UNIVERSITY GRADUATE CENTER

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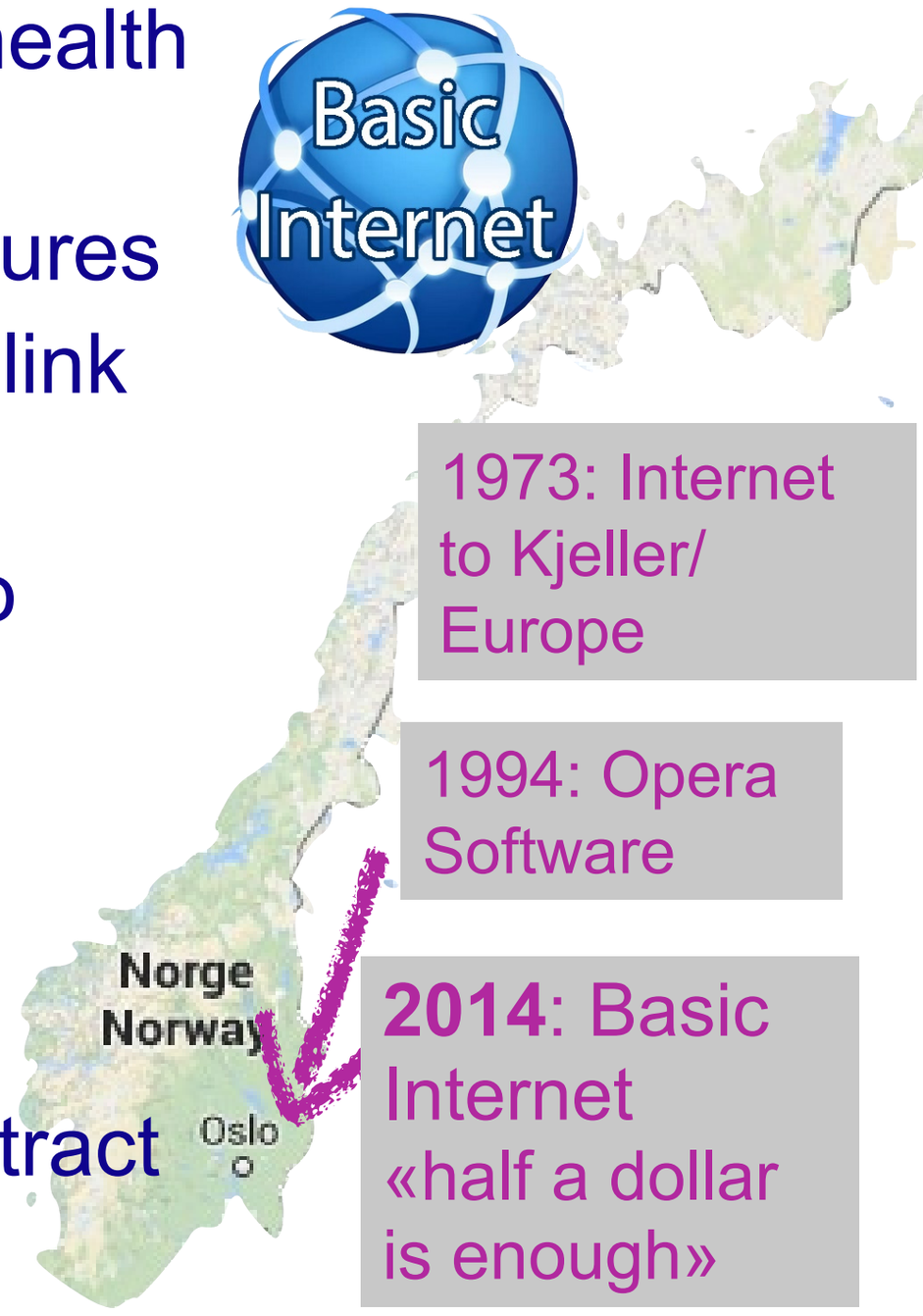
Digital Inclusion for Sustainable Developments

Josef Noll

Co Founder and Evangelist at **Basic Internet Foundation**
Prof. at **University Graduate Studies (UNIK), University of Oslo (UiO)**
Head of Research at **Movation AS**
Oslo Area, Norway

Executive Summary

- Knowledge is the basis for education, health and entrepreneurship
- Basic Internet is access to text and pictures
  - for 300-400 people on a thin satellite link
  - no need for broadband
- develops the market, complementary to market actors
- roll-out through local partners
- Foundation by experienced people
- Now:
  - Norwegian Development Agency contract with Orange for pilot in Mali



Outline

- History and Motivation
- Knowledge is the basis for education, health and entrepreneurship
- Digital Inclusion
  - Basis for Innovation
  - United Nations Sustainability Goals
- Basic Internet is access to text and pictures
  - for 300-400 people on a thin satellite link
  - no need for broadband
- Economy
- Technology challenges
- Conclusions

UNIK .... and the Internet

- Research and Education at Kjeller
- Close relation to FFI, IFE, NILU,...
- Professors from UiO (Oslo) and NTNU (Trondheim)

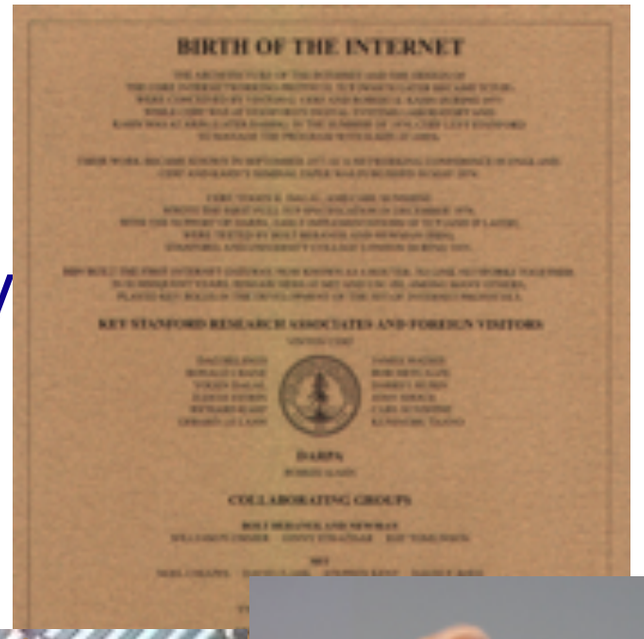
- The building where the Internet (Arpanet) came to Europe in June 1973

Source: Wikipedia

> 1971 (at which point 23 hosts, at universities and government research centers, were connected to the ARPANET); 29 by August, 1972, and 40 by September, 1973.
>
> At that point, two satellite links, across the Pacific and Atlantic Oceans to Hawaii and Norway (NORSAR) had been added to the network. From Norway, a terrestrial circuit added an IMP in London to the growing network.

The Internet and Scandinavia

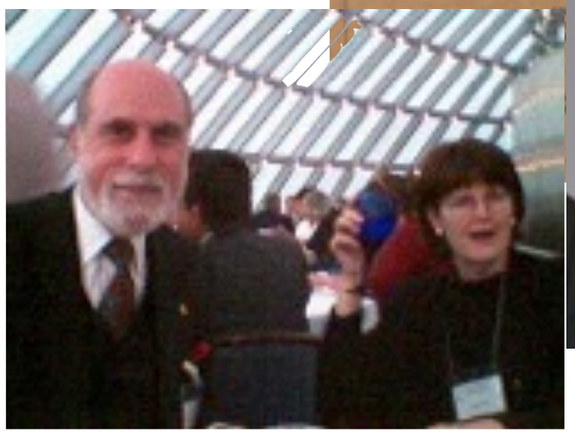
- The first connection of Arpanet outside of the USA (and Hawaii) was to **Scandinavia** (Kjeller, June 1973)
- List_of_Internet_pioneers [Wikipedia]
  - Yngvar Lundh, Paal Spilling
- Application development
  - .php, OpenSource, Linux, Skype, Spotify
  - OperaSoftware, FAST Search
  - Nokia, Ericsson
  - Telenor, TeliaSonera
- Mobile Internet:
  - GSM
  - Adaptation
  - ‘


BIRTH OF THE INTERNET

KEY STANFORD RESEARCH ASSOCIATES AND FOREIGN VISITORS

DARPA

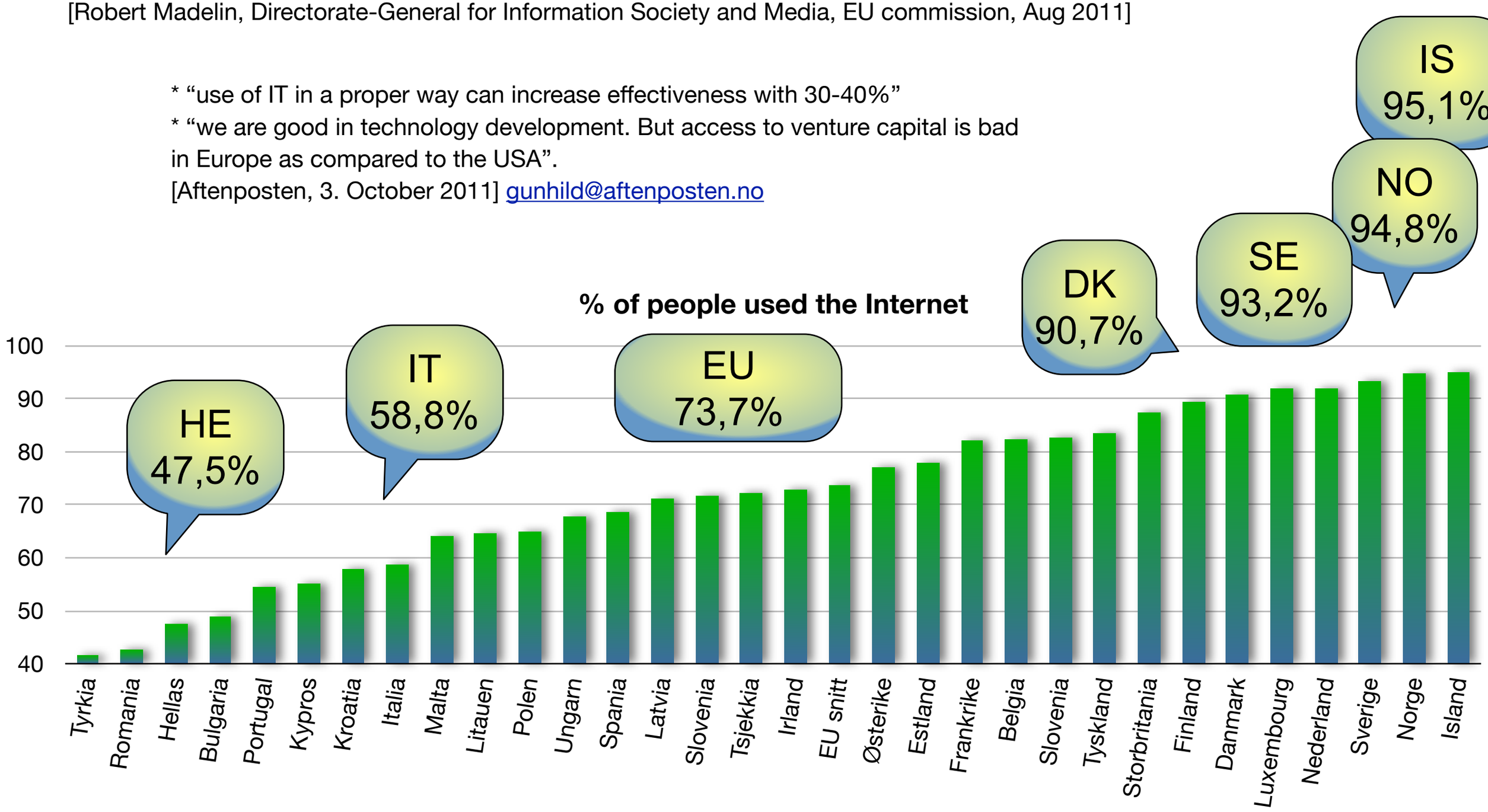
COLLABORATING GROUPS



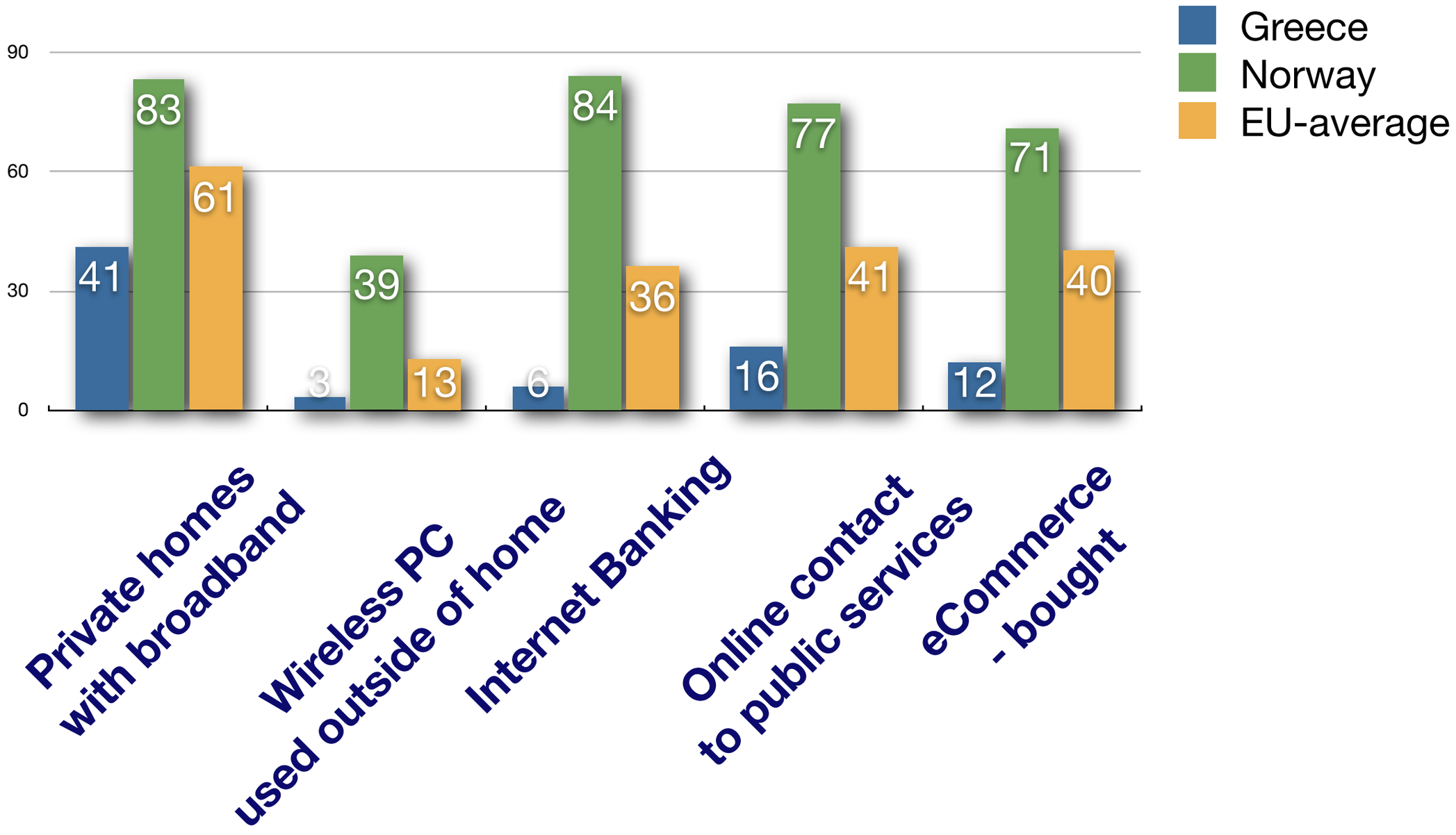
Internet usage in Scandinavia

[Robert Madelin, Directorate-General for Information Society and Media, EU commission, Aug 2011]

* “use of IT in a proper way can increase effectiveness with 30-40%”
* “we are good in technology development. But access to venture capital is bad in Europe as compared to the USA”.
[Aftenposten, 3. October 2011] gunhild@aftenposten.no

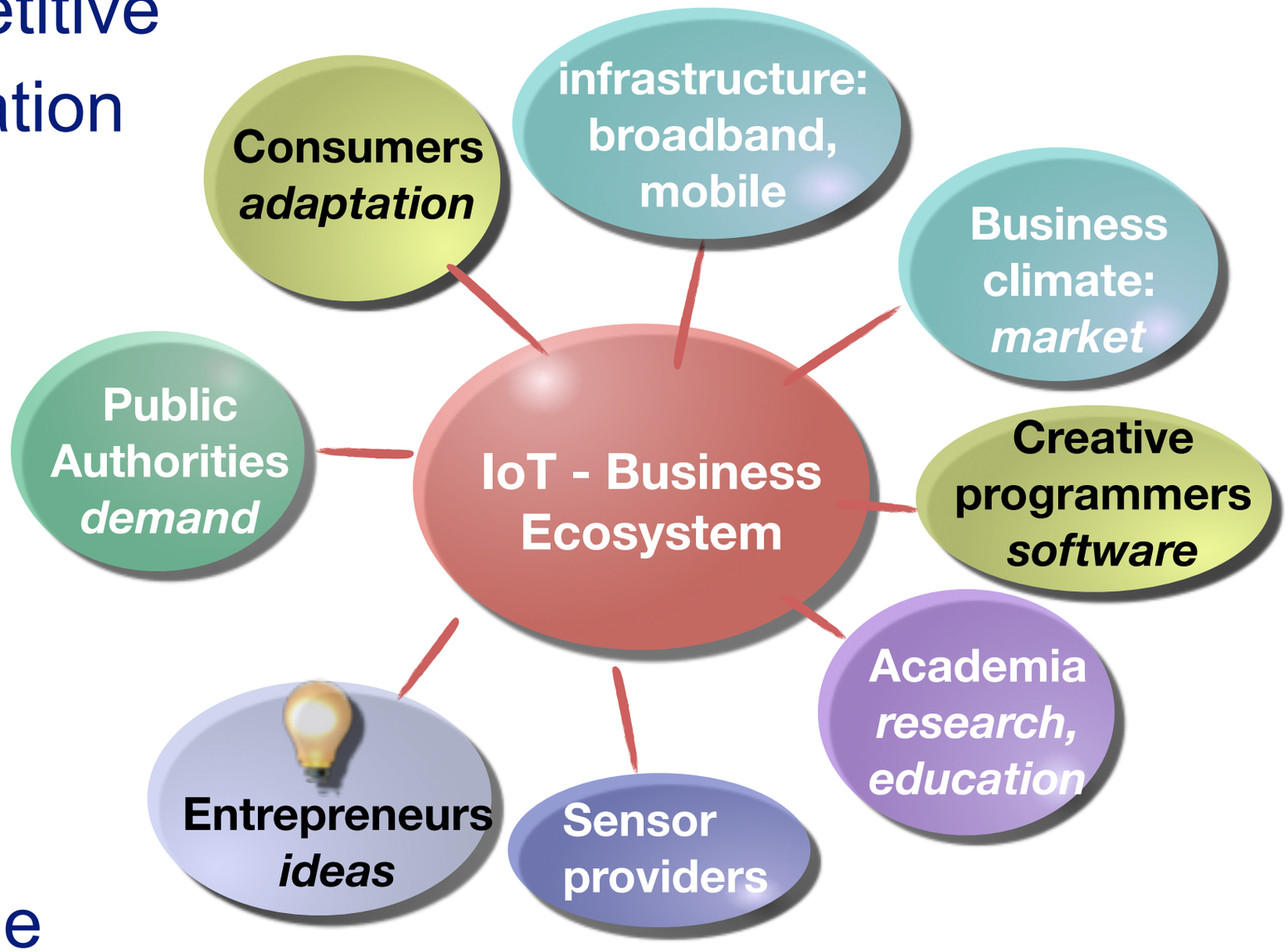


Internet service usage



Human perspective in
The IoT ecosystem

- Creating business
  - openness, competitive
  - climate for innovation
- Public authorities
  - trust, confidence
  - demand
- **Consumers**
  - **(early) adapters**
  - **education**
- Infrastructure
  - broadband, mobile
  - competition



Internet-driven services

- App economy
  - «All services» come through mobile devices
  - from «parts» to services
- Ambient Assisted Living (AAL)
  - Sensors supporting care information
  - Proactive Health professionals
    - call if you have not taken your medicine
    - call if your blood pressure is too high
- Hospital access
  - BasicInternet at 5 hospitals
- Producing sensors vs analysing data
  - sensor producers don't see the use of their sensors
- Information providers (Google)
  - become industry suppliers

«Free basic access for low capacity services»
The Basic Internet Vision @Basic4all

MIT and the global GDP

- 50% of U.S. economic growth after 1945 attributed to technological innovation

MIT alumni startups (2011 numbers)

- 25,800 active companies
- 3.3 million people employed
- $2 trillion gross domestic product
- 10th world rank in GDP
- 19% higher per capita income than Ca
  than USA)

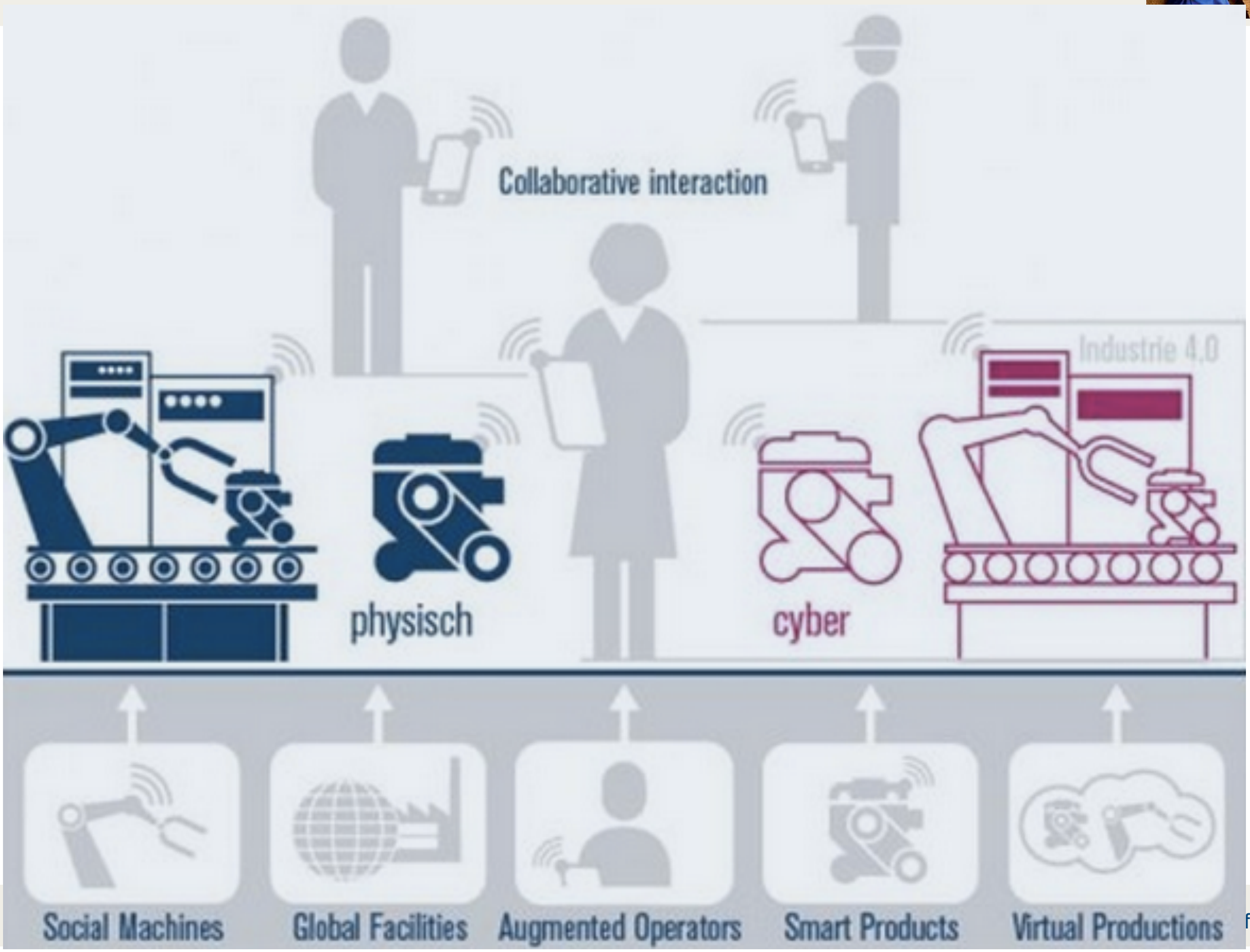
Role of education

- 75% of the world's GDP growth in developing countries

25 largest economies
by GDP (PPP) in 2015 in Billions

1	China	18,976
2	United States	18,125
3	India	7,997
4	Japan	4,843
5	Germany	3,815
6	Russia	3,458
7	Brazil	3,259
8	Indonesia	2,840
9	United Kingdom	2,641
10	France	2,634

Industrie 4.0 vision



Source: Trumpf / Forschungsunion Wirtschaft & Wissenschaft

EU Commission activities

- Four focus areas for Industrie 4.0
  - Digital Innovation Hubs
  - Leadership in digital platforms
  - **Closing the digital divide gap**
  - Providing framework conditions
- Collaboration with regional/structural funds (ESIF) and Juncker package (EPIF)
- Connectivity is the challenge both in terms of
  - Availability/Security and
  - Affordability

Digital Divide & Digital Inclusion

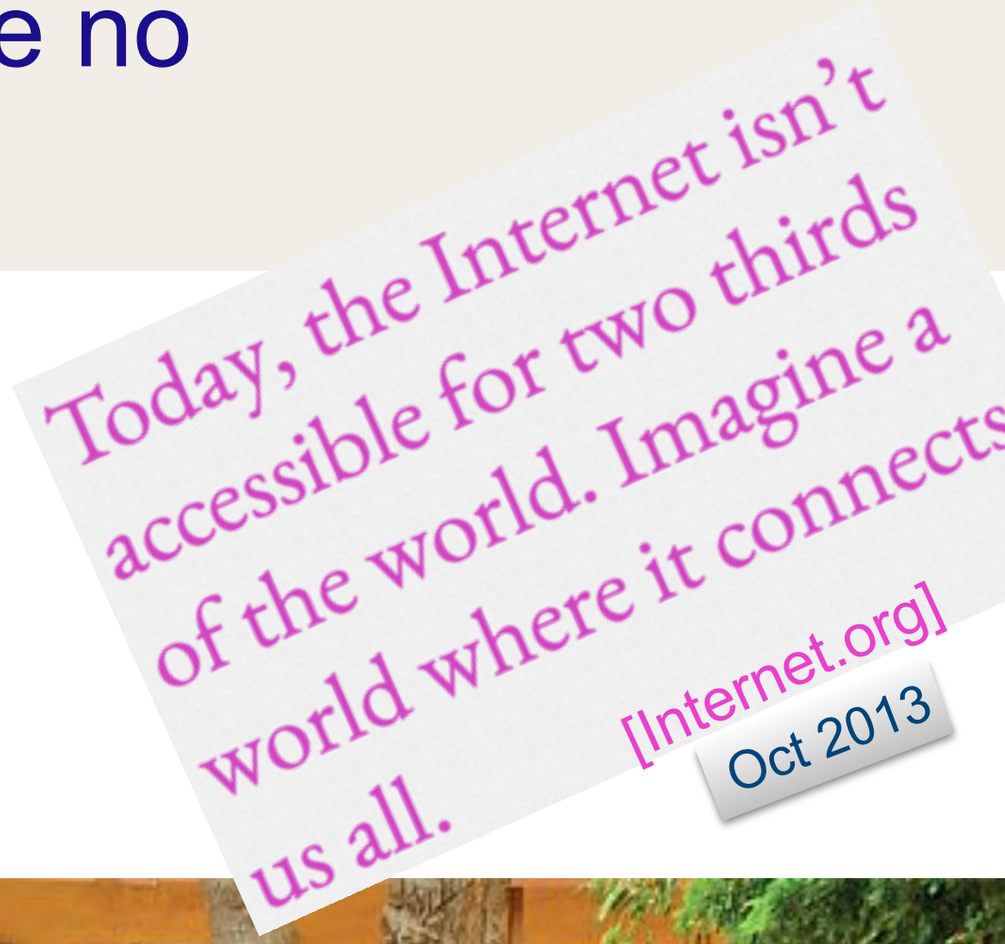
- Basic school in education
  - 3 basics: read, write, mathematics,
  - +2 innovation drivers: express, ICT

- University education
  - basics: analysis, problem solving, evaluation
  - innovation by: english writing, innovation management

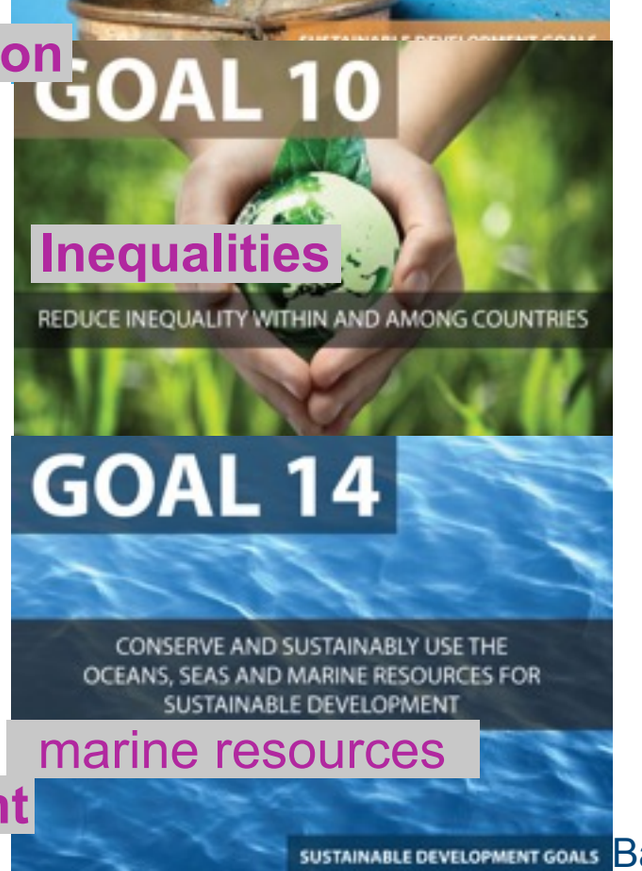
- the Global World perspective for beyond 2050
  - Human-Bond-driven systems
  - Knowledge-, sustainability-driven economy

2/3 of the World's population have no access

- Knowledge is the basis for health, education and entrepreneurship
- Provide access to basic information, means
  - access to education
  - access to health information
  - opportunity for entrepreneurship



United Nations
Sustainable Development Goals



#Basic4All
The Role of Free Access

Education & Lifelong

Health & Well-Being

Empower Women & Girls

Growth & Employment

Infrastructure & Innovation

Inequalities

Sustainable development

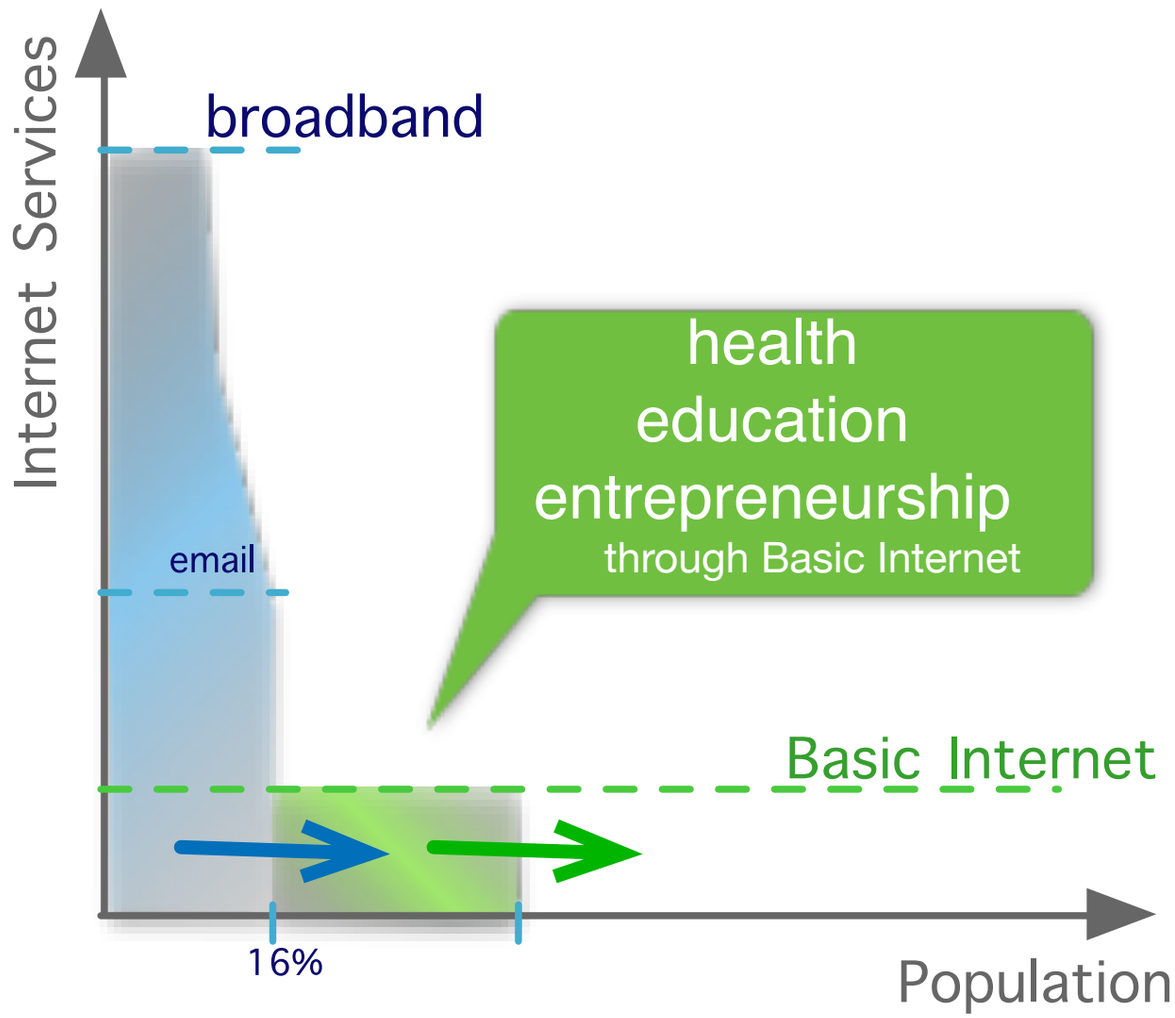
inclusive societies

#Basic4All

Access to basic information to everyone

- A typical situation in Africa
- Need for
  - those who don't have Internet coverage
  - those who don't have income for access
  - those who don't have rich parents
- We develop the market
  - Basic Internet is complementary to traditional industry

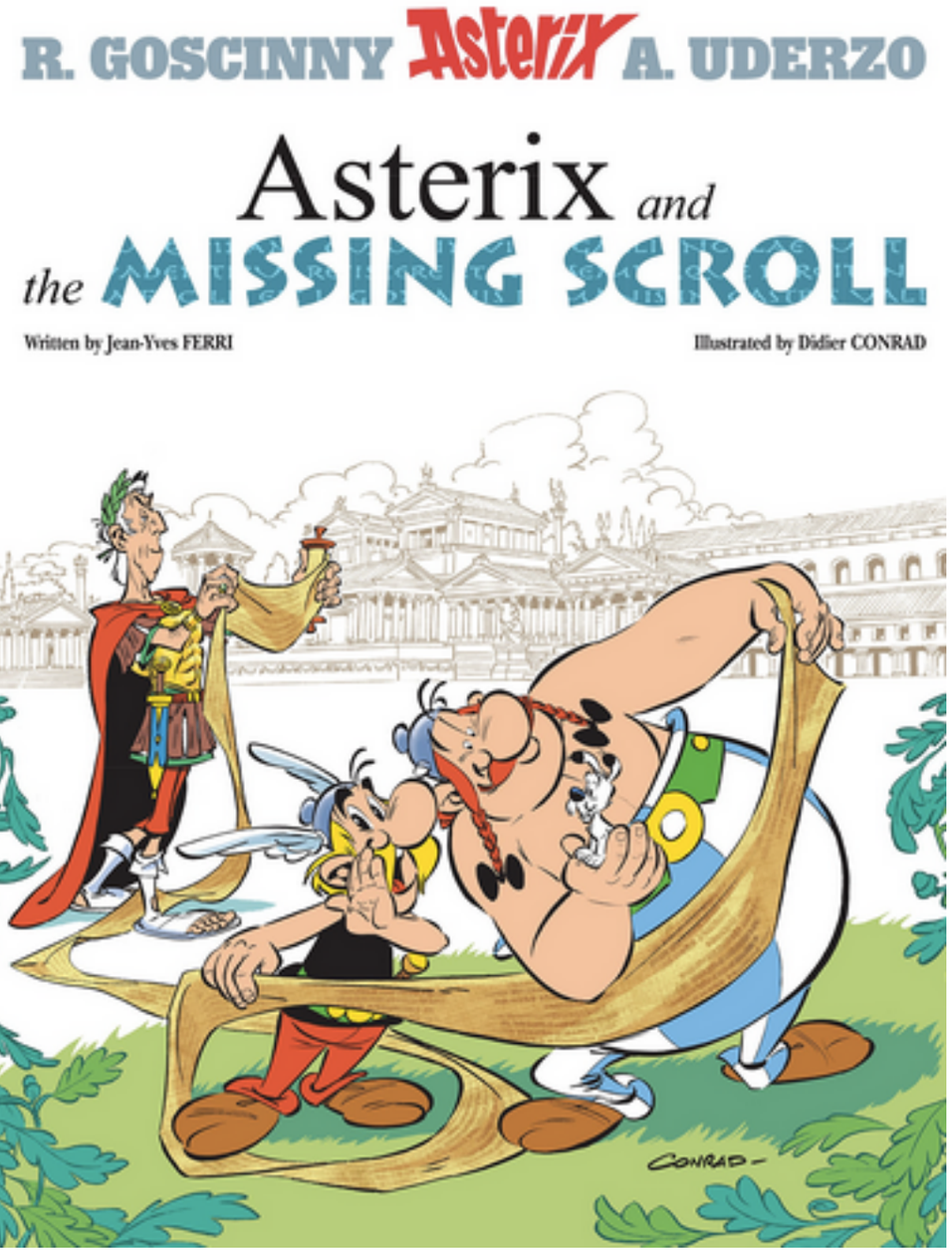
- The World
  - Internet access spammed by video and gaming
  - Roaming (3G/4G) - affordability
  - Authentication (WLAN) - availability



The role of information

Information
- knowledge that you get about someone or something
- facts or details about a subject

[source: merriam-webster.com/dictionary]



- Net Neutrality
- Basis for economic development
- «Children are good in using IT»
  - video, gaming, snapchat,…
- «Children are bad in retrieving information»

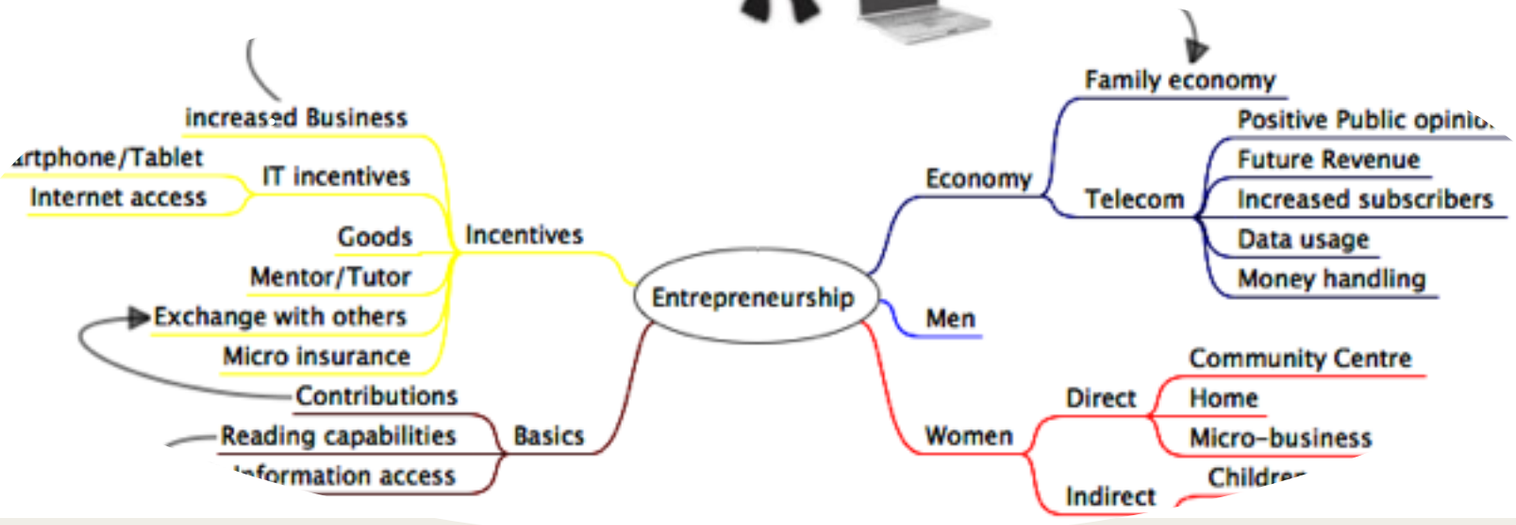
#Basic4All

Development Focus

- Education
  - Digital Inclusion
  - Free access to Basic Information

- Health
  - sensor/app supported health informatic
  - new role of health professionals

- Innovation
  - Women entreprene
  - Knowledge-based



Free Information access:
Removing the digital divide

- Societal aspects
  - –everyone has access to information
  - –on all WLAN (&mobile) networks

- Technical requirements
  - –browser with just text & picture
  - –compressed content to be transmitted over radio
  - –proxy-based splitting of information

Example: Opera Mini

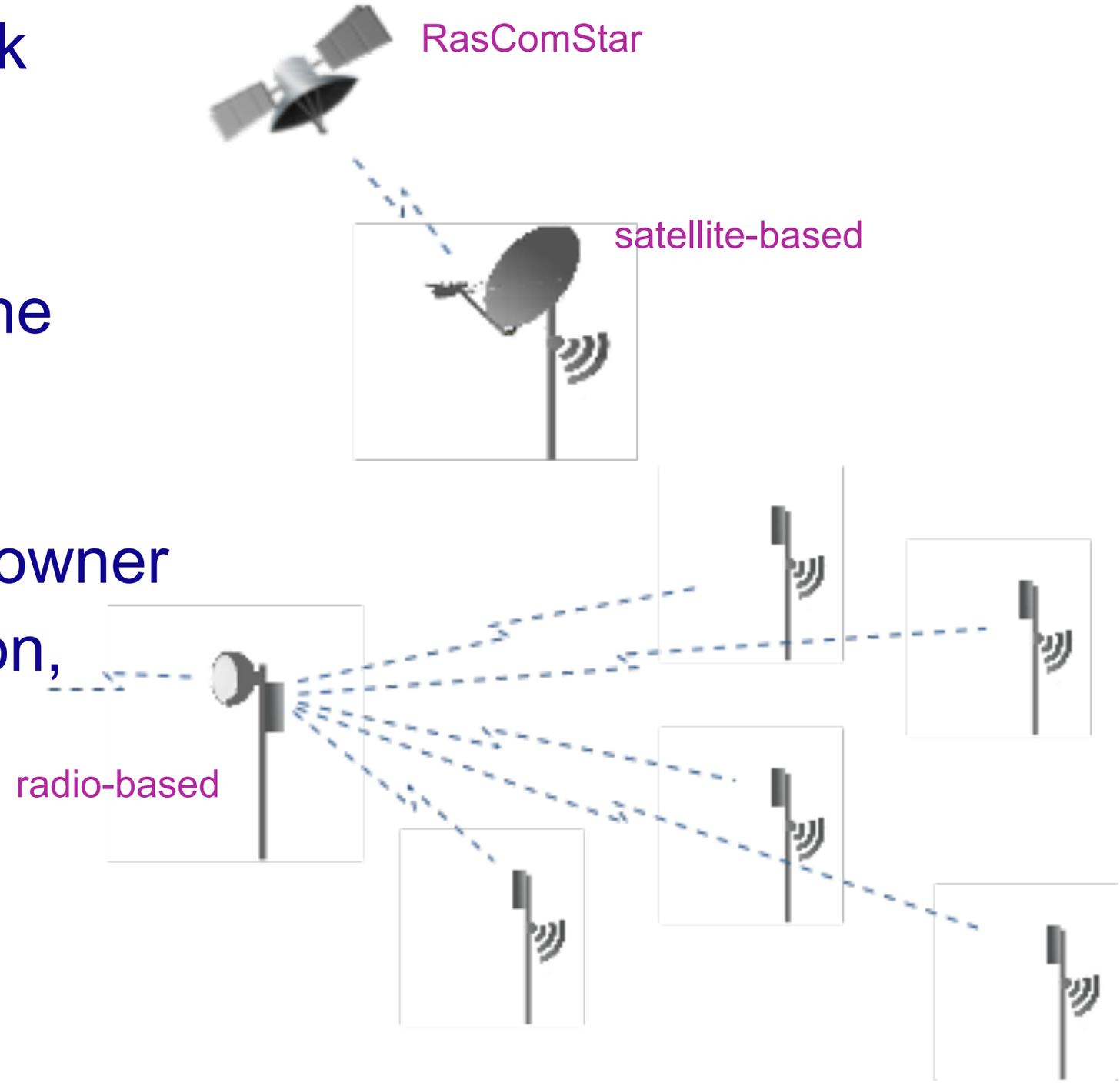
- –encrypted request from Opera Mini browser
- –Opera access Web page, removes animations, and compresses the page
- –Compressed page is sent to device
- –typical 80% reduction

- Usage results
  - –4 MByte average user
  - –20 MByte max user/month

[Opera Software, Nigeria, 2011]

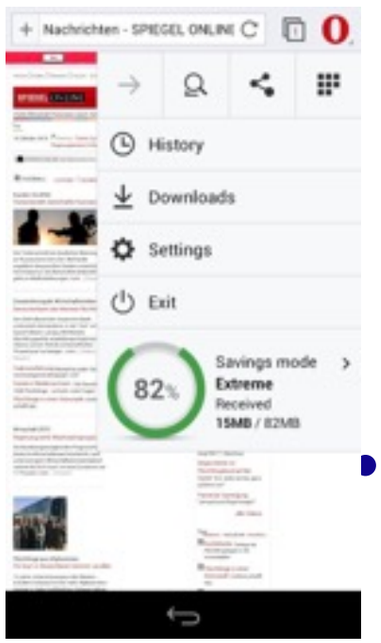
Basic Internet provision
through Partners

- Satellite, radio or mobile link
  - local roll-out
  - with partners in Africa
- Mobile Operators: extend the reach, prepare the market
- CSR: increase innovation
- Own deployment: hot-spot owner
- AID organisations: education, health information
- Sponsored access
- Higher education: educate teachers



Technological challenges

- Goal: free information to everyone
  - compressed text
  - low/medium-size pictures
- Information type filtering
  - filter dynamic elements
  - Web browser
    - Opera Mini
    - http2 standard
  - Basic Internet App Store
    - traffic amount, capacity



- Network protocol
  - signalling versus data amount
  - mobile network load

- Centralised management
  - open protocols, e.g. TR-069
  - Customer premise equipment (CPE) and Auto-configuration server (ACS)
    - auto-configuration
    - software management, modules
    - status and performance
    - diagnostics

- IoT extension
  - set-up, configuration of communication
  - secure (encrypted) communication
  - update/revoke security certificates

Technology
High-level challenges

#Basic4All
let us know your interest to become part of BasicInternet

v3.0 Business Extensions: IoT, App
v2.5 IoT and App extension
v2.0 Technology extensions
v1.5 Market agreements Africa
v1.2 Market agreements Pilot markets
v1.1 Operational Kjeller Innovation
v1.0 Operational Demonstration Kongo
v0.9 Technology demonstration at UNIK

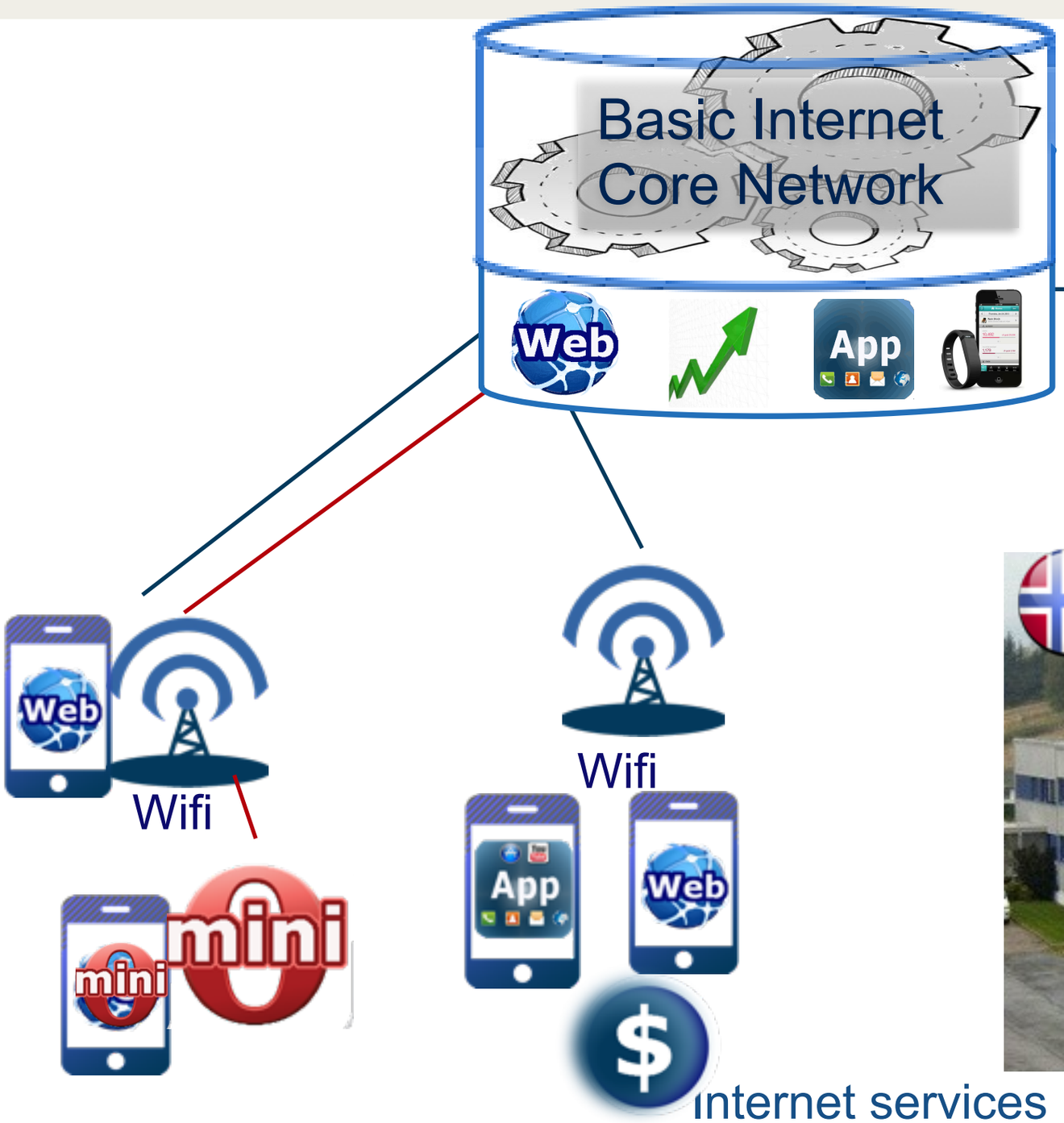
v2.5 IoT and App extension [edit]

- Define App requirements to be able to use "Basic Internet"
- Define use-case IoT
- IoT-app (Summary low-cost application for IoT sensor supply, - New, - v2.7)
- Basic Internet App requirements (Summary business for Apps with own proxy access, -
- PowerConsumption Links (Summary Provide documentation on Power Consumption of
- AP monitoring through Mikrotik (Summary Add local monitoring on the «client side» of th solution is that we in the Mikrotik a «monitoring» of IP addresses who provide traffic. No set-up allowing us to provide a «busy hour» and other measures., - Open, Answer, - v2.5
- Cache for Base Stations (Summary Add a cache at our base stations to increase "virtual

v2.0 Technology extensions [edit]

- TR-069 on MikroTik RouterOS (Summary TR-069 protocol implemented on MikroTik Ro
- Video in Opera Mini redirected to accounting unit (Summary Currently Opera Mini does requested video should point to an accounting page, - New)
- Own infrastructure for Basic Internet (Summary Customers provide their own infrastructu

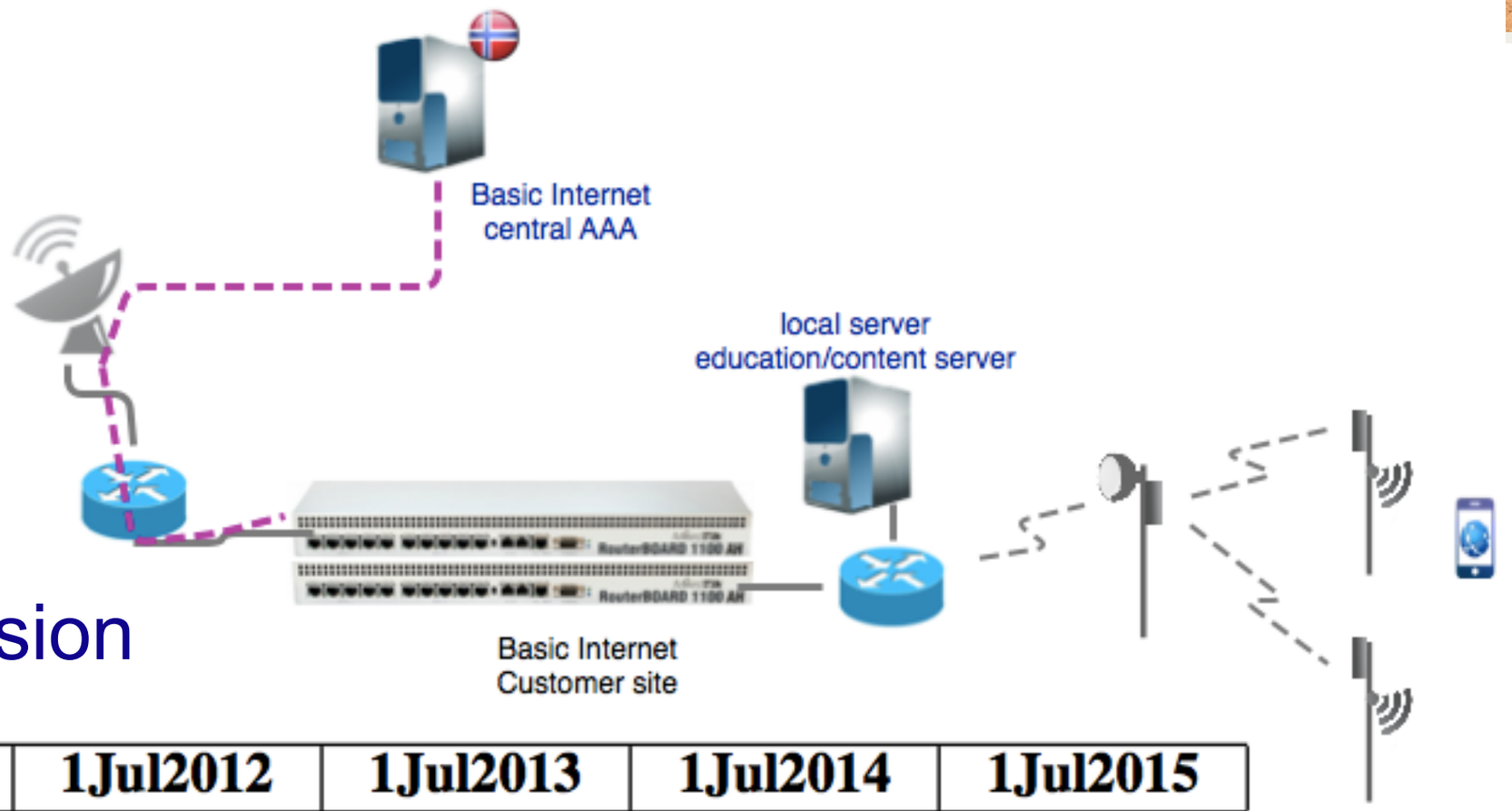
Basic Internet Core Network
at Kjeller



internet services
through vouchers

Examples of challenges
Network infrastructure

- DHCP lease time
  - IP addresses
  - 20.000 students
  - mobile network



- Intelligent compression

	1Jul2012	1Jul2013	1Jul2014	1Jul2015
av. web site [kB]	1090	1485	1829	2135
Images [kB]	684	909	1159	1348
Scripts [kB]	210	225	293	344
Video [kB]				204

Internet provision
International Activities

- Latvia - «free Wifi European capital»
- Germany - Government vs Freifunk
- Romania - E-NET
- Wireless Cities
  - Bologna, Bristol, Dublin, ,…
  - Municipal_wireless_network [wikipedia.org]
- IT-industry
  - Google, Microsoft, Yahoo - Wifi
  - Internet.org
  - zero rated content

freifunk.net

- Access
  - Google Loom
  - Facebook Solar Aircrafts
  - Thales/Alenia Zepelin
  - Satellite
  - Fibre/Virtual Fibre

Our extended partner network:
Business Ecosystem

psi
Healthy lives. Measurable results.

AGENCE UNIVERSITAIRE DE LA FRANCOPHONIE

CTiF

ASHOKA
Everyone A Changemaker™

Web Edu

Web Health

mini News

YouTube

App

Access

Access

Access

Back-bone

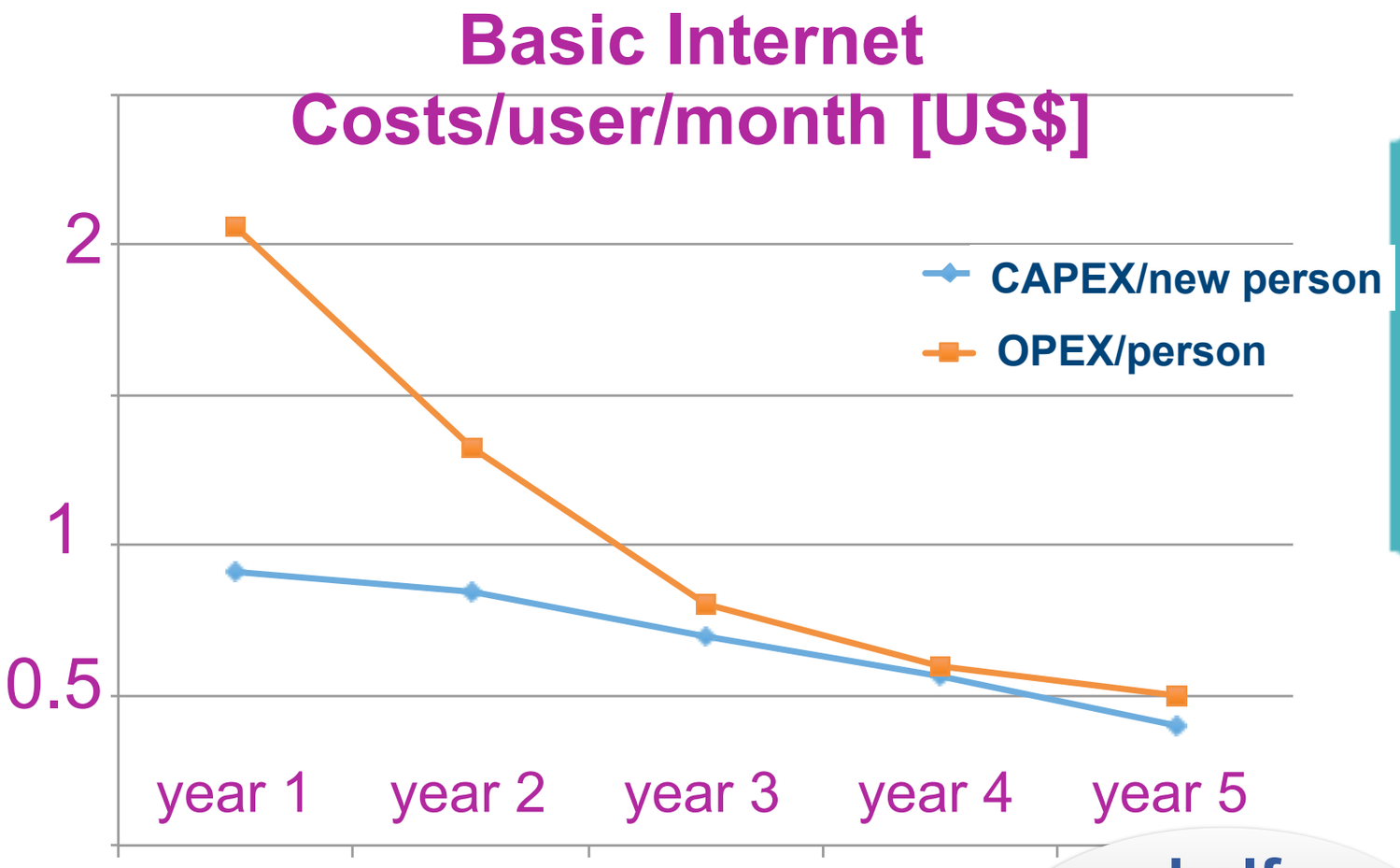
Proxy

$ Billing

Satellite

3G/4G

Society costs
Cost of ICT development



Child Protection
Child taken into care average cost per year
£64,819

Unemployment
Job Seekers Allowance per claimant per year
£10,025

Care for the Elderly
Residential care for older person per year
£28,132

exclusion
Education
Exclusion from school per pupil per year
£11,192

- local Wifi spots
- based on Satellite connectivity

half a dollar is enough*

Source: UK GOVERNMENT UNIT COST DATABASE
www.data.gov.uk/sib_knowledge_box/toolkit

Activities - DRC (Congo)
Implementation

- Internet access
  - University of Lisala
  - Deployment at 4 other universities in Kinshasa (DRC)
  - 10 additional implementations
- IPXextenso, Orange
  - 2 successful pilots
  - 570 planned installations
  - expected: 2000 villages
- upcoming pilots in Mali++

#Basic4All Conclusions

- Digital Inclusion is the key for sustainable development
  - Complementary to traditional industry
  - Relevant for Africa (and the World)
- Net neutrality
  - access to information, compressed text and pictures
  - reach of 300-400 people on a 1 Mbit/s thin satellite link
- Technology challenges
  - Information type filtering
  - Network load (DHCP, data vs signalling)
  - Remote maintenance (TR-069)
  - Browser development (http2)
  - IoT extension (App store)
- A collaborative foundation from Kjeller (Norway)