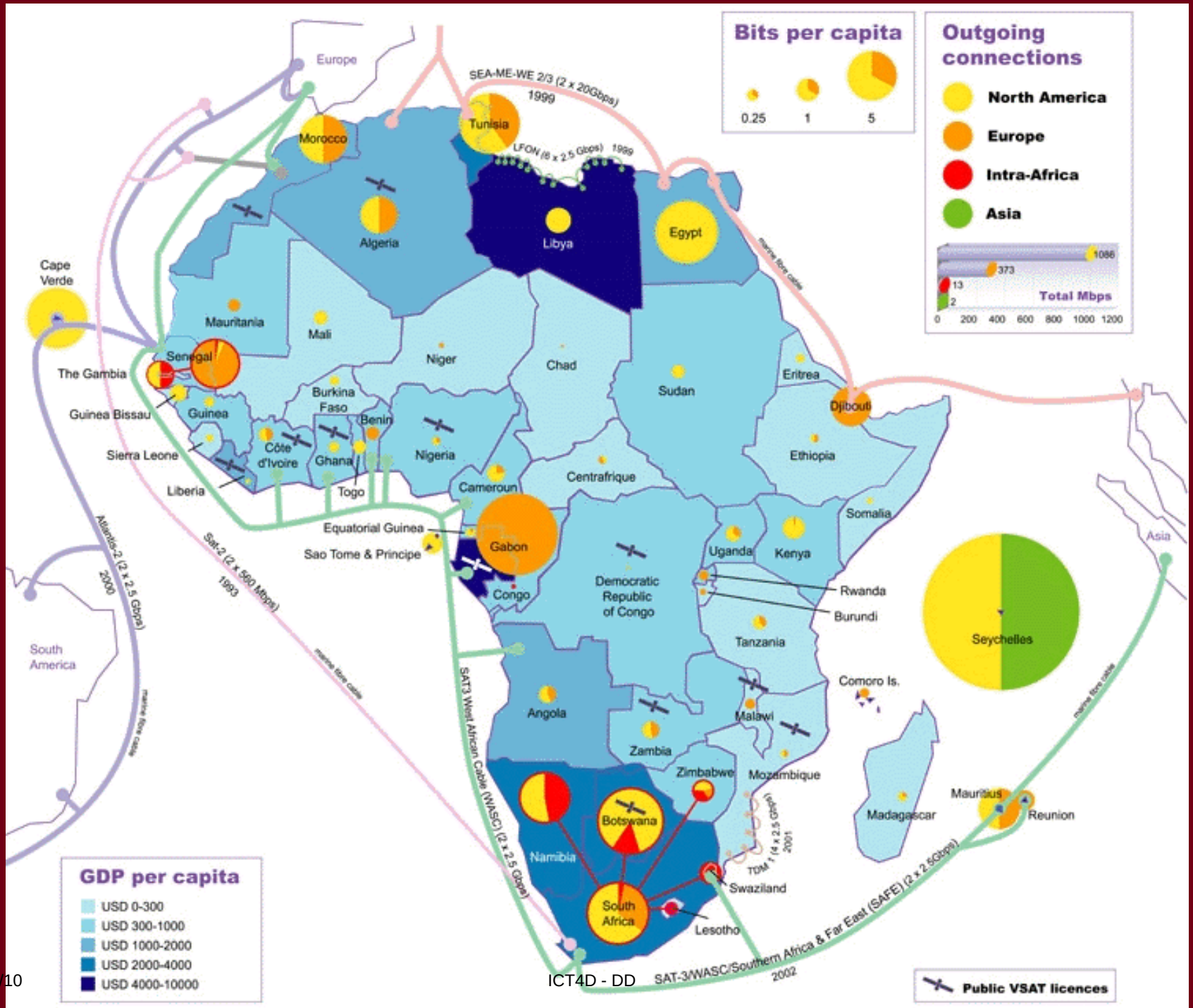
- disparities in the access and use of ICT
- it is the growing gap between those who have access to the Information Society and those who are deprived of such access

The Status of Teleaccess: **Inside Africa**



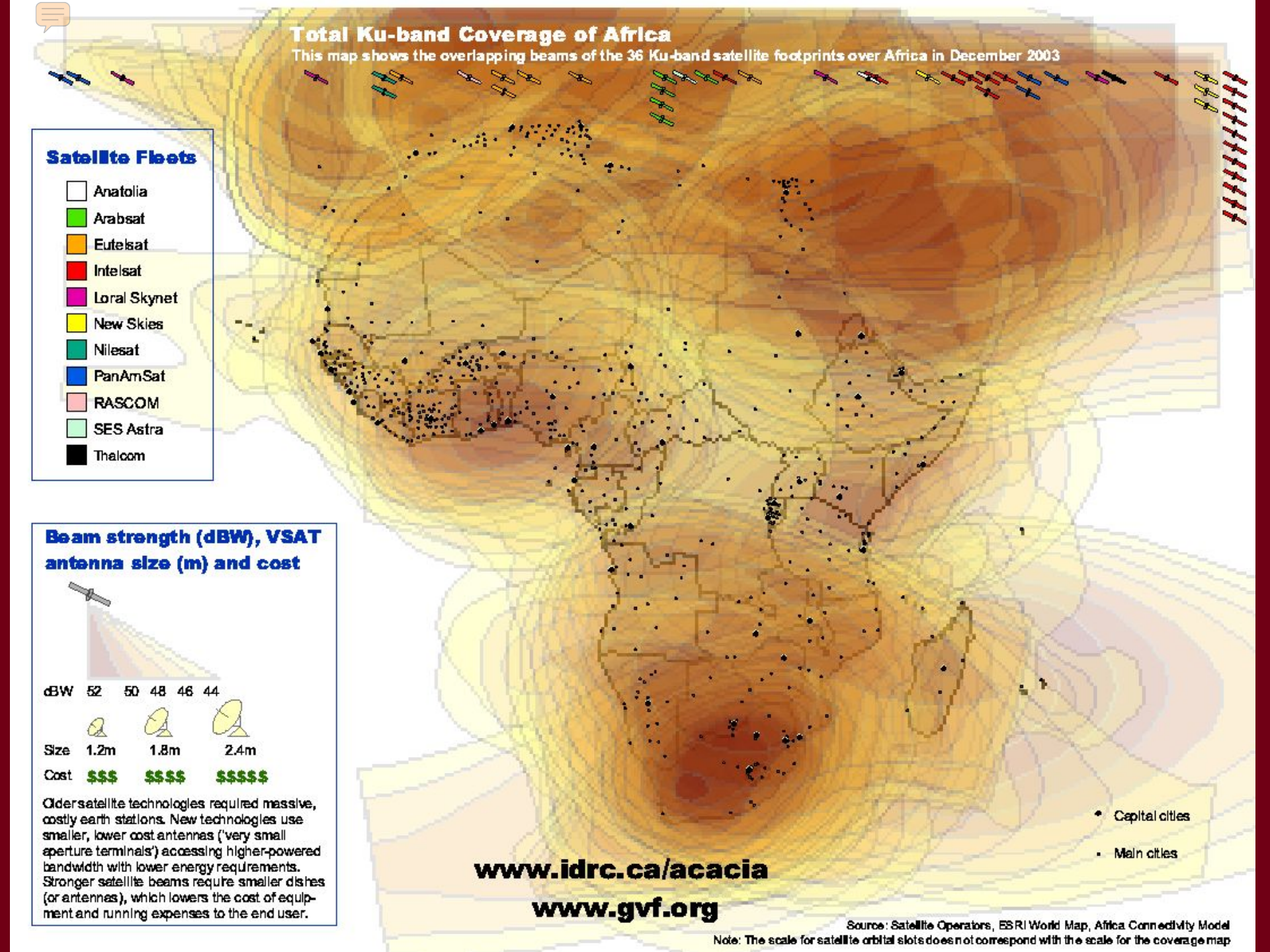
The circle in each country represents fixed lines. The size of the circle indicates, to exact size, teledensity in each country. The pie chart shows the split of fixed lines between the largest city (darker segment) and the rest of the country (lighter segment).

IDRC CRDI | Acacia | www.idrc.ca/acacia | Canada


Bits per capita
0.25
1
5
Outgoing connections
North America
Europe
Intra-Africa
Asia
1086
373
13
2
Total Mbps
0
200
400
600
800
1000
1200
Europe
SEA-ME-WE 2/3 (2 x 20Gbps)
1999
Tunisia
Morocco
LFON (8 x 2.5 Gbps) 1999
Algeria
Libya
Egypt
Cape Verde
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Djibouti
Senegal
The Gambia
Guinea Bissau
Guinea
Burkina Faso
Benin
Nigeria
Sierra Leone
Liberia
Côte d'Ivoire
Ghana
Togo
Cameroun
Centrafrique
Ethiopia
Somalia
Equatorial Guinea
Sao Tome & Principe
Gabon
Congo
Democratic Republic of Congo
Uganda
Kenya
Rwanda
Burundi
Tanzania
Seychelles
Comoro Is.
Asia
South America
Atlantis-2 (2 x 2.5 Gbps) 2000
Sat-2 (2 x 560 Mbps) 1993
marine fibre cable
SAT3 West African Cable (WASC) (2 x 2.5 Gbps)
Angola
Zambia
Malawi
Zimbabwe
Mozambique
Madagascar
Mauritius
Reunion
Botswana
Namibia
South Africa
Swaziland
Lesotho
TDM 1 (4 x 2.5 Gbps) 2001
SAT-3/WASC/Southern Africa & Far East (SAFE) (2 x 2.5Gbps) 2002
GDP per capita
USD 0-300
USD 300-1000
USD 1000-2000
USD 2000-4000
USD 4000-10000
Public VSAT licences

Total Ku-band Coverage of Africa

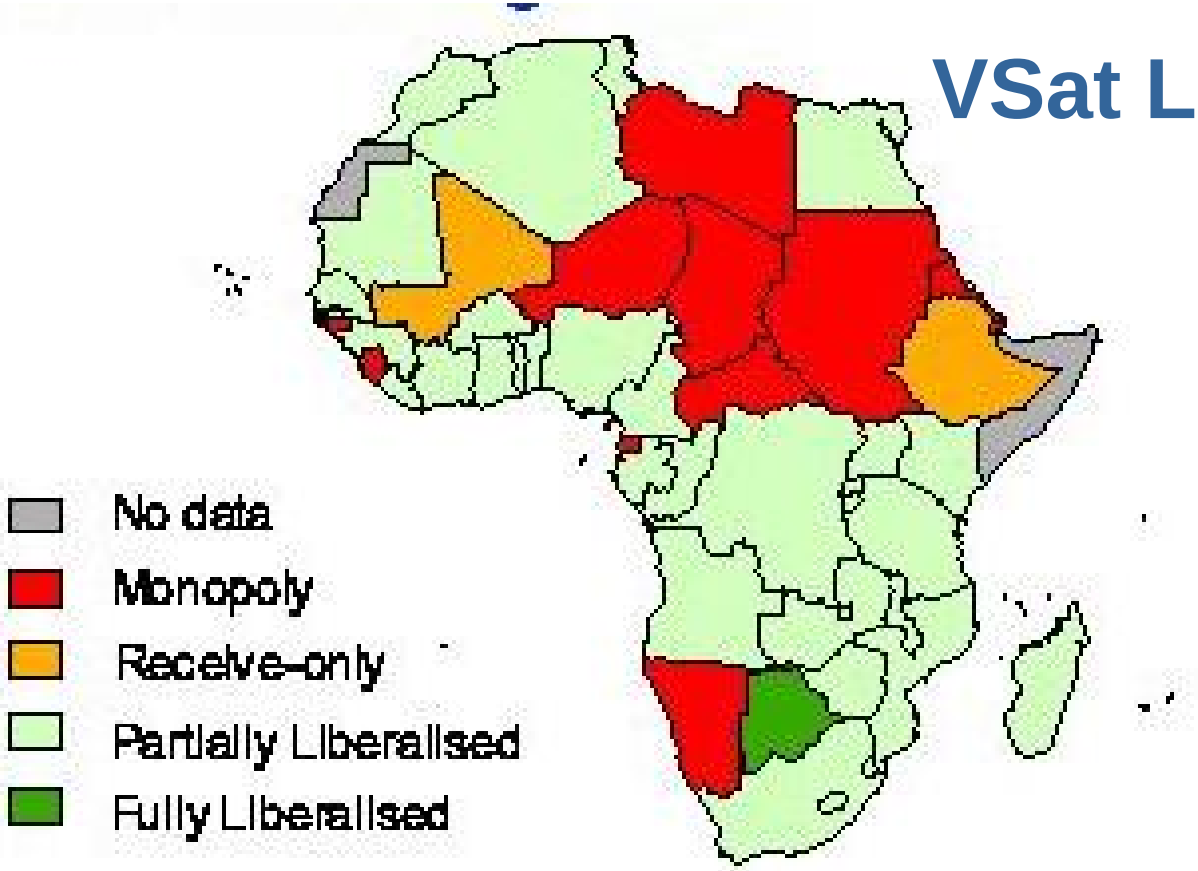
This map shows the overlapping beams of the 36 Ku-band satellite footprints over Africa in December 2003



Source: Satellite Operators, ESRI World Map, Africa Connectivity Model

Note: The scale for satellite orbital slots does not correspond with the scale for the coverage map

VSat Licensing Status

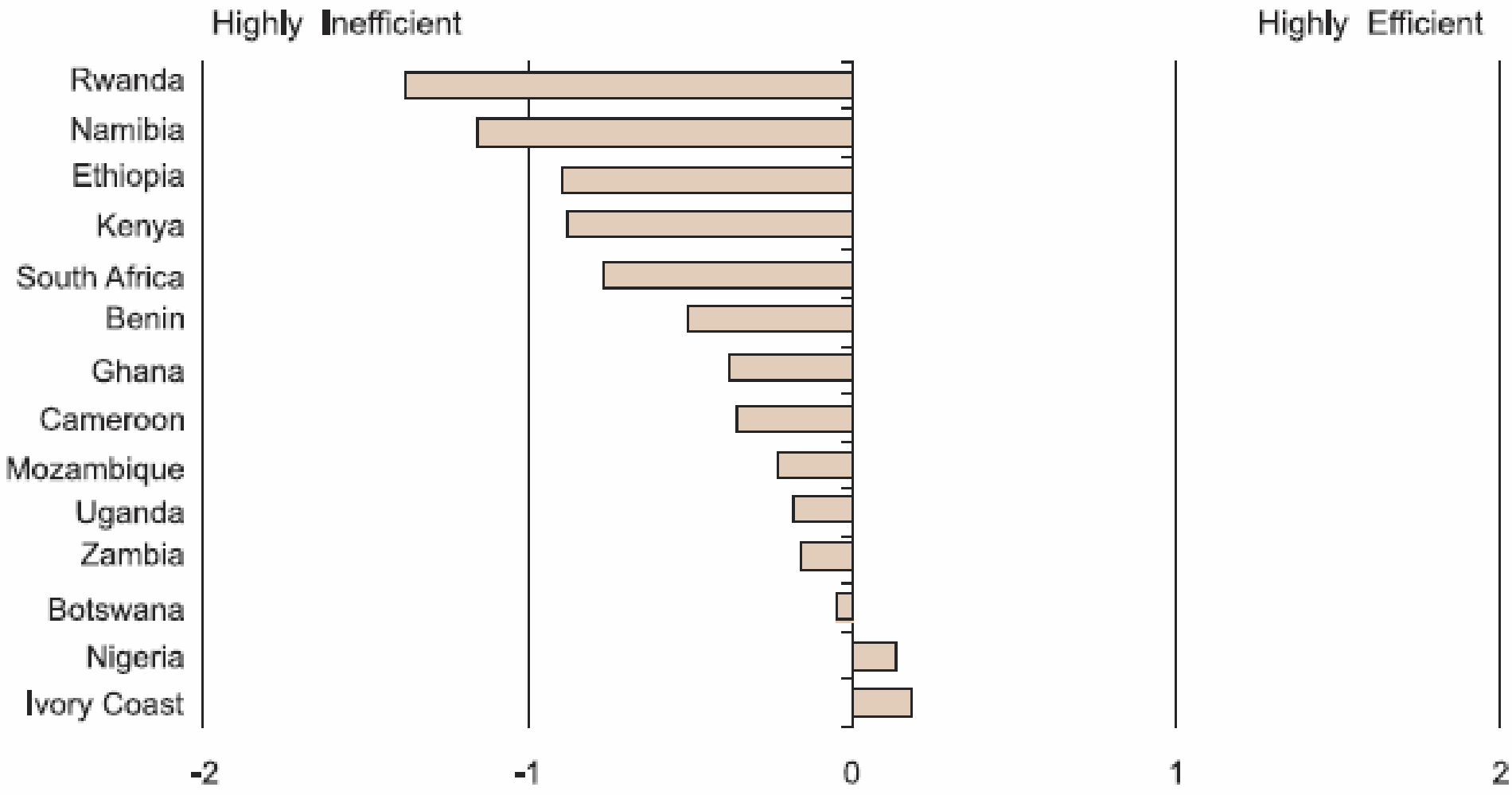


VSAT liberalisation allows some groups other than incumbent telco's to establish satellite services, but with persistent restrictions. This map shows where VSAT services are under monopoly, or have been partially liberalised. Receive-only licences are those where VSAT terminals can receive broadcast or data signals, but cannot send signals. Partially and fully liberalised does not reflect the expansion of an integrated national network as incumbents are not yet obliged to interconnect with new licensees.

Regulator

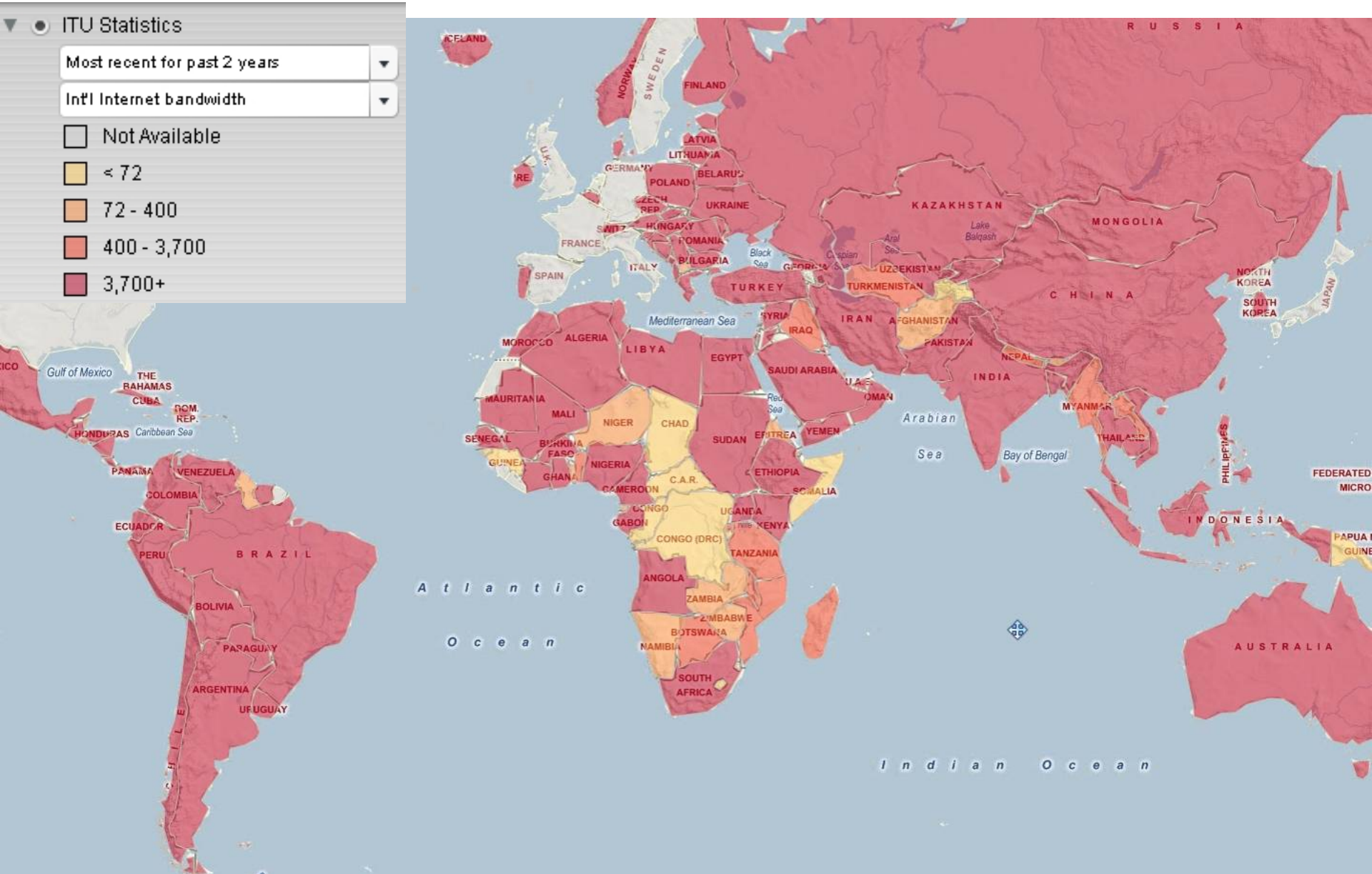
- ICASA
  - Licensing telecommunications, postal and broadcasting service providers,
  - monitoring compliance of licensees,
  - developing policy,
  - managing the frequency spectrum and
  - protecting consumers within the communications environment.
- "Universal Service"
- "Universal Access"

Telecommunication Regulatory Environment Assessment

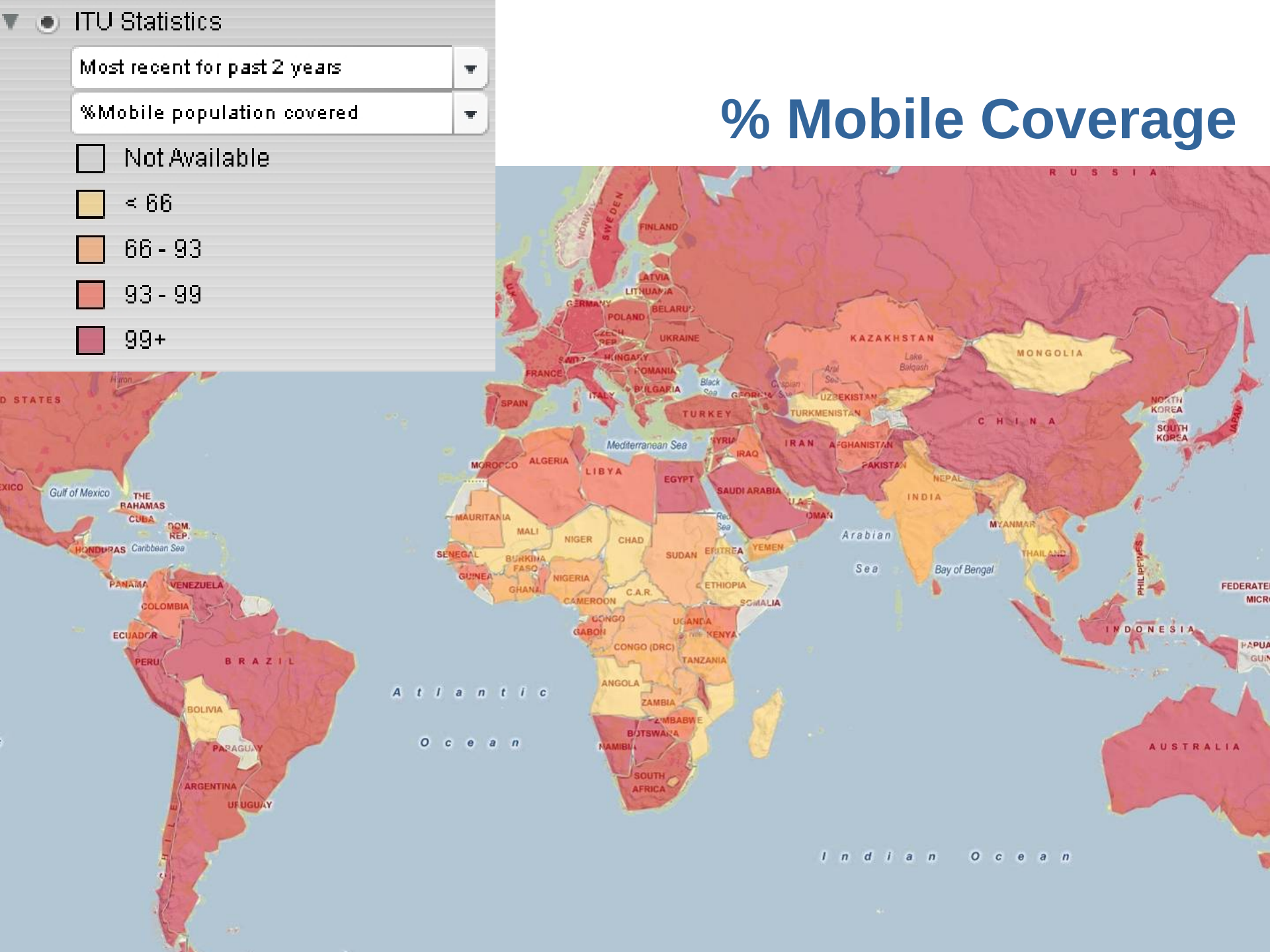



Africa / Libya / Morland / mit allen künigreichen so zü vnsern zeiten darin gefunden werden.
Hispania
Granat
Gades
Sardinia
Mare mediterraneum
Sicilia
Malta
Candia
Cyprus
SYRIA
Libanus
Asia
ARABIA deserta
ARABIA Petrea
ARABIA Felix
Medina
Mare Rubrū
Barbaria
Mauri
Hippa
AFRICA
Regnū Tunis
Carthago
Marmarica
Ammon
Alexādria
Cyrene
AEGYPTVS
Syene
Nilus fl.
Insule Canarie
Budezor
Niger palus
Nigrita
Dara fl.
Caput Albū
Hodeni
Tagaza
LIBYA Interior
Lacus Libyae
LIBYAE desertum
NVBIAE Regnum
Nubia
Meroe
Regnum Senega
Capu Virde
Regnū Gambrae
Senega fl.
AETH
REGNVM Orguene
REGNVM Habesch
Hamarich Sedes Pre te Iohan
REGNVM de Seylam
Calamansa regio
Ginega
Regnum MELLI
Imperiū Nebeorum
Cotia
Sinus Rubrus
Monoculi
REGNVM Melinde
Azania regio
Tellus Psitacorum
QVIOLA Regnum
Zaphala aurifodina
AFRICAE extremitas
Caput bone spei
Vnnd diß groß land / das ein dritten
theil der weldt begreifft / ist zü vnser zeit
ein schiffung erfundenn / die auß Hispa-
nia zü den Canarien inseln / vñ darnach
fürbaß biß zum Caput bone spei / das ist
ein tröstliche schifflendung im ausserstẽ
spitz Africe / vnnd vonn dannen biß gen
Callicuth gath / da här man alle specerey
vnnd gewurtz bringt.

International Internet Bandwidth



% Mobile Coverage



What Causes the Digital Divide?

- Mirrors and exacerbates existing disparities:
  - gaps in education (for example, illiteracy)
  - personal handicap
  - location (rural-urban)
  - gender
  - race
  - income level
- The South African Digital Divide grows out of our history of division and historical backlogs for large groups of people:
  - a particular South African version of colonial history.
- The Digital Divide also arises from global circumstances which apply to all developing countries.

Consequences of the Digital Divide

Reflected in computer systems with

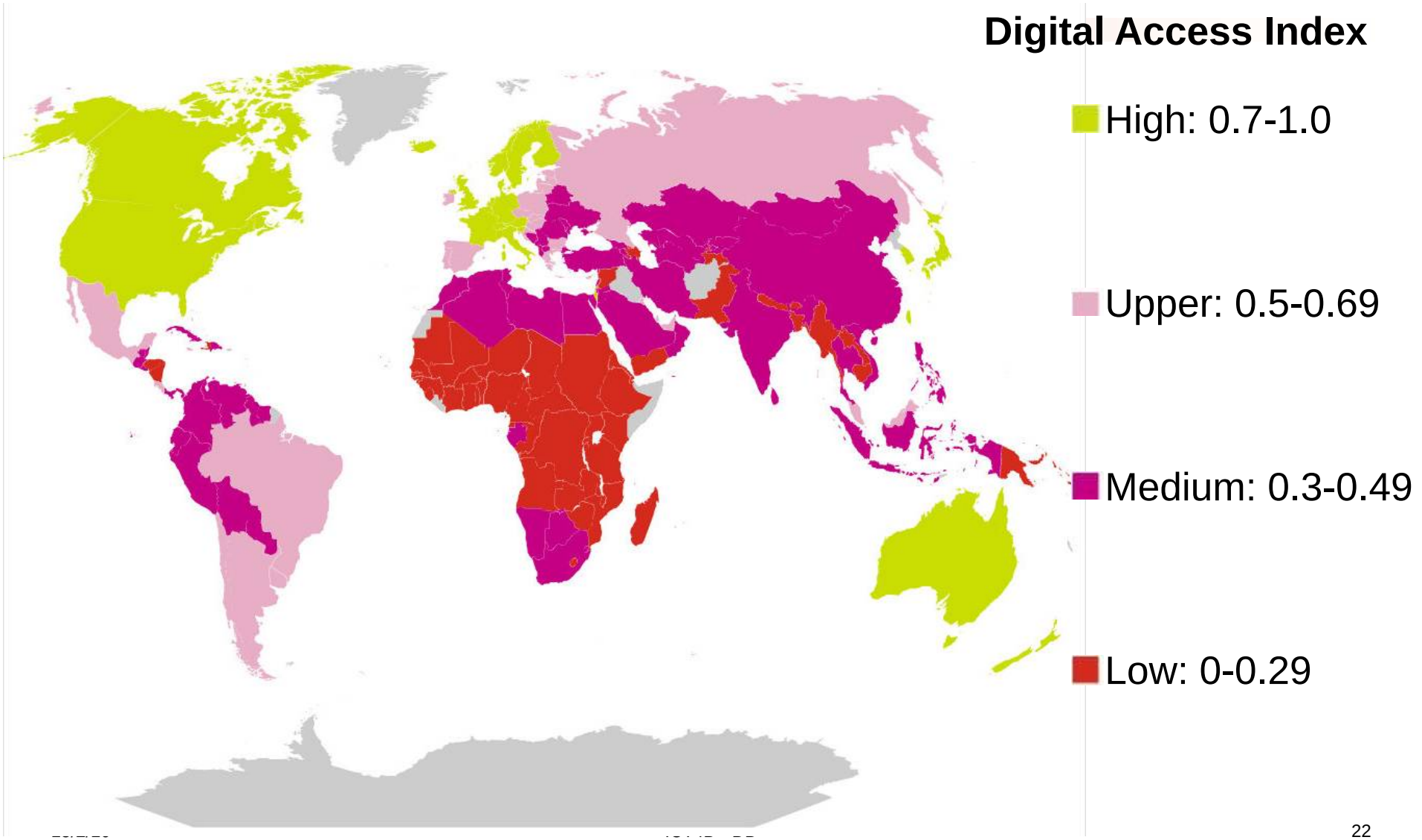
- cultural bias in the applications and contents
- poor digital infrastructure
- inappropriate computer equipment

Aspects of the Digital Divide

Global Digital Divide (international): The global disparity between those countries at the forefront of the Information Economy and the developing countries.

Local Digital Divide (domestic): This refers to the disparities between groups in a particular country

Global Map of Digital Inclusion



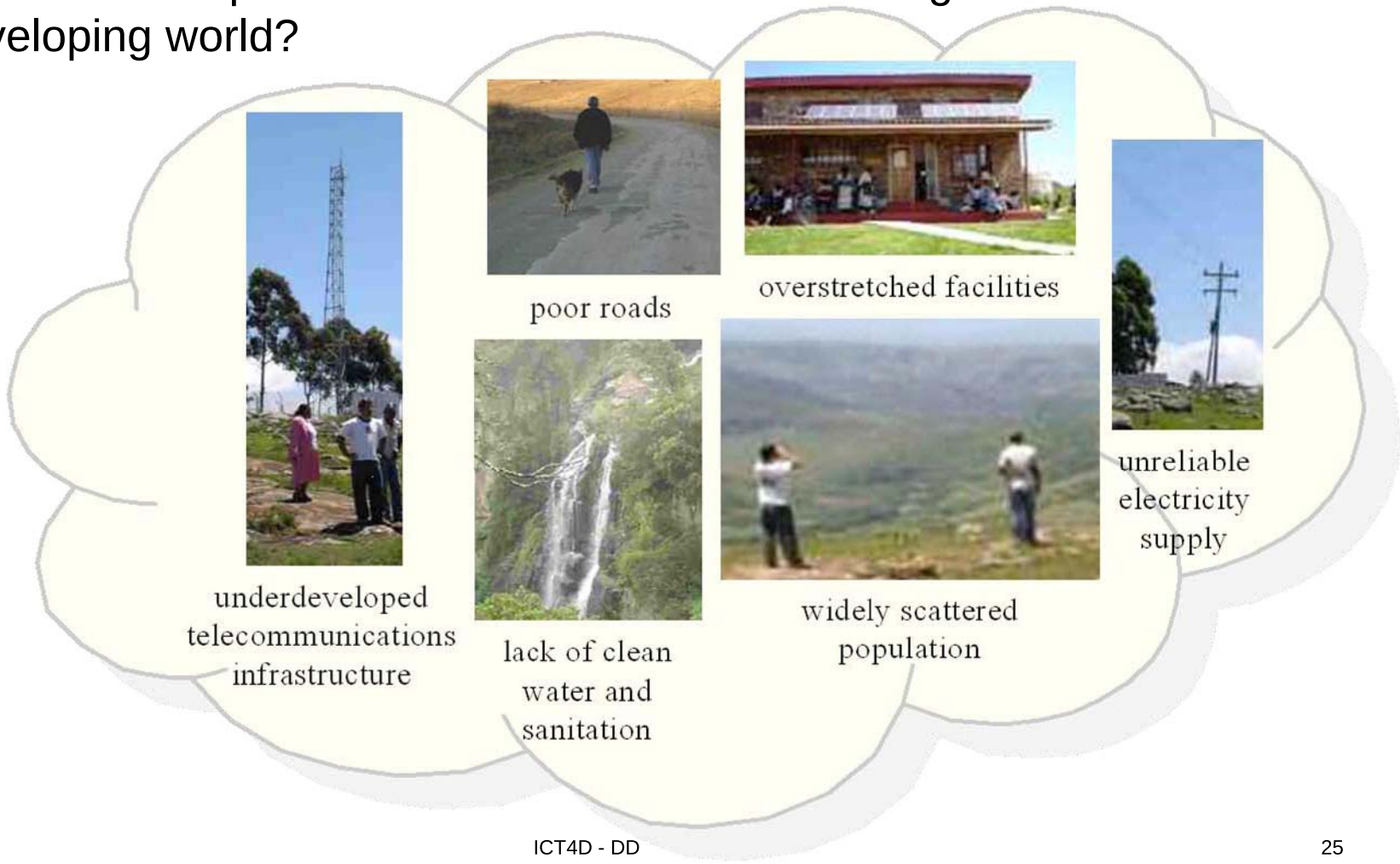
Statistics

- Consider the ICT disparities between developed and developing countries, e.g. between United States and South Africa
- Access to PCs
  - United States, 65.89% of inhabitants
  - South Africa, 7.26% of inhabitants
- Internet usage:
  - United States, 55.13% of inhabitants
  - South Africa, 6.82% of inhabitants
- [taken from World Telecommunication Indicators, issued by International Telecommunications Union, December 2003]

GSM Worldwide

Software Development for Development

- How do we develop software for rural and disadvantaged communities in the developing world?



How to bridge the Digital Divide?

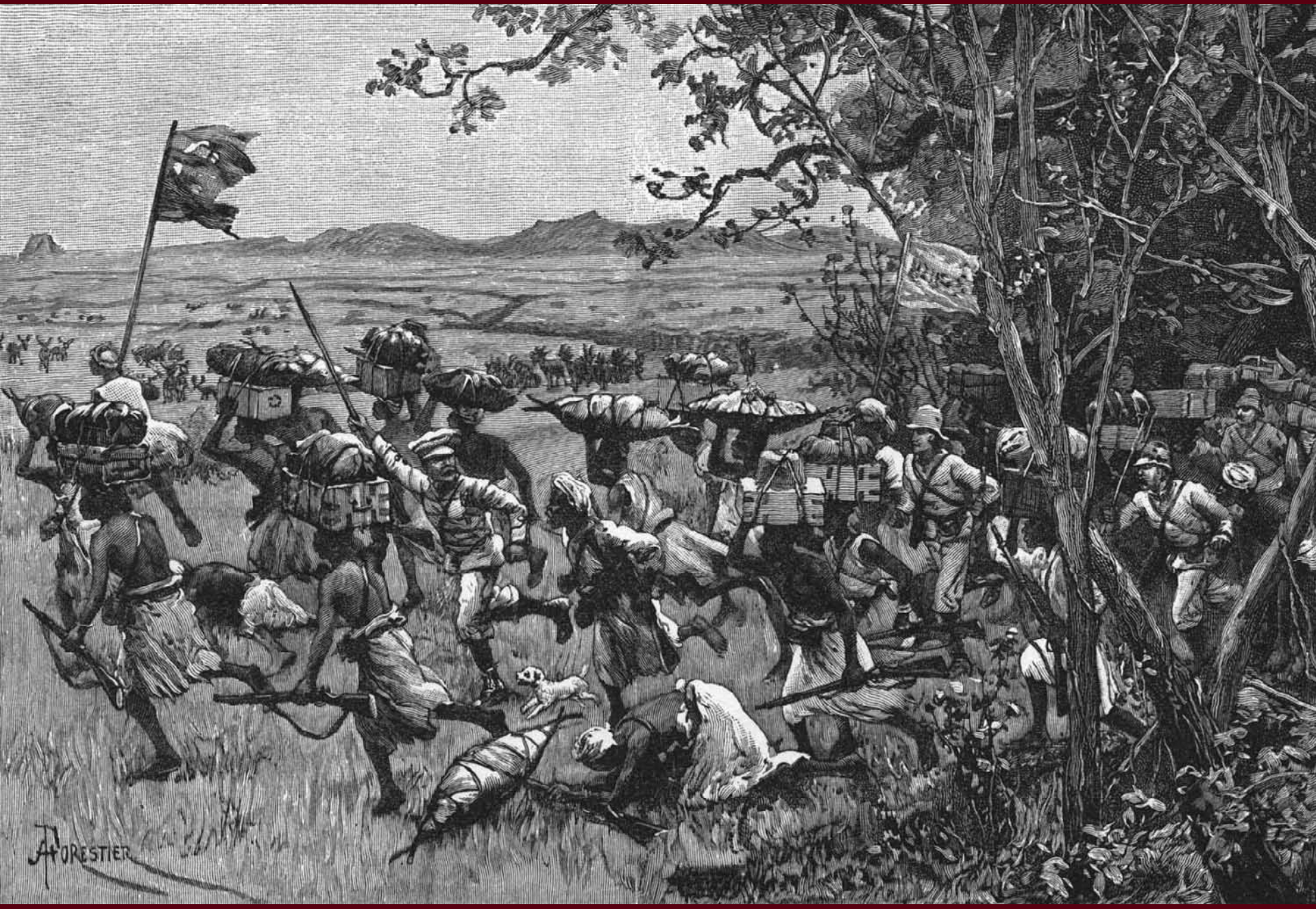
- studies and proposed solutions
  - highlighting the problem and
  - suggesting answers
- on-the-ground initiatives
  - providing sustainable solutions in under-serviced communities
- policy reform
  - government policy needs to change to make ICT more accessible

Failure: Telecentres

- Government and Business have setup a number of telecentres
  - computers labs with phone and fax facilities
  - particularly in the rural areas
- Faced with number of problems
  - lack of adequate security
  - lack of technical support
  - lack of appropriately skilled staff
- Telecentres have largely not served their purpose

One Laptop Per Child (OLPC)

- Initiative of Nicholas Negroponte, Professor at MIT
- Attempt to produce and distribute an affordable laptop which can be distributed to children in developing countries
- Allows children access to knowledge and opportunities to “explore, experiment and express themselves”
- Runs a customised distribution of Linux
- Too early to tell if this is going to work


A. FORESTIER

Questions

- Does the developing world not have more pressing needs?
  - housing, healthcare, food security, climate change
- Should developing world always try to catch up to the latest ICT?
  - should it choose appropriate technologies?
- Is ICT a panacea, or does it have some role or no role to play at all?
  - need an informed approach

Technologies

A few technologies make ICT more accessible:

- Wireless networks
  - doesn't require physical landlines
- Mobile devices - cellphones and PDAs (Personal Digital Assistants)
  - less expensive and easier to use than PCs
- Voice over IP (VoIP)
  - doesn't require sophisticated telecommunications infrastructure
- Open Source Software
  - Cost-effective and can be customised to local needs

Conclusion: Disruptive Technologies

Do you need this in your life?

or “Beware of Geeks Bearing Gifts”

The role of a Computer Scientist is to adapt technologies to the users and their situation.

- That’s your job
- that’s why ICT4D needs you

Conclusion: FOSS$_4$DEV

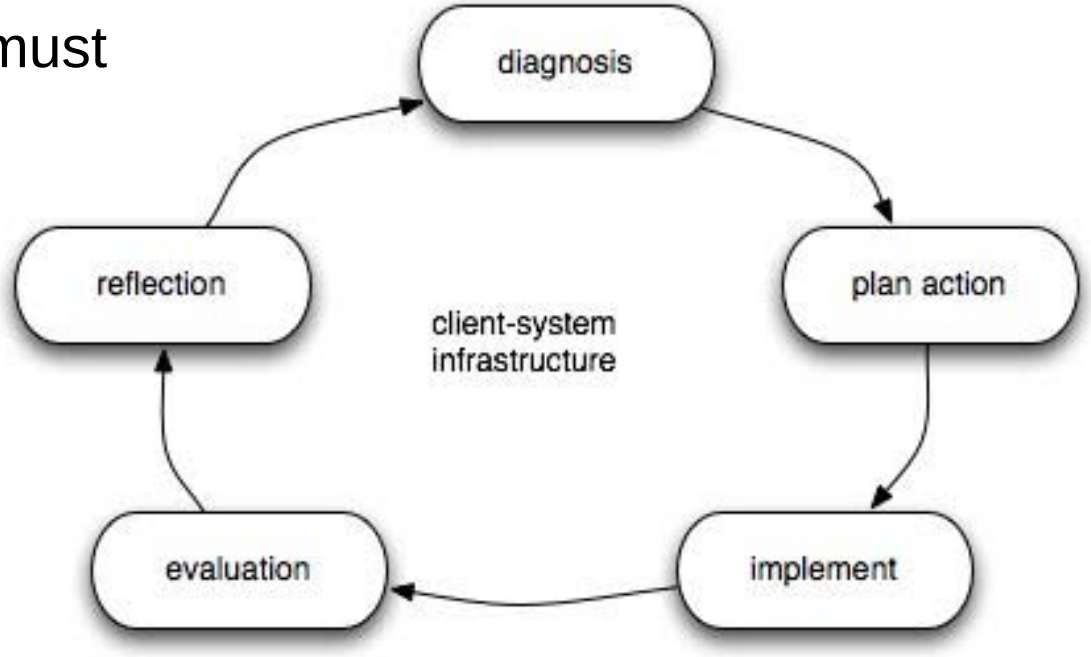
- Creating Free and Open Source Software for Development requires the methods and skills that we advocate.
- FOSS depends on access to source-code
  - need local Software Engineering skills to use and modify code appropriately
- Significant lock-in to proprietary software in the developing world due to a lack of skills in exploiting FOSS
  - Bridges.org: “Specific software applications that could make computers more useful to local communities — such as putting ICT to work to improve healthcare and education, and designed with cultural factors in mind — are still missing”
- We must address such issues and take ownership of FOSS$_4$DEV

Community-Based Computer Science

- Ubuntu based Computer Science??
- Software Engineering (SE) as a profession has to change to emphasize the social and economic needs of local communities.
  - Ethics focussed on dealing with development priorities.
- IT professionals have to accept a new interdisciplinary approach to SE
  - co-development of applications in a socially sensitive fashion
  - projects are difficult to manage!
- Universities & NGO's: design and implement new approaches to using technology to support local communities in developing countries

Critical Action Research

- Facilitating change by facilitating action
- Cyclical software development: participatory design + prototype evaluation.
- Flaws
  - users don't appreciate technological possibilities
  - software designers must bridge cultural gaps



Software Engineering for Development

- *Socially Aware Software Engineering* methodology.
  - Basis of Critical Action Research: facilitating change in a community through facilitating action
  - Participatory Design require the end user to participate in the software design process
    - Flaw 1: user community knows about technological possibilities
    - Flaw 2: software designers can bridge cultural and linguistic gaps
- The technological requirements exist within a complex web of other needs, relationships and societal obligations
- Our tentative solution:
  - Local “interpreters” or champions who can bridge the gaps
    - Act as our *intermediaries* into the communities
  - Carry out iterative development cycles incorporating aspects of participatory design and user-centred HCI into SE


ÆTHIOPIA
INFERIOR,
vel
EXTERIOR.
Angola.
Mozambique.
Maitachazi
Agag.
Linea sub Tropico Capricorni.
Septentrio.
Meridies.
Caput Bonæ Spei