

Architecting the **Internet** for the **Challenged**

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The talk is all about..



The Internet is a human right

Internet access is an **essential utility**

Internet is an important (potentially life saving) enabler

Technological advances facilitate better healthcare and monitoring

Social networks to predict epidemic spread

Massive increase in online courses, digital economy, e-governance etc..

..and hence a **human right**

ISOC 2012 survey with 10,000 users in 20 countries

83% agreed or agreed strongly that access to Internet is a human right

2/3 agreed or agreed strongly that the Internet would play a significant role in solving global problems:

Reducing child mortality (63%)

Improving maternal health (65%)

Eliminating extreme poverty and hunger (61%)

Preventing trafficking of women and children (69%)

Internet access is challenged

Solving Political, Regulatory, Social challenges are mandatory

Geographic

Conventional Internet access has physical limitations

Access in many parts of the least developed world are less reliable, power constrained, significantly lower capacity and higher latency

Economic

Access to fixed broadband in some developing countries costs almost 40x the national average income

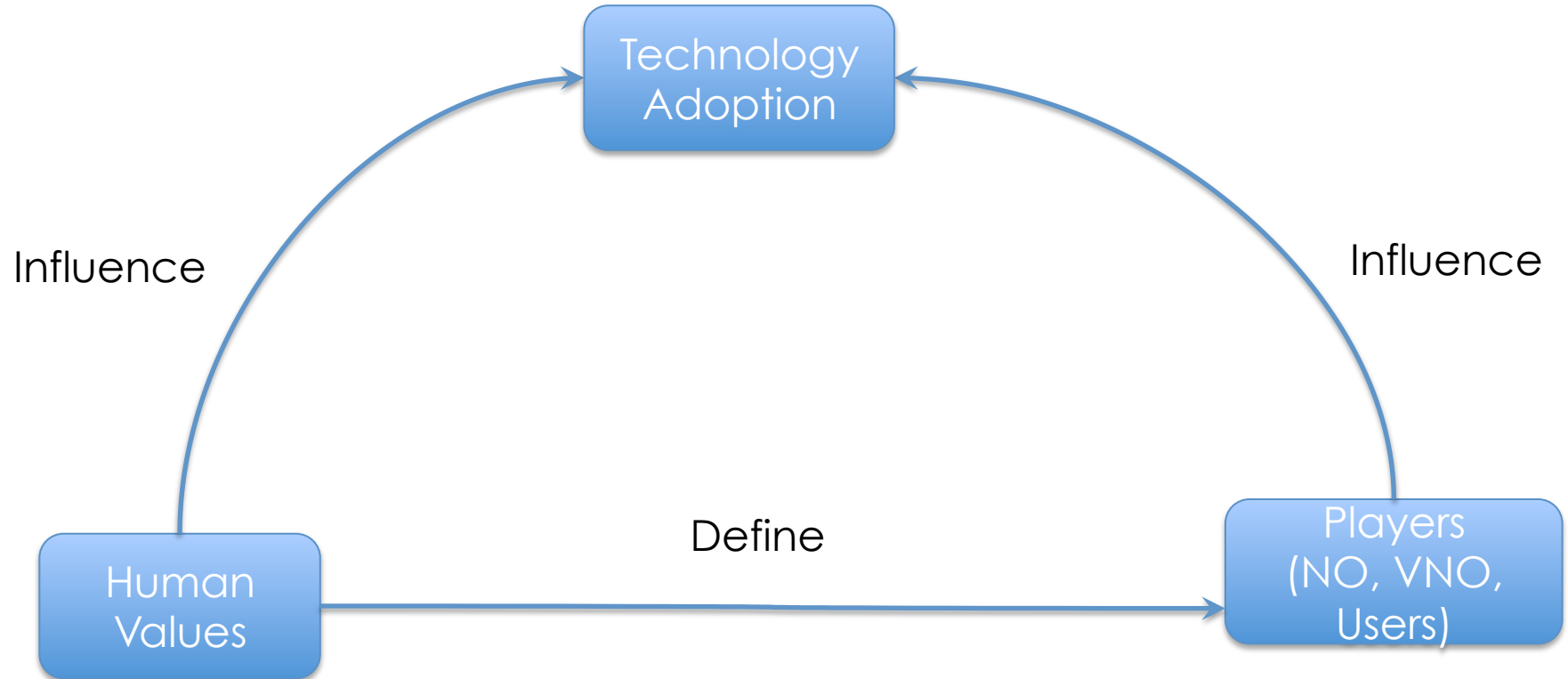
In developed countries, affordability limits broadband access in impoverished communities

Technological

Survival of the fittest: Transport protocols were developed to capitalize on the **best-effort** nature on the Internet

Compete for capacity (UDP, TCP, SCTP, DCCP etc)

Triple bottom line approach



Q1: How to incorporate human values and behaviour into new net offerings?

Q2: What are the roles and incentives of the players

Q3: How would the new VNOs look like?

Q4: What is the “right” enabling architecture?

Decoupling CAPEX/OPEX

Extend stakeholder value chain for incentivizing access by creating new Virtual Network Operators that have a socio-environmental objective (e.g. local government, NGO)

UK's digital by default programme could achieve savings of £2.2 bn/yr!

Share costs: Effectively decouple CAPEX and OPEX: NO can setup infrastructure or provide existing infrastructure while VNO can manage the infrastructure or vice versa

SDN would facilitate such decoupling

Network operator's infrastructure are under-utilised

Over-provisioning; Statistical multiplexing; different user access patterns; 95 percentile pricing

Network operators can sell "additional" connectivity utilising the (already paid) under-utilised resources at lower cost

Q5: What are the challenges in enabling this vision?

Flexible and Resilient Internet: The Wish List

Lower Quality access by default to all: Enabling less than best effort access

Flexible Service Offerings: Micro-pricing, reverse payment

Resilient delay tolerant network: Deliver data even during disconnections/loss

Time Shifting (efficient use of network capacity): Transmit data during off peak hours (upload or filling caches)

Enabling edge caching: Reduce wastage, enable edge users to share content locally

Shift from **always-on** to **almost always-off** Internet!

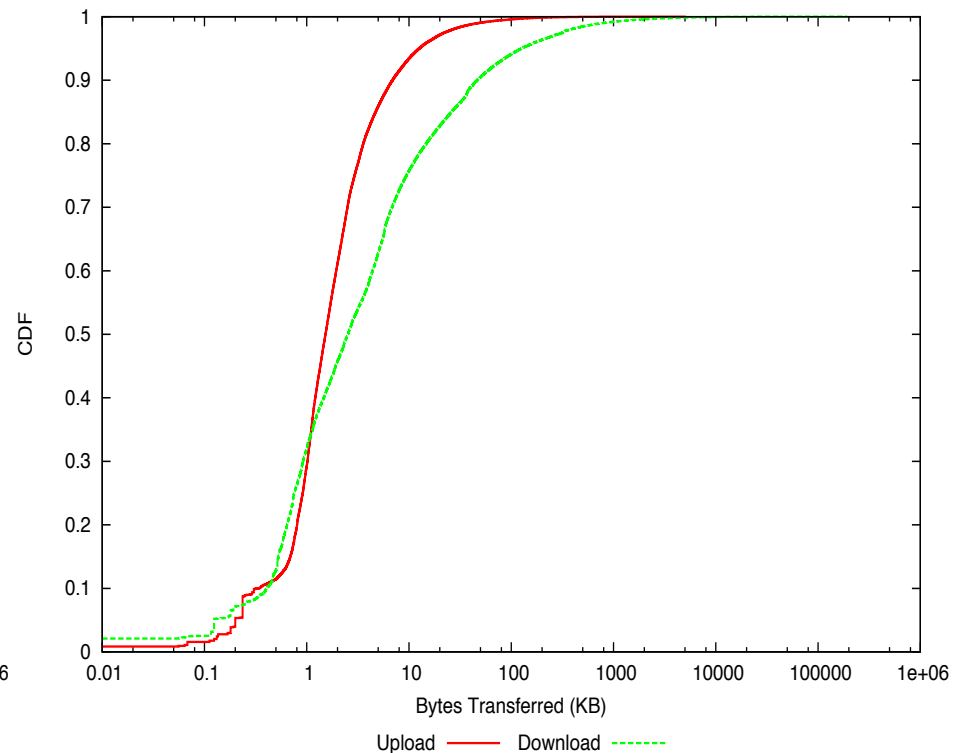
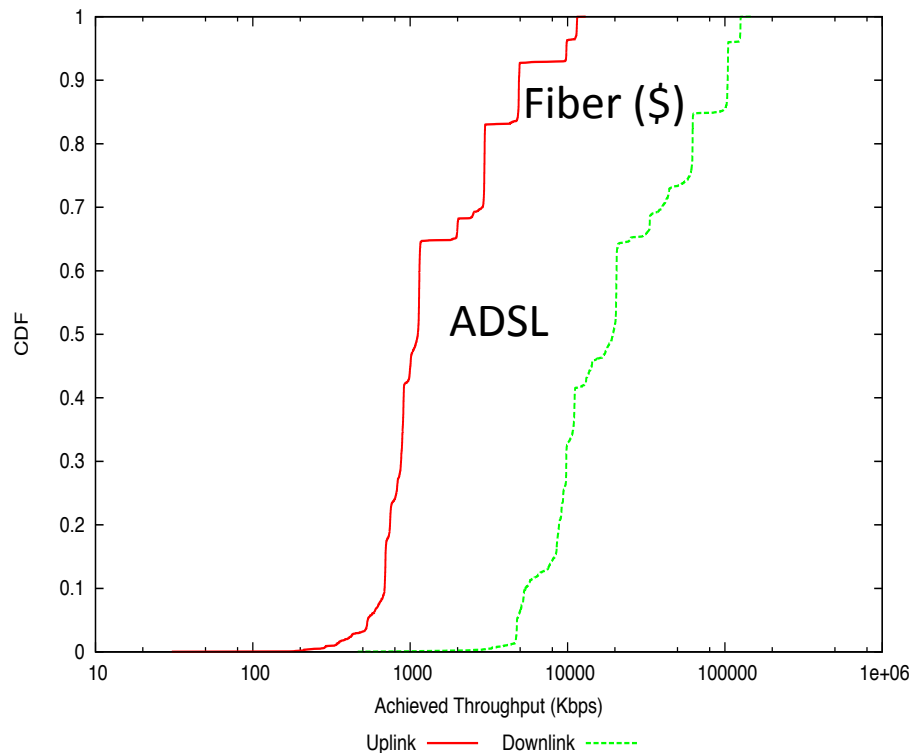
Technologies such as DTN, ICN exist but have not yet seen widespread deployment

Q6: What are the barriers for deployment & how do we bring all of them together?

Reducing Wastage : Its just not a CDN issue

Measurements taken from an urban area in Nottingham, UK

Measurements taken from 20 homes (mix of fiber & adsl) providing a crowdshared WiFi infrastructure and around 15 public users accessing the infrastructure

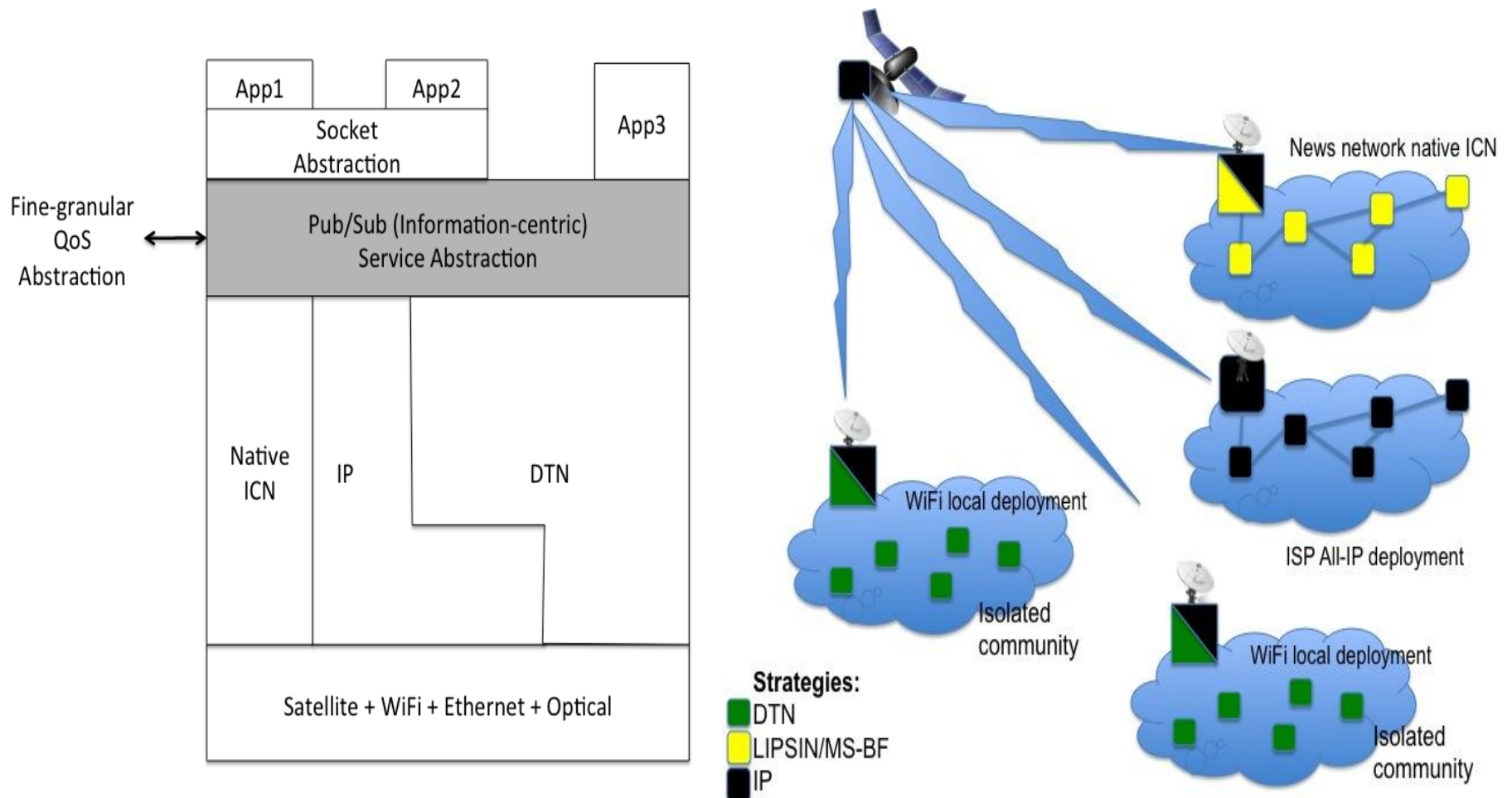


Web 2.0 : Users not only accessing content but also generating content over asymmetric low capacity uplinks

Q7: How would least developed countries cope with this trend?

Q8: Shouldnt we start thinking about pursuing a pub/sub approach?

Strawman Internet Architecture?



Q9: What are the challenges in adoption?

Q10: Should'nt the IETF follow a triple bottomline approach?

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