



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

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5G, 6G and Wifi Network Slices

Josef Noll,

Professor, University of Oslo, Department of Technology Systems

Secretary General, Basic Internet Foundation

Kjeller, Norway, m: +47 9083 8066, e: josef@jnoll.net



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...”



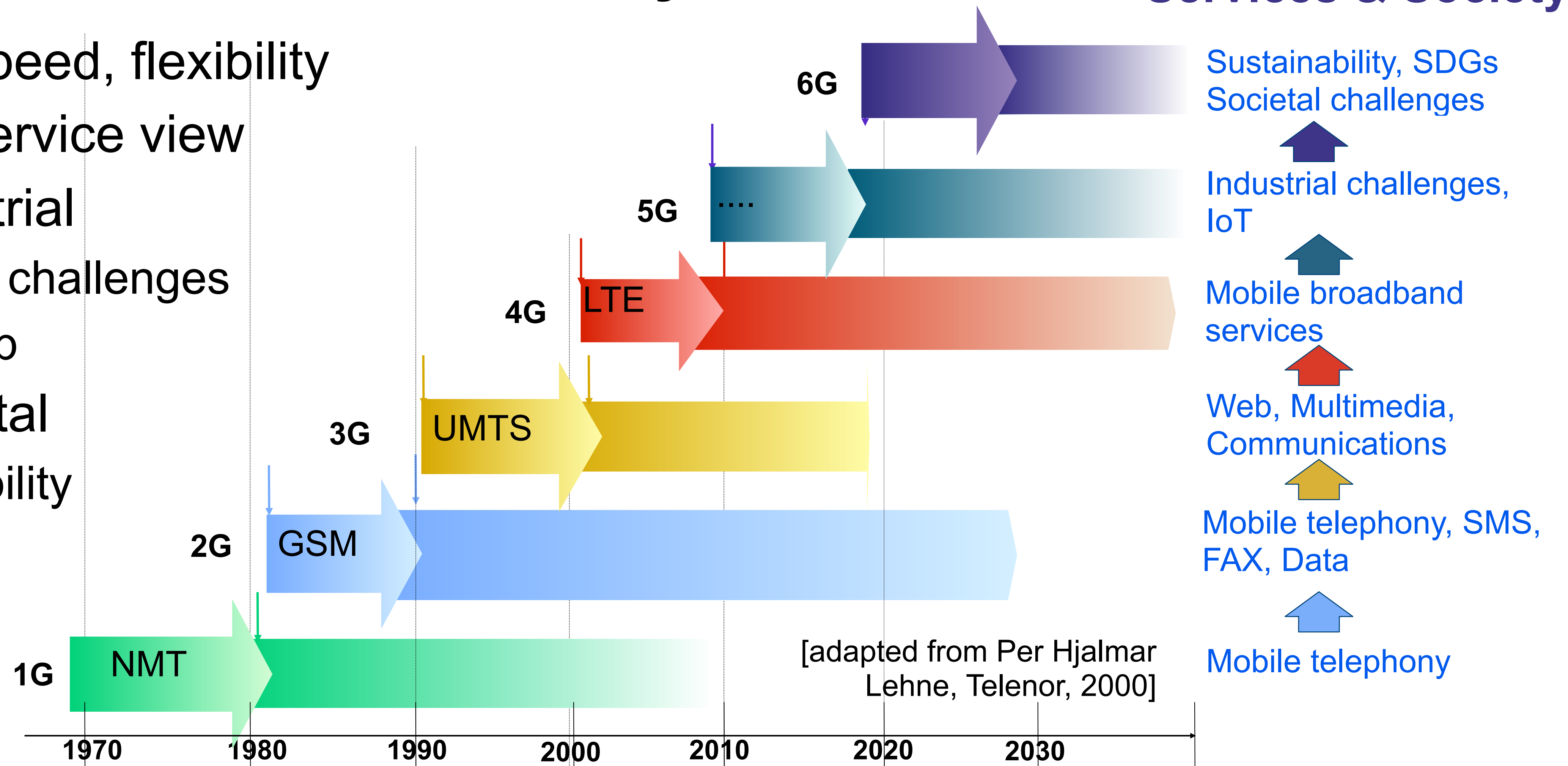
Discussion

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



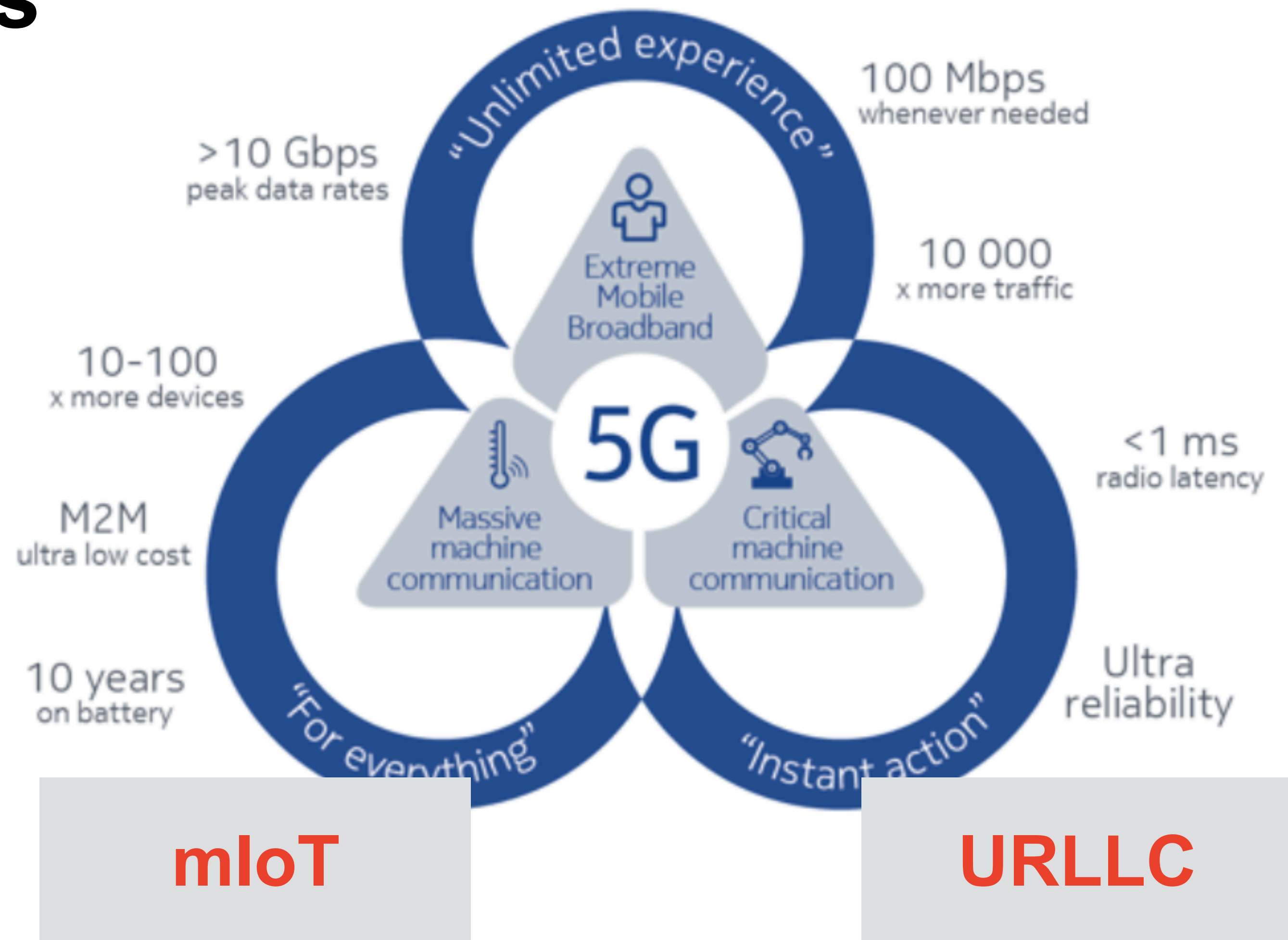
6G: Digitisation of the Society

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



5G: Industrial Challenges

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



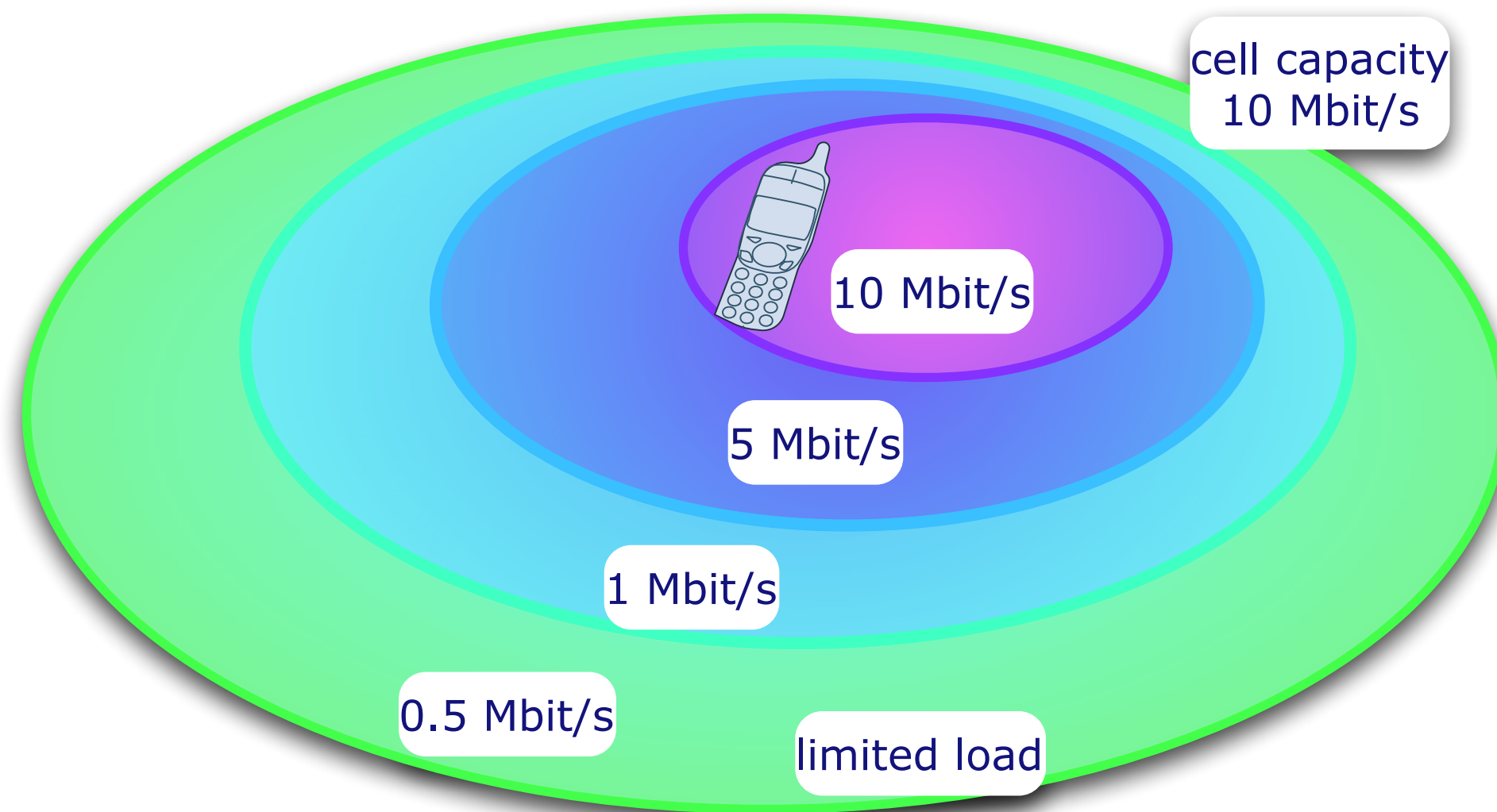
[source: Nokia <https://networks.nokia.com/5g/get-ready>]



5G access: radio and business dilemma

- The radio dilemma

→ outdoor to indoor

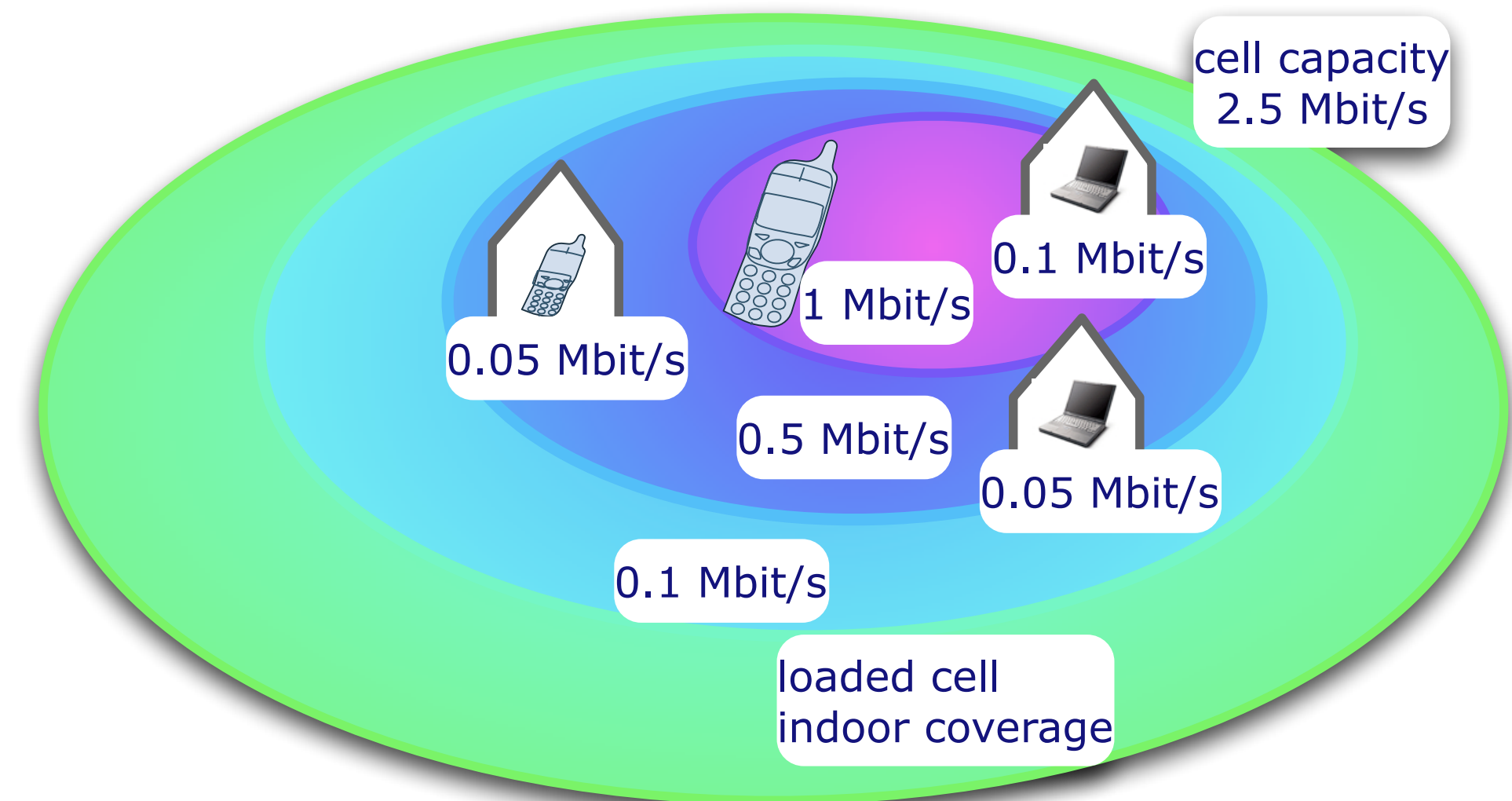


“coverage cell”

- The business dilemma

→ 5G access is expensive (range)

→ changing access means losing revenue



“70-80% indoor usage”

[Original drawings: Jørgen Grinnes, Telenor, **2010**]

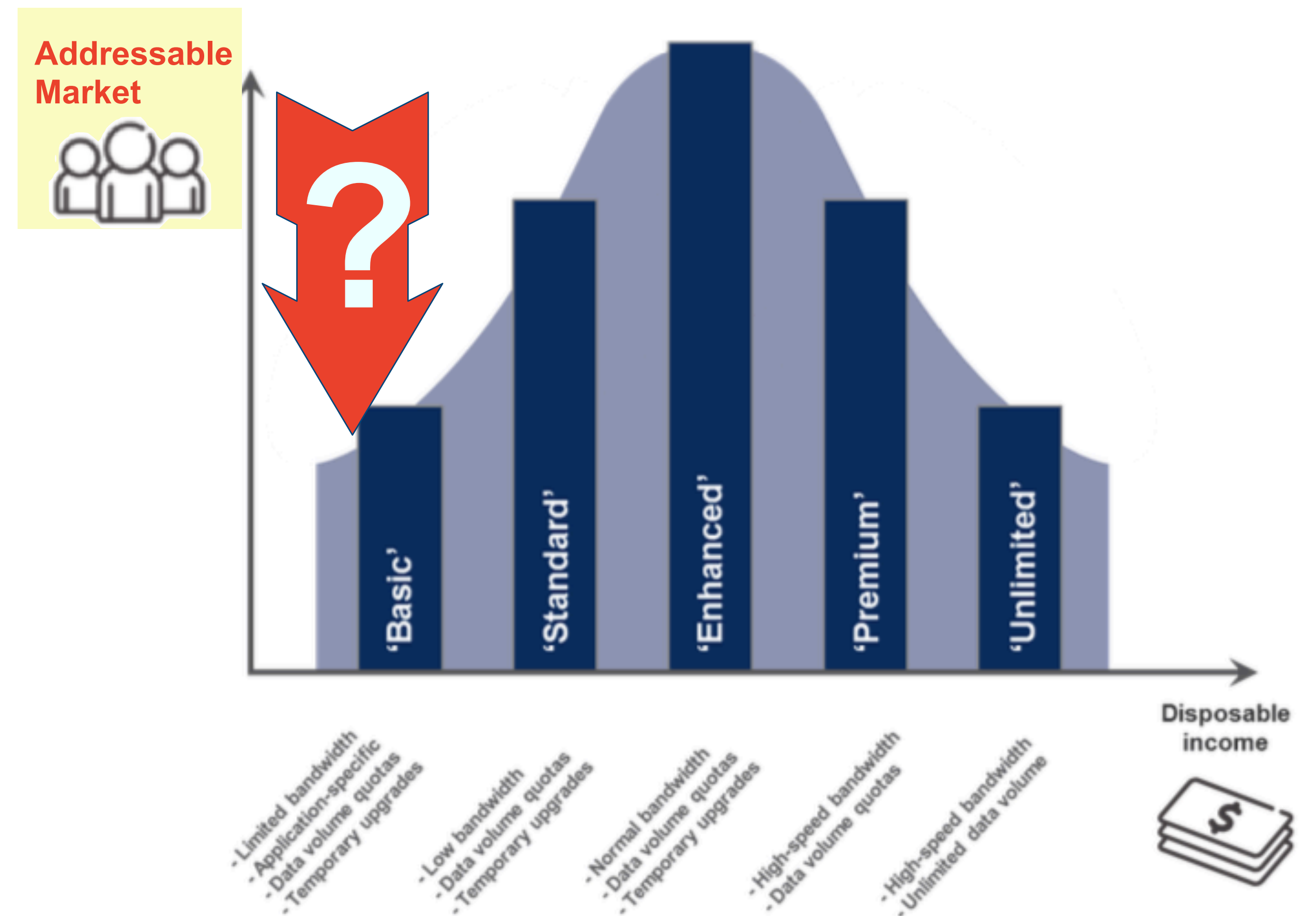


5G business & digital inclusion

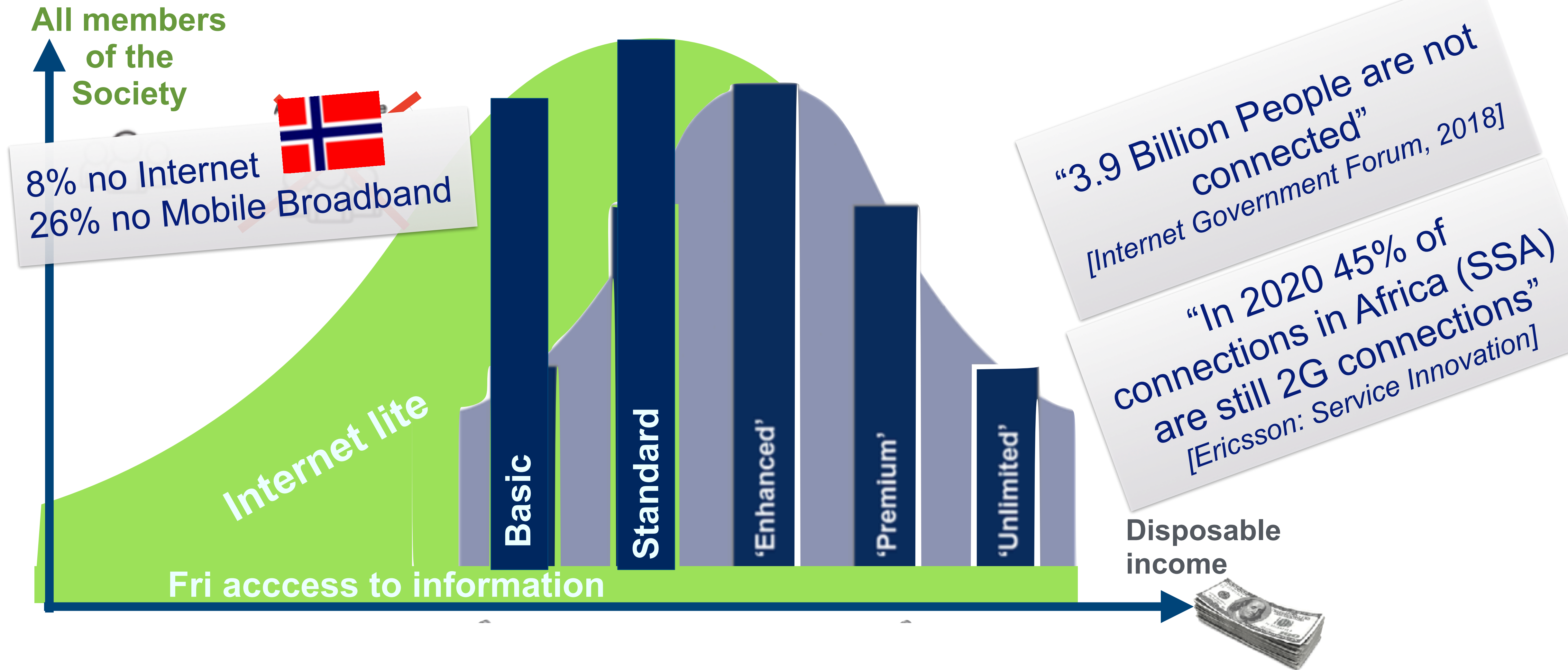
- 5G for digital inclusion?
 - ➔ cost of network, services
 - ➔ IoT, digitisation, automation
 - ➔ “the divide is bigger than ever”



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

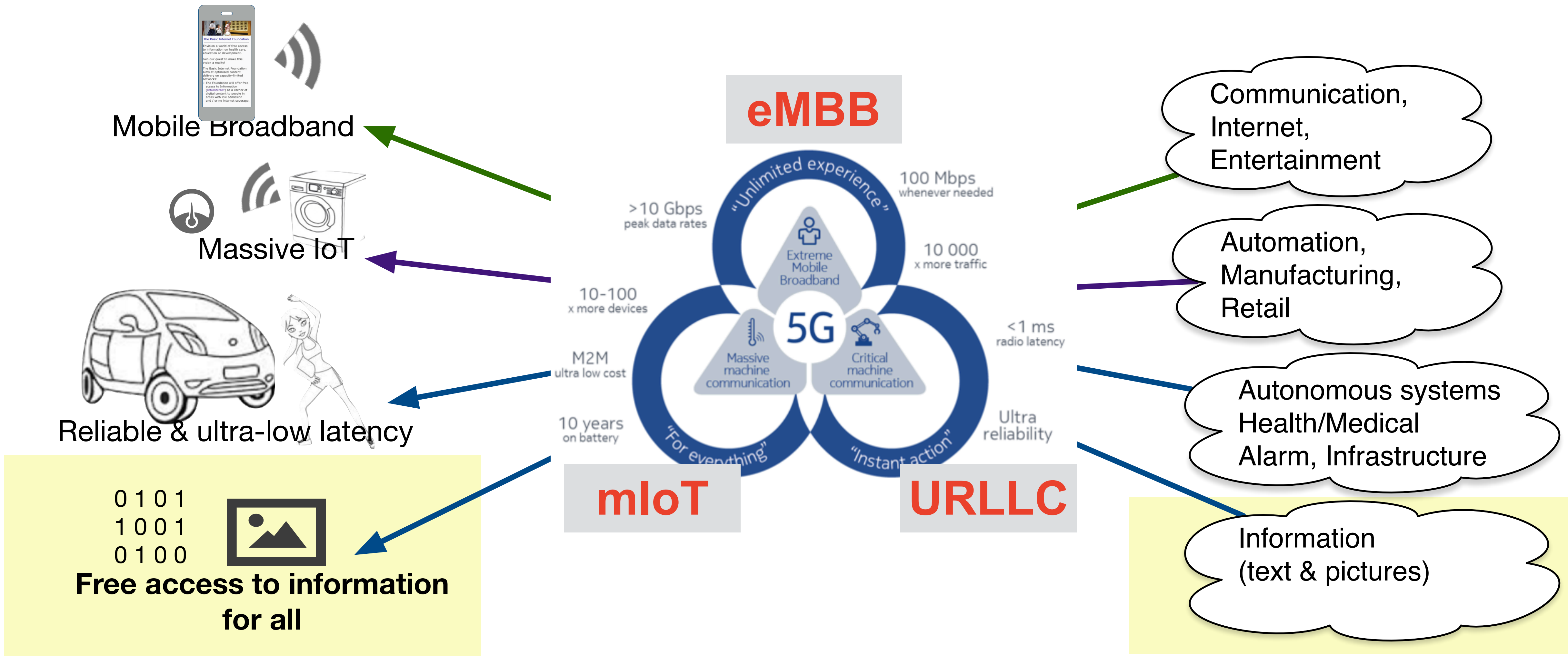


6G (#5GforAll) for digital inclusion



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

5G network slicing for Free Access to Information for All



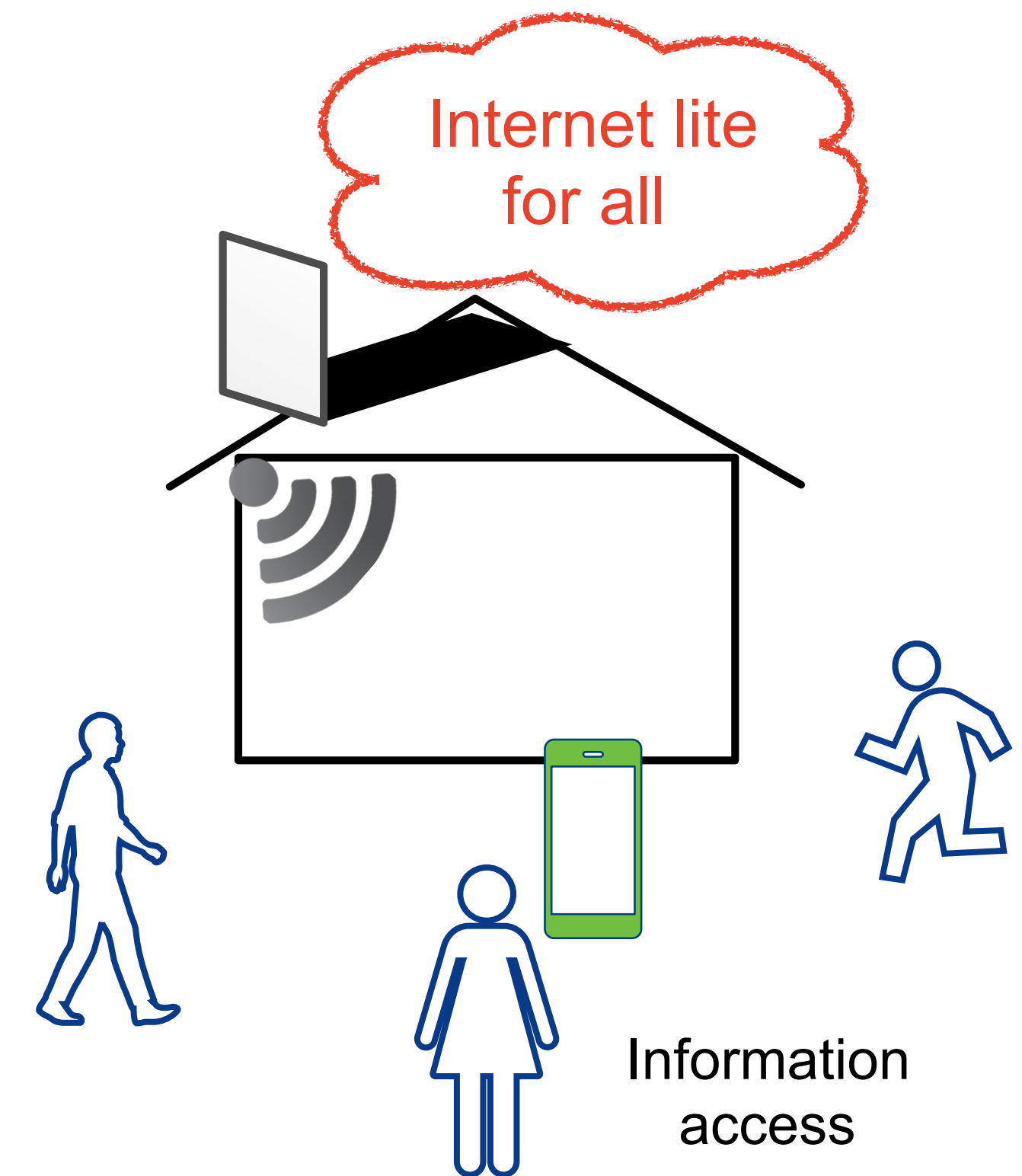
Home Domain for Digital Inclusion

- 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

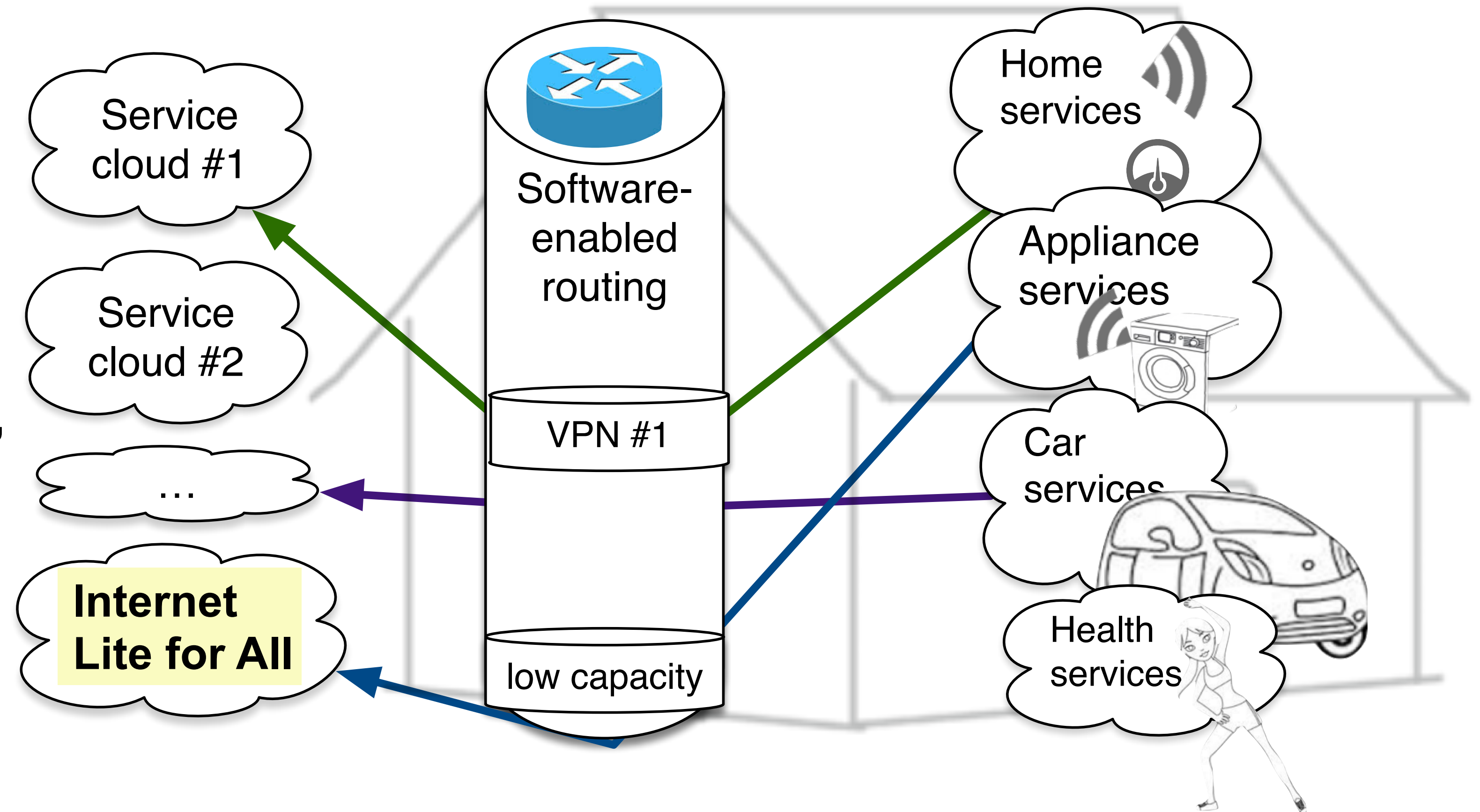
[2] Det norske ekomarkedet 2017, NKOM.no, 2018

[3] “Sauebonden som aldri...”, 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)



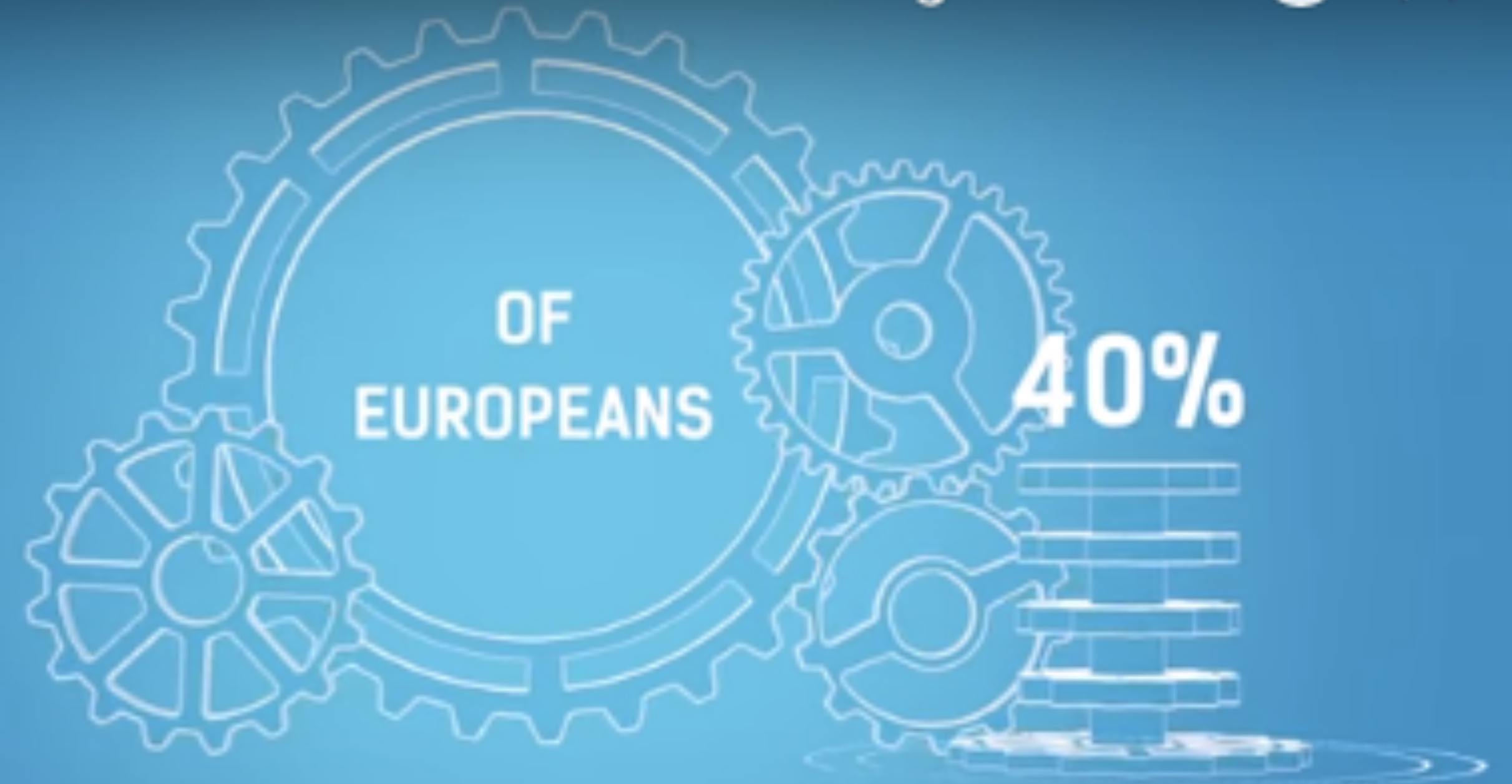
Digital Agenda Scoreboard 2015: Strengthenin...



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

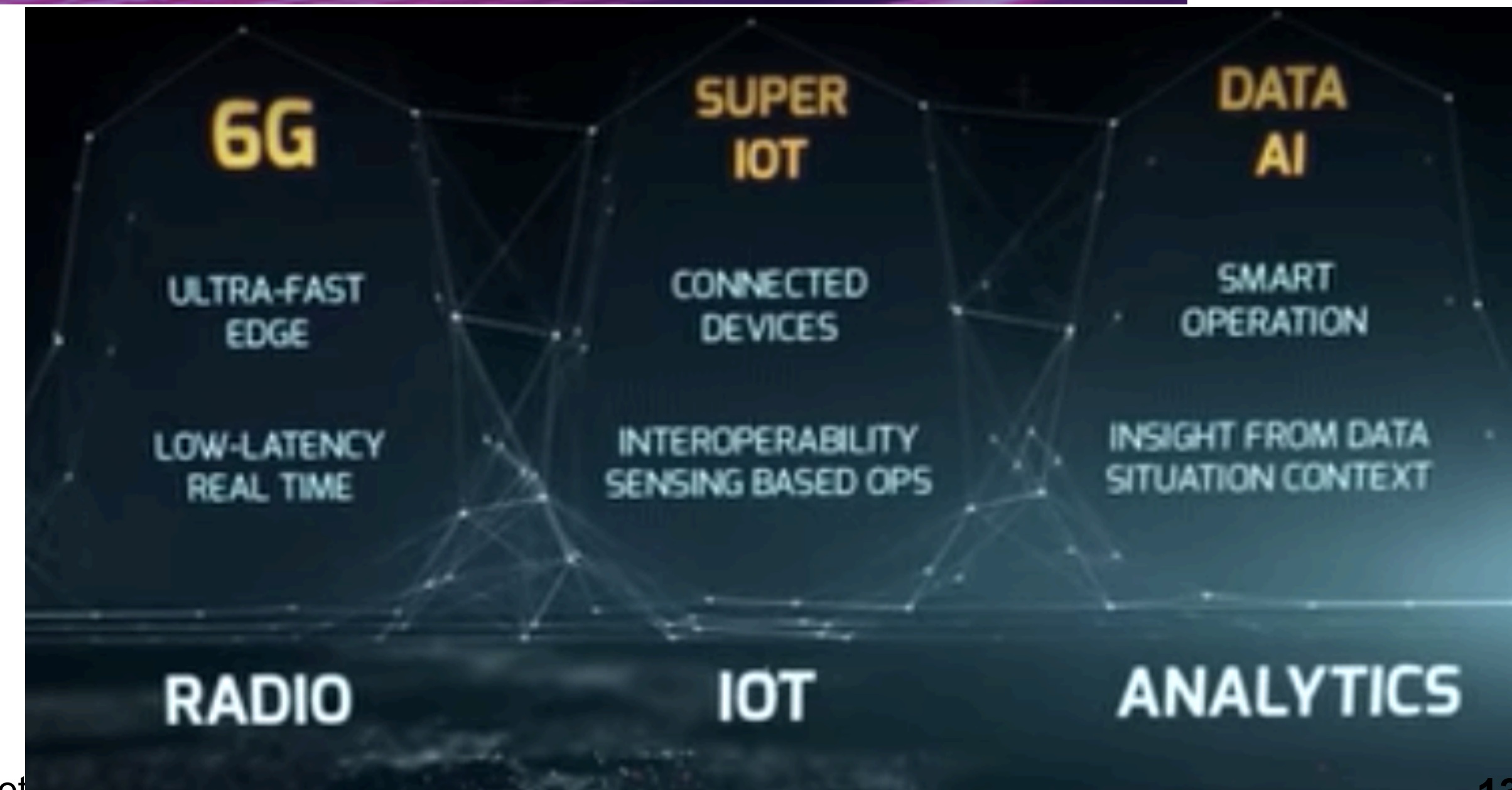
fri access to information - the catalyst for the goals

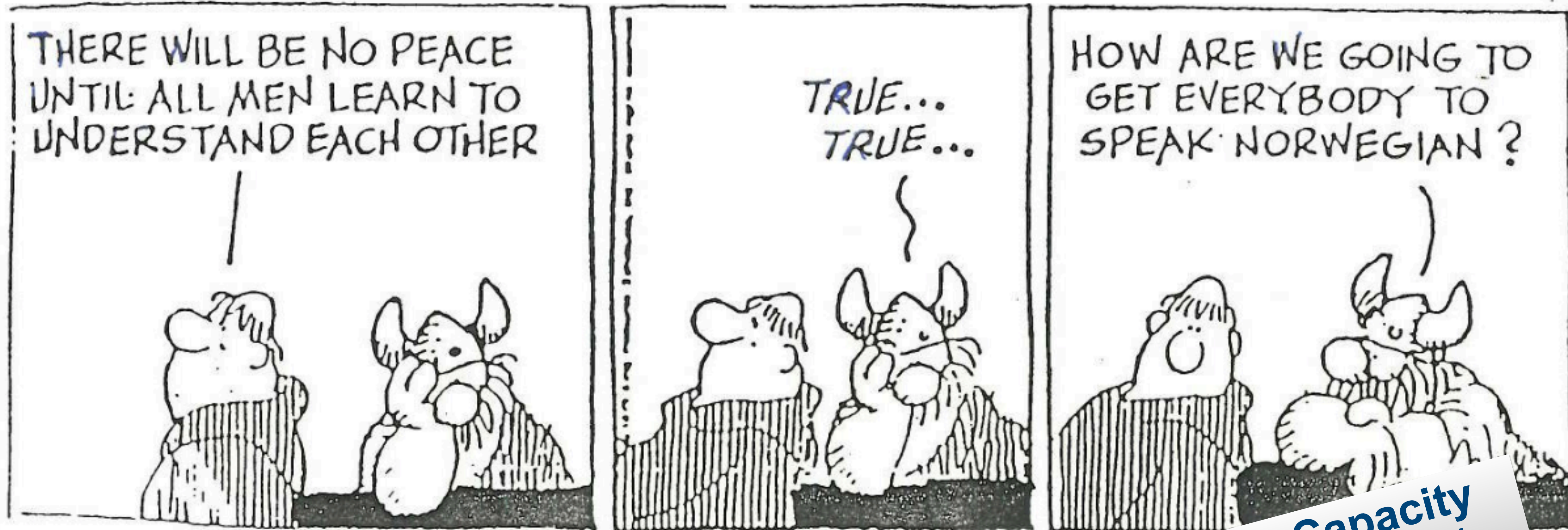




6Genesis.com by Oulu University

- 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



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

IKT er den nye oljen
Brekke

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

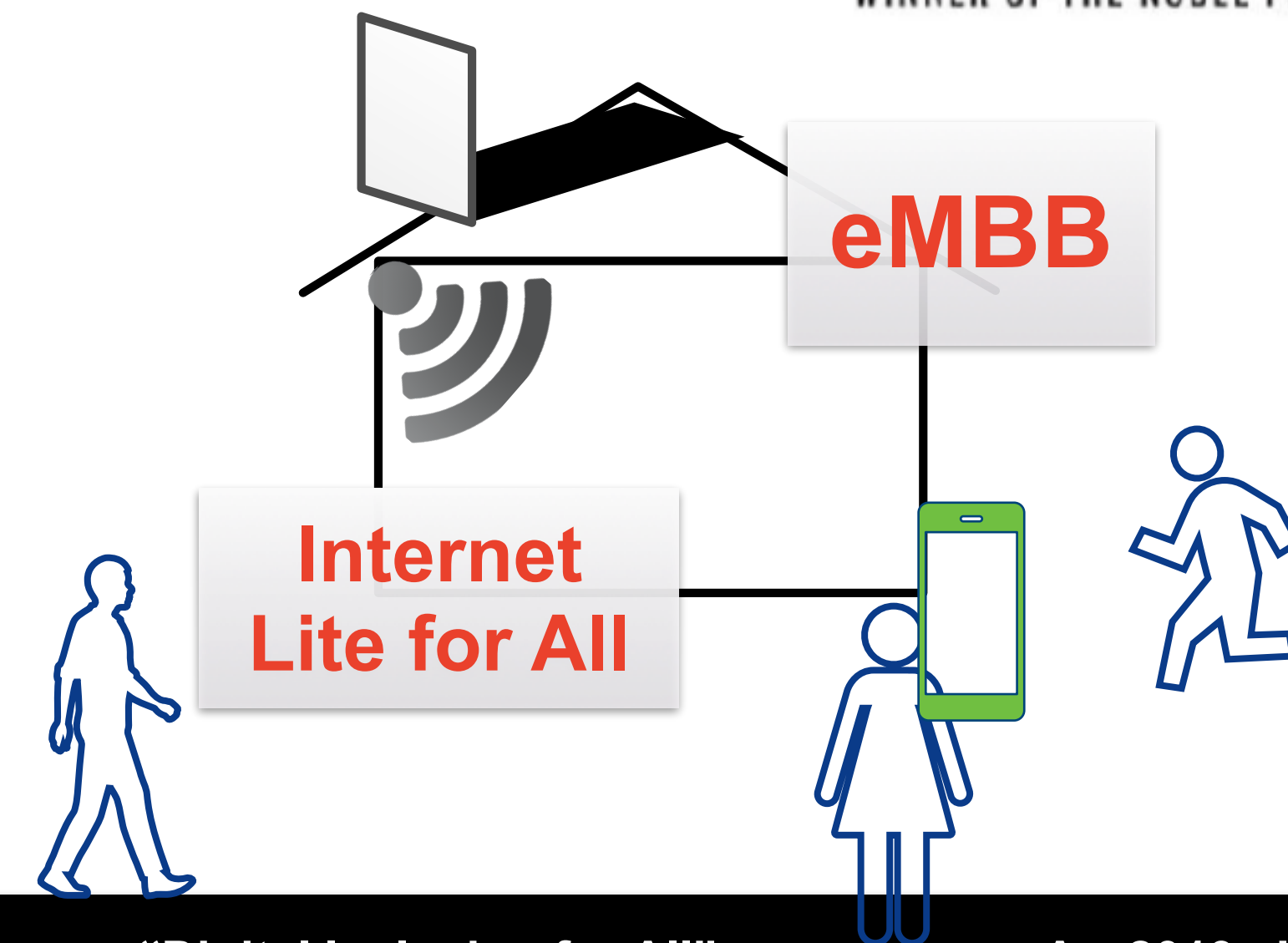


Digital Divide



THE **PRICE OF INEQUALITY**

JOSEPH E. STIGLITZ
WINNER OF THE NOBEL PRIZE IN ECONOMICS



“Digital Inclusion for All”

Apr2019, Josef Noll