



UiO : **Department of Technology Systems**
University of Oslo

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Sustainable Development in the Network of the Future

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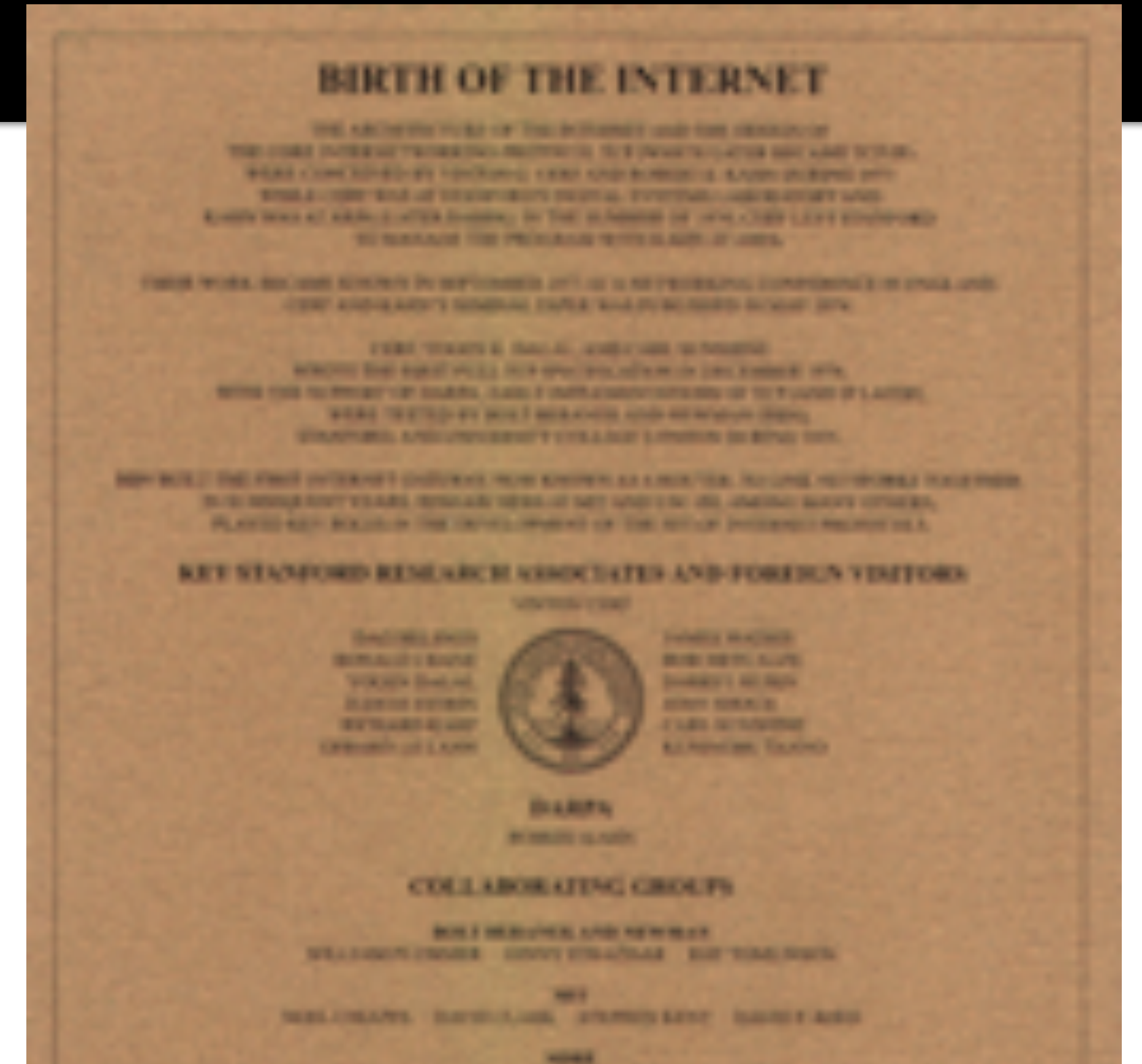
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Is IP a good carrier for 5G?

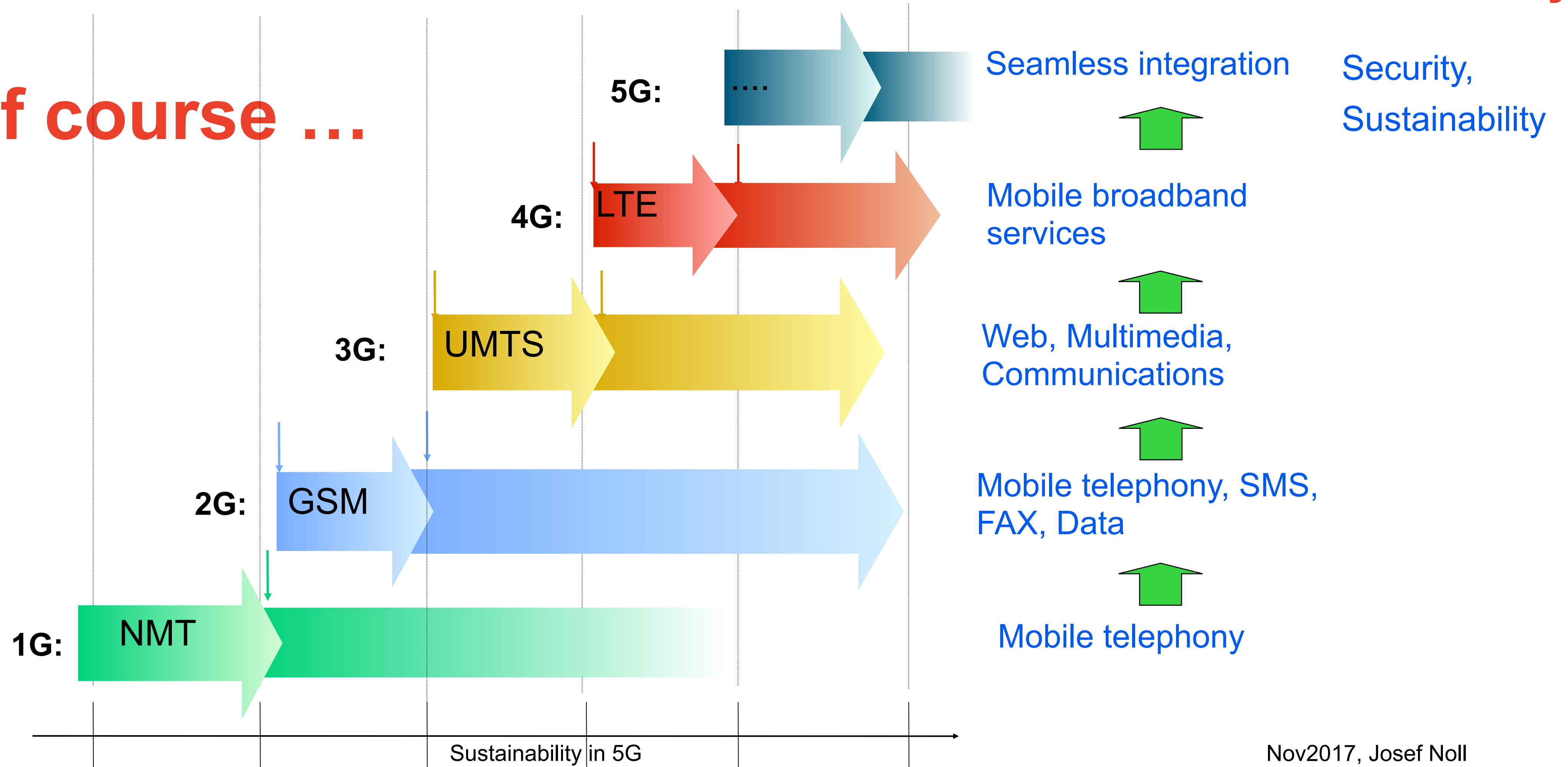
of course, not.....



Will IP be the dominating carrier for 5G?

YES, of course ...

Service & Sustainability



5G Research Topics

IP?



What have we forgotten?



- (i) Massive mobile broadband,
→ social networks for things
- (ii) billions of devices and
→ Internet of Things (IoT)
→ automated processes
→ Edge computing
- (iii) ultra-reliable and ultra-low latency networks.
industrial automation



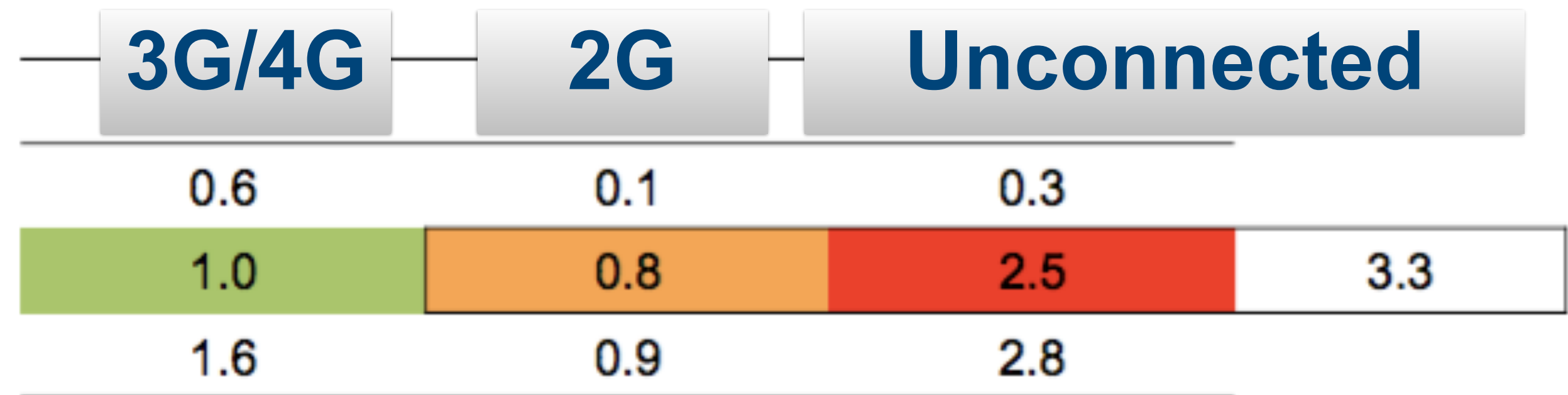
Connectivity & Affordability



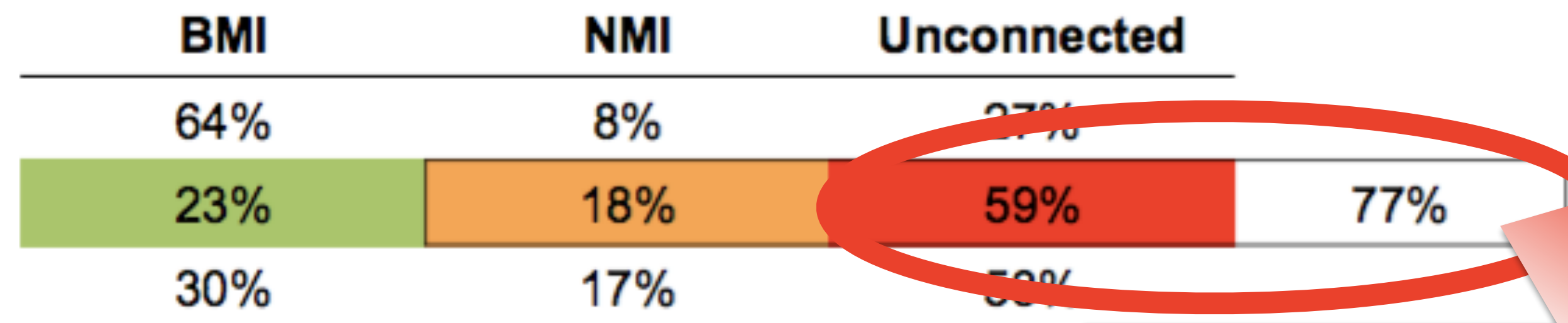
The Unconnected Market Landscape

Unique Mobile Internet Users

Population 15+ (bn)	Total
Developed World	0.9
Developing World	4.3
Total	5.2



Penetration 15+ (%)	Total
Developed World	100%
Developing World	100%
Total	100%



77% don't have decent access

Source: GSMA Intelligence; figures reflect position at end of 2014
 BMI = Broadband Mobile Internet (3G/4G); NMI = Narrowband Mobile Internet (<3G)

[Source: GSMA, Nov2015]

The TelCo Business Model

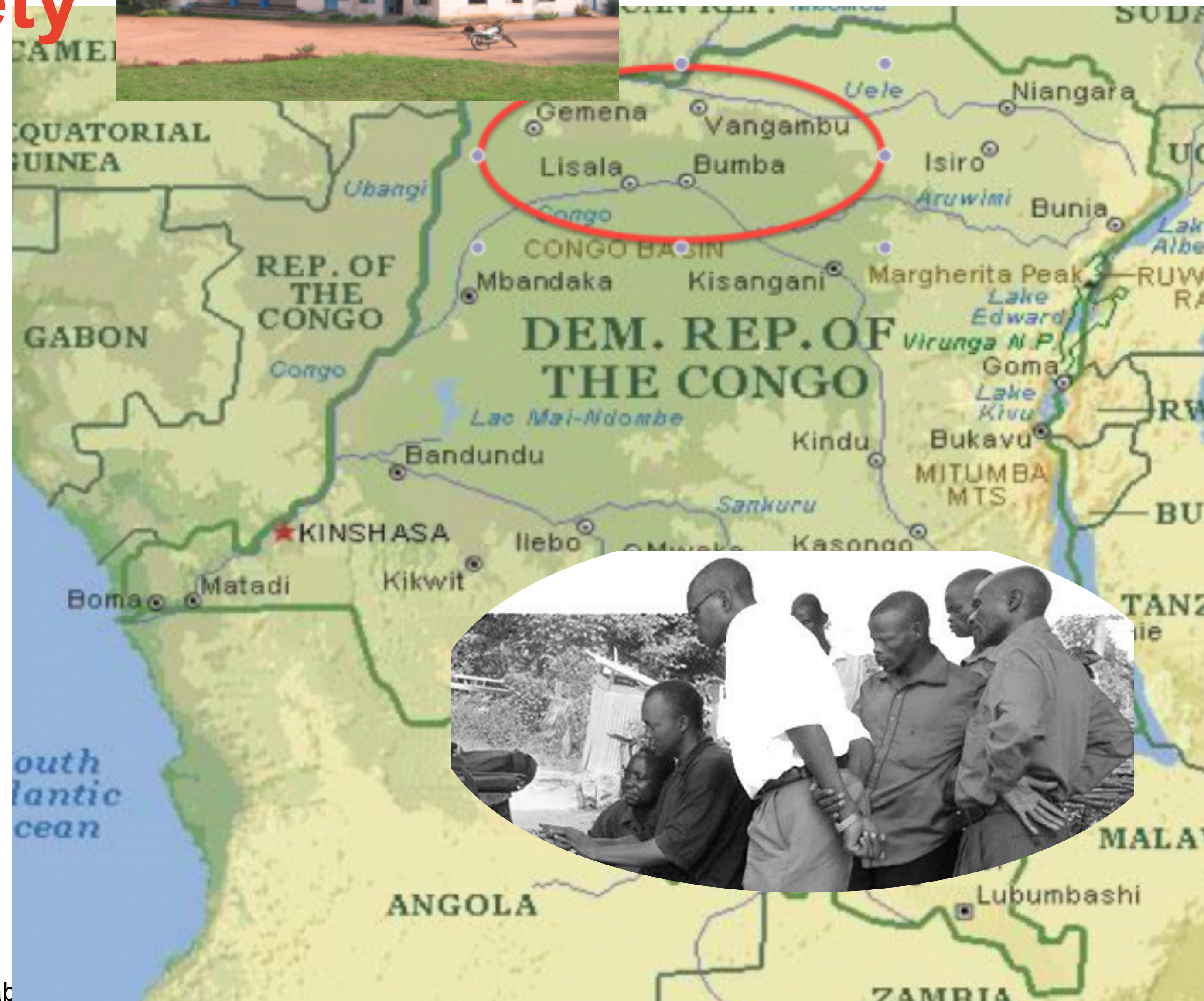
- Revenue driven
 - ➔ roll-out in urban
 - ➔ focus on voice (GSM)
 - ➔ Mobile Broadband for Premier League, Bollywood,
- Infrastructure Investors
 - ➔ min 13% revenue

Telecom
revenue-driven
targeting leveraged creation
voice & mobile broadband
subscription based (SIM)
mobile network: coverage & capacity
operator cost model



(iv) Societal: Digital Society

- Combat the Digital Divide
 - ➔ Lisala: 2 x size (NL+BE)
 - ➔ no Internet (2010)
- Expensive access:
 - ➔ 2000 US\$/month for 1 Mbit/s
 - ➔ Note: 80 Mbit/s for 66 US\$ (NO), factor: 2.420 or 0.04%



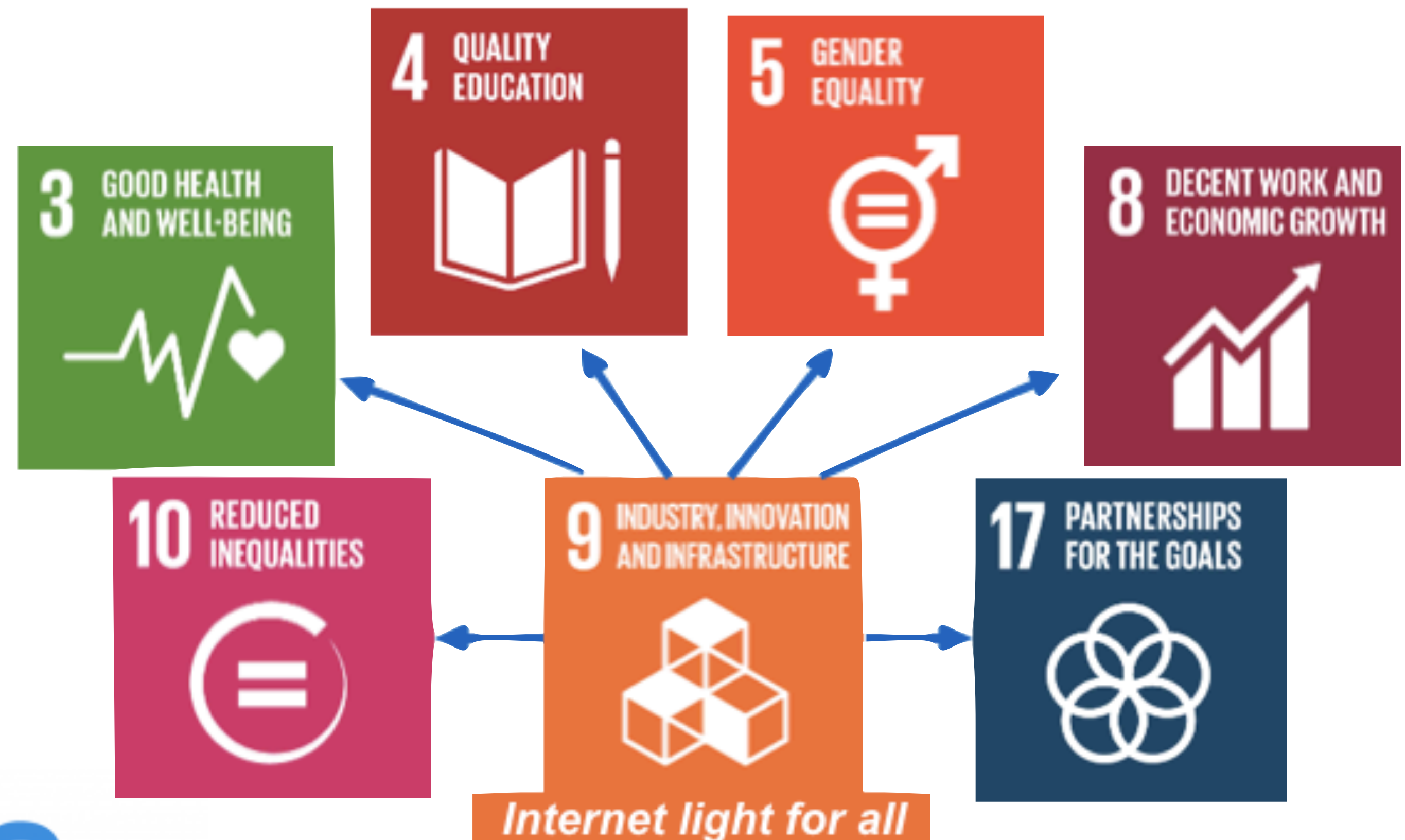
Internet is a basic human right

- Is Internet access and online freedom of expression a basic human right?
- “All people should be allowed to connect to and express themselves freely on the Internet.”
- The United Nations’ Human Rights Council unanimously backed that notion in a resolution on **5 July 2012**. All 47 members of the Human Rights Council including China and Cuba signed the resolution.



(iv) Societal: Sustainability and Digital Society

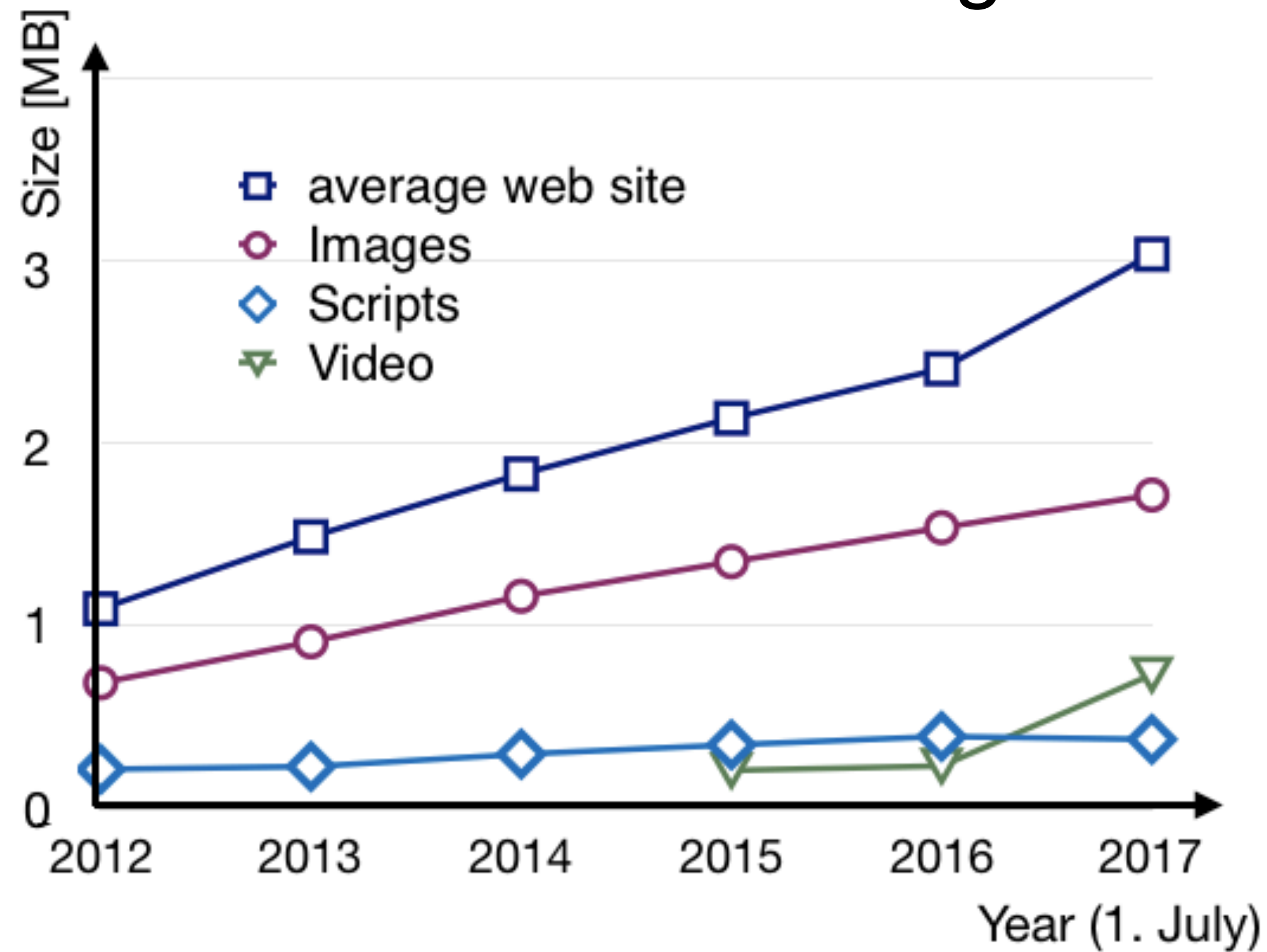
- Combat the Digital Divide
- Support the Sustainable Development Goals (SDGs)
- (iv) provide free access to information for all



Internet light: Demand for information only

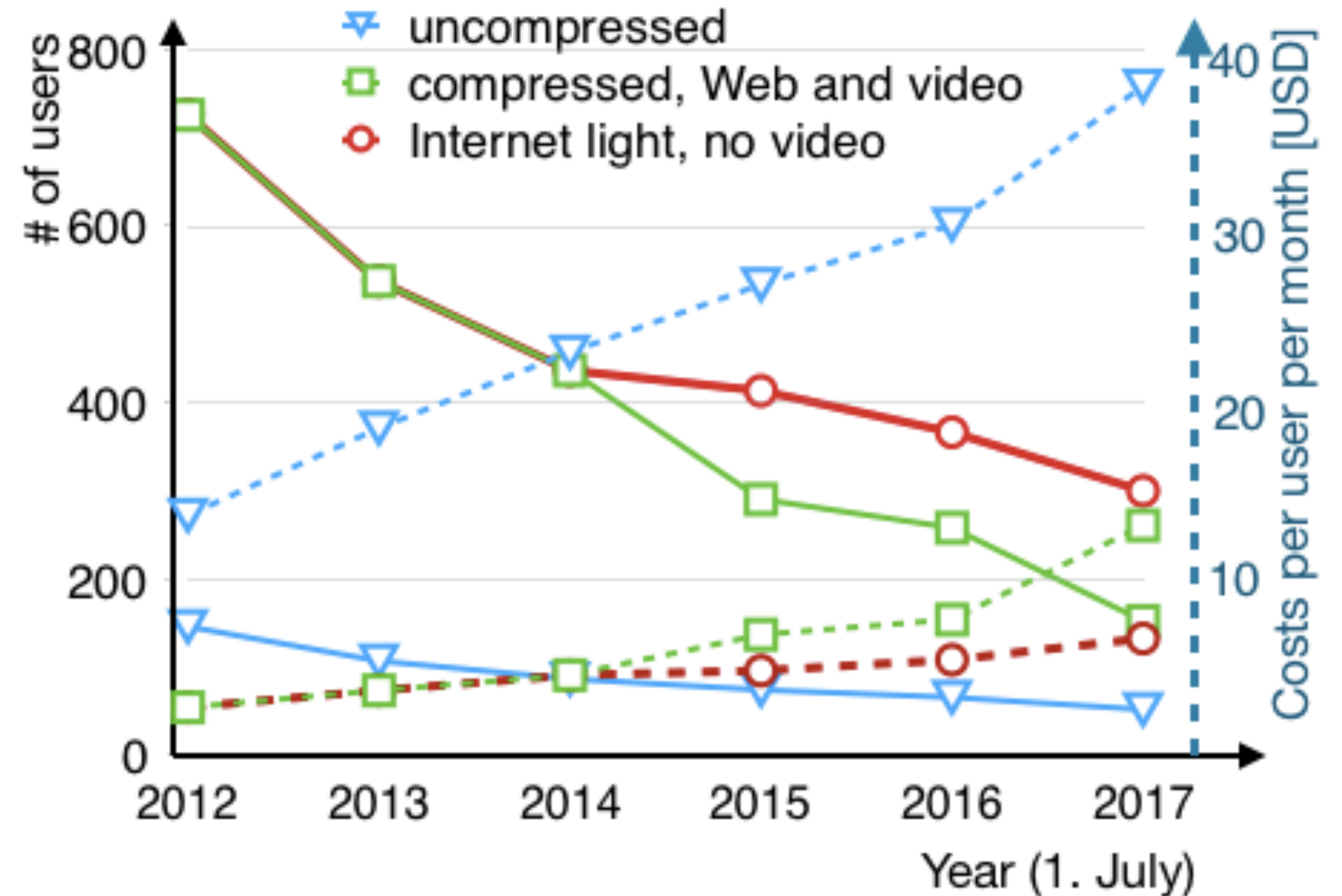


Growth of Web Pages



[Source: [httpArchive.org](http://Archive.org)]

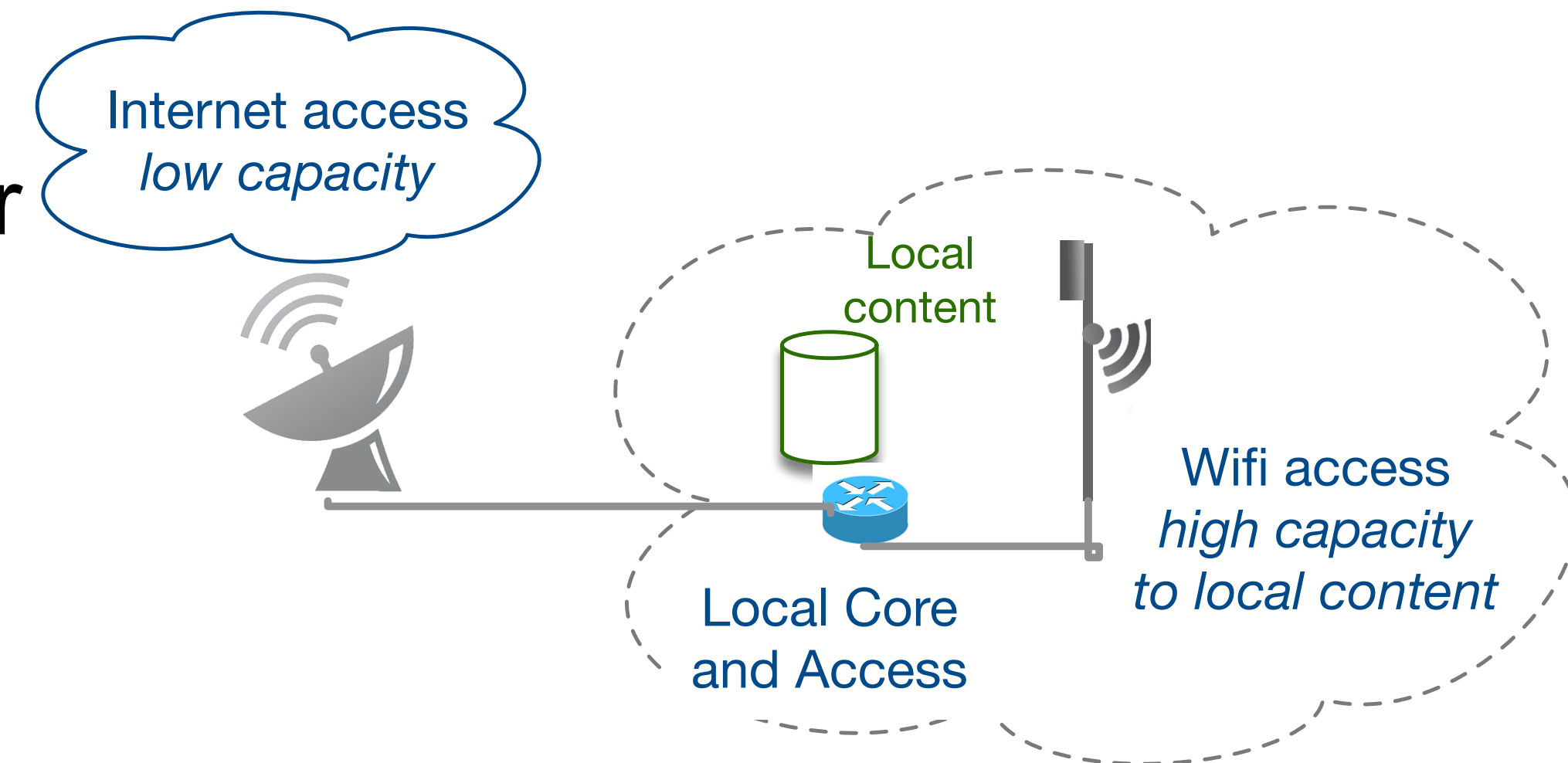
of users/Cost per month (using 1 Mbit/s satellite line)



Why free access to information? Connect the Unconnected (CTU)

Goal: Include people with 1 USD/month for communications

- **Reality** in Tanzania (as an example for Africa)
 - ➔ 49 Million people, 69% living in villages
 - ➔ over **4.000 villages are unconnected**, accounting for **13 M People**
 - ➔ **35% of people** without access to mobile data
- **Internet light for all** is sustainable
 - ➔ free access to **text, pictures** and **local video**
 - ➔ requires 2-2,5% of bandwidth, **>97%** available for **commercial use**
 - ➔ 10 min with video - or - 10 month with information
 - ➔ >300 people with free access = 1 commercial user



2. Migration and Partnership with Africa

- Example: Digital Tanzania
 - ➔ Unconnected: 13 Million people in 4.000 villages
 - ➔ Combined effort of
 - ➔ IT industry,
 - ➔ World Bank,
 - ➔ Telecom and
 - ➔ **Industry**



1 USD/month for Telecom



GSM + Wifi
 - 200W
 - MicroBTS

Cost: 70 kUS\$/village

Digital Health Spot for 300 €

Creating digital access for the unconnected



Digital inclusion
The catalyst for sustainable development

300 € digital health hotspot

60.000 € connecting a village in TZ

250.000.000 € connecting all villages in TZ

89.000.000.000 € EU border control per year



Digital society



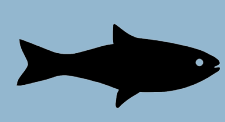
Agricultural and rural development



Education



Health



Food, water and shelter



80 € Solar panel



30 € Regulator



50 € Hotspot



20 € USB-charger



50 € Tablet



15 € LED light



20 € Battery



20 € Materials

Summary

- **5G** development
 - ➔ (i) Massive mobile broadband,
 - ➔ (ii) billions of devices and
 - ➔ (iii) ultra-reliable and ultra-low latency networks
 - ➔ **NEW**: (iv) the free access to information for all.
- **Net neutrality**
 - ➔ access to information, compressed text and pictures through **Internet light for all**
- Partnership with Africa, pilots for **Digital Inclusion** through *Internet light for all*
 - ➔ Focus in **Tanzania** on **health**
 - ➔ Focus in **DRC** on education/**work**
- **Catalyst** for Sustainable Development Goals (SDGs)



Partners



FR



ES



Ministry of Health, TZ



UiO



TZ



USA



UK



TZ