Development of Technologies in Africa

6 April 2018

Outline

- Acquisition of technology: reflections on Internet for Blockchain
- share experience in acquisition of Internet technology in the region (four phases)
- inform Blockchain Technology shifts (two viewpoints)

As Africa adopted Internet

Foundation	Beginning	Formation	Growth
86-90	91-95	96-00	2000-2005+
Preconditions	First Connections	Structures & communities	Formal Institutions

20+ years

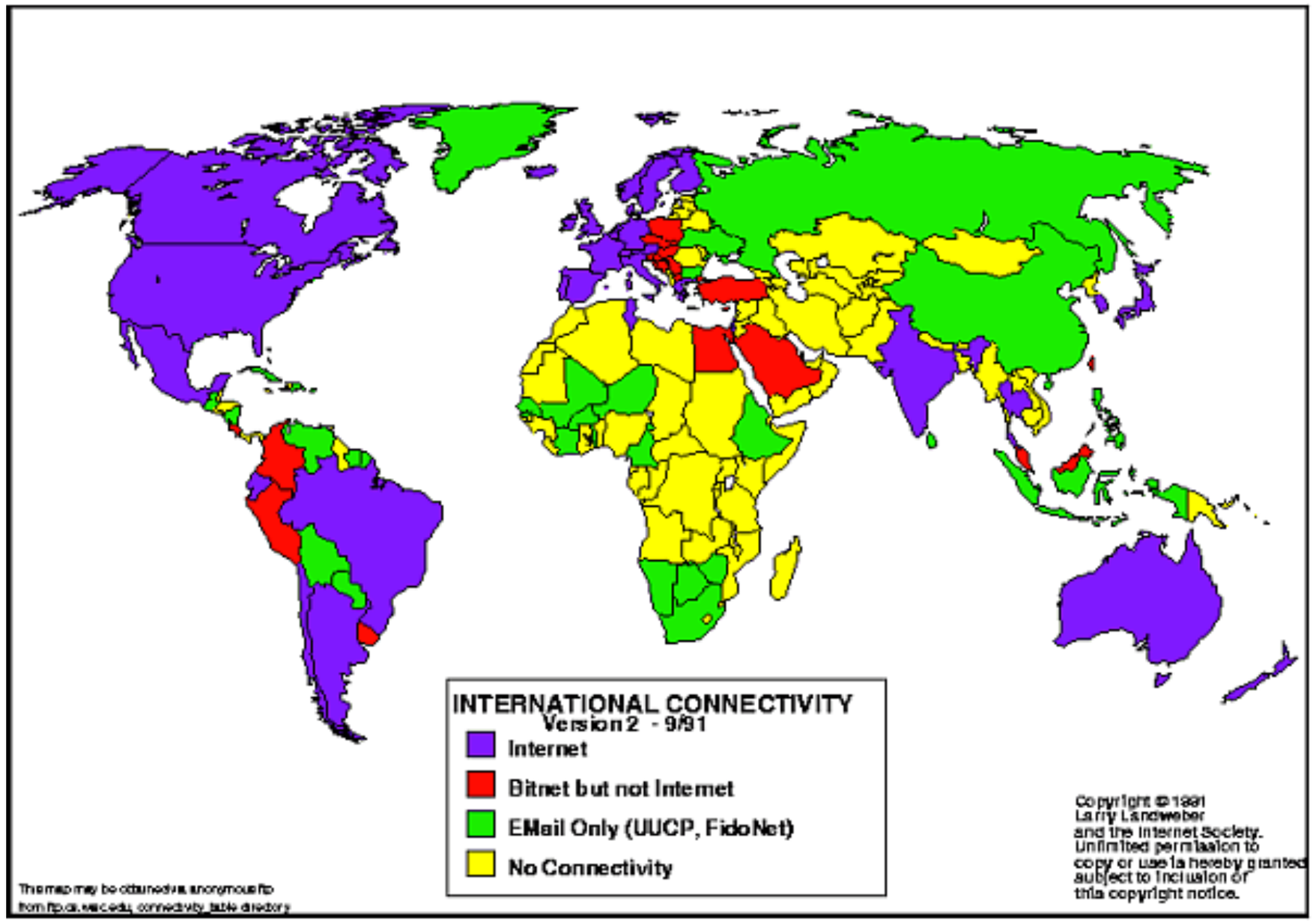
Foundation 86-90

- Computer science education
- Monopoly telecom
- Enterprise computer systems
- Email scene
- PCs and literacy schools

The beginning 91-95

- Adopting TCP/IP over proprietary network standards
- Access/connectivity issues
- Telecommunication tensions
- Emergence of ccTLDs
- Web experience

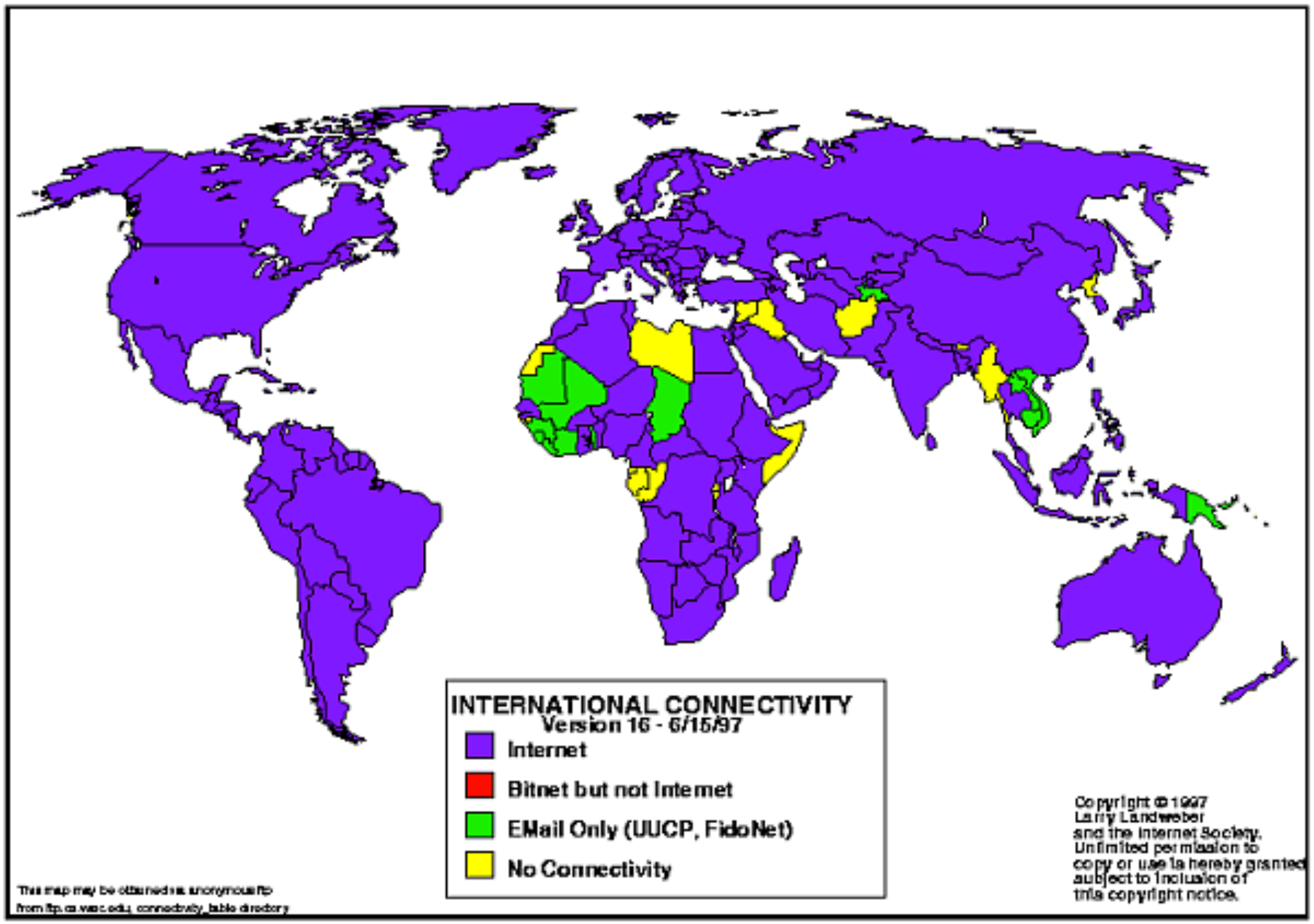
9/91 Internet Society, country connectivity



Formation and self organizing 96-2000

- Secondary cities connectivity
- Telecommunication policy reforms
- ICT 4 development emphasis
- Global internet coordination
- African participation in global, Cotonou convention
- Technology acquisition and sharing, NOGs
- Mobile arrived

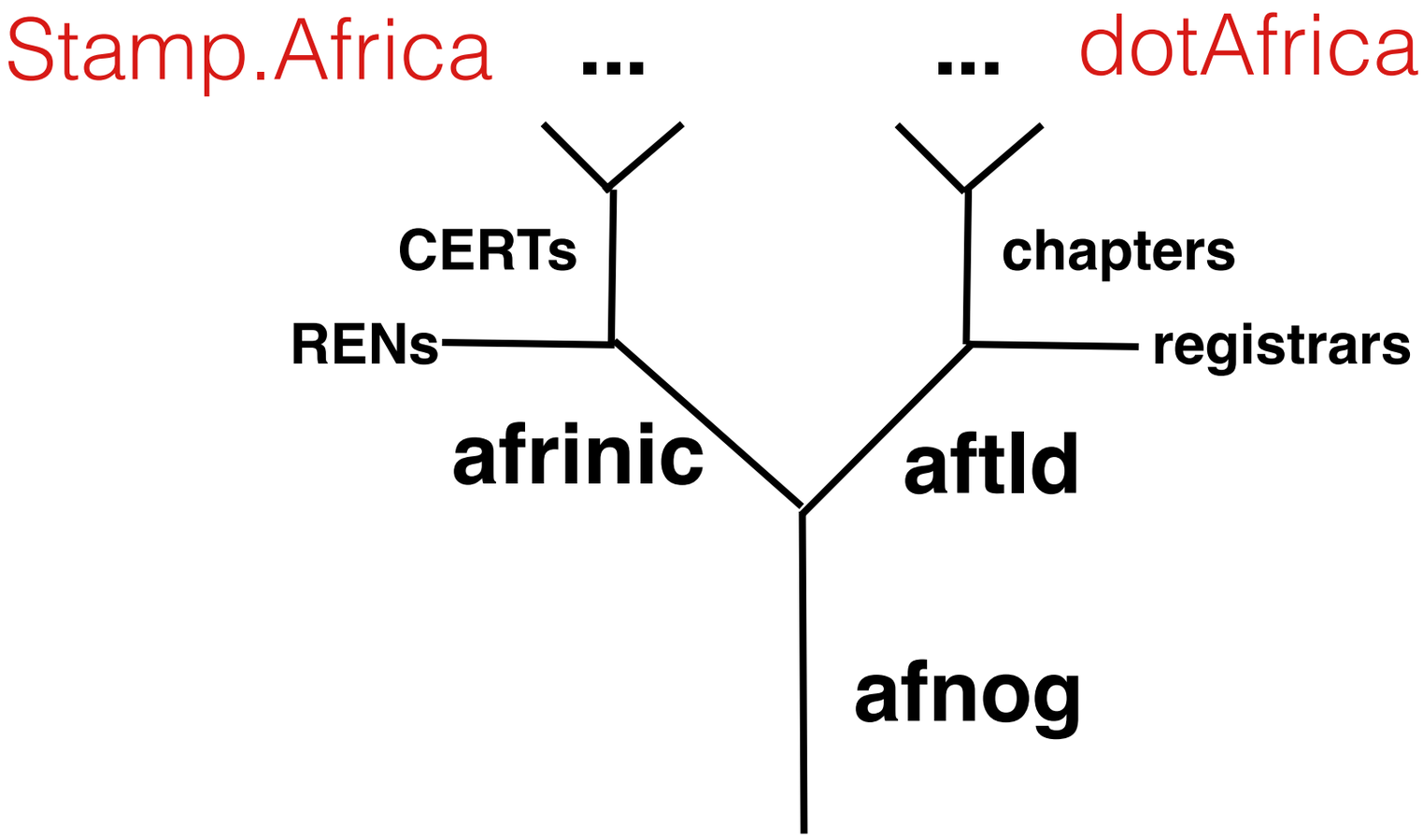
6/15/97 Internet Society, country connectivity



Af*, Internet institutions 2001-2005

- Internet on global agenda: WSIS,IGF, national ICT plans
- Community and capacity: NOGs, ccTLDs, a NIC, NRENs, CERTs, registrars,...
- Submarine cables and mobile uptake
- New issues: cyber security and crime, cross border connectivity and adopting bottom up multi stakeholder processes

How Af*, technical communities grew



The technology shifts

Axes	Foundation 86-90	Beginning 91-95	Formation 96-00	Maturity 01-05+
Policy	**Centralized**	**Reforms**	**Regulator**	**Competition**
Infrastructure	**National operator**	**Separation**	**Private**	**Private/ Public**
Workforce	**Telco**	**Computer sciences**	**Industry**	**Proliferation**
Governance	**Quasi Corporate**	**Corporate**	**Dialog Forums**	**Multi Stakeholder**

Technology Shifts

- UI explosion PCs followed by Mobile and IoT in ubiquity
- TCP/IP adoption over telecom switches
- Web, applications, ccTLDs Registries, Registrars appeared
- path to secure web (https), PKI, online business, online payment, e-cash,mobile money....

Technology Shifts (2)

- Shift to private sector led ecosystem
- Policy and standards decision power in hands of multi stakeholder community in bottom up approach (not mere consultation) e.g IANA stewardship transition
- Issues: fragmentation/net neutrality, cyber security and weaponization of cyber space, cross border interconnection, privacy and rights...
- Governance of/on Internet

Blockchain

Blockchain as records

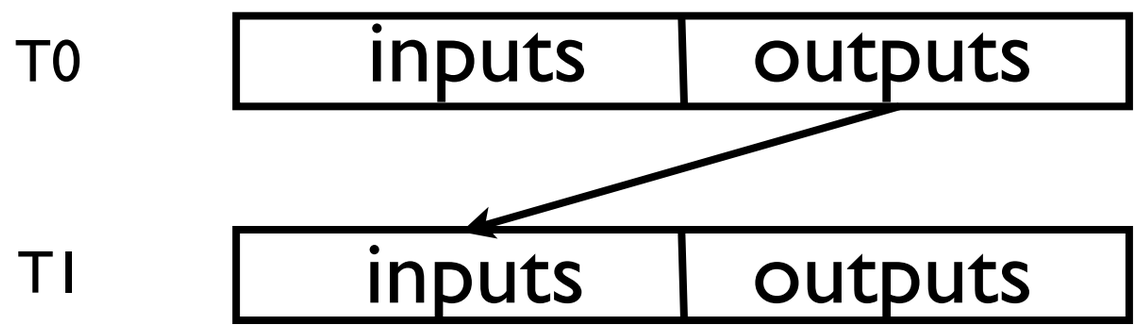
- Ordered permanent records
- Records may be: Transactions, data or programs
- Employs computer science techniques: **networks**, **cryptography**, **consensus**, **electronic ledger** and **contracts**

What if transaction value is generalized from coin to other

- <**input** address, **value**, **output** address>
- The **value** can literally be any **asset/rights**: land, property, other digital assets and maintain rules about addresses and signatures
- May be implemented as a new private blockchain or application off existing public blockchain platforms (bitcoin or ethereum family)

Bitcoin Transactions- first application

Each input spends previous output



Each output waits as unspent Tx output (**UTXO**) until an input spends it

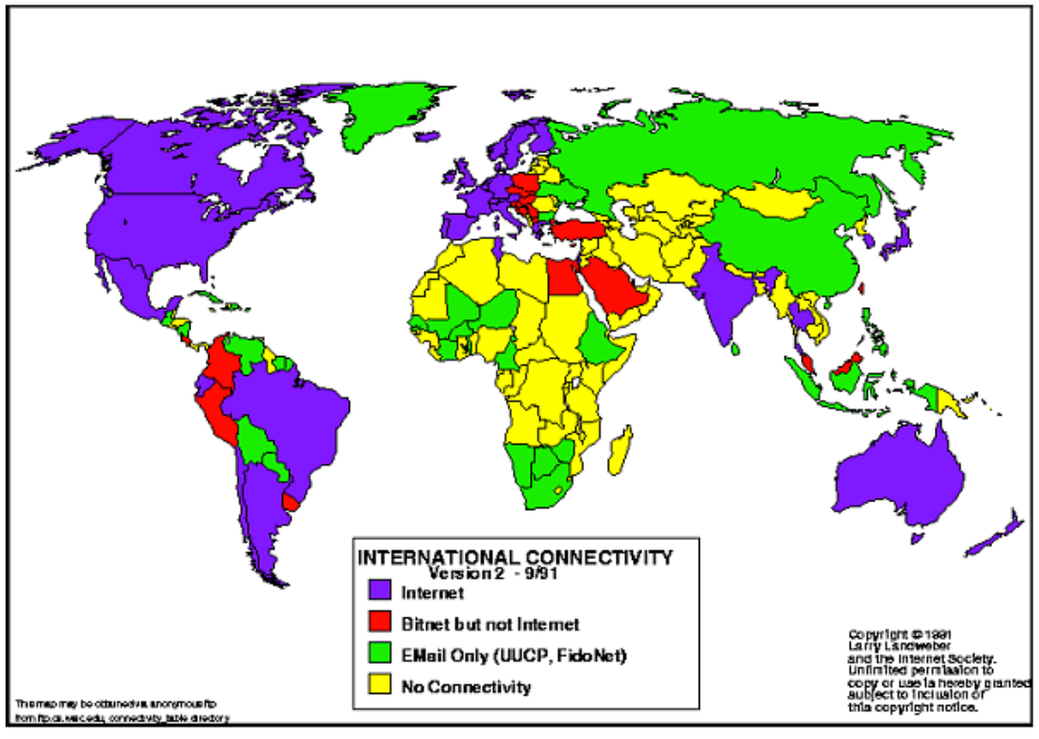
If blockchain record contains “data” transactions

- Use a digest (hash) to increase Integrity
- The data may be interpreted by an external program
- When interpretation is unwieldy use state machines

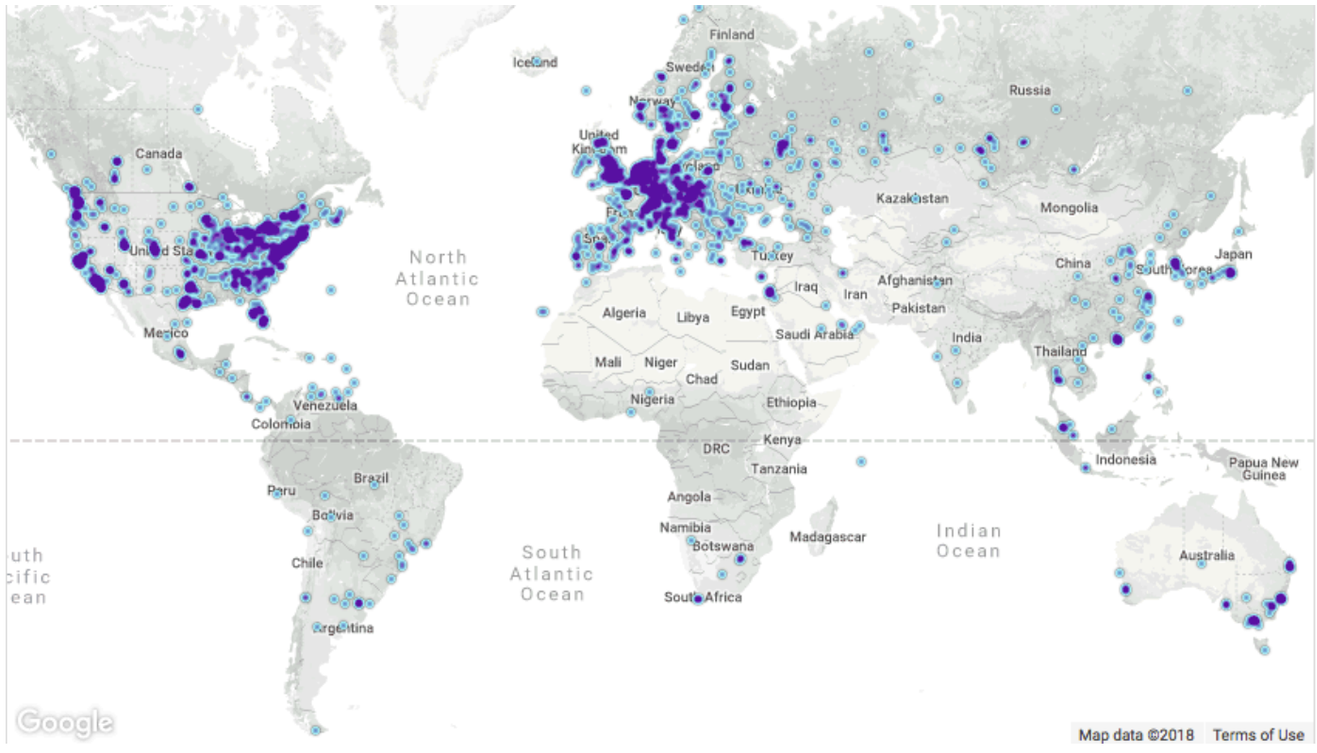
If contains code, smart contracts

- Ethereum is favored platform
- Autonomous agents, smart contracts
- Applications that know about money and with wallets
- State changes effected by Transactions and invocation of function in contracts on the blockchain

9/91 Internet Society, country connectivity



2018 Bitnodes



Blockchain comes with..

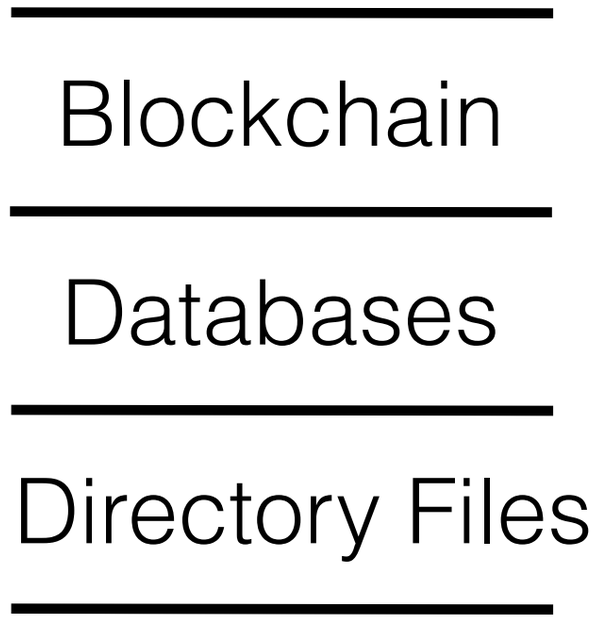
- Immutable, immortal records
- Identity management using key pairs
- Open permission less access to global ledger
- Copies of ledger are on distributed computers
- Peer to peer transactions (without intermediary)
- Pseudo anonymity

Blockchain as Network layer

Transaction : public key hash : broadcasts	Trust economic
Web : Domain names	social
Internet : IP addresses	logical
Transmission : interfaces	physical

Blockchain as Data Structure

- immutable, Txid
- organized, columns
- files, filenames



A new software opportunity

- applications that know about money and with wallets (smart contracts)
- applications using immutable records to commit (info,nonce)

As Asset

- victim of the new Internet, global vs local or sovereign blockchain
- recognition in law
- tax matters
- what institutions for governance of and on blockchain? how to self organize them
- Adoption of blockchain in Africa should be more rapid from Internet experience

As Registry

- openness
- contribution to nodes and miners
- role of education networks bsafe.net
- developing the future industries

Blockchain Technology shifts

Axes	Internet	Asset	Registry
Policy	**Private sector led**	**recognize digital currency**	**open**
Infrastructure	**cables+data centers**	**nodes+miners**	**nodes+miners**
Workforce	**net, web, mobile development**	**new**	**new**
Governance	**MS of/on net**	**MS of/on blockchain**	**open**

Conclusion

- From Internet experience, it took time (20+ years) to acquire technology in Africa
- Africa may adopt blockchain, digital currencies, digital assets technologies rapidly, as an opportunity
- Africa should beware that global society may ‘deprecate old technologies’ so risk an economic divide, a different “digital divide”
- Africa should build the businesses and communities in the blockchain ecosystem, better than as Internet

Thank you