



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

# EyeNetworks Fagdag, 29-30Apr2019, Oslo

## 5G, 6G and Wifi Network Slices

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## Outline

*“The last time I was connected by wire was at birth”*

- Mobile development
  - ➔ From Network development
  - ➔ To Societal Empowerment
- Wifi and 5G/6G
- Sustainability and Responsibility in 6G
- Privacy, Internet and net-neutrality
  - ➔ Facebooks Free Basics
  - ➔ India: “We have been colonised once...”



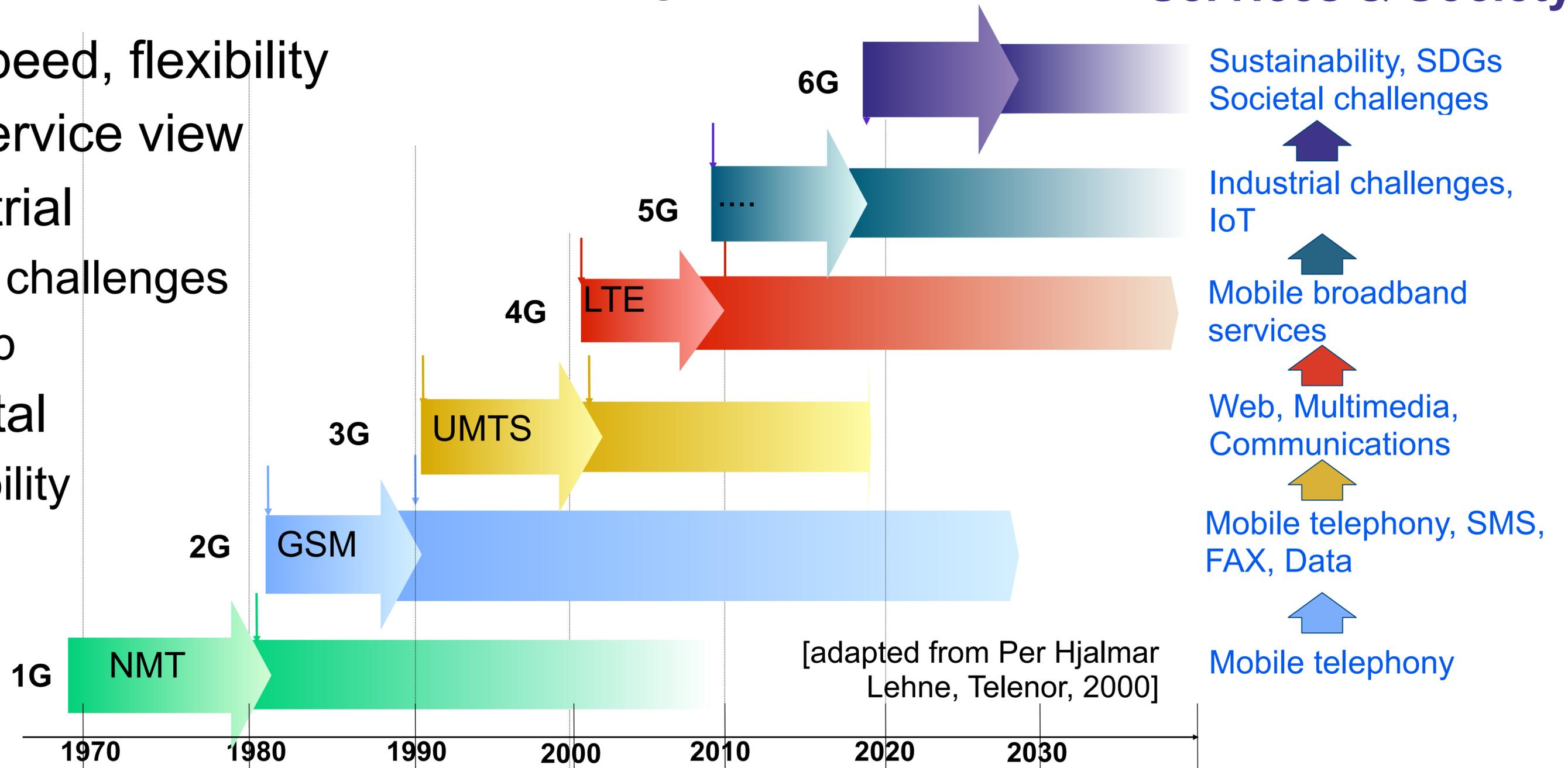
*“Internet had the ability to dismantle the divide. Internet failed miserably, the divide is bigger than ever.”*  
Kate Gilmore, Human Rights, UNO



Discussion

## 6G: Digitisation of the Society

- 1G-3G: Speed, flexibility
- 3G-4G: Service view
- 5G: Industrial
  - Business challenges
  - ownership
- 6G: Societal
  - sustainability

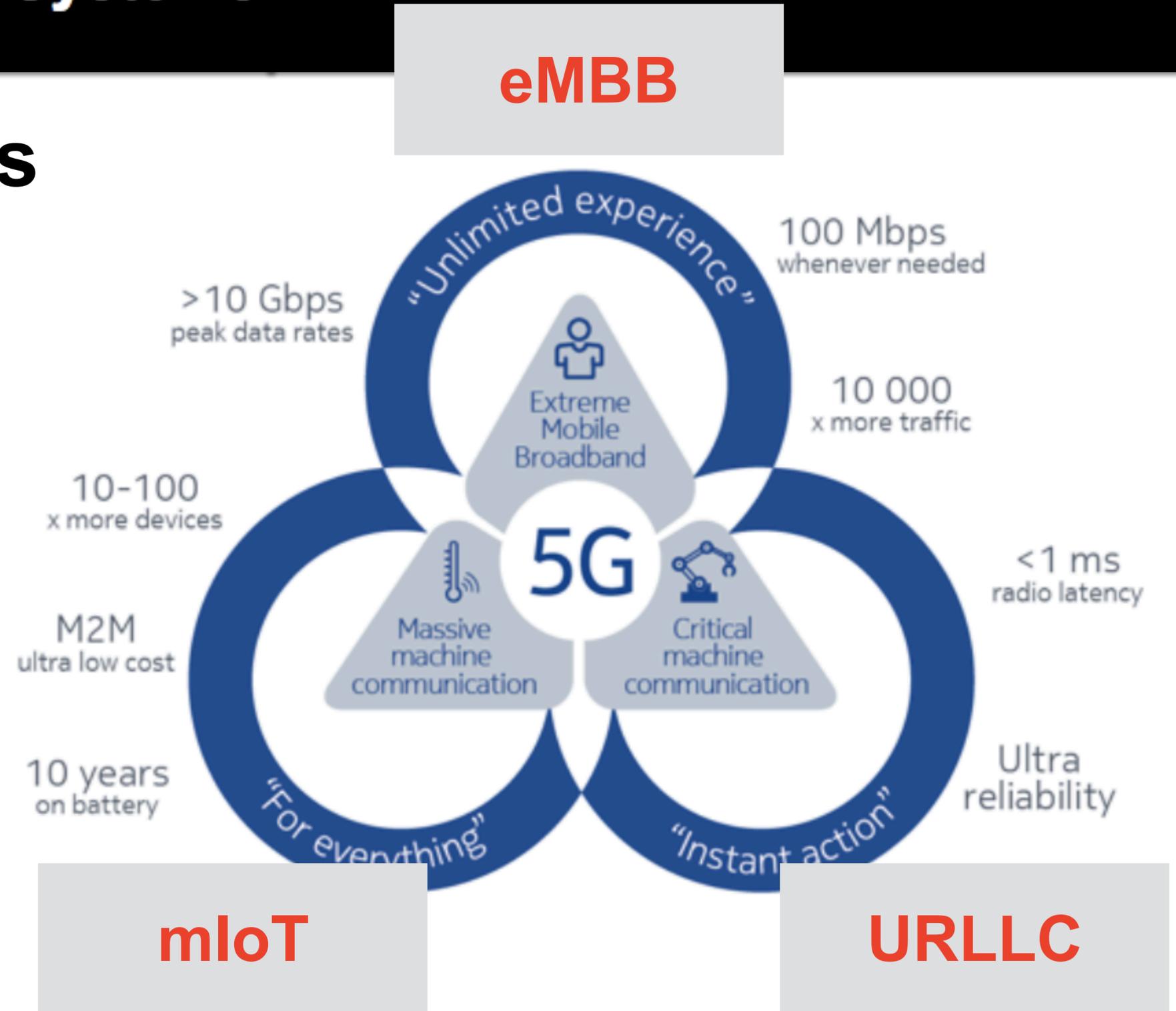


[adapted from Per Hjalmar Lehne, Telenor, 2000]



## 5G: Industrial Challenges

- enhances Mobile Broadband
- massive IoT
- ultra Reliable, Low Latency communication



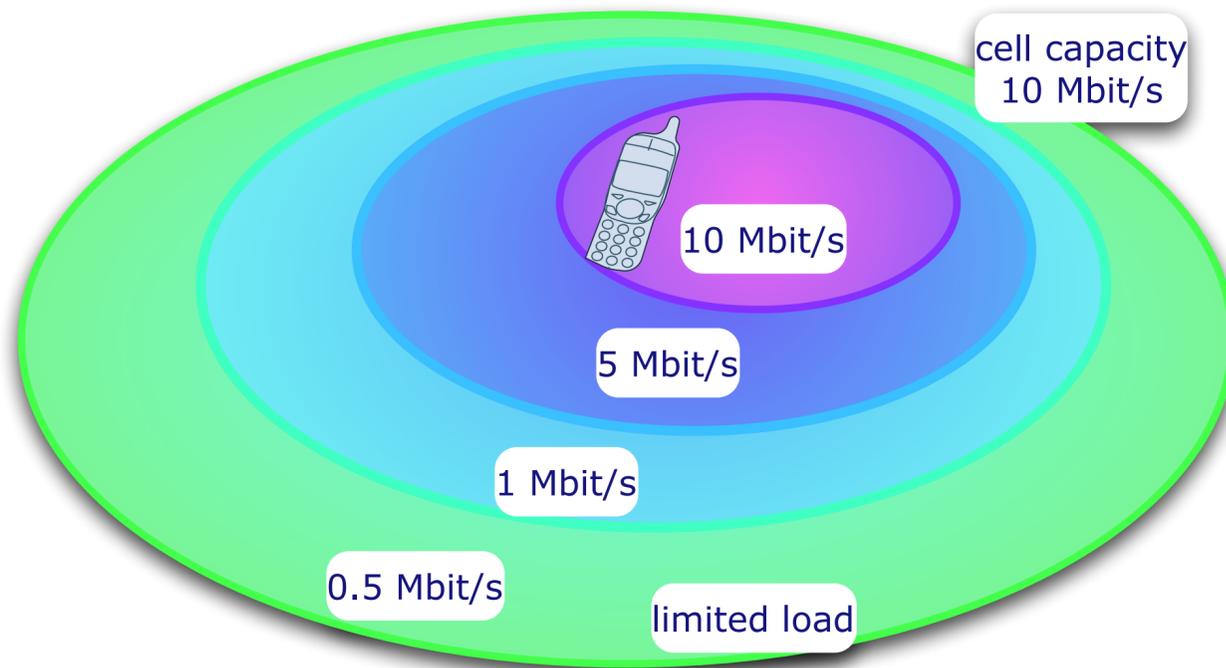
[source: Nokia <https://networks.nokia.com/5g/get-ready>]



## 5G access: radio and business dilemma

- The radio dilemma

→ outdoor to indoor

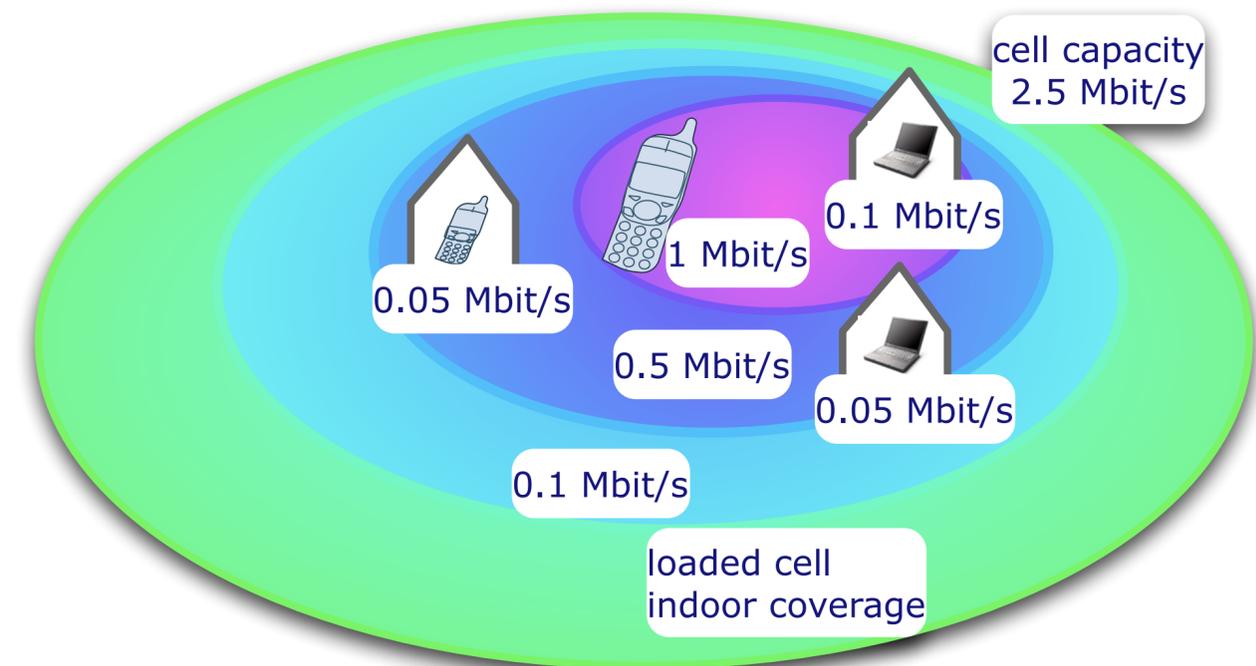


“coverage cell”

- The business dilemma

→ 5G access is expensive (range)

→ changing access means losing revenue



“70-80% indoor usage”

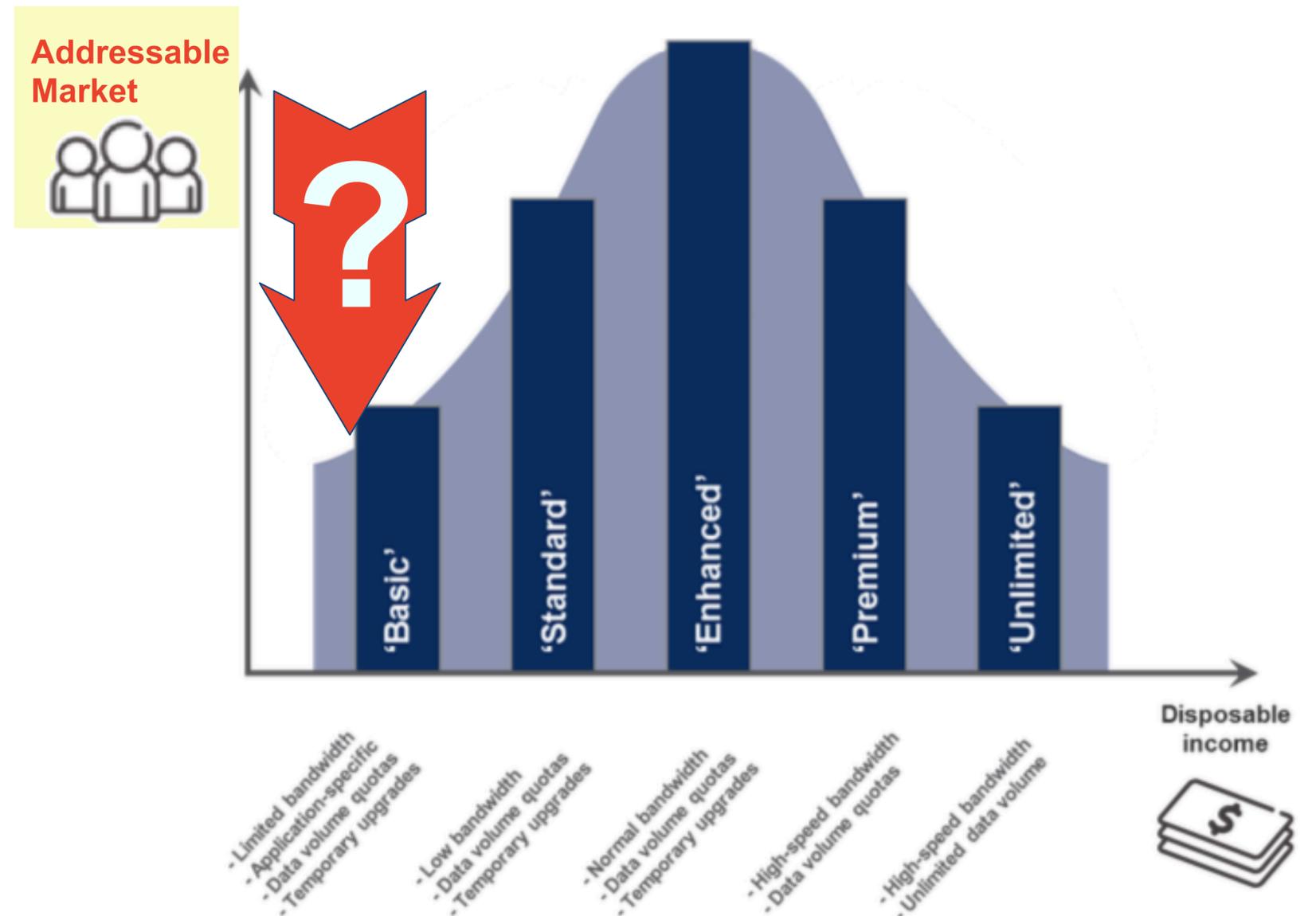
[Original drawings: Jørgen Grinnes, Telenor, 2010]



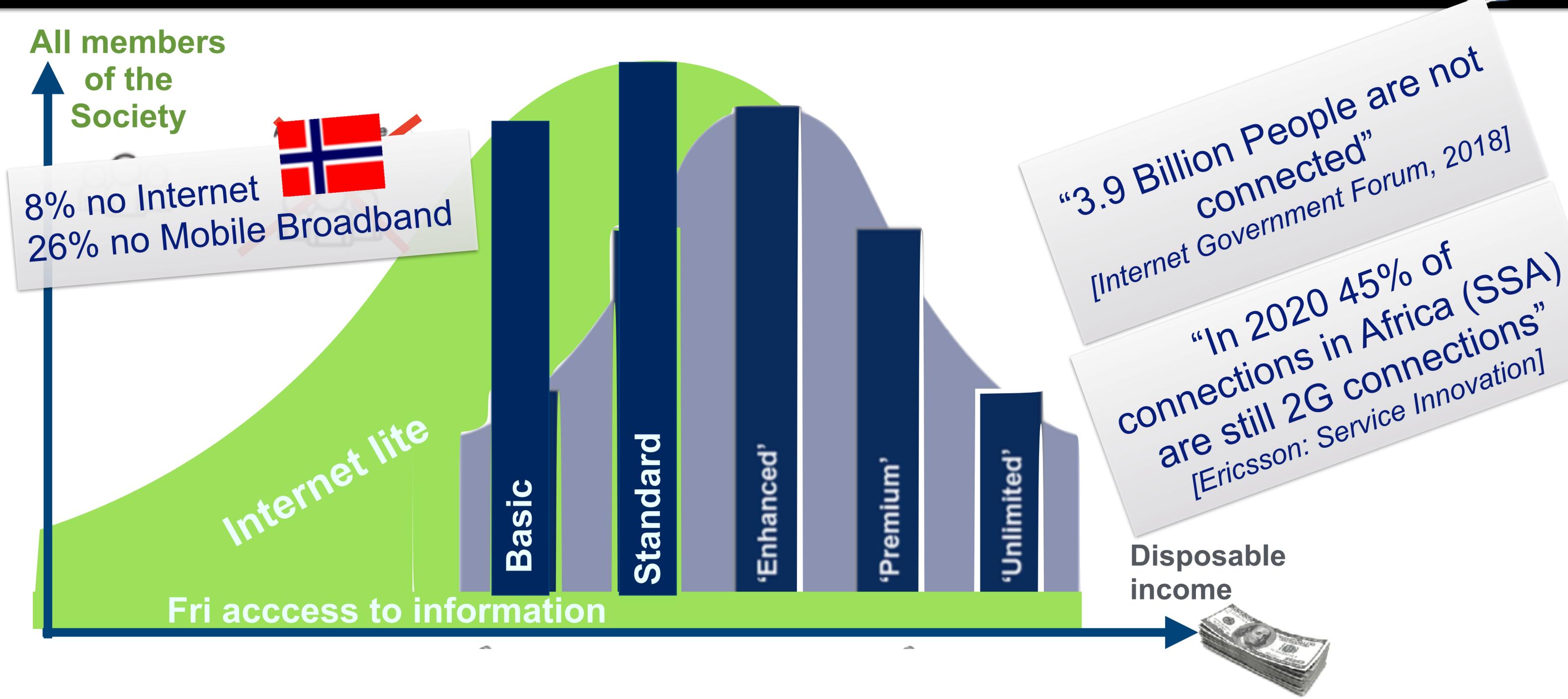
## 5G business & digital inclusion

- 5G for digital inclusion?
  - ➔ cost of network, services
  - ➔ IoT, digitisation, automation
  - ➔ “the divide is bigger than ever”

[Source: Service Innovation through Smart Networks, Ericsson, 2018]



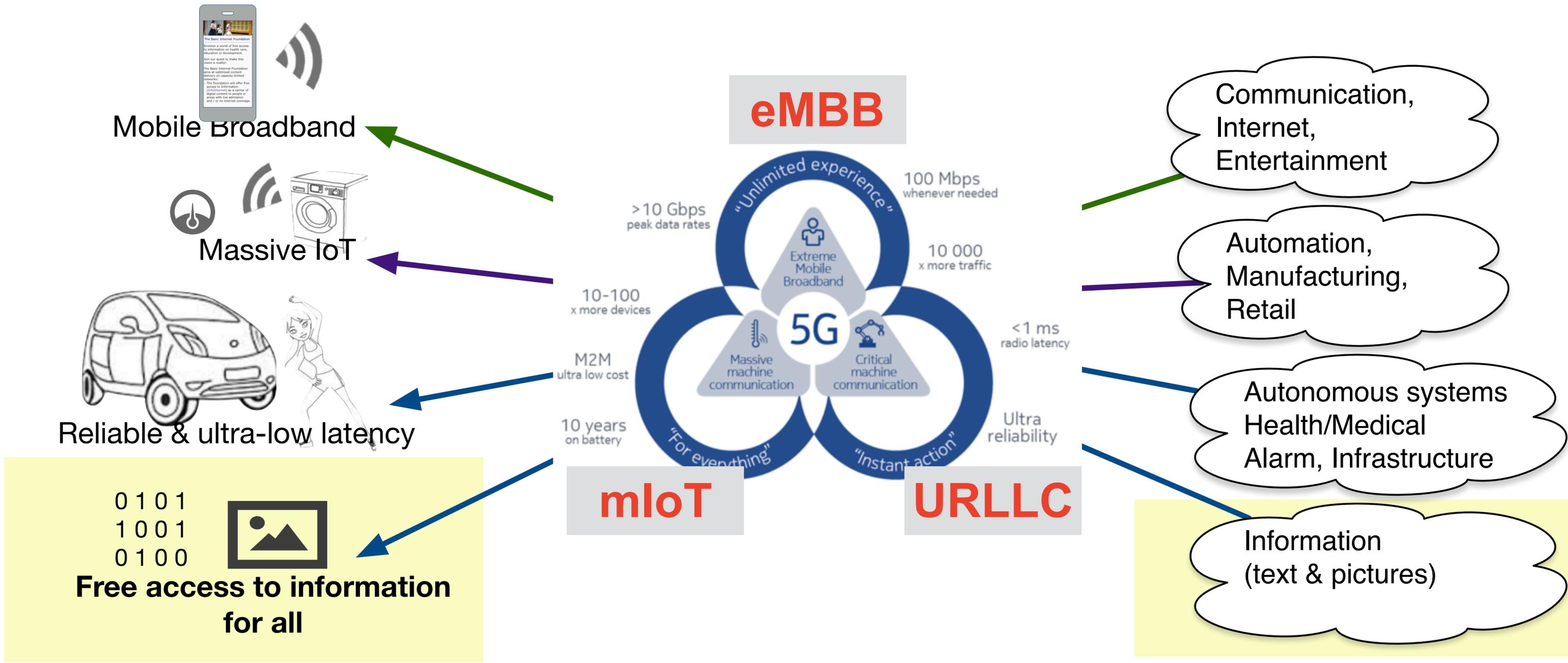
# 6G (#5GforAll) for digital inclusion



[Adapted from: Service Innovation through Smart Networks, Ericsson, 2018]



# 5G network slicing for Free Access to Information for All



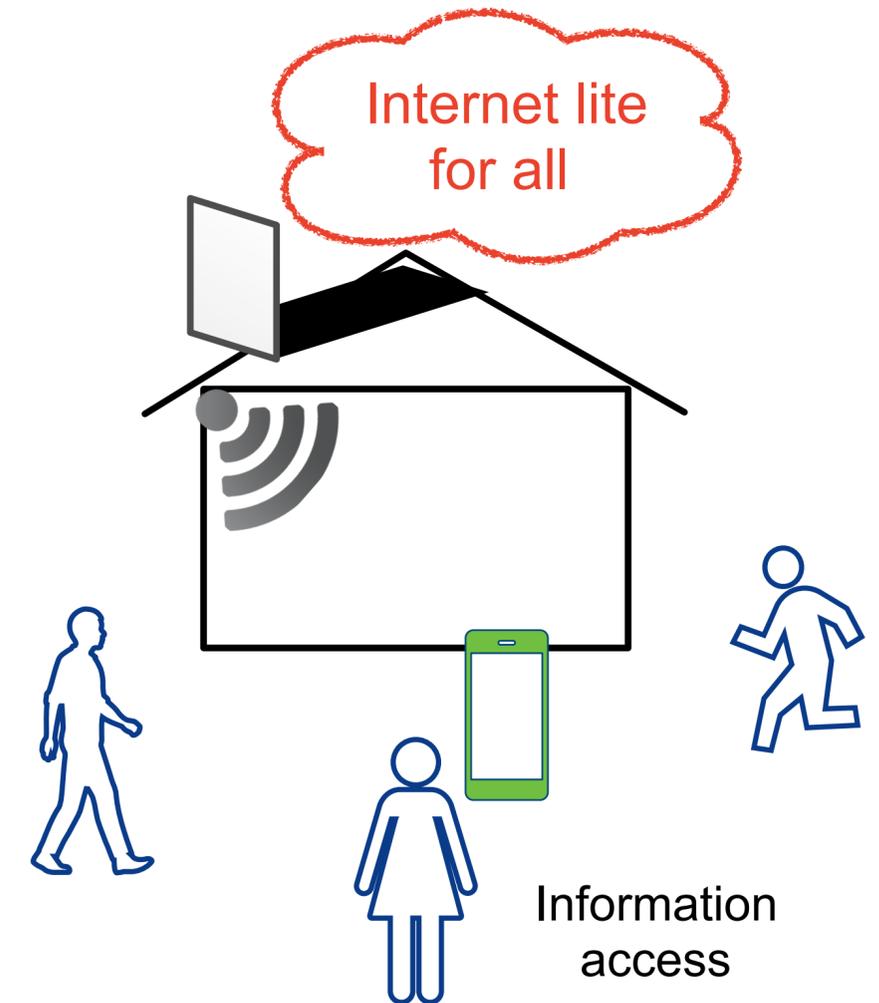
## Home Domain for Digital Inclusion

- The digital Divide

- 10x increase in Mobile Broadband (2013-2019) [1]
  - Netflix, YouTube, Hulu
- 26% of NO-subscribers don't have MB [2]
- 8% (400.000) in Norway not connected to the Internet [3]

- Home access for digital inclusion

- "Internet lite for all"
  - Free access to information everywhere
  - Premium access to broadband



[1] Service Innovation through Smart Networks, Ericsson, 2018

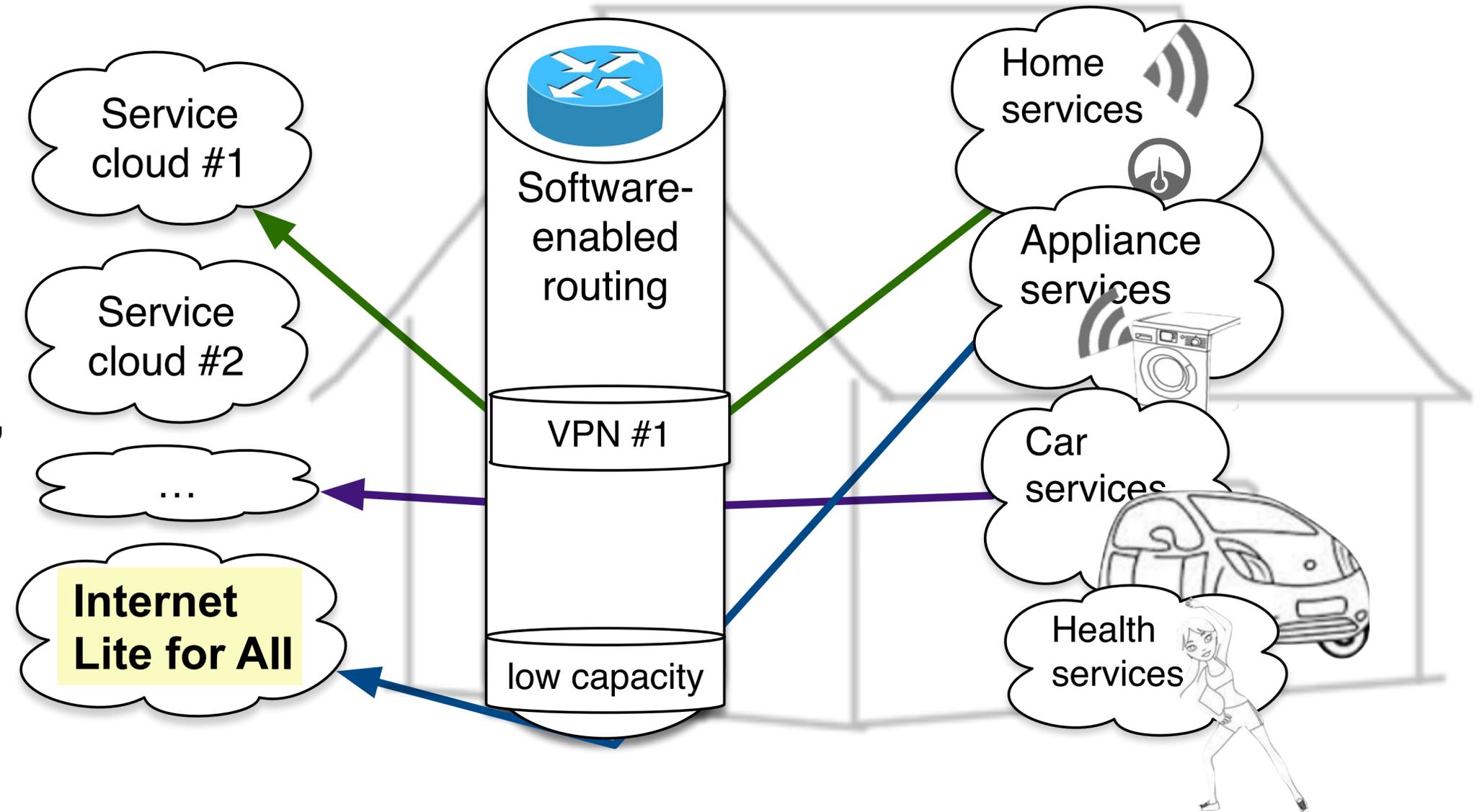
[2] Det norske ekomarkedet 2017, [NKOM.no](http://NKOM.no), 2018

[3] "Sauebonden som aldri...", [aftenposten.no](http://aftenposten.no), 7Okt2018

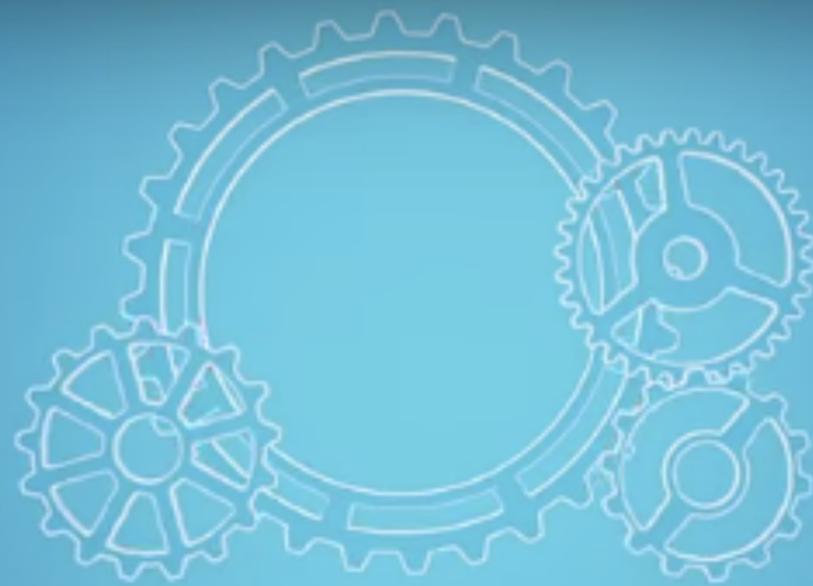


## Wifi development: Learn from Industrial Automation and Mobile Networks

- “What to secure?”
- Network segregation  
→ *Network slicing*
- From Confidentiality, Integrity, Availability (CIA)
- to Availability, Integrity, Confidentiality (AIC)



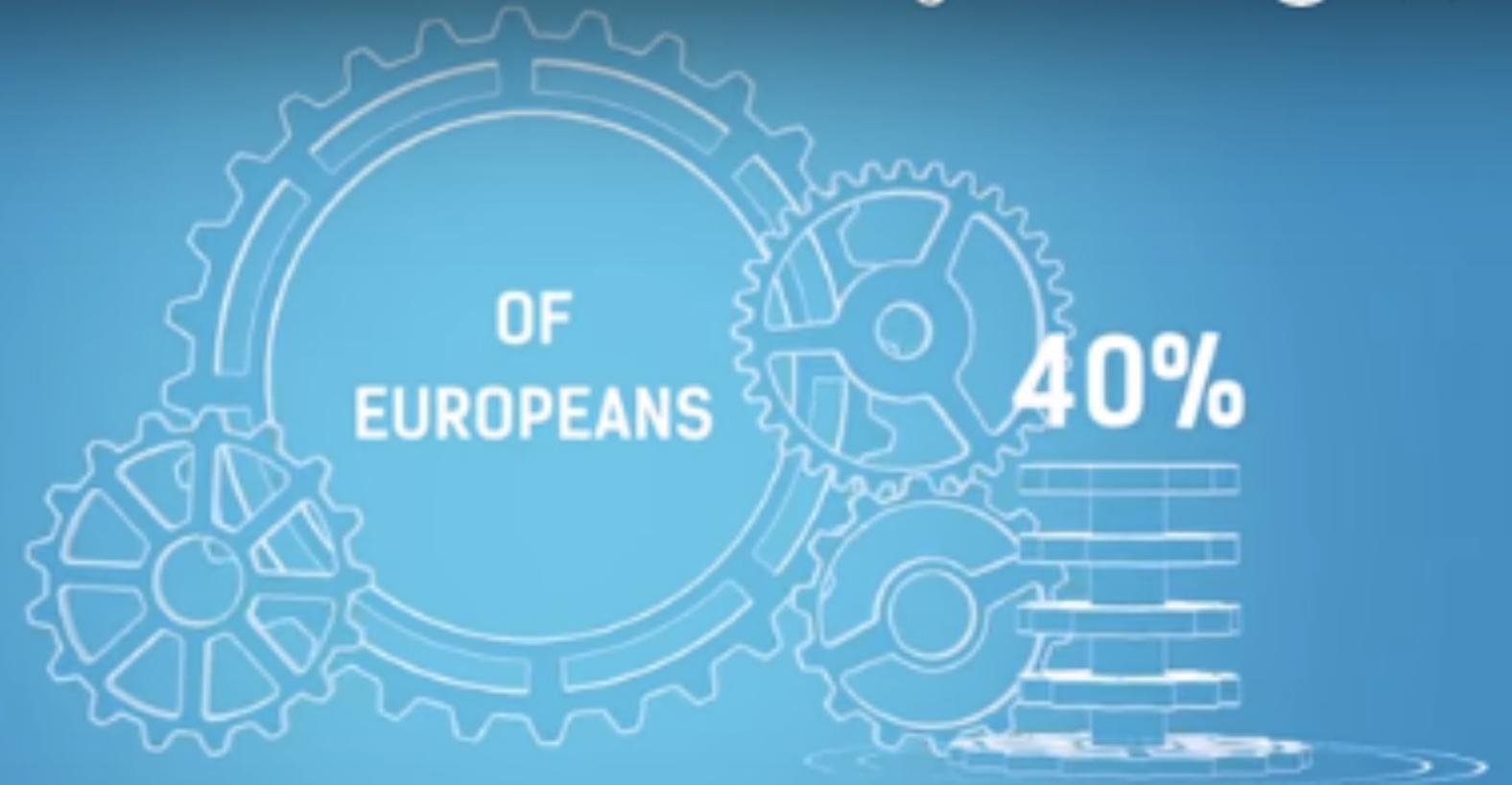
Digital Agenda Scoreboard 2015: Strengthenin... ⌚ ➡



A DIGITAL SOCIETY IS MADE OF  
DIGITALLY-SKILLED CITIZENS

## #1) Digital Inclusion and Empowerment

Digital Agenda Scoreboard 2015: Strengthenin... ⌚ ➡



DON'T EVEN HAVE BASIC DIGITAL SKILLS



Source: EU commission(2015)

# #2) Societal Development Goals

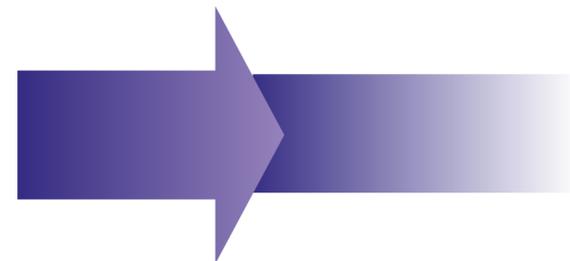
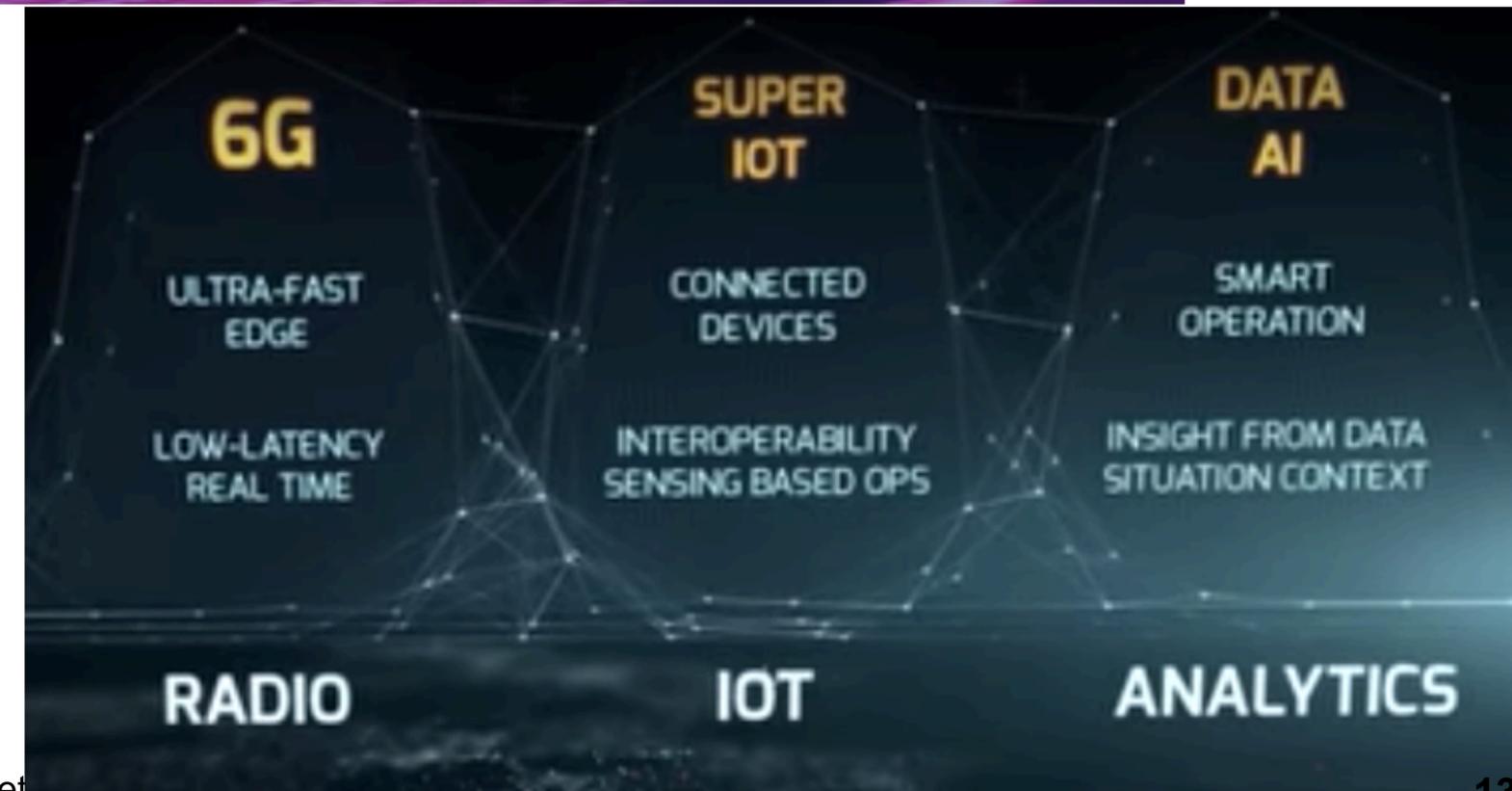
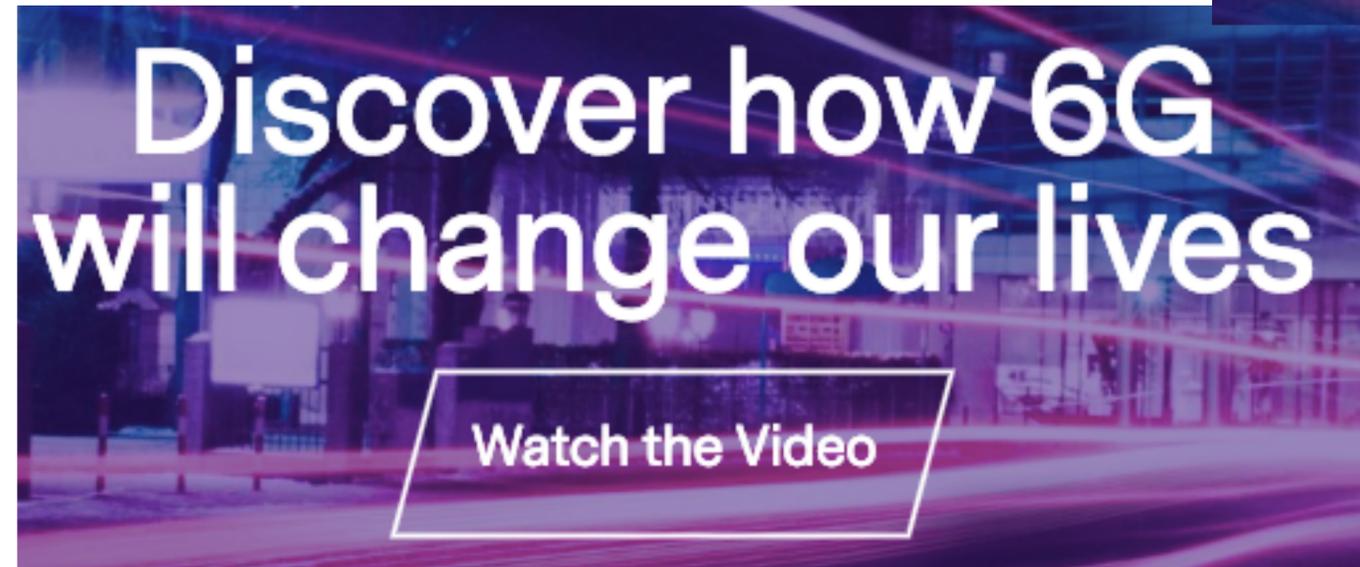
*fri access to information - the catalyst for the goals*





## 6Genesis.com by Oulu University

- Lighthouse project in Finland
  - ➔ 251 M€ funded
- Goals
  - ➔ Support industry in finalization of 5G
  - ➔ Develop the fundamental technology needed to enable 6G
  - ➔ Speed up digitalization in society
- Focus on Sustainable Development
  - ➔ FI, SE, NO, DK academic collaboration





**Inclusiveness - Trust - Capacity**  
United Nations High Level Panel on Digital Cooperation 2019



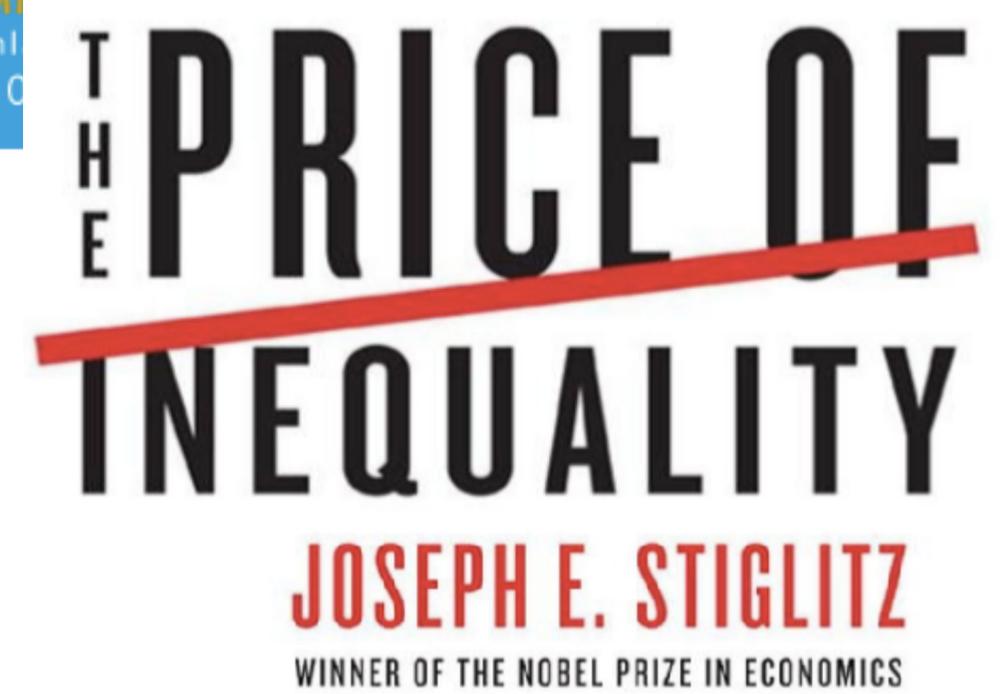
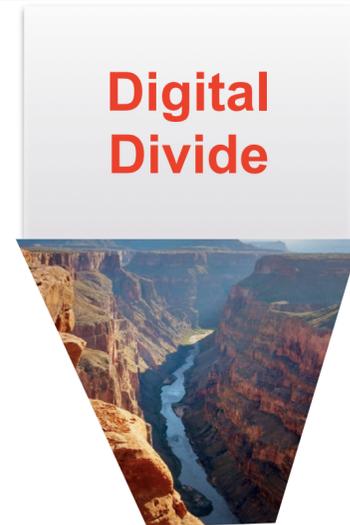
# 5G, 6G, Wifi- Discussion

- Mobile & Wireless evolution
  - ➔ from technology
  - ➔ to services
  - ➔ to societal empowerment
- Wifi - Digital Inclusion and Empowerment
- Internet Lite for All
  - ➔ free access to information



<http://www.6gsummit.com>

6G WIRELESS SUMMIT  
Levi • Lapland • Finland  
24-26 March 2020



**Sharing Economy:**  
“Telenor will create a digital ecosystem in Pakistan”

Ved å bygge internett for alle, og ved å skape relevante og uunnværlige digitale tjenester, kan vi bidra til en bedre verden, skriver Sigve Brekke.  
FOTO: Heiko Junge, NTB scanpix

